Annex 2: Feasibility Study of the Project "Adapting Philippine Agriculture to Climate Change"

Overview

The feasibility study consists of the following 11 sections:

Section 2.1 to 2.3 provide supporting analyses of climate change, impacts, vulnerability of the Philippine complex agriculture systems and adaptation response both technical analysis and perspectives of smallholders, indigenous people and gender. Section 2.4 presents the Philippine context for climate resilient agriculture including existing policies, programmes and projects and enabling conditions as well as barriers for CRA transformation. Section 2.5

provides analysis of tested and available CRA options including their cost-benefit analysis. Section 2.6 analyzes the current state of climate information services and their delivery in the country. Section 2.7 discuss the learning from Farmer Field School (FFS), Climate Resilient Field School (CRFF) while Section 2.8 discusses access to finance, including lending and insurance mechanisms as strategic options for climate resilient agriculture. Section 2.9 details the project target area and beneficiaries identification and selection. Section 2.10 reviews farmer organization/cooperative development in the Philippines as the basis for CRA enterprise development. Lastly, section 2.11 provides detailed description of the project components and activities.

Section 2.1: Climate Rationale: Trends and projections of climate changes and impacts in the Philippines

Contents

2.1.1 Country level climate context - Philippines in the face of climate change

1. Globally, The Philippines is ranked 4th in terms of climate-related losses for the period of 1999-2018, with 289 events killing 85,955 people and costing 0.6% of GDP (Eckstein et al. 2018). The Philippines, a country made up of 7,107 islands, lies in the most cyclone-prone region in the world. The Philippine climate is driven by the country's location, physical geography, and large-scale systems, such as monsoons, tropical cyclones, and the El Niño-Southern Oscillation (ENSO). The country is highly exposed to natural hazards, including cyclones, landslides, floods and droughts. As the majority of the population reside in the country's vast coastline and depend on climate-sensitive natural resources, this exposure leads to extreme vulnerability to the impacts of climate change.

Baseline climatology of the Philippines

2. Philippine climate is tropical and maritime, characterized by **high temperatures and highly variable precipitation** (Figure 1). The eastern seaboard (Climate Type II) is characterized by the lack of a dry season, with pronounced rainfall from November to April. Moving westward, Climate Type III and Type IV climatologies have less pronounced seasons with a dry period from November to April in Type III. The northwestern region of the country (Type I) has two pronounced seasons with the dry season persisting from November to April. Climatic variables in the Philippines are strongly controlled by **large-scale phenomena such as monsoons, tropical cyclones, and the El Niño-Southern Oscillation** (ENSO).

3. On average, the Philippines experiences **high temperatures and humidity, varying seasonally from 25.5°C in January to 28.3°C in May** (PAGASA). Spatial variability in temperature is strongly controlled by altitude, which varies drastically with the complex topography reaching up to 3 km.

4. The El Niño-Southern Oscillation (ENSO) drives cycles in extreme weather that impact the Philippines. Studies find that the Philippines experiences **prolonged dry periods during El Niño events** (Jaranilla-Sanchez et al., 2011) **while heavy rainfall and flooding are often observed during La Niña** (Pullen et al., 2015).

5. **Two types of monsoons impact the Philippines annual**ly: the southwest monsoon (SWM) from May to October bringing heavy rainfall to the western coast and the northeast monsoon (NEM) from October to March bringing rainfall to the eastern side of the country (Francisco et al., 2006; Narisma et al., 2013; Yumul et al., 2011). Interannual variability on these monsoons is strongly linked to the ENSO phenomenon (Salinger et al., 2014; Figure 2).

6. An average of **20 tropical cyclones (TCs) enter the Philippines Area of Responsibility each year with about 7 to 9 making** landfall (Cinco et al., 2016). TCs, occurring mainly between July to November, bring increased rainfall along their path. While historically cyclones heavily impacted the north of the country, recently the southern regions have also experienced severe TCs (David, 2013).

7. Spatial analysis of tropical cyclones (TCs) in the Philippines shows the highest number of TCs in the northeastern regions (shown shaded Figure 3) and the lowest TCs occurrence in the southwestern part of the country (shown horizontally hatched Figure 3) (Cinco et al., 2016).

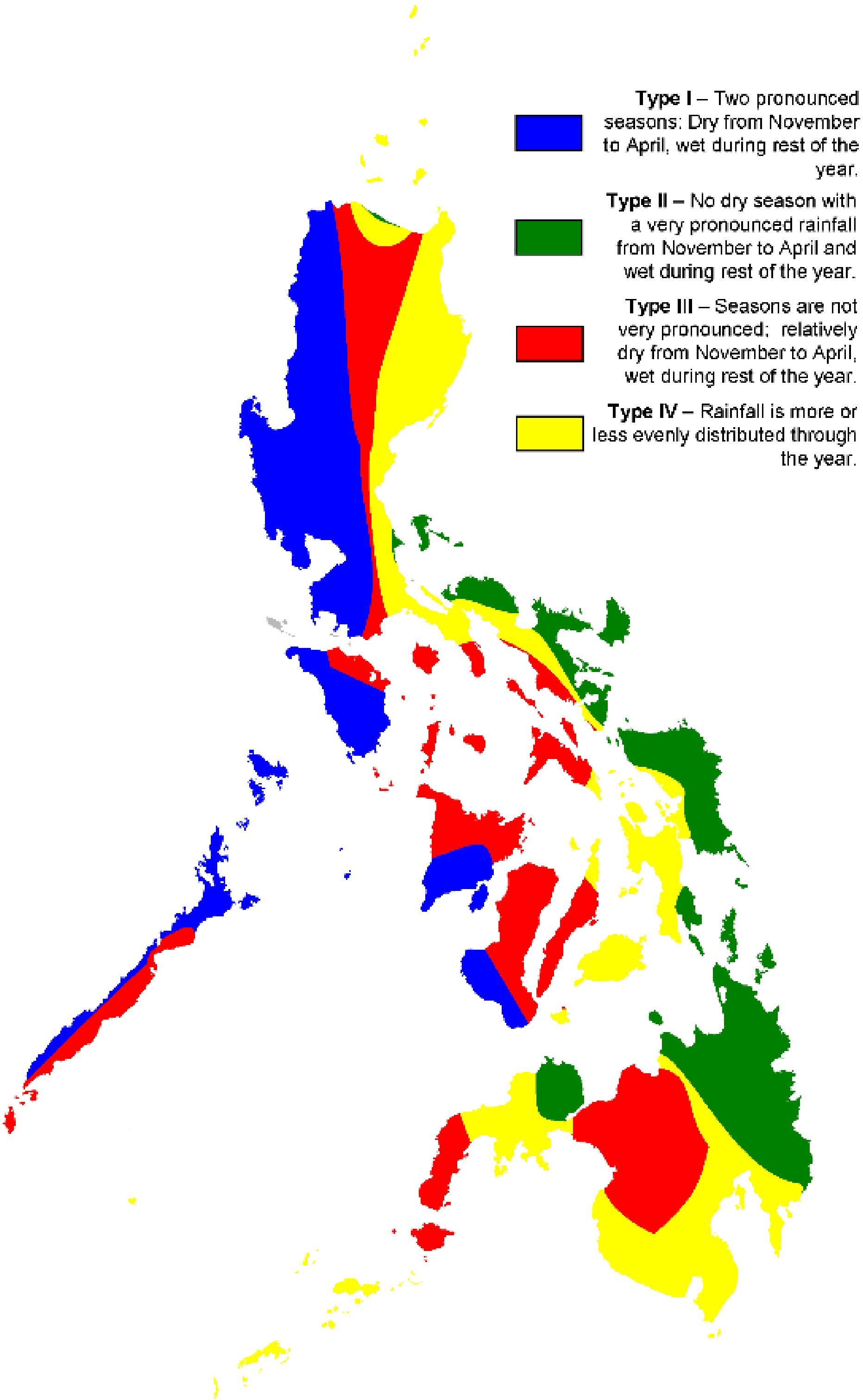

Figure 1: Climatological map of the Philippines demonstrating the 4 main climate types determined by the annual cycle of precipitation.

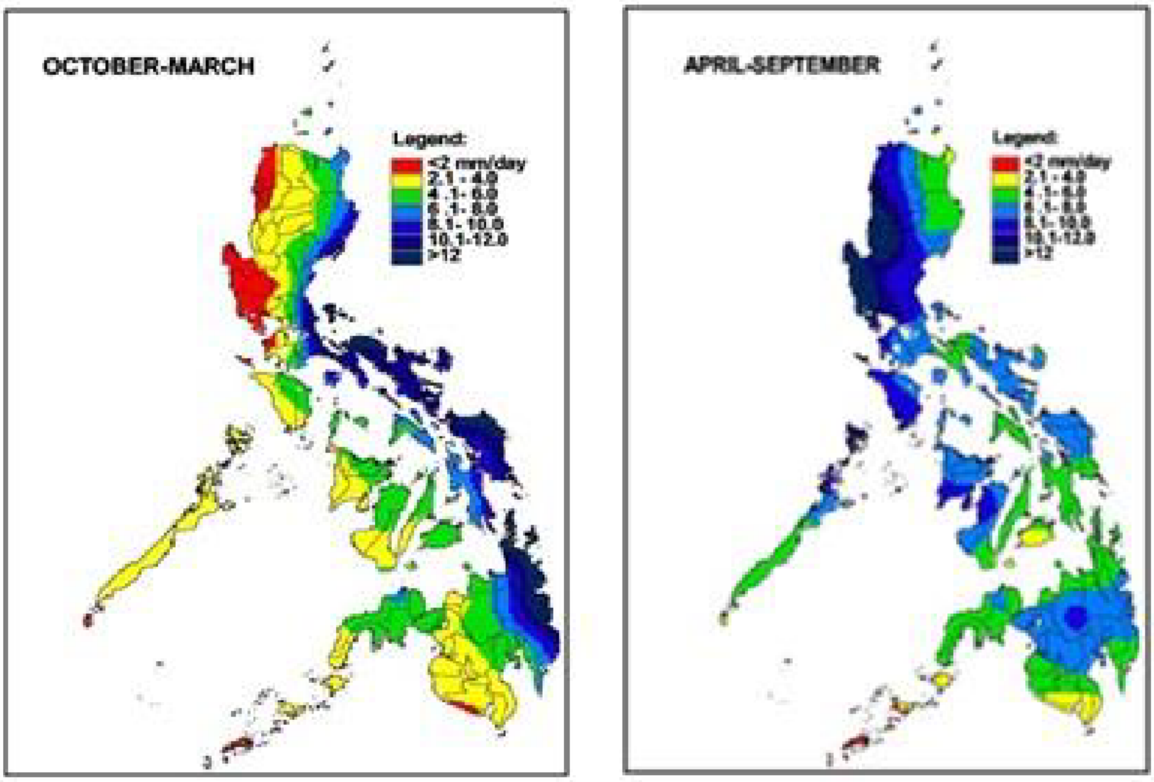

Figure 2: Seasonal rainfall distribution during (a.) SWM and (b.) NEM. Data from APHRODITE (Asian Precipitation-Highly Resolved Observational Data Integration Toward Evaluation of Water Resources) gridded station dataset.

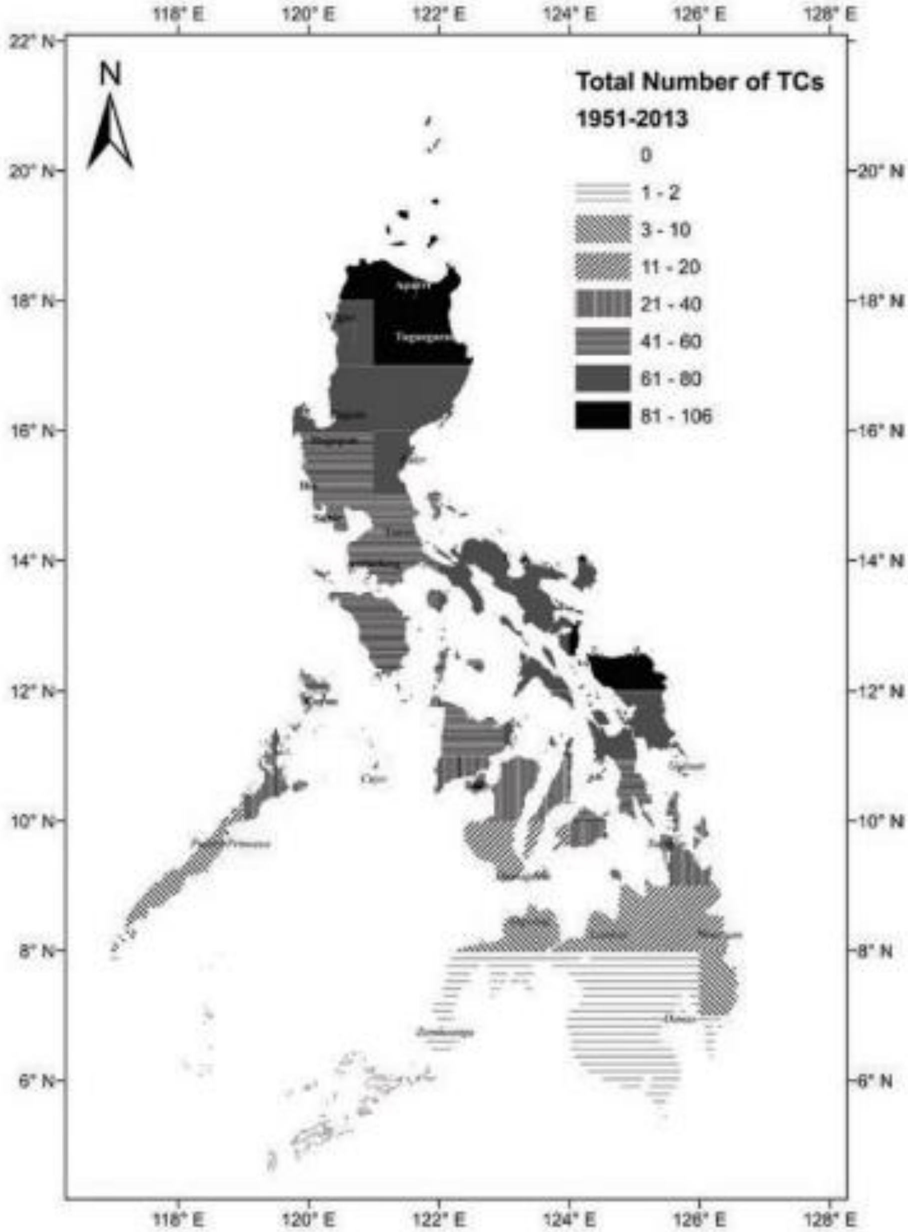

Figure 3: Total number of tropical cyclones (TCs) per 1° x 1° grid over the period 1951-2013 (Cinco et al., 2016).

Historical climate trends

Temperature

8. Over the period 1951-2010, annual mean temperature in the Philippines has increased by a total of 0.65°C (PAGASA, 2011). Importantly, **annual mean temperature has increased over the last 30 years (1981-2010) at a higher rate (0.16°C per decade)** compared to the average rate over the last 60 years of 0.11°C per decade (Figure 4).

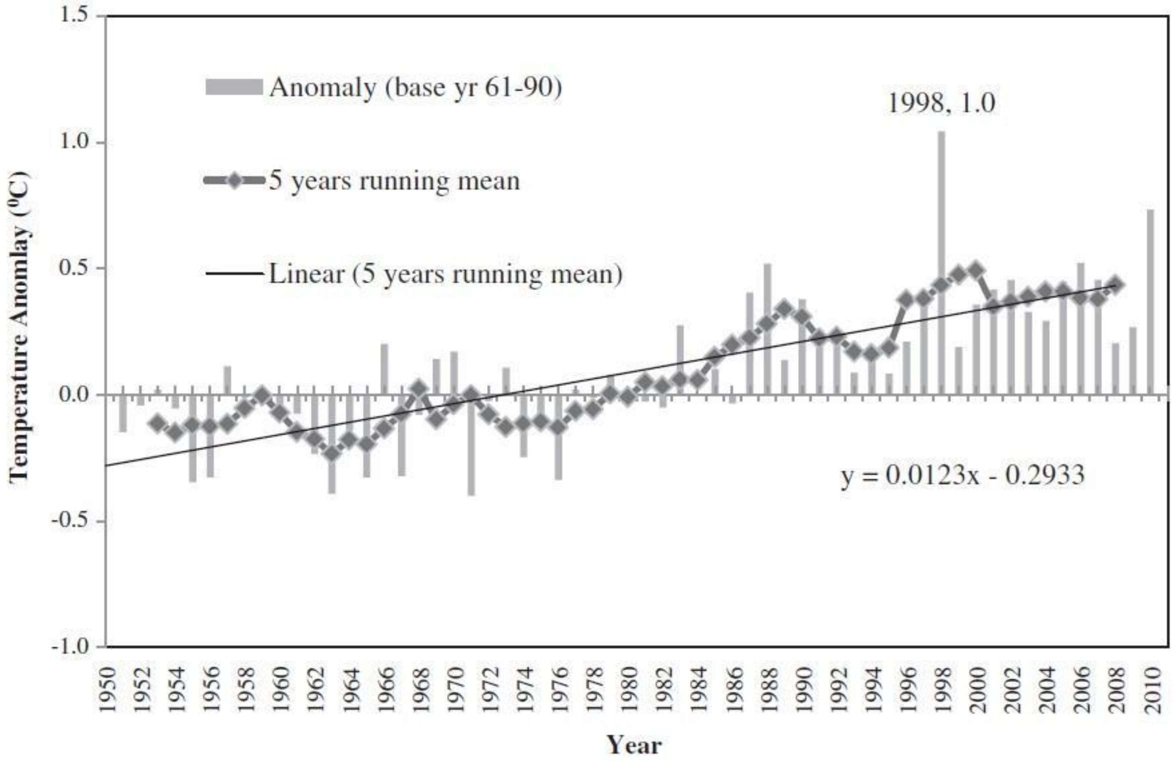

Figure 4: Observed annual mean temperature anomalies in the Philippines during the period 1851-2010 compared with the 1961-1990 normal values.

9. Mean annual minimum (nighttime) temperature increased by 1.0°C between 1951 and 2010, three times the increase in mean annual maximum (daytime) temperature. This trend highlights the **increase in nighttime temperature and reduction in diurnal variability**.

10. Extreme temperature indicators over the period 1951-2008 show that the **number of hot days (maximum** temperature **above 99th percentile) is increasing and the number of cold nights is decreasing** in most areas of the country (Figures 5a and 5b).

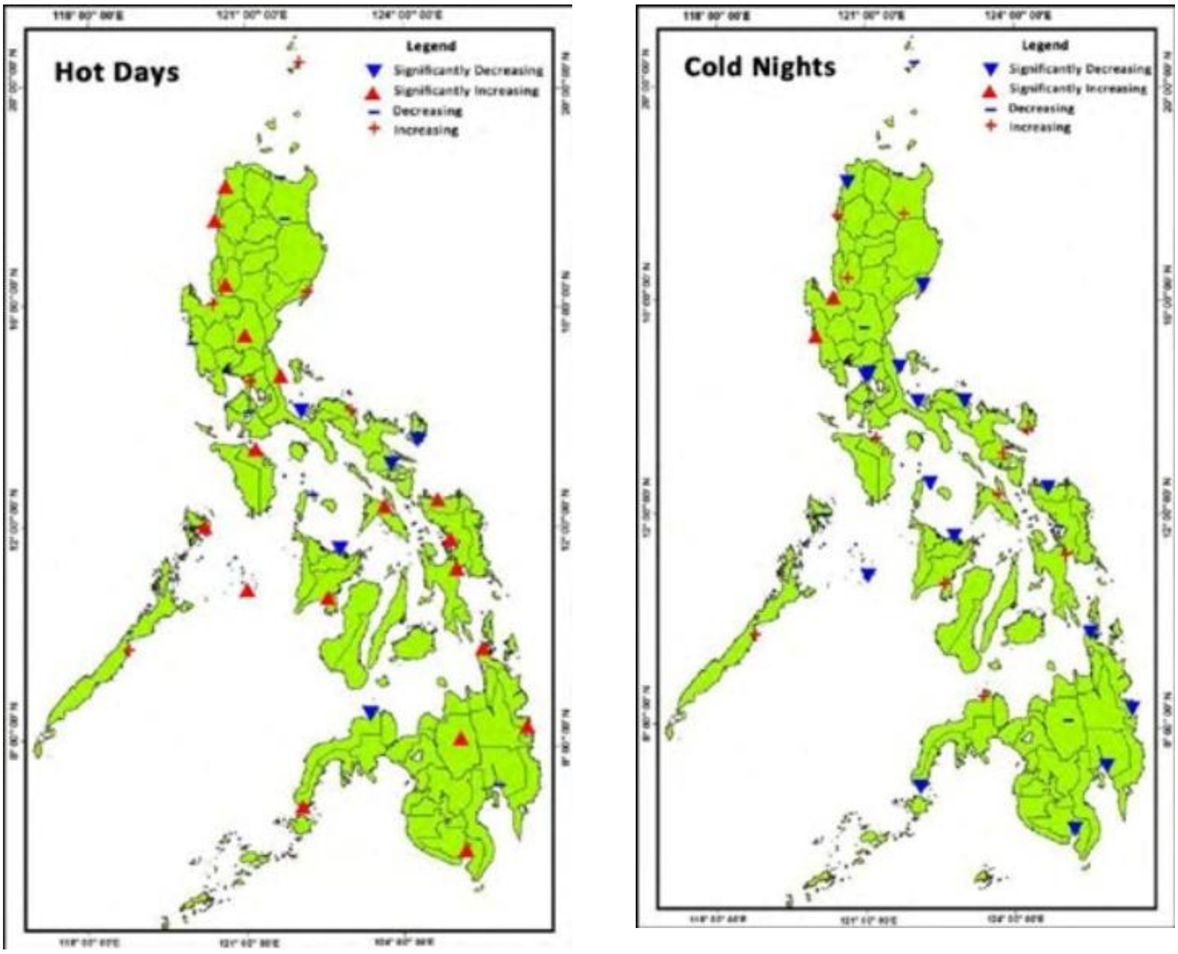

Figure 5a and 5b: Trends over the period 1951-2008 in the frequency of hot days (maximum temperature above 1971-2000 mean 99th percentile) and cold nights (minimum temperature below the 1971-2000 mean 1st percentile.

Precipitation

11. Annual rainfall in the Philippines varies spatially between 935 mm to 4,064 mm (PAGASA). The rainy season in the country on average starts mid-May until September, however this timing is sensitive to southwesterly wind associated with the Asian summer monsoon (Akasaka, 2010).

12. Rainfall variability is driven by large-scale weather systems (monsoons and cyclones) as well as the convergence of the northeasterly winds from the Northern Hemisphere and the southeasterly winds from the Southern Hemisphere at the equator (Francisco et al., 2006). Tropical cyclones contribute up to 50% of total annual rainfall in the north of the country (but as low as 4% in the southernmost areas).

13. Due to the multifactorial controls on rainfall in the country, analysis of historical trends in rainfall show conflicting results depending on the time period, season and geographic location analyzed (Ortiz et al., 2016). Spatial variability shows that over the period 1951-2010, the annual total rainfall over northern sections of Luzon, Palawan, western sections of Visayas and central and western Mindanao have declined. In the areas central Luzon, eastern Visayas and the northeastern and southwestern sections of Mindanao, rainfall has increased over the period between 10-40mm/decade.

14. Rainfall in the Philippines is highly seasonal. Figure 6 below shows trends in seasonal rainfall demonstrating a statistically significant increase in rainfall specifically in the eastern portion of the Visayas in December-January-February (DJF), a period already marked by the northeast monsoon and therefore increasing potential risk of flooding.

15. A significant drying trend is observed over the northeastern portion of Luzon and central and northwestern Mindanao in almost all seasons (Figure 6).

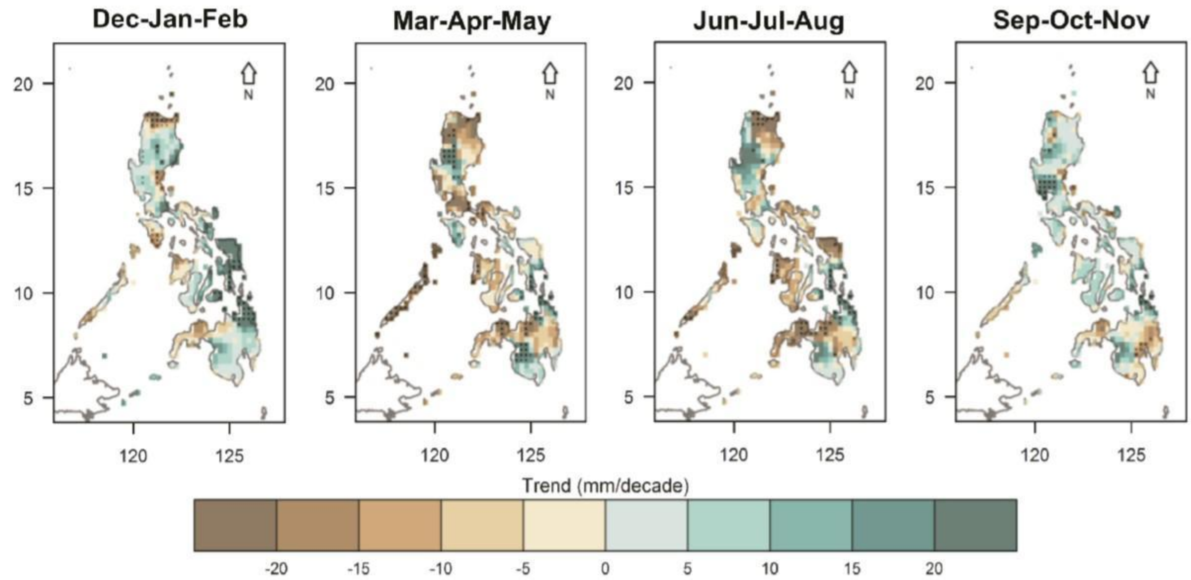

Figure 6: Observed trends in seasonal total rainfall in the Philippines during the period 1951-2010. Areas marked with dots denote statistical significance at 5% level based on the Mann-Kendall test (PAGASA, 2018).

16. Analysis of extreme precipitation indicators show tendencies toward drier dry seasons (January-March) and wetter rainy seasons (July-September) in northwest and central Philippines (Villafuerte et al., 2014). These trends suggest an increase of both wet and dry extremes annually, which contribute to the flood and drought potentials in the country, both posing potential risks to vulnerable agricultural communities.

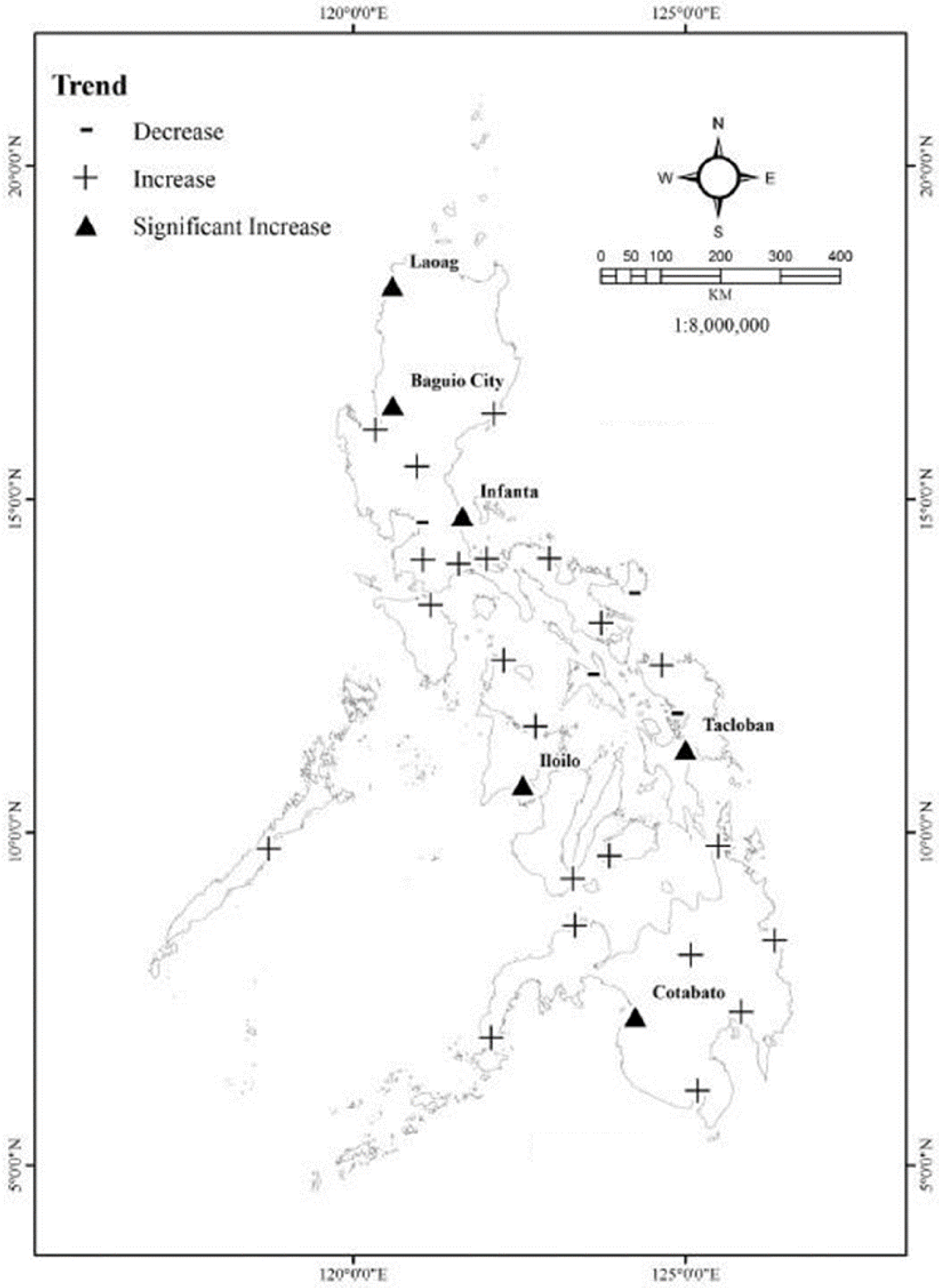

Figure 7: Trends in extreme daily rainfall intensity in the Philippines (1951-2010) compared with the 1961-1990 values.

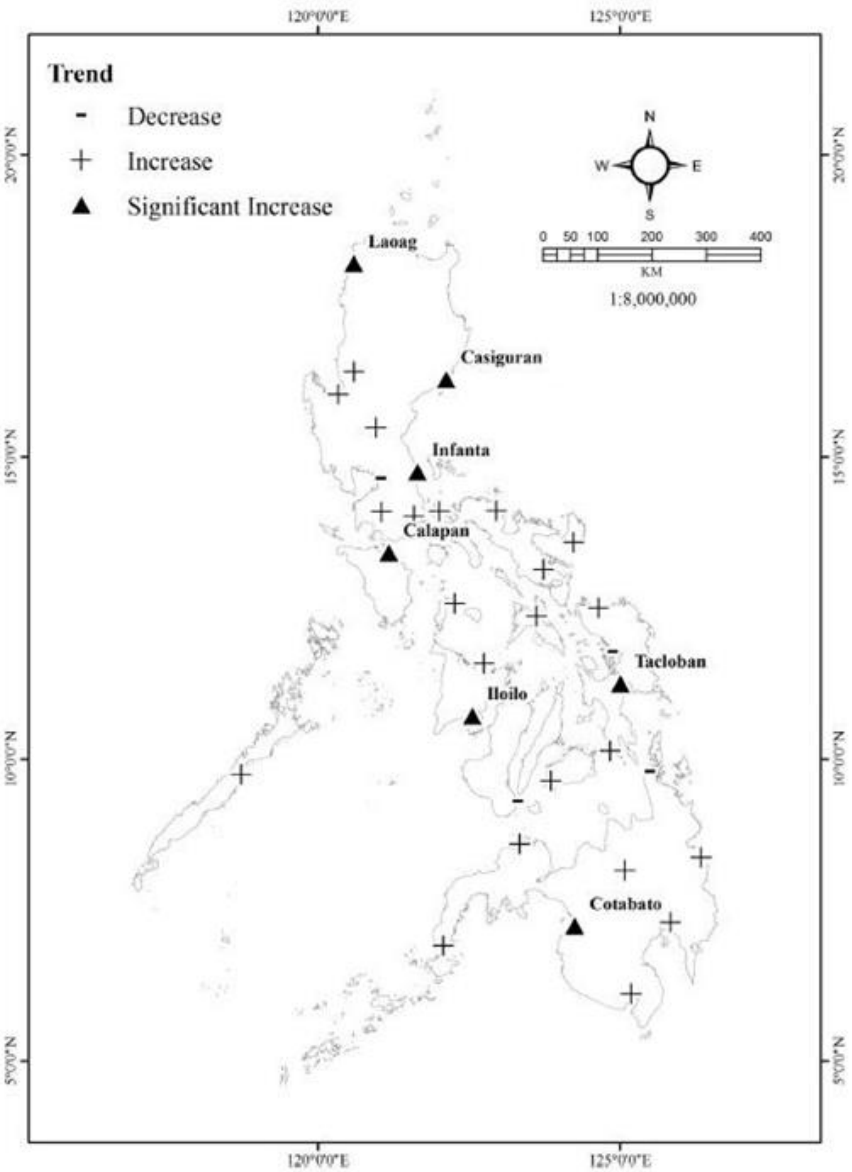

Figure 8: Trends of extreme daily rainfall frequency in the Philippines (1951-2010) compared with the 1961-1990 mean value.

17. Extreme rainfall events (350 mm or higher) increased in the latter part of the 20th century, however there was no clear trend in total annual rainfall (Thomas et al., 2013). Seasonal trends in rainfall illuminate important signals within the seasonal cycles of precipitation across the country.

Tropical cyclones

18. Trends in tropical cyclones over the period 1851-2015 show no distinct increase in frequency, however an increase in the number of extreme typhoons (very strong intensity) was observed between 1987-2004 and 2012-2013 compared to the rest of the dataset (Cinco et al., 2016).

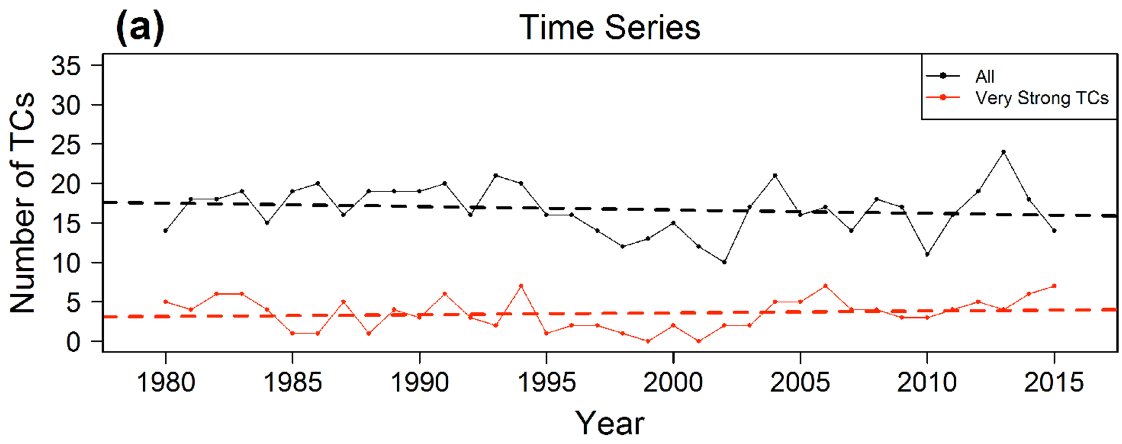

Figure 9: Number of total tropical cyclones (black) and very strong (maximum sustained winds >170 kph) tropical cyclones (red) over the period 1981-2015.

19. Studies show a shift in cyclone genesis location depending on ENSO cycles. During El Niño, the genesis location shifts to the southeast, while during La Niña it moves toward the northwest. This shift changes the track, intensity and duration of the TCs (Lyon et al., 2014).

Drought

20. The Philippines experiences recurring drought events accentuated by the increasing incidence of the El Niño phenomenon, particularly due to its position in the equatorial region (Perez and Blanco, 2017).

21. Extreme precipitation indicators over the period 1961-2010 indicate an increasing trend in the number of days without rain with statistical confidence in the provinces Ambulong (2.9% per decade), Baguio (5.9% per decade) and Dagupan (4.0% per decade), as well as a decreasing trend in the heavy rainfall days. These findings suggest a climatic change towards a prolonged dry period and an overall decreasing trend in rainfall during the SWM season over western Philippines in the recent decades (Cruz et al., 2013).

22. El-Niño induced dry spells and drought conditions severely impacted the Philippines between December 2015 and September 2016. Figure 10 below shows the impacted areas of the March 2016 drought, which are mainly in Mindanao. A total of 676,465 people were affected by this event (ACAPS briefing note).

Figure 10: Map of drought affected provinces in the Philippines in March of 2016 as measured by PAGASA and mapped by MapAction (ACAPS briefing note).

Sea level rise

23. Measurements of sea level rise from tide gauge observations (Figure 11) indicate a rapid increase in sea level rise in Manila and gradual increase in sea level in Legazpi and Davao. No apparent trend was observed in Cebu or Jolo, Sulu.

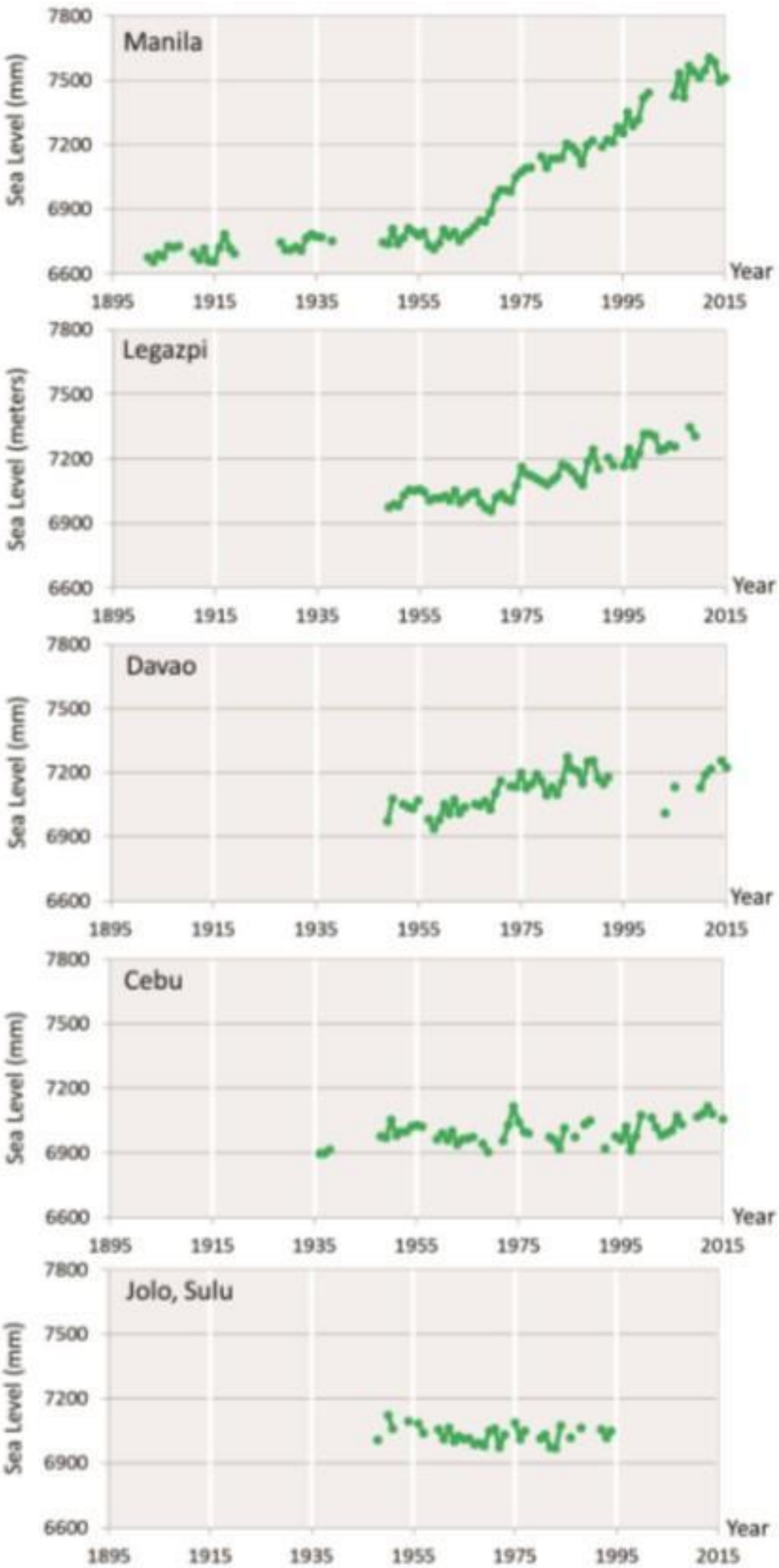

Figure 11: Sea level rise in selected areas (mm) above the Revised Local Reference (RLR) level (7,000 mm). (National Mapping and Resource Information Authority)

Monsoon onset

24. Farmer and other key stakeholders observations, such as DA operations officer, LGU extensionists, PAGASA, have noted changes and greater unpredictability in the onset of monsoons, both delay and early onset, causing harvest to fall later, even within typhoon season, and difficulties in timing of planting and other production activities to fit with wet periods, etc.

Future climate projections

Temperature

25. Projections of mean annual temperature in the Philippines show increases in the future. The magnitude and rate of increase depends on the emission scenarios and model used. In the mid-21st century (2036-2065) the modelled outputs overlap between the low (RCP4.5) and high (RCP8.5) scenarios, predicting a 0.9 to 1.9°C increase in temperature (Daron et al., 2018) (Figure 12).

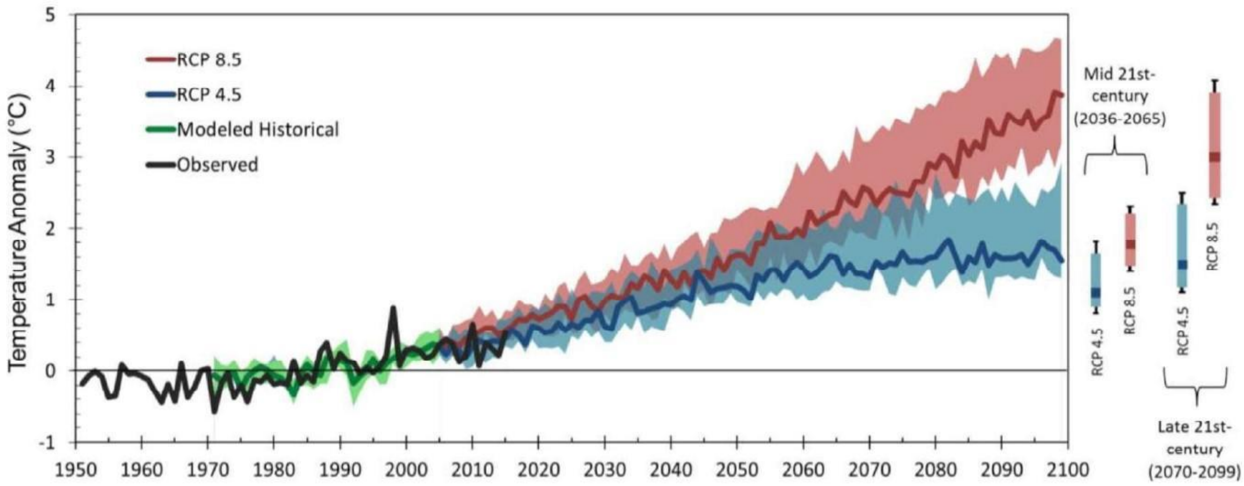

Figure 12: Annual mean temperatures change over the Philippines from 1971-2000 baseline. The black (green) line shows observed (RCM) temperatures over the past based on observed GHG concentrations. The red (blue) line shows RCM projected annual temperature over the period 2005-2100 for RCP scenarios 8.5 (4.5). Vertical bars on the right show the median and spread of projections at the mid- and end- of the 21st century.

26. Projected temperature varies greatly seasonally as shown in Figure 13 below. The top panels show projected temperature by the year 2049 under RCP4.5. The most significant temperature rise is in the MAM season specifically in the central northern provinces and in the central south. The bottom panels illustrate temperature rise by the year 2079 under RCP4.5 and also highlight the largest increases in MAM and DJF in the central northern and southern provinces (PAGASA, 2014).

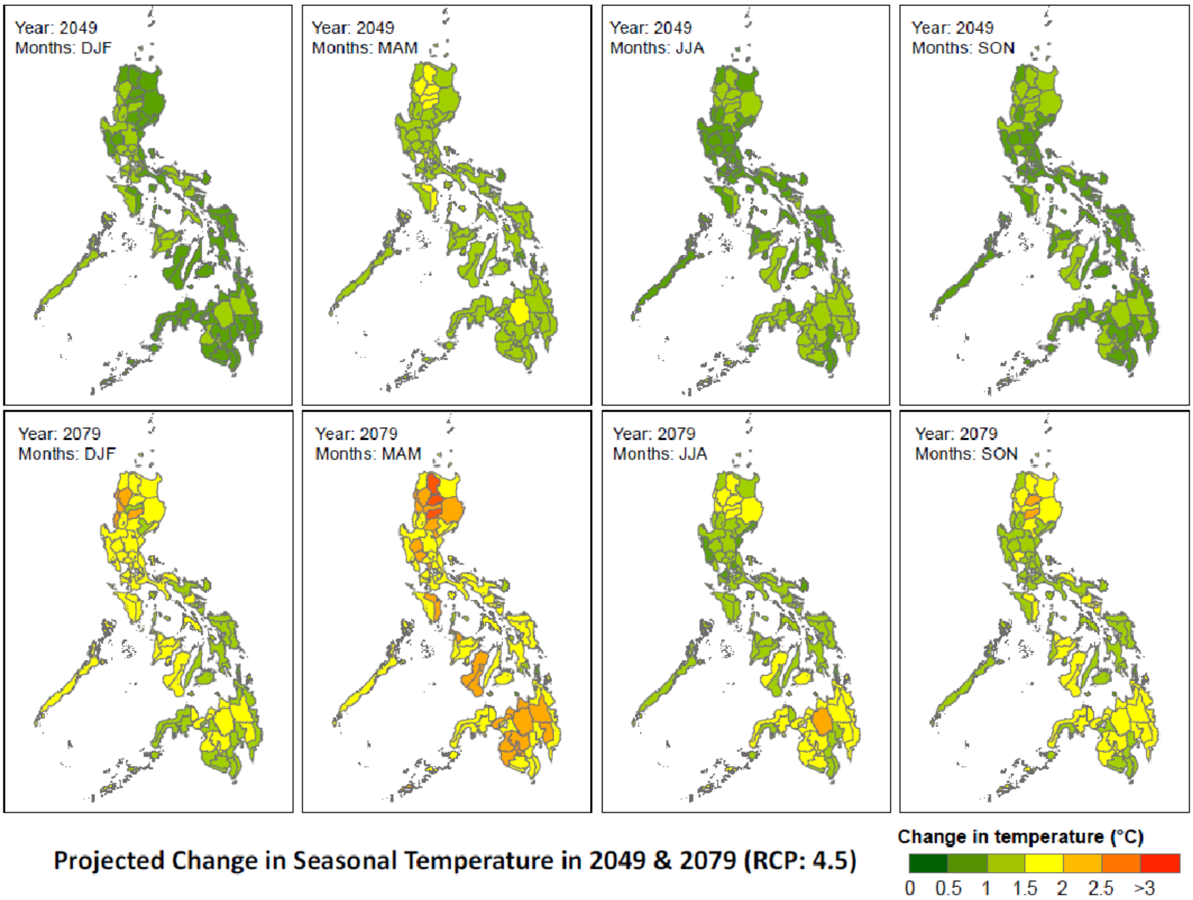

Figure 13: Projected change in seasonal temperature by the year 2049 and 2079 under RCP4.5. Each panel represents a three month period, December-January-February (DJF), March-April-May (MAM), June-July-August (JJA) and September-October-November (SON) (PAGASA, 2014).

Precipitation

27. The direction of change in annual rainfall across available projections is less certain with a range between -16 to +18% for the future period 2036-2065 compared to the historical period under RCP8.5 (Daron et al., 2018).

28. Regional changes in precipitation can explain some of the uncertainty as projections show that seasonal precipitation will decrease in the south of country and increase in the north. Under both high and low emission scenarios, rainfall is projected to increase particularly in the northern regions in DJF by 2049 and across all seasons by 2079 (Figure 14). The southern areas, however, are projected to experience decreases in seasonal precipitation especially in the MAM and SON seasons by the year 2049 and during all seasons by 2079 (Figure 14).

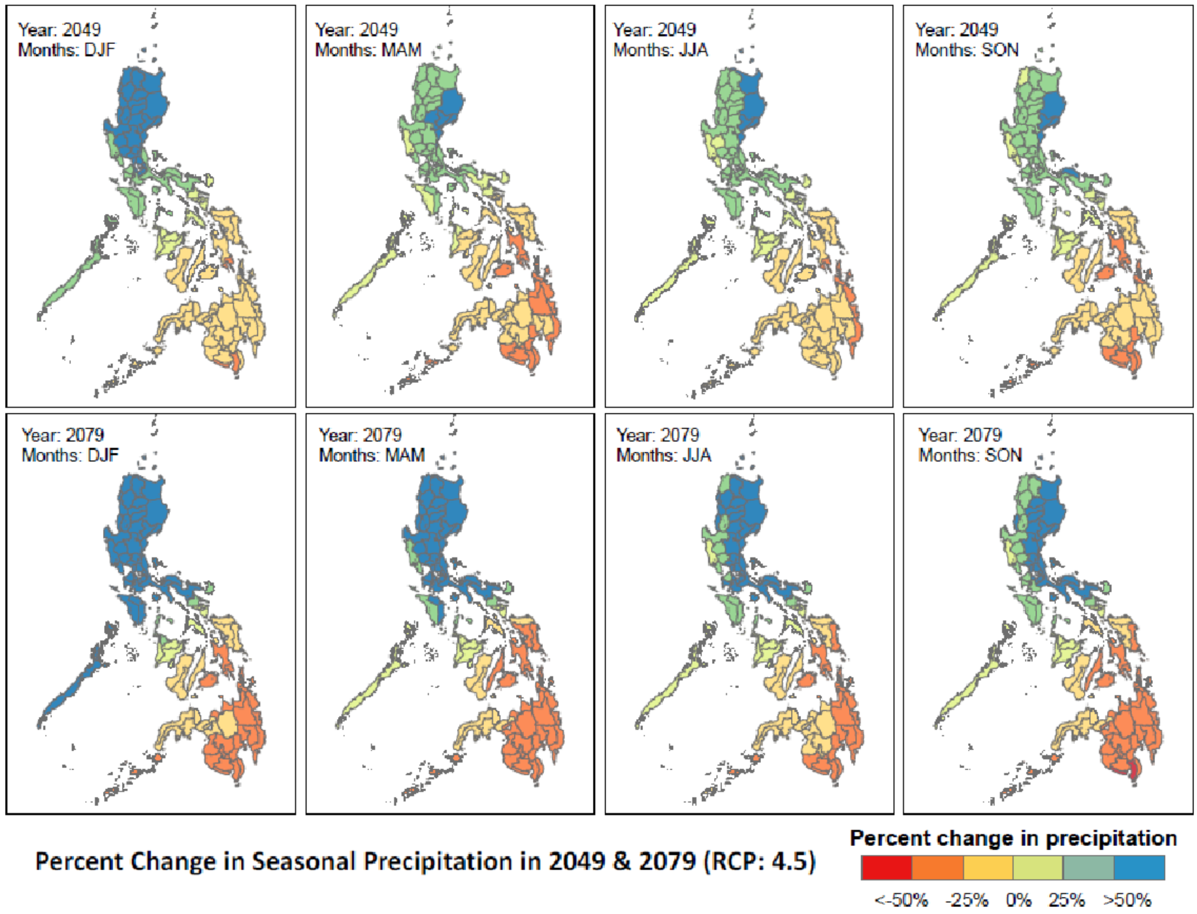

Figure 14: Percent change in seasonal precipitation by the year 2049 and 2079 under RCP4.5. Each panel represents a three month period, December-January-February (DJF), March-April-May (MAM), June-July-August (JJA) and September-October-November (SON).

Tropical Cyclones

29. Models can estimate changes in environmental drivers of tropical cyclones (TCs) and project relative frequency and intensity of TCs under different climate model simulations. Under RCP 8.5 scenario for the future (2035 to 2064) compared to the baseline (1971 to 2000) for three climate models, there is consensus on increasing surface temperature (Figure 15). The combined drivers project increased intensity and decreased frequency of TCs in the Philippines. Arrows indicate the magnitude of change and dashes indicate no discernible change.

	Downscaled HadGEM2-ES	Downscaled CNRM-CM5	Downscaled MRI-CGCM3
Surface temperature	↑	↑	↑
Mid-level relative humidity	↕	—	↑
Wind shear	↑	—	↑
Low-level relative vorticity	↕	—	↕
Expected change in TC intensity	↑	↑	↑
Expected change in TC frequency	↓	—	↓

Figure 15: Summary of changes in the key driving variables known to influence TC variability and change in the region for different climate model simulations and resulting change in intensity and frequency of TCs. Small (large) arrows indicate a small (large) change, bi-directional arrows show changes that vary across time or space, and dashes show that there are no discernible changes projected (UK MET office, 2016).

30. Projected changes in intensity and frequency vary greatly depending on the season. Table 1 shows future projected changes in TC frequency and intensity both annual and by season for 5 model simulations. All simulations agree on increases in intensity in the SON season and decrease in frequency in the JJA season (Table 1).

Simulation	Changes to frequency					Changes to intensity				
	Annual	DJF	MAM	JJA	SON	**Annual**	DJF	MAM	JJA	SON
1	**-21.95**	+620.00	-37.50	-26.67	-20.00	**+1.67**	+4.68	-1.62	+1.03	+1.97
2	**-14.81**	-22.58	-4.35	-13.04	-17.20	**+4.42**	+3.91	+7.43	+3.23	+4.32
3	**-1.52**	-8.33	-13.33	-1.92	+3.77	**+1.75**	-4.91	+1.5	+1.74	+2.05
4	**-4.76**	+22.20	-36.36	-7.81	+18.46	**+4.56**	+9.97	+20.30	+6.29	+0.87
5	**-12.56**	-2.17	-8.00	-4.88	-32.26	**+2.02**	+1.38	+0.83	+2.66	+3.14

Table 1: Percentage changes in the annual and seasonal frequencies and maximum wind speeds of simulated TCs between the future periods (2035 to 2064) compared to the historical period (1971 to 2000) for the RCP8.5 scenario. Model simulations 1 to 3 are HadGEM3-RA driven by HadGEM2-ES, CNRM-CM5 and MRI-CGCM3, and simulations 4 and 5 are PRECIS and RegCM4 driven by HadGEM2-ES (UK MET office, 2016).

31. The Philippines will experience increased storm surges and storm surge height in the future due to rising sea level. Sea level is expected to rise between 15 and 30 cm by the mid-21st century and by 30 to 110 cm by the end of the century (UK MET office).

32. These analyses are supported by the most recent IPCC Sixth Assessment Report (AR6), which states that there will be an increase in the proportion of category 4-5 tropical cyclones (the highest categories) and an increase in associated rainfall. The latest climate projections, available on the IPCC

AR6 Interactive Atlas, also indicate a future projected significant increase in rainfall for the northern part of the Philippines, and a small non-significant future reduction in the south.

Summary and overview of high impact areas of the country

33. The Philippines has experienced rising temperatures over the last 50 years and is projected to see continued increases in the future, especially in the spring (MAM) months. With minimum (nighttime) temperatures increasing 3x faster than maximum temperatures, decreased diurnal variability will impact agricultural productivity. Historical precipitation trends show a tendency toward drier dry seasons (January-March) and wetter rainy seasons (July-September) especially in the north and central regions of the country. Recent projections of future precipitation show increases in northern regions and decreases in the south. Drought prone areas in the south will be further impacted as a result of this decrease. Trends in tropical cyclone suggest no significant trend in the number of TCs, however show an increase in the intensity of TCs and have caused significantly more damage in recent years. In addition, in recent years the southern regions of the country have experienced TCs which historically were not impacted by such events.

34. Due to the extreme diversity of landuse and agricultural practices, and extreme vulnerability particularly of rural farmers, the intensification of extreme events and slow onset climatic changes will be detrimental to livelihoods in the Philippines. The following sections will discuss these impacts in more detail at sub-national scale. Figure 16 below shows the 2010 landcover map of the Philippines overlain with major land use and climate impact regions identified.

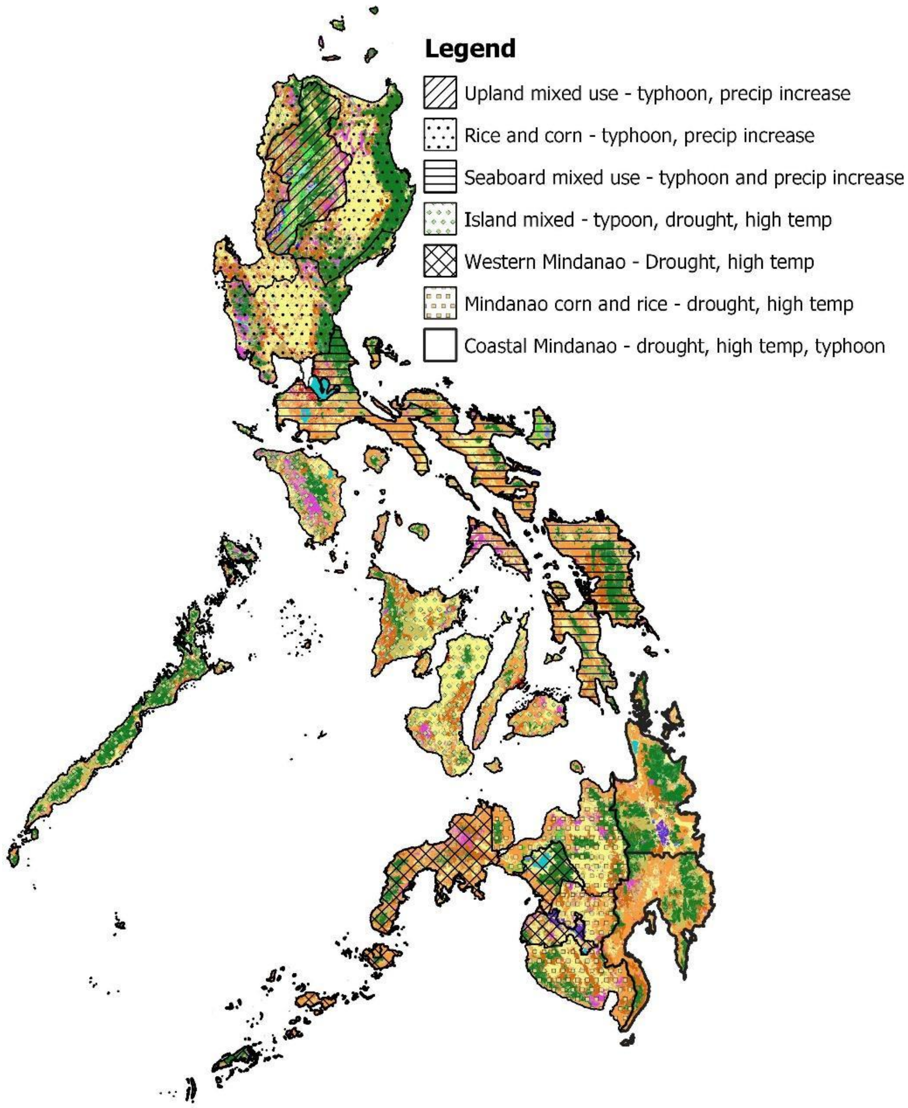

Figure 16: Landcover map of the Phillipines and broad land use and climate impact regions outlined in legend.

2.1.2 Climate trends and projections by priority climate change region

North-east Luzon and Cordillera

Current climate and agriculture

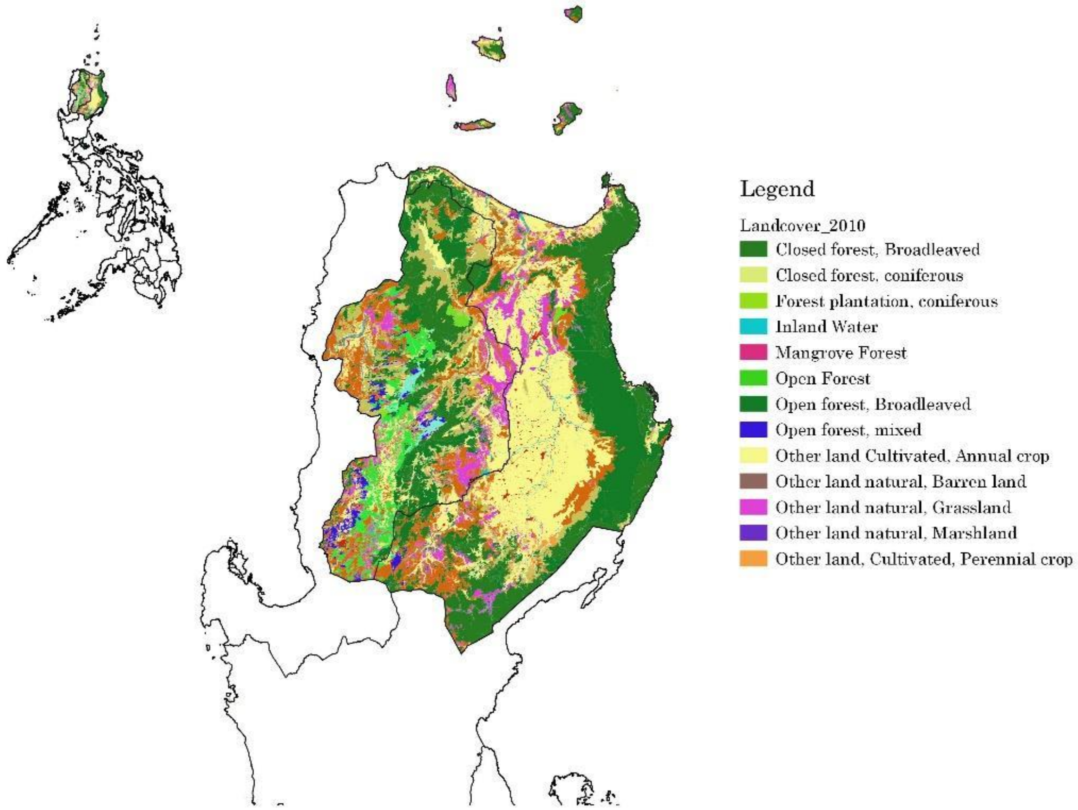

Figure 17: Landcover map of North-east Luzon and Cordillera.

35. Based on the modified coronas classification system (MCCS) for climate typology, Luzon is comprised of all four climate types present in the Philippines. The eastern side of the island is classified as type II with no dry season and a pronounced period of heavy rain from December to February. The center Cordillera region is classified as type III with a short dry period from December to February.

36. The key climate-related challenges affecting agriculture in Luzon are tropical cyclones or typhoons and drought. Up to 54% of rainfall in Luzon can be attributed to tropical cyclones, an increase of 19% from 15 years ago (Bagtasa G, 2017).

37. Drought also affects all commodities especially upland corn production areas which are rain-fed. The severity of the droughts in Luzon is strongly tied to the El Niño Southern Oscillation (ENSO), which has a strong modulating effect on rainfall patterns in the Philippines. The 2015-2016 El Niño event, one of the most powerful in modern times, is causing dry spells in the west of Luzon, including Benguet (IFRC, 2016).

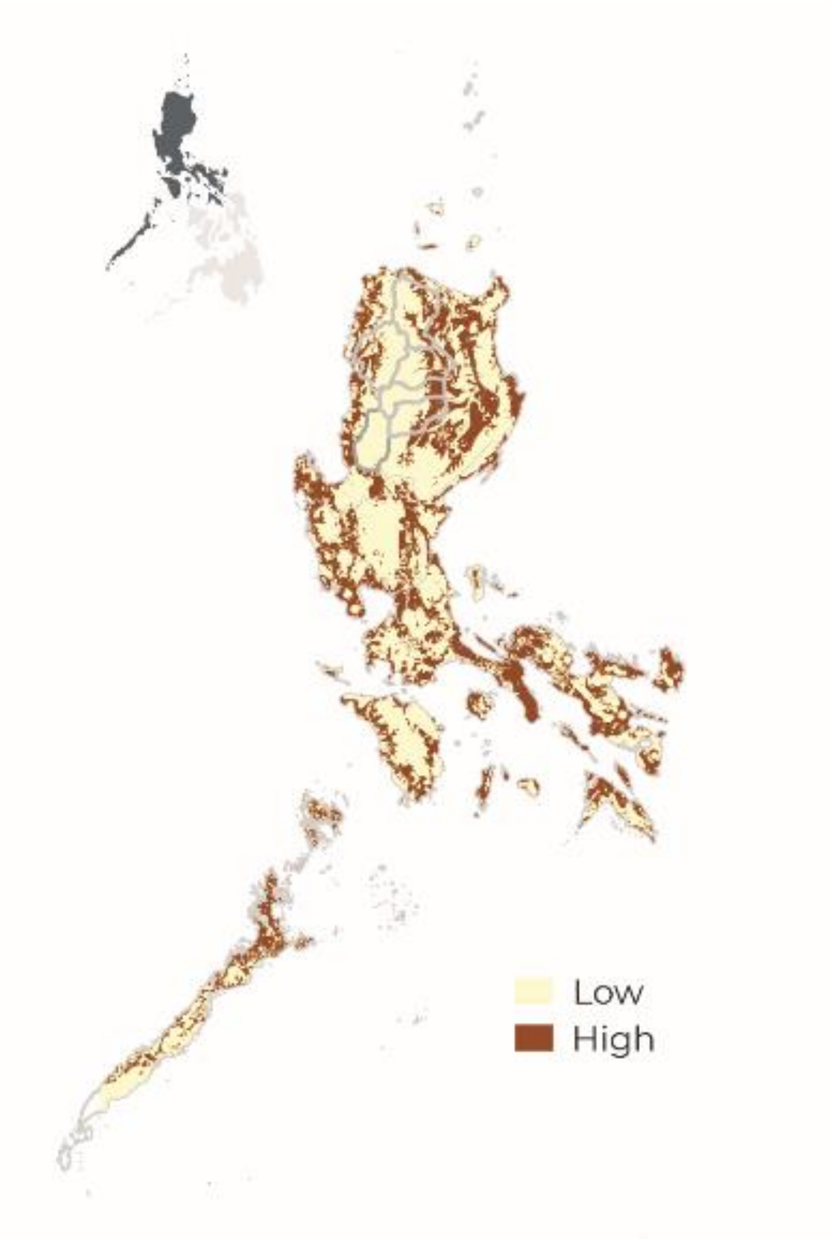

Figure 18: The drought map was acquired from the AMIA 1 dataset. It is produced using the integration of groundwater potential from NWRB, incidence of drought from the Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA), and air temperature.

38. Luzon is the top contributor to the agricultural production of the Philippines. Central Luzon remains to be the rice granary of the country while the Cordillera Region is the key source of cabbage, potato, and other highland vegetables. Luzon has also a major contribution to corn production.

39. Lowland rice farming communities are vulnerable to flooding due to heavy rains caused by strong typhoons while highland vegetable and upland corn farming communities are vulnerable to soil erosion, landslides, and strong winds.

Future

40. Based on the baseline condition (1997-2000), corn has a high to very high climate suitability in the Eastern side of Luzon specifically in Region 2 (Cagayan Valley), East of Region 3 (Central Luzon), Region 4A (CALABARZON), Region 5 (Bicol), and majority of Region 4B (Mindoro, Marinduque, and Romblon). By 2050, the climate suitability of corn in the region is expected to decrease by roughly 60% from very high to marginally suitable in the northern part of Luzon and all over Region 4 (CIAT, Figure 19).

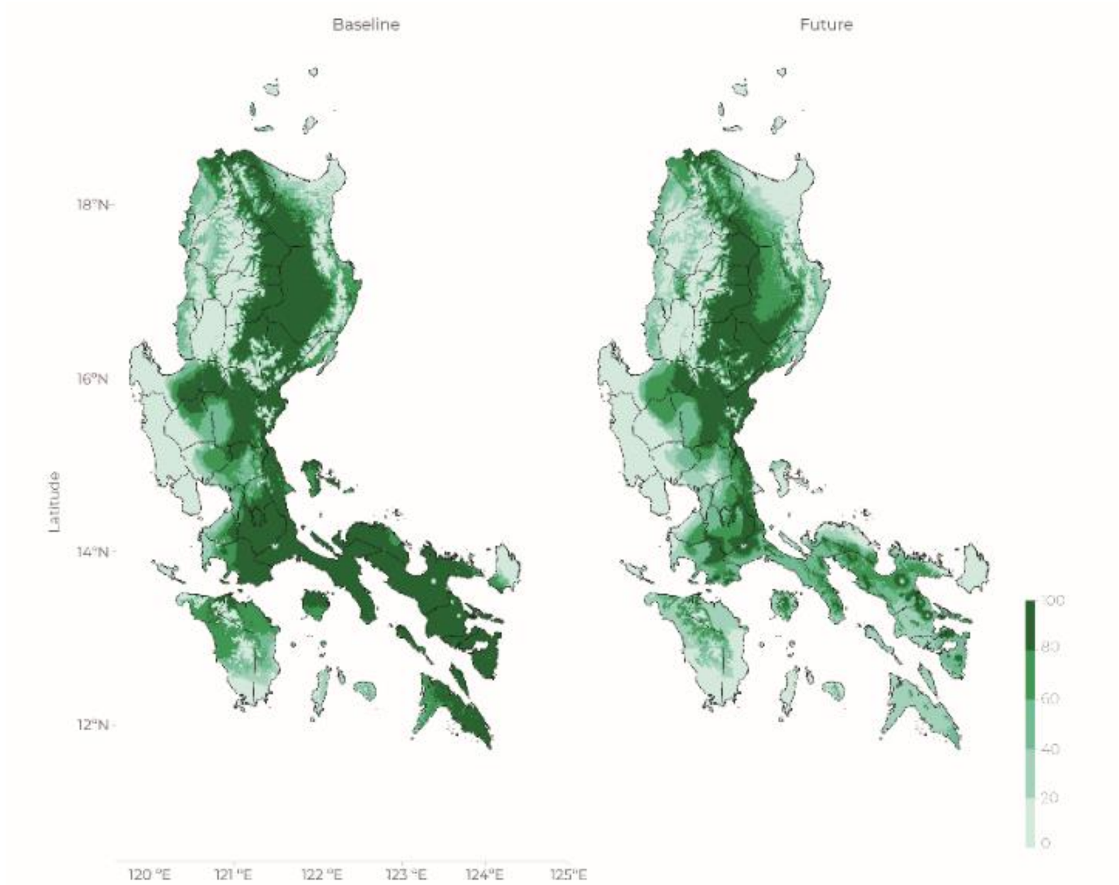

Figure 19: Climate suitability of corn, current and 2050. The climate suitability maps represent how well the crop will thrive in area based on climatic factors such as temperature and rainfall. The suitability ranges from 0 to 100 percent with an interval of 20: 100 - very high, 80 - high, 60 - moderate, 40 - marginal, and 20 - very marginal.

41. Rice is typically suitable in almost all the lowlands of Luzon in the baseline condition (1997-2000). It has a high to very high climate suitability in Region 1 (Ilocos), Region 2 (Cagayan Valley), Region 3 (Central Luzon), Region 4A (CALABARZON), Region 5, and majority of Region 4B (Mindoro, Marinduque, and Romblon). By 2050, some areas will experience losses while others will become more favourable to grow rice. The northern part of Luzon, Region 2, will start to decrease its suitability by roughly 60% from very high to marginal suitability. Region 1, Region 3, Region 4A, Region 5, and Region 4B, however, will gain suitability by almost 80% (CIAT, Figure 20).

42. An IFPRI study in 2015, projected that by 2050 the impacts of climate change on low fertilizer, rainfed rice would worsen in Luzon, with some areas experiencing losses of 20% (Rosegrant, M.W et al. 2016).

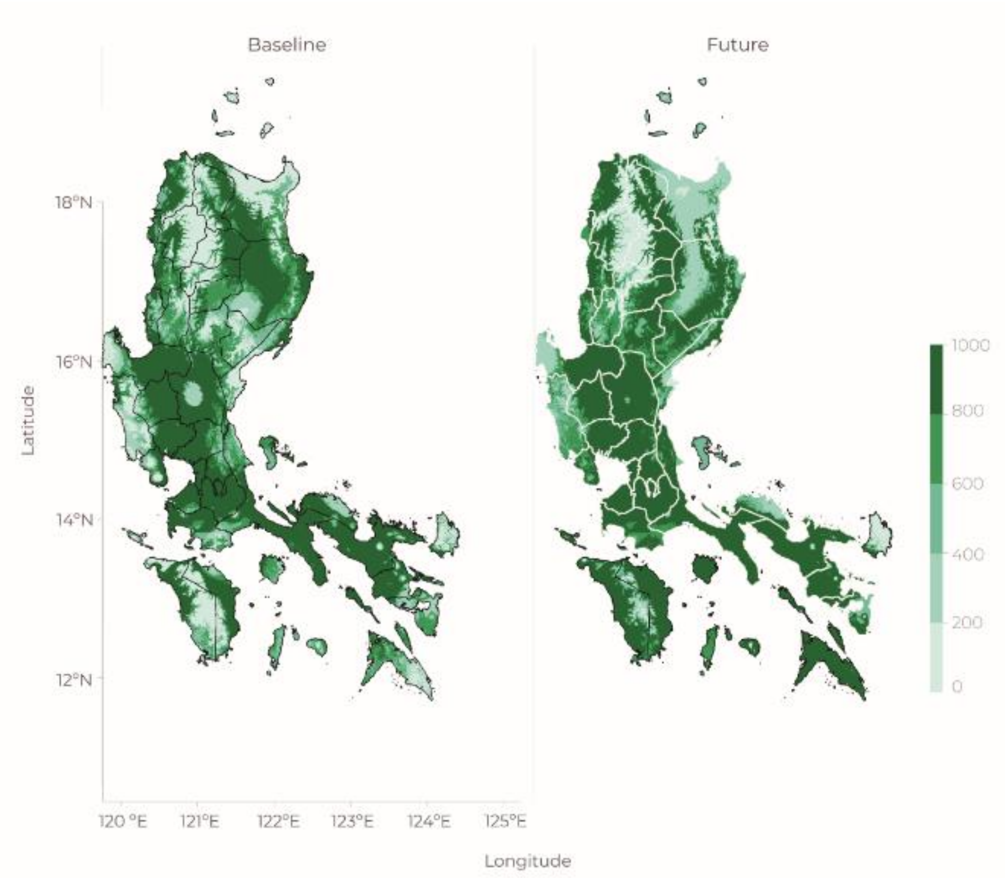

Figure 20: Climate suitability of rice, current and 2050. The climate suitability maps represent how well the crop will thrive in area based on climatic factors such as temperature and rainfall. The suitability ranges from 0 to 100 percent with an interval of 20: 100 - very high, 80 - high, 60 - moderate, 40 - marginal, and 20 - very marginal.

Eastern Seaboard (Bicol)

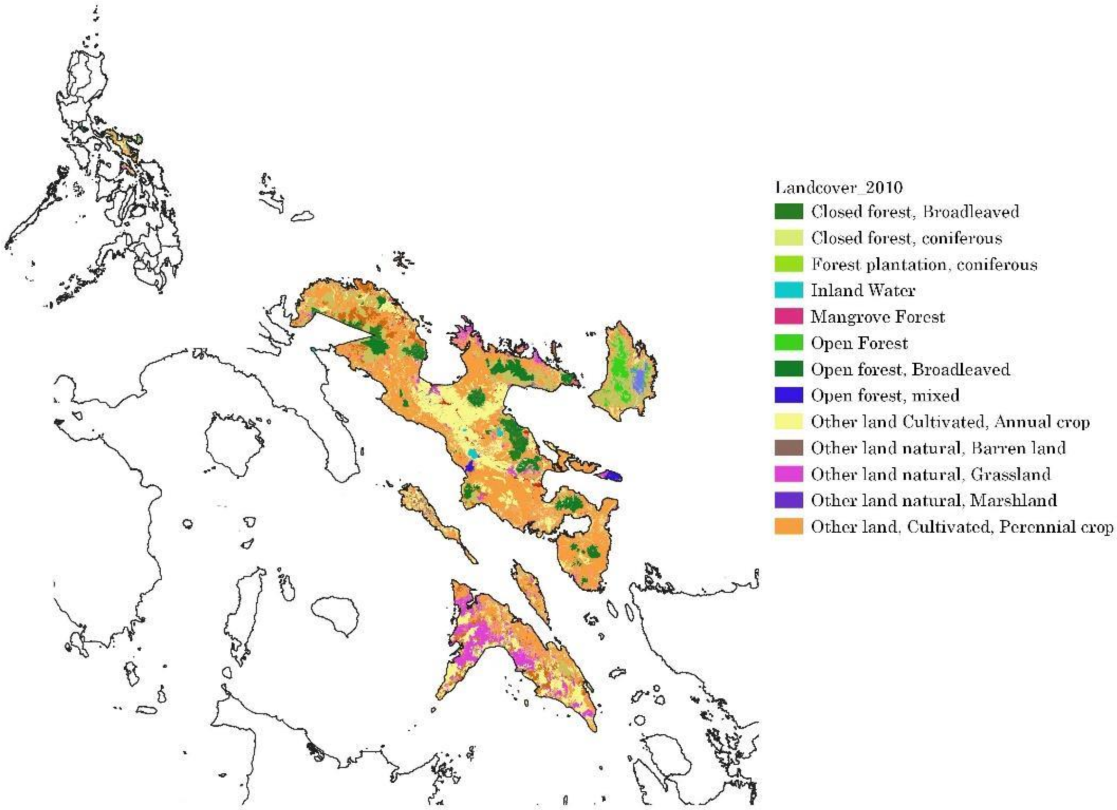

Figure 21: Landcover map of Bicol region

43. Eastern Seaboard, particularly Bicol region, has elements of both Luzon and Eastern Visayas in terms of climate and agriculture. See Figures 18 for drought map, 19 and 20 for climate suitability of corn and rice. The increase in mean temperatures and hot days experienced in Visayas and Bicol, coupled with the reduction in the rain bought by the southwest monsoon have increased the frequency and intensity of droughts (Cruz et al. 2017). Coconut is the country's top export commodity (NEDA, 2017). In total across the Philippines, an estimated 33 million coconut trees across 295,191 ha were damaged by typhoon Yolanda, risking the livelihoods of more than one million farming households (Rodriguez, 2014). The region has mainly coconut-based and other mixed farming systems, largely rainfed (6th largest producer in country) with some irrigated areas. The region did not show significant effect of climate change on coconut by 2050. The assessment, however, does not take into account the impact of extreme events such as droughts and typhoon. Increases in tropical cyclone intensity, strong winds, and storm surges will pose significant threats to the coconut-based farming system of the region.

Western Central Mindanao (Northern Mindanao, SOCCSKSARGEN)

Current climate and agriculture

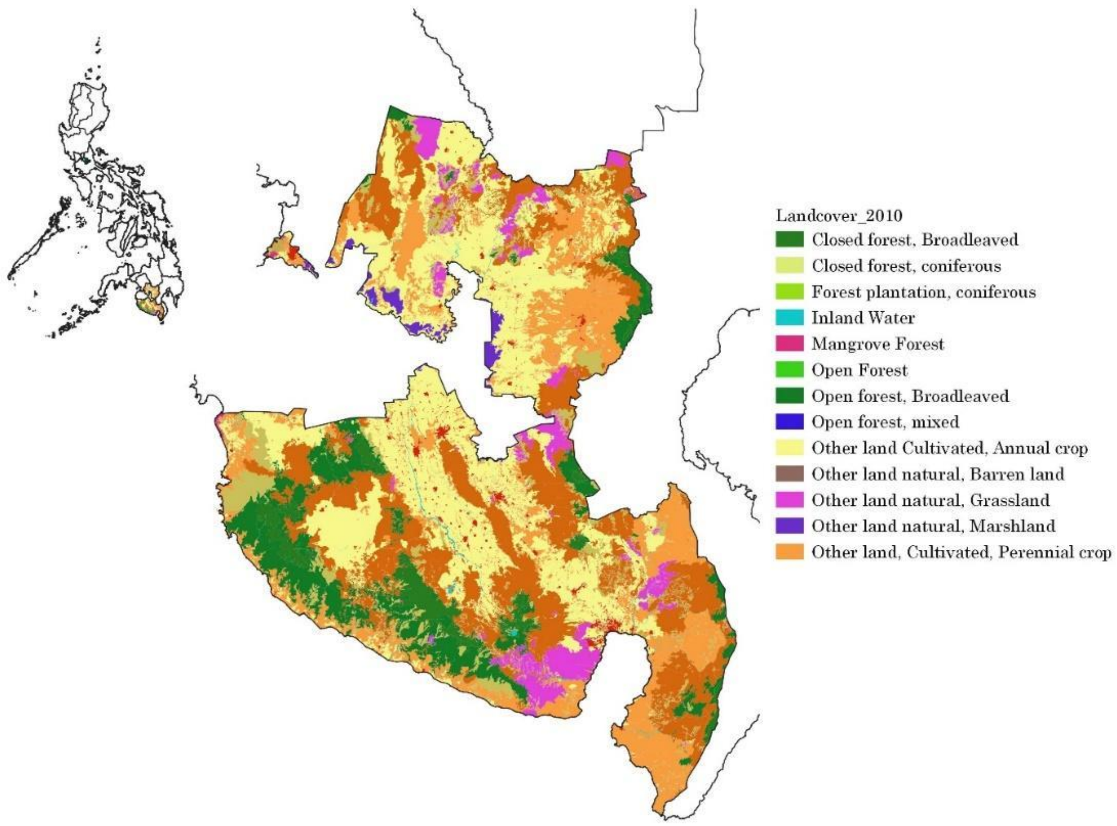

Figure 22: Landuse map for SOCCSKSARGEN province.

44. Based on the modified coronas classification system (MCCS) for climate typology, Mindanao is comprised of three of the four climate types in the Philippines. The eastern side of the island (in Region 13) is classified as type II with no dry season and a pronounced period of heavy rain from December to February. The center of the island (Regions 10, 11 & 12) is classified as type IV with rain distributed evenly throughout the year, while the western portion of the island (Regions 9 & ARMM) are classified as type III with a short dry period from December to February (PAGASA, 2011).

45. While historically Mindanao has avoided the impacts of typhoons, due to its geographic location south of the typhoon belt, a recent analysis of tropical cyclones trends in the Philippines observed a southward shift in the landfall of typhoons, with a reduction in the incidence in Northern and Central Luzon and increases in Visayas and Mindanao (David C P, 2013).

46. Mindanao and Bukidnon province (Northern Mindanao) in particular have been identified as particularly drought-prone areas (Cruz, R. et al. 2017). This can be seen in Figure 26, with large areas in Southern Bukidnon and Central Davao del Norte identified as high risk for drought. In 2016 Mindanao experienced a severe drought which directly impacted Bukidnon and Davao del Norte, with many provinces declaring a state of calamity. It is estimated that 181,687 farmers and 224,834 hectares of agricultural land in the Philippines were affected, with an estimated USD 81 million of losses in agricultural production (IFRC, 2016).

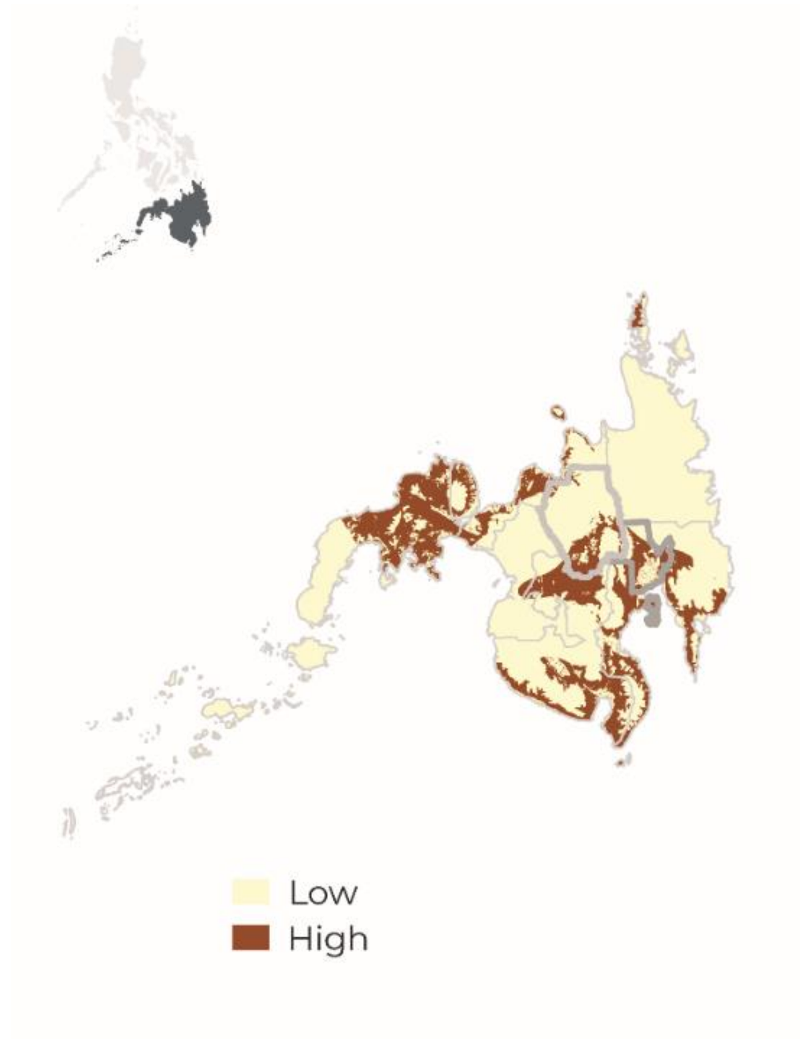

Figure 23: The drought map was acquired from the AMIA 1 dataset. It is produced using the integration of groundwater potential from NWRB, incidence of drought from the Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA), and air temperature.

47. An Oxfam assessment in Mindanao in April 2016, found that the impacts of drought resulting from the 2015 El Niño had devastated yields and left families reducing the quality and quantity of their meals (Oxfam, 2016).

48. Drought and heavy rains are the key climate-related hazards affecting Mindanao's agricultural sector. In recent years, farmers have observed longer periods of drought and heavier rains. In addition, the effects of typhoons—traditionally affecting island groups further to the north—have increasingly been experienced by farmers in Mindanao (CIAT, 2018).

49. The Mindanao island group is considered the agricultural basket of the Philippines, accounting for 40% of all agricultural production and 60% of agricultural exports. Yellow corn (Bukidnon), coffee (Bukidnon) and cacao (Davao del Norte) are especially important commodity value chains in the region.

Future

50. Based on the suitability map for coffee Robusta (Figure 27 below), Robusta can be widely planted in Mindanao but with some limitations in high elevation areas. Based on the result of the model, a large share of suitable areas are at risk for coffee in the low-lying areas of Mindanao, specifically, low lying areas of SOCCSKSARGEN, Caraga, Davao, and Zamboanga Region. These areas are important production areas for coffee with SOCCSKSARGEN and Davao represent >50% of the coffee production in the Philippines

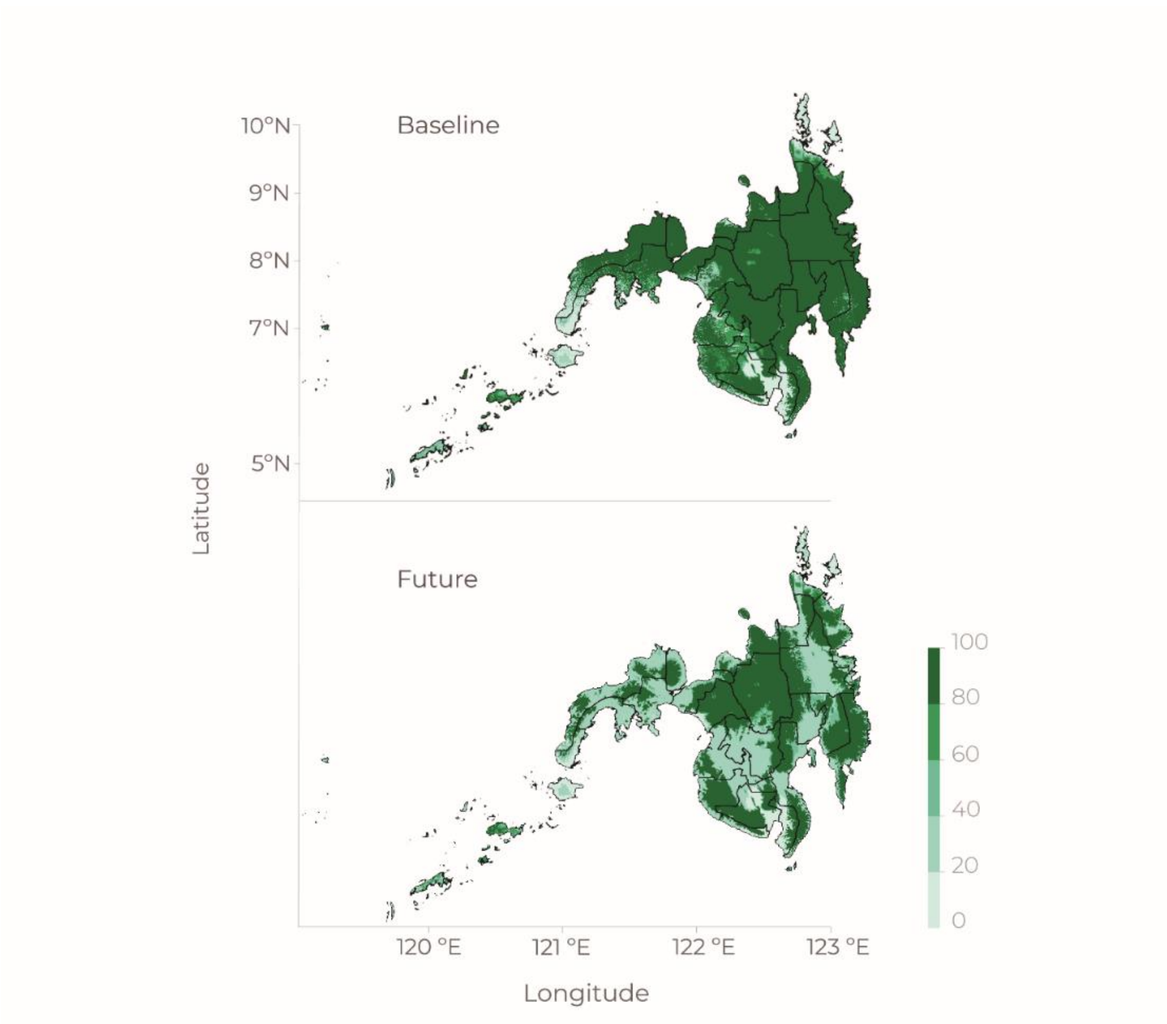

Figure 24: Climate suitability of coffee, current and 2050. The climate suitability maps represent how well the crop will thrive in an area based on climatic factors such as temperature and rainfall. The suitability ranges from 0 to 100 percent with an interval of 20: 100 - very high, 80 - high, 60 - moderate, 40 - marginal, and 20 - very marginal.

51. Based on the baseline condition (1997-2000), corn has a very high climate suitability in more than 60% of Mindanao island. Particularly, it is considered highly suitable in the regions of Zamboanga, ARMM, SOCCSKSARGEN, and Northern Mindanao. By 2050, the crop's suitability is expected to decrease in the regions of Zamboanga, ARMM, and SOCCSKSARGEN. Whereas some areas in Davao and Caraga will become favorable to grow the crop.

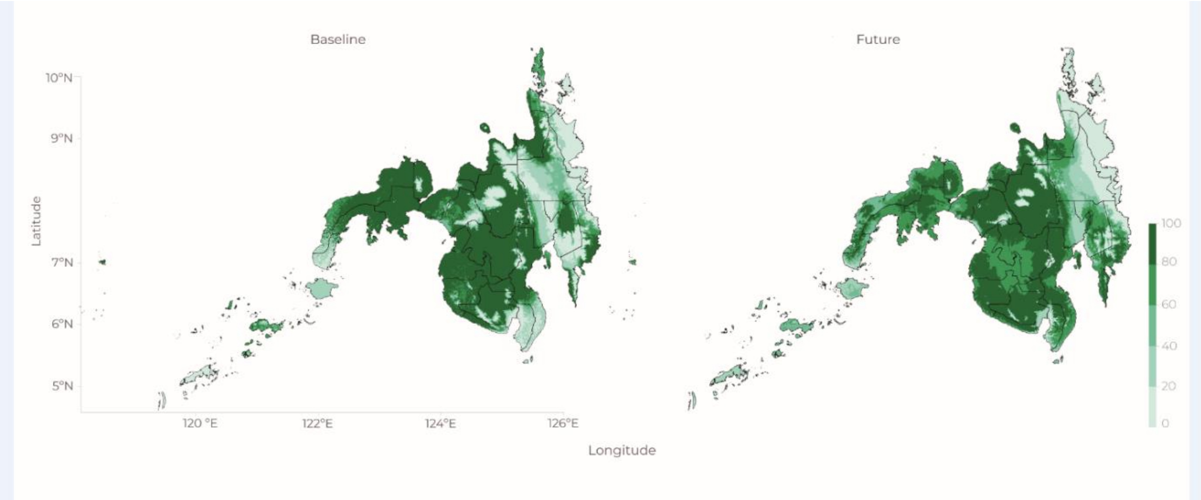

Figure 25: Climate suitability of corn, current and 2050. The climate suitability maps represent how well the crop will thrive in an area based on climatic factors such as temperature and rainfall. The suitability ranges from 0 to 100 percent with an interval of 20: 100 - very high, 80 - high, 60 - moderate, 40 - marginal, and 20 - very marginal.

52. Mindanao is highly suitable for cocoa production currently and under the projected impacts of climate change. The suitability mapping approach used is however unable to account for the impact of extreme events on cocoa production in Davao del Norte. El Niño induced droughts have already been linked with falling cocoa yields in Brazil and will likely have similar impacts on production in the Philippines (Gateau-Rey L, 2018).

Summary

53. The climate rationale highlights the diverse climate landscapes and climate risks observed across regions in the Philippines. Compounded with the highly variable agricultural systems within and between regions, the climate risks and impacts identified are context and location specific and appropriate resilience measures need to be identified and assessed accordingly.

54. These analyses of climate trends and projections by region are also supported by the WMO-GCF platform (climateinformation.org) - see Table 2. Each of these regions and provinces has distinct geographical, agricultural, and demographic characteristics. Table 3 summarizes project target regions, their farming systems, socio-economic and geographical features, and expected climate change impacts. Table 4 also summarizes the agricultural context and major climate-related hazards identified in the project regions, and some of the key climate resilient measures that will address those risks. However these measures will be continuously refined to meet local needs, incorporate traditional knowledge and apply updated scientific information.

Table 2 – Changes in key climate variables with respect to 1981-2010 based on CORDEX East Asia (GCF-WMO platform (climateinformation.org). Ensemble agreement is indicated in brackets – "many" indicates "many models agree on the direction of change" while "some" indicates "some models agree on the direction of change", according to climateinformation.org.

RCP8.5 in 2071-2100 with respect to 1981-2010

	Province	Temperature (degrees C)	Precipitation (%)	Aridity actual (%)	Soil moisture (%)	Water discharge (%)	Water runoff (%)
Region II – Cagayan Valley	Cagayan	+2 (many; increase)	-6 (some; decrease)	-2 (some; decrease)	-7 (many; decrease)	-21 (some; decrease)	-19 (many; decrease)
Region II – Cagayan Valley	Isabela	+2 (many; increase)	-8 (some; decrease)	-3 (some; decrease)	-11 (many; decrease)	-19 (some; decrease)	-26 (many; decrease)
Cordillera Autonomous Region	Apayao	+2 (many; increase)	-5 (many; decrease)	+5 (some; increase)	-7 (many; decrease)	-11 (many; decrease)	-11 (many; decrease)
Cordillera Autonomous Region	Ifugao	+2 (many; increase)	-8 (some; decrease)	+8 (some; increase)	-11 (many; decrease)	-24 (some; decrease)	-24 (some; decrease)
Cordillera Autonomous Region	Kalinga	+2 (many; increase)	-5 (some; decrease)	+7 (some; increase)	-9 (many; decrease)	-18 (some; decrease)	-17 (some; decrease)
Region V – Bicol	Camarines Norte	+3 (many; increase)	+1 (many; increase)	+5 (many; increase)	-2 (many; decrease)	-7 (some; decrease)	-6 (some; decrease)
Region V – Bicol	Camarines Sur	+3 (many; increase)	+2 (many; increase)	+1 (many; increase)	-2 (some; decrease)	-5 (some; decrease)	-3 (some; decrease)
Region X - Northern Mindanao	Bukidnon	+3 (many; increase)	-20 (some; decrease)	+35 (some; increase)	-16 (many; decrease)	-39 (some; decrease)	-39 (some; decrease)
Region XII – Soccsksargen	North Cotabato	+3 (many; increase)	-13 (some; decrease)	+19 (many; increase)	-15 (many; decrease)	-35 (many; decrease)	-26 (many; decrease)

RCP8.5 in 2041-2070 with respect to 1981-2010

	Province	Temperature (degrees C)	Precipitation (%)	Aridity actual (%)	Soil moisture (%)	Water discharge (%)	Water runoff (%)

Region II – Cagayan Valley	Cagayan	+1 (many; increase)	0 (some; increase)	+15 (many; increase)	-2 (many; decrease)	-2 (some; decrease)	-2 (many; decrease)
Region II – Cagayan Valley	Isabela	+1 (many; increase)	-2 (some; decrease)	+1 (some; increase)	-4 (many; decrease)	-1 (some; decrease)	-7 (some; decrease)
Cordillera Autonomous Region	Apayao	+1 (many; increase)	-1 (some; decrease)	+2 (many; increase)	-4 (many; decrease)	-4 (some; decrease)	-4 (some; decrease)
Cordillera Autonomous Region	Ifugao	+1 (many; increase)	-3 (some; decrease)	+4 (many; increase)	-6 (many; decrease)	-9 (some; decrease)	-9 (some; decrease)
Cordillera Autonomous Region	Kalinga	+1 (many; increase)	-2 (some; decrease)	+11 (many; increase)	-6 (many; decrease)	-7 (many; decrease)	-6 (many; decrease)
Region V – Bicol	Camarines Norte	+2 (many; increase)	0 (some; increase)	+2 (many; increase)	-2 (many; decrease)	-5 (some; decrease)	-4 (some; decrease)
Region V – Bicol	Camarines Sur	+2 (many; increase)	0 (some; decrease)	-2 (some; decrease)	-2 (some; decrease)	-4 (some; decrease)	-3 (some; decrease)
Region X - Northern Mindanao	Bukidnon	+2 (many; increase)	-16 (some; decrease)	+19 (some; increase)	-11 (some; decrease)	-30 (some; decrease)	-30 (some; decrease)
Region XII – Soccsksargen	North Cotabato	+2 (many; increase)	-12 (some; decrease)	+9 (some; increase)	-14 (some; decrease)	-27 (some; decrease)	-22 (some; decrease)

RCP4.5 in 2071-2100 with respect to 1981-2010

	Province	Temperature (degrees C)	Precipitation (%)	Aridity actual (%)	Soil moisture (%)	Water discharge (%)	Water runoff (%)
Region II – Cagayan Valley	Cagayan	+1 (many; increase)	-2 (some; decrease)	-9 (some; decrease)	-3 (many; decrease)	-2 (many; decrease)	-4 (some; decrease)
Region II – Cagayan Valley	Isabela	+1 (many; increase)	+1 (some; increase)	-3 (some; decrease)	-3 (many; decrease)	-2 (many; decrease)	-2 (many; decrease)
Cordillera Autonomous Region	Apayao	+1 (many; increase	-2 (some; decrease)	+17 (some; increase)	-5 (many; decrease)	-4 (some; decrease)	-4 (some; decrease)
Cordillera Autonomous Region	Ifugao	+1 (many; increase	-1 (many; decrease)	+6 (many; increase)	-5 (many; decrease)	-6 (many; decrease)	-6 (many; decrease)
Cordillera Autonomous Region	Kalinga	+1 (many; increase	+1 (some; increase)	+4 (some; increase)	-3 (many; decrease)	0 (some; decrease)	0 (some; increase)
Region V – Bicol	Camarines Norte	+1 (many; increase	+4 (many; increase)	0 (some; decrease)	-1 (some; decrease)	+3 (some; increase)	+3 (some; increase)
Region V – Bicol	Camarines Sur	+2 (many; increase	+4 (many; increase)	-1 (some; decrease)	+1 (some; increase)	+4 (some; increase)	+4 (some; increase)

Region X - Northern Mindanao	Bukidnon	+2 (many; increase	-2 (some; decrease)	+14 (some; increase)	-4 (many; decrease)	-5 (some; decrease)	-5 (some; decrease)
Region XII – Soccsksargen	North Cotabato	+1 (many; increase	-3 (some; decrease)	+2 (many; increase)	-5 (some; decrease)	-5 (many; decrease)	-7 (many; decrease)

RCP4.5 in 2041-2070 with respect to 1981-2010

	Province	Temperature (degrees C)	Precipitation (%)	Aridity actual (%)	Soil moisture (%)	Water discharge (%)	Water runoff (%)
Region II – Cagayan Valley	Cagayan	+1 (many; increase)	-1 (some; decrease)	-16 (many; decrease)	-1 (many; decrease)	-2 (some; decrease)	-7 (some; decrease)
Region II – Cagayan Valley	Isabela	+1 (many; increase)	0 (some; increase)	-5 (some; decrease)	-2 (some; decrease)	-2 (some; decrease)	-6 (some; decrease)
Cordillera Autonomous Region	Apayao	+1 (many; increase)	+4 (some; increase)	+1 (some; increase)	-1 (some; decrease)	+7 (some; increase)	+7 (some; increase)
Cordillera Autonomous Region	Ifugao	+1 (many; increase)	-1 (some; decrease)	-1 (some; decrease)	-2 (some; decrease)	-8 (many; decrease)	-8 (many; decrease)
Cordillera Autonomous Region	Kalinga	+1 (many; increase)	0 (some; increase)	-3 (some; decrease)	-1 (some; decrease)	-5 (many; decrease)	-5 (many; decrease)
Region V – Bicol	Camarines Norte	+1 (many; increase)	+4 (some; increase)	-1 (some; decrease)	+1 (some; increase)	+2 (some; increase)	+2 (some; increase)
Region V – Bicol	Camarines Sur	+1 (many; increase)	+4 (some; increase)	0 (some; increase)	0 (some; increase)	+2 (some; increase)	+2 (some; increase)
Region X - Northern Mindanao	Bukidnon	+1 (many; increase)	-2 (some; decrease)	+2 (some; increase)	-4 (some; decrease)	-6 (some; decrease)	-6 (some; decrease)
Region XII – Soccsksargen	North Cotabato	+1 (many; increase)	+1 (some; increase)	+12 (some; increase)	-1 (some; decrease)	-6 (some; decrease)	-4 (some; decrease)

Table 3. Baseline farming systems and climate change impacts in priority regions targeted by the project

High-impact areas and project target regions	Major baseline vulnerable farming systems	Socio-economic and geographical features	Expected climate change impacts
High-impact Area: Northeast Luzon Project focus: Cagayan Valley - Region II	Rice (irrigated and rainfed; 12% of national production, ranked 2nd) and corn (maize; 21% of national production, ranked 1st) for subsistence and national staple food supply.	Large number of small-scale farmers and agriculture workers. High rural population density. In project provinces, number of farm households: 420,000; number of rural poor: 510,000; poverty rate: 18%.	Increase in flooding and damage due to heavy precipitation and tropical cyclones. Increase in temperature damage, and droughts from combined effects of extreme heat, lower precipitation and lower soil moisture.
High-impact Area: Cordillera Project focus: Cordillera Administrative Region	Upland and mountain farming (rice and corn), agroforestry, often subsistence. Indigenous food production systems. Commercial vegetables in more accessible areas (1st ranked for potato and cabbage, and other vegetables).	Relatively low population density, with the majority of the population being indigenous peoples. High levels of poverty. In project provinces, number of farm households: 80,000; number of rural poor: 160,000; poverty rate: 30%.	Increase in damage due to increased heavy precipitation and resulting landslides. Increase in temperature damage, and droughts from combined effects of extreme heat, lower precipitation and lower soil moisture.
High-impact Area: Eastern Seaboard Project focus**:** Bicol – Region V	Coconut-based and other mixed farming systems, largely rainfed (6th largest producer in country). Some irrigated areas.	High densities of poor small-scale farmers. Small areas of indigenous peoples in upland areas. In project provinces, number of farm households: 170,000; number of rural poor: 782,000; poverty rate: 31%.	Increase in tropical cyclone intensity. Increase in wind damage and likelihood of cyclone-related floods. In coastal areas, increase in likelihood of storm surges.
High-impact Area: Western and Central Mindanao Project focus: Northern Mindanao - Region X and SOCCSKSARGEN - Region XII)	Rainfed corn and rice, some irrigated areas. Mixed upland farming, cash crops (e.g. coffee and cacao) and agroforestry. (Together 2nd ranked corn producing area)	High densities of poor small-scale farmers. Various groups of indigenous peoples especially in upland areas. Muslim communities in the western provinces. In project provinces, number of farm households: 270,000; number of rural poor: 1.24 million; poverty rate: 44%.	Increase in temperature, and reduced precipitation, and drought from combined effects of extreme heat, lower precipitation and lower soil moisture. Possibly new areas exposed to tropical cyclones, with damage and extreme rain events.

Table 4. Climate risks in different regions and farming systems, and adaptation interventions that will address the risks

Region	Major farming systems	Climate variable	Historical trend	Future projection (primary)	Secondary climate impact	Adaptation interventions (and mitigation, if any)	Adaptation benefits (and mitigation, if any)
North East Luzon	1) Rice lowland farming 2) Corn lowland farming	Rainfall	Slight increase in rainfall in DJF and MAM and slight decrease in JJA and SON between 1951-2010	Increase in precipitation in all seasons by >50% by 2050 under RCP4.5	Increase in flooding during rainy season and increase in drought during dry season	Flood tolerant varieties, timing of farm practices, farm infrastructure and design, disaster insurance	More climate-resilient production (i.e. flood), and higher and stable income for farmers
		Temperature	Decrease in number of cold nights (1951-2010)	Increase in temperature by up to 1.5C by 2050 under RCP4.5	Increase in extreme temperature, drought during dry season	Heat and drought tolerant varieties, timing of farm practices (shorter growing seasons), water managements and conservation, including alternate wetting and drying method, irrigation, seasonal and short-term forecasts	More climate-resilient production (i.e. heat and drought), and higher and stable income for farmers. Efficient water use. Reduced methane emissions.
		Tropical cyclone	Increasing intensity, slightly decreasing frequency	Increase in TC intensity	Increase in flooding and damage due to TC	Early warning systems, Strengthened infrastructure, disaster insurance, integrated farming practices	Production damage and loss are reduced through anticipatory actions.
		Sea level rise	Sea level rise between 1993-2015 up to 4.5-5 mm per year (UK Met)	Continuous increase	Increase in flooding and damage. Saline intrusion.	Early warning. Stress tolerant varieties.	More climate-resilient production (i.e. saltwater), and higher and stable income for farmers.
Cordillera	1) Mixed upland farming	Rainfall	Slight increase in rainfall in DJF and MAM and slight decrease in JJA and SON between 1951-2010	Increase in precipitation in DJF by >25% by 2050 under RCP4.5	Increase in flooding during rainy season	Integrated farming practices, soil, slope and canopy protection	Soil conservation and less erosion.

		Temperatur e		Increase in temperature by up to 2C in MAM by 2050 under RCP4.5	Increase in extreme temperature, drought during dry season	Heat and drought tolerant varieties, timing of farm practices (shorter growing seasons), water managements and conservation, irrigation, seasonal and short-term forecasts	More climate-resilient production (i.e. heat and drought), and higher and stable income for farmers. Efficient water use.
		Tropical cyclone	Increasing intensity, slightly decreasing frequency	Increase in TC intensity	Increase in flooding and damage due to TC	Early warning systems, Strengthened infrastructure, disaster insurance, integrated farming practices	Production damage and loss are reduced through anticipatory actions.
Eastern Seaboard (Bicol)	1) Mixed farming 2) Coconut	Rainfall	Decreased rainfall by up to -20 mm/decade between 1951-2010 especially in JJA and SON	Increase in precipitation by >50% in SON by 2050 under RCP4.5	Increase in flooding during rainy season	Flood tolerant varieties, timing of farm practices, farm infrastructure and design, disaster insurance	More climate-resilient production (i.e. flood), and higher and stable income for farmers.
		Temperatur e	Decrease in cold nights over period 1951-2010	Increase in temperature by up to 1-1.5C by 2050 under RCP4.5	Increase in extreme temperature, drought during dry season	Heat and drought tolerant varieties, timing of farm practices (shorter growing seasons), water managements and conservation, irrigation, seasonal and short-term forecasts	More climate-resilient production (i.e. heat and drought), and higher and stable income for farmers. Efficient water use.
		Tropical cyclone	Increasing intensity, slightly decreasing frequency	Increase in TC intensity	Increase in flooding and damage due to TC	Early warning systems, Strengthened infrastructure, disaster insurance, integrated farming practices	Production damage and loss are reduced through anticipatory actions.
		Sea level rise	Sea level rise between 1993-2015 up to 4.5-5 mm per year (UK Met)	Continuous increase	Increase in flooding and damage. Saline intrusion.	Early warning. Stress tolerant varieties.	More climate-resilient production (i.e. saltwater), and higher and stable income for farmers.

Western Central Mindanao (Northern Mindanao and SOCCSK-SARGEN)	1) Corn dryland farming 2) Rice dryland farming 3) Mixed farming	Rainfall	Increase rainfall by up to 40 mm/decade (PAGASA) 1951-2010 especially during JJA	Decrease precipitation by up to 25% in MAM and SON by 2050 under RCP4.5	Increase in drought during dry season, increase in heatwave	Flood tolerant varieties, timing of farm practices, farm infrastructure and design, disaster insurance	More climate-resilient production (i.e. flood), and higher and stable income for farmers.
		Temperature	Increase in number of hot days 1951-2008 (Cinco *et al.*, 2013)	Increase in temperature by up to 1.5-2C in MAM and JJA by 2050 under RCP8.5	Increase in extreme temperature, drought during dry season	Heat and drought tolerant varieties, timing of farm practices (shorter growing seasons), water managements and conservation, irrigation, seasonal and short-term forecasts	More climate-resilient production (i.e. heat and drought), and higher and stable income for farmers. Efficient water use.
		Tropical cyclone	Increasing intensity, slightly increasing frequency, possible.	Increase in TC intensity	Increase in flooding and damage due to TC	Early warning systems, Strengthened infrastructure, disaster insurance, integrated farming practices	Production damage and loss are reduced through anticipatory actions.

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Section 2.2: Addressing multiple climate impacts with adaptation responses in Philippine smallholder agriculture (Synthesis)

Contents

2.2.1 Adaptation needs in Agriculture in the Philippines

Overview of needs under the Philippine Climate Change Assessment (PhilCCA) Working Groups science reviews

1. For country submissions to the UNFCCC, the PhilCCA Working Groups (WGs) synthesized scientific information from international and local literature in order to provide an assessment of climate change for the Philippines and identify gaps in the scientific literature. It contains comprehensive information on climate change science in the Philippines that can guide everyone in making strategic decisions. The three volumes of PhilCCA and corresponding key findings are as follows:

Working Group 1: The Physical Science Basis. The report identified many areas that need further examination, such as influence of large-scale climate drivers (e.g ENSO, the Madden-Julian Oscillation, the Pacific Decadal Oscillation) on Philippine climate, the effect of sea level rise on saltwater intrusion and storm surges along coastal areas, and local climate impacts of aerosols and land use change, as well as their interaction with the enhanced greenhouse effect. However, such studies require reliable long-term observation records with adequate spatial coverage that is representative of local climate in the country. In light of the high climate-related risk faced by the Philippines and other countries similarly situated in our region, the study stressed the importance of magnifying and sustaining ongoing research activities and to establish a mechanism to consolidate, synthesize, and share scientific data that will be relevant for impact assessment, adaptation and mitigation planning, and development policy formulation.[1]

Working Group 2: Impacts, Vulnerabilities and Adaptation. This assessment provided the current understanding of climate change impacts, vulnerabilities, and adaptation in the Philippines with a focus on critical areas: ecosystems, freshwater resources, coastal systems and low-lying areas, agriculture and fisheries, and human health. In general, major impacts to agricultural production include higher incidence of pests and diseases, low crop productivity/yield, stunted growth, delays in fruiting and harvesting, declining quality of produce, increased labor costs, and low farm income (Tolentino & Landicho, 2013)[2]. The Project preparation findings very much reflect and further deepen these analyses.

Challenges to adaptation identified in the study include the following: (i) absence of localized climate/weather forecast and lack of time-series data that can be used for developing forecasting models; (ii) limited options and inadequate agricultural credit services; (iii) lack of market orientation and appropriate crop insurance schemes; (iv) lack of irrigation facilities; and (v) the unsuitability of varieties and poor quality of seeds provided in seed subsidies (Reyes et al., 2009b). Capacity building in making use of climate information was also identified as mechanism to improve decision tools towards climate risk management strategies[3]. The literature review also identified a wider range of adaptation recommendations (see Box 1 below from WG 2).

[1] PhilCCA Working Group 1: The Physical Science Basis

[2] PhilCCA Working Group 2: Impacts, Vulnerabilities, and Adaptation

[3] Ibid

Working Group 3. Mitigation of Climate Change. This volume focuses on climate change mitigation issues, challenges, and opportunities to provide guidance on low carbon pathways across the energy, agriculture, forestry and other land-use, and waste sectors.

Mitigation strategies in the agriculture sector include improvement in fertilizer management, crop diversification, feed management, manure management, and promotion of organic agriculture. There have already been scientific and empirical studies that guide the legislation of appropriate policies to mainstream these strategies. However, challenges on the adoption of these technologies, including the financial aspect, communication, and capacity building remain[4].

Box 1 Adaptation option identified in wider literature review of adaptation recommendations in the Philippines (WG2 5.7)

The findings of the International Center for Tropical Agriculture (CIAT) profiling on specific crops (Table 1) is also in line with wider literature on adaptation options for agriculture in the Philippines as identified in the WG2 submission and summarized below.

For agriculture:

Government programs

- Review programs currently being implemented vis-à-vis climate change risks
- Mainstream climate change in plans/programs
- Better institutional linkages on and collaboration on weather data, water, between farmers policy makers
- Review subsidies such as fertilizers, seeds, etc. Modify subsidies, if necessary, and support services to influence farm level practices
- Establish/support risk-transfer mechanisms for climate related risks (like weather-based insurance, and private insurance systems)
- Fund research and development of adaptation and CC technologies
- Establish/enhance post-harvest facilities
- Strengthening extension services and LGU level
- Enhance the implementation of the agrarian reform program for marginalized farmers
- Increase awareness on and advocate on CCA

Technologies

- Assess and promote crop varieties that increase tolerance and suitability

[4] PhilCCA Working Group 3: Mitigation of Climate Change

- Weather and climate information systems, early warning systems that provide weather and climate forecast
- Decision support tools such as weather/climate forecast /information
- Better data access and Geographic Information System (GIS)-based mapping of climate, soil, and water resources for crop/variety matching
- Water management innovations, including efficient and effective irrigation technologies
- Farmers' Field Schools/ demonstration farms for supporting adoption of Climate Resilience Agriculture (CRA) practices and technologies

Farm production/management practices

- Variety and Crop diversification (vertical/horizontal)
- Land use change and farming system change
- Adoption of organic farming
- Community-based seed production
- Sustainable rice intensification
- Rainwater collection for irrigation, small water impoundments, and other
- Encourage water efficiency
- Change of timing/crop calendar of farming activities to fit observed changes in growing seasons/local climates
- Implementation of selective irrigation practices, timing of irrigation and crop cycles
- Sloping agriculture land technology
- Alteration of practices found to be unsustainable

Farm financial management

- Diversification of livelihoods to augment family income
- Establishment of cooperatives to lower costs of production inputs/develop marketing strategies
- Empowerment of women in farm management

Key elements for a climate adaptive system in agriculture addressing multiple impacts

2. **Understand complexity of climate impacts and potential responses by region.** Table 1 below outlines the projected impacts (based on analysis Section 2.1). The first point to note is the complexity of impacts even for each region, remembering that each region also has a set of existing agroecological zones and climate typologies. This is reinforced by the participatory assessment of climate impacts and responses as observed by local stakeholders (see next section). While drawing on existing and potential climate impact-specific responses (see also next section), very briefly summarised in the Table below, this clearly highlights the need for systems resilient to multiple impacts.

3. **Profiling of CRA options to increase resilience:** a large number of practices and technologies have been identified and prioritized by stakeholders in high climate change impact regions (identified under GCF preparation process), often several for each region and for different impacts in same area.

These have been reviewed from a wider evidence-based perspective, as well as examined through cost benefit analysis (CIAT CBA study, synthesised below and further detailed e.g. Section 2.5. They are all based on practices for which there is some early promising adoption, as observed by local stakeholders, including within some trial programs by government. For the range of key farming systems noted above, and range of potential climate impacts, some major examples are given here, which would be recommended as CRA options for support through mainstream programs.

4. For the main staple crop rice, the most important option will be the increase in the use of more stress tolerant varieties, for dealing with both flooding and drought (and even coastal salinity in some areas), and of practices such as alternate wetting and drying, to reduce water consumption and so cope with reduced precipitation, but also to contribute to mitigating the emission of methane. For corn and coconut farming systems, and upland crops (see Section 2.3, also as they relate to indigenous systems and gender), more integrated and managed and sloping land agriculture will be important, for better soil composition and stability, and layered cropping systems, to harness better water in drought conditions, and reduce the impacts of heavy rainfalls, and provide stronger shelter from strong winds. Particularly for upland farming systems and crops, including vegetables shelters and small water harvesting systems will also be important. Studies also showed the critical roles of adaptation in the value chains: of safeguarding input systems, such as seeds storage, and improving local post-harvest technologies and facilities to maximize returns even during extreme events.

5. **Cross cutting and systemic approaches:** Nevertheless, there are important cross cutting characteristics of the CRA options that are emerging, that the country (and its farmers) will need to gear up towards - in a paradigm shift from more long term input oriented approach, to a more sustainable agroecological approach, recognizing environmental limits and needs for resilience. For this the country's agriculture system will need to *continuously* adapt to constantly changing climatic conditions (and increasing seasonal uncertainty/unpredictability due to CC). This means farmers and communities will need to be able to choose among options of what is appropriate at farm, agro-ecological and market level, and assess requirements and access to support, investments etc – on an ongoing basis. These will be very much about assessing different practices, as to their local suitability, soil conditions, and how to match these with reliable climate information, to help timing of planting, match crop calendars, and combinations of crops. It also means addressing the need for diversification for resilience, and even the livelihoods within the household, also including for livestock and processing – (especially noted by women). Farming communities need to be involved to recognise and build local agroecological robustness, including critical watershed and water needs, which will become pressing with climate change facing the agriculture systems in the Philippines.

6. Overall at the core is assisting farmers to adopt multiple localized options, and ensuring they have information and resources to do so. Ultimately a **systemic adaptive capacity** in the agriculture sector must link farmers, farming communities, and their local to national support institutions, in a regular feedback mechanism. Some of this is being initiated e.g. through Adaptation and Mitigation Initiative in Agriculture (AMIA) - however there are identified gaps and challenges. Strengthening of the country's institutions and mechanisms for a climate adaptive system will require further attention on:

- ***Generating credible localized agrometeorological information system*** to address increased variability, requirements for short to long term climate information, forecasts and predictions, but also generate systemically advise on how to use them and match them with the right agriculture responses. This needs to be embedded in an institutionalized information generating, delivery and feedback mechanism, systems which may be desirable in normal circumstances, will be a future necessity for most of the country as it faces climate change.

- ***Identification of CRA options in a participatory and evidence-based manner*** under different and combined expected climate change effects in highly CC exposed regions (more below on options, and more detailed descriptions by crops).
- ***Building up mainstreaming mechanisms*** where climate information and CRA options are integrated for practical use in local plans and budgets, and build the capacity to implement those plans, including for the extension for CRA with farmers on a large scale.
- ***Building capacity and support mechanisms for farmers to adopt*** technologies and address barriers on range of technologies and practices for CRA, also future situations that cannot be predicted presently.

Table 1: Climate risks in different regions and farming systems, and adaptation interventions that will address the risks

Region	Major farming systems	Climate variable	Historical trend	Future projection (primary)	Secondary climate impact	Adaptation interventions (and mitigation, if any)	Adaptation benefits (and mitigation, if any)
North East Luzon	1) Rice lowland farming 2) Corn lowland farming	Rainfall	Slight increase in rainfall in DJF and MAM and slight decrease in JJA and SON between 1951-2010	Increase in precipitation in all seasons by >50% by 2050 under RCP4.5	Increase in flooding during rainy season and increase in drought during dry season	Flood tolerant varieties, timing of farm practices, farm infrastructure and design, disaster insurance	More climate-resilient production (i.e. flood), and higher and stable income for farmers
		Temperature	Decrease in number of cold nights (1951-2010)	Increase in temperature by up to 1.5C by 2050 under RCP4.5	Increase in extreme temperature, drought during dry season	Heat and drought tolerant varieties, timing of farm practices (shorter growing seasons), water managements and conservation, including alternate wetting and drying method, irrigation, seasonal and short-term forecasts	More climate-resilient production (i.e. heat and drought), and higher and stable income for farmers. Efficient water use. Reduced methane emissions.
		Tropical cyclone	Increasing intensity, slightly decreasing frequency	Increase in TC intensity	Increase in flooding and damage due to TC	Early warning systems, Strengthened infrastructure, disaster insurance, integrated farming practices	Production damage and loss are reduced through anticipatory actions.
		Sea level rise	Sea level rise between 1993-2015 up to 4.5-5 mm per year (UK Met)	Continuous increase	Increase in flooding and damage. Saline intrusion.	Early warning. Stress tolerant varieties.	More climate-resilient production (i.e. saltwater), and higher and stable income for farmers.
Cordillera	1) Mixed upland farming	Rainfall	Slight increase in rainfall in DJF and MAM and slight decrease in JJA and SON between 1951-2010	Increase in precipitation in DJF by >25% by 2050 under RCP4.5	Increase in flooding during rainy season	Integrated farming practices, soil, slope and canopy protection	Soil conservation and less erosion.

		Temperature		Increase in temperature by up to 2C in MAM by 2050 under RCP4.5	Increase in extreme temperature, drought during dry season	Heat and drought tolerant varieties, timing of farm practices (shorter growing seasons), water managements and conservation, irrigation, seasonal and short-term forecasts	More climate-resilient production (i.e. heat and drought), and higher and stable income for farmers. Efficient water use.
		Tropical cyclone	Increasing intensity, slightly decreasing frequency	Increase in TC intensity	Increase in flooding and damage due to TC	Early warning systems, Strengthened infrastructure, disaster insurance, integrated farming practices	Production damage and loss are reduced through anticipatory actions.
Eastern Seaboard (Bicol)	1) Mixed farming 2) Coconut	Rainfall	Decreased rainfall by up to -20 mm/decade between 1951-2010 especially in JJA and SON	Increase in precipitation by >50% in SON by 2050 under RCP4.5	Increase in flooding during rainy season	Flood tolerant varieties, timing of farm practices, farm infrastructure and design, disaster insurance	More climate-resilient production (i.e. flood), and higher and stable income for farmers.
		Temperature	Decrease in cold nights over period 1951-2010	Increase in temperature by up to 1-1.5C by 2050 under RCP4.5	Increase in extreme temperature, drought during dry season	Heat and drought tolerant varieties, timing of farm practices (shorter growing seasons), water managements and conservation, irrigation, seasonal and short-term forecasts	More climate-resilient production (i.e. heat and drought), and higher and stable income for farmers. Efficient water use.
		Tropical cyclone	Increasing intensity, slightly decreasing frequency	Increase in TC intensity	Increase in flooding and damage due to TC	Early warning systems, Strengthened infrastructure, disaster insurance, integrated farming practices	Production damage and loss are reduced through anticipatory actions.
		Sea level rise	Sea level rise between 1993-2015 up to 4.5-5 mm per year (UK Met)	Continuous increase	Increase in flooding and damage. Saline intrusion.	Early warning. Stress tolerant varieties.	More climate-resilient production (i.e. saltwater), and higher and stable income for farmers.

Western Central Mindanao (Northern Mindanao and SOCCSK-SARGEN)	1) Corn dryland farming 2) Rice dryland farming 3) Mixed farming	Rainfall	Increase rainfall by up to 40 mm/decade (PAGASA) 1951-2010 especially during JJA	Decrease precipitation by up to 25% in MAM and SON by 2050 under RCP4.5	Increase in drought during dry season, increase in heatwave	Flood tolerant varieties, timing of farm practices, farm infrastructure and design, disaster insurance	More climate-resilient production (i.e. flood), and higher and stable income for farmers.
		Temperature	Increase in number of hot days 1951-2008 (Cinco *et al*., 2013)	Increase in temperature by up to 1.5-2C in MAM and JJA by 2050 under RCP8.5	Increase in extreme temperature, drought during dry season	Heat and drought tolerant varieties, timing of farm practices (shorter growing seasons), water managements and conservation, irrigation, seasonal and short-term forecasts	More climate-resilient production (i.e. heat and drought), and higher and stable income for farmers. Efficient water use.
		Tropical cyclone	Increasing intensity, slightly increasing frequency, possible.	Increase in TC intensity	Increase in flooding and damage due to TC	Early warning systems, Strengthened infrastructure, disaster insurance, integrated farming practices	Production damage and loss are reduced through anticipatory actions.

2.2.2 Climate impacts and adaptation responses in Philippine smallholder agriculture for main crops in high climate impact areas

7. As designed under the project support, localized climate and agromet advisories will help inform the types of climate resilient agriculture (CRA) practices to use on the country's core crops. These practices will largely depend on the climate and agroment data at the time; however, this section of the feasibility study details some possible strong practices based on the existing climate information and research on adaptation options for Filipino farmers. The summary is based on an extensive analysis and process with stakeholders led by International Center for Tropical Agriculture, (CIAT CGIAR South East Asia group) the in 2018-2019, with leading regional science universities, and DA, and farmers and value chains representatives, after assessing regional climate change trends.

8. The final detailed Climate resilience profiles (CRPs) of Luzon, Mindanao, and Visayas, also covering climate impacts and responses on value chains is found in the Appendix.

9. Description of Climate Resilient Agriculture (CRA) Practices: Initial impact and adaption descriptions are intended to provide an indication of the general scope of field-level activities which may be promoted within the national crop programmes, and the overviews are categorized under the following cropping systems: (i) rice; (ii) corn; (iii) coconut; (iv) coffee; (v) cacao; (vi) potato; and (vii) cabbage/other vegetables. Further analyses examining complexity of upland and indigenous farming systems, coconut systems, and gender analysis in agriculture in the Philippines is provided in Section 2.3.

General farmer perceptions of climate change

Climate from farmer's perspectives

10. Climate change is perceived as a real threat by farmers across farming systems in the Philippines (synthesis from CIAT Regional profiles and workshops).

11. Farmers' perception on the manifestations of climate change

- Changes in climate pattern such as less predictable and extreme weather conditions, like intensifying and irregular rainfall pattern, more frequent (and stronger) typhoons (tropical cyclones), and prolonged drought season.
- Increase of temperature during summer manifested by wilting and drying up of crops, even at times for irrigated rice.
- Farmers have also observed that Mindanao has been experiencing typhoons, where historically it didn't as it lies below the typhoon belt

12. Farmers' perception/observation on the impacts of climate change

- The occurrence of drought and heavy rains alter cropping seasons and may lower the volume of production.
- Increased flooding or heavy rains washed away fertilizer application
- Unusually heavy rains cause erosion and deforestation
- High postharvest losses in manual drying of corn and rice have been experienced as grains get wet with abrupt rains
- Prolonged drought caused drying up of creeks and springs and low water level in rivers, reducing supplies for agriculture

- It has become more challenging to plan for on-farm activities, such as choice of crop to plant since the wet and dry seasons (onset and length of seasons) is more uncertain
- Increased vulnerability of plants to stress, both from heat and too wet conditions, result in wilting, blight, leaf rusting, clubroot, leafminer and other plant pests and diseases
- Extreme weather also affects animal production, affecting alternative sources of income

13. Indigenous knowledge on weather forecasting
    - Indigenous people of Benguet usually predict the end of the typhoon by observing the coming of a migratory bird called 'Kiling' in local dialect. They have had traditional cropping calendar with local dialects to name each month of the year.
    - At present, local folks claimed cultural way on weather forecasting is not applicable due to changes in climate pattern. As a result, the timing for planting is difficult to ascertain.
    - Benguet farmers in high elevated farming communities before can predict the time of frosting as it usually occurs from one o'clock to two o'clock in the morning so they know when to activate the sprinklers to combat the frost. Now, however, frost occurs anytime in the morning and evening.

Rice – Impacts and adaptation options

14. **Main Impacts:** Rice is a staple crop predominantly grown in Luzon and the Central Visayas and mainly impacted by climate-related risks of drought and typhoons[5]. Unsustainably high temperatures and prolonged dry spells have lowered rice yields in the regions – even for irrigated rice – and increased crop vulnerability to armyworm and brownspot. Even a 1°C increase during the growing season can reduce rice yields by as much as 10%.[6] The impacts of tropical storms and intense rainfall on rice production affect multiple stages, including harvesting, storage, and processing (for example, lowland rice farmers in Luzon are susceptible to flooding caused by the tropical storms).

Climate vulnerabilities across the rice value chain

Value Chain Stage	Impact
Hazard: Typhoon	
Seed planting	● Inundation and wind damage results in low quality seeds
Production	● Damage to irrigation structure, affecting water delivery ● Low crop survival rate (35-40%) during the vegetative and flowering stages of rice which cause damages amounting to production loss of 50% or more of the usual harvest ● Low quality of grains and spoiling ● Observed high population of golden snails
Hazard: Drought	
Production	● Lack of water results in possibility of missing the next cropping especially farms with no access to irrigation system ● Also an observed high population of golden snails, infestations of armyworm, occurrence of blast and brownspot ● Fewer man-hours to work due to intense heat
Harvesting, storage and processing	● Higher labor costs and drying expenses

Rice – on-farm adaptation Drought and rainy season (unless indicated the practices were valid for both drought and heavy precipitation)

Hazard	Adaptation Practices
Preparation planning stage	● Terracing, incorporation of agroforestry practices, and planting of high value trees on paddy or farm boundaries ● Integrated Farming System (IFS) through the integration of livestock and several crops ● Establishment of water harvesting techniques and systems (farm dams, water impoundment and rainwater collection) to secure water supply
Production	● Use of high yielding and early maturing varieties ● Use of drought resistant rice varieties ● Synchronized planting of rice, planting of more than one variety ● Planting of organic crops ● Indigenous pest control practices including the manual pick-up of golden snails and destroying their eggs. Use of botanical attractants such as sweet potato, vines, papaya & banana leaves to control snails ● Planting of nitrogen-fixing leguminous crops on the boundaries of their paddies ● Use of combine harvesters, especially in emergency harvesting operations ● Integrated crop-livestock systems, and on-farm diversification

[5] See Feasibility Study Part 1
[6] See Peng et al., 2004, as indicated in the Feasibility Study Part 1, BX Annex

	● Crop insurance
processing stage	● Use of mechanical dryers, use of batch and solar dyers to reduce moisture content of harvested rice (cost as a potential barrier)

Rice - Prioritised CRA/adaption practices

Main Responses:

15. Within the Visayas, farmers are prioritizing the expansion of: (i) water harvesting techniques; (ii) impoundment facilities; and (iii) alley cropping using nitrogen-fixing leguminous or organic crops along rice paddy boundaries. Visayas- and Luzon-based rice farmers also selected (i) integrated farm systems; and (ii) the adoption of drought-tolerant varieties, agroforestry techniques, and crop insurance as promising adaptation practices. With adoption rates for each practice currently ranging between 0-60%, there is opportunity for improved uptake.

- ***Integrated Farming System (IFS): e.g. rice-onion crop rotation in Luzon***

  The IFS develops resilience through biodiversity and focuses on increasing the functional diversity of a farm (in contrast to monoculture systems). It requires nutrient cycling and management, appropriate pest management, adapted animal breeds or crop varieties, and soil and water management. For an integrated farming system of rice-onion crop rotation, the onion production will draw on remaining nutrients from the rice field while disrupting the cycle of pests and diseases. Onion has a low crop water requirement, thus the crop can succeed in dry climates and moderately high temperatures. Rice and onion also have the same periods of maturity, which adheres to the cropping seasons. Traditional farmers plant rice for only one season and leave their rice fields unplanted for the next season, whereas farmers practicing CRA would plant rice during the first season and onion in the next cropping season. Seasonal rotation of onion in rice fields can significantly intensify land use during prolonged dry seasons. It can optimize production by enhancing soil fertility and preserving the productive integrity of the soil. The practice can deliver higher annual income to farmers, with reduced input costs for irrigation, chemical fertilizers and pesticides.

- ***Use of Stress-Tolerant Rice Varieties***

  The Philippines has a wide range of rice varieties developed to address the impacts of climate change. These include submergence-tolerant, drought-tolerant and early-maturing varieties. One of the **early-maturing rice varieties** is PSB Rc10 (Pagsanjan), which yields an average of 4.8MT per hectare. Farmers prefer to use this variety to shorten the planting season in periods of high flood risk. PSB Rc10 can be harvested as early as 106 days after seeding. It also has a good milling recovery of 66.62%. The other **variety that can withstand flooding** is PSB Rc18 (Ala). It can survive in complete submergence for 5-7 days and can be harvested 123 days after seeding. This long grain variety produces an average yield of 5.1MT per hectare. Both rice varieties reduce the risk of production losses during flooding, increasing the resilience of the farmer to the adverse effects of climate change.

- ***Water Harvesting in irrigation-scarce areas (e.g. Bihol, Visayas)***

  For rice production in drought-prone and irrigation scarce areas, the establishment of water saving technology is the top prioritized CRA practice. One example of water saving technology is a small water impounding project (SWIP). SWIP is a water harvesting and storage structure designed for soil and water conservation and flood control consisting of an earth embankment spillway, outlet works, and canal facilities. The storage structures typically consist of concrete water canals, built in the middle of the rice fields, which distribute water to surrounding farms.

SWIPs are managed by farmers' associations. In order to have access to the water saving technology, farmers must register as a member of the farmers' association responsible for the management of the technology. Maintenance of the structures are typically paid for by farmers in kilos of grains (depending on the size of farm) directly to the association.

- ***Organic Red Rice Production (e.g. in Visayas)***

Another prioritized CRA practice for rice production is organic red rice production. Organic red rice production involves the production of transplanted red rice using organic inputs. Using organic inputs contributes to the improvement of air quality by reducing carbon dioxide emission and providing soil carbon sequestration. Organic red rice production already has strong support (i) as part of DA-NIR's Promotion and Development of Organic Agriculture Program; (ii) from the Negros Island Organic Producers' Association (NIOPA); and (iii) in the form of recommendation by the Municipal and City Agriculture Office, validated by the Regional Director of Department of Agriculture.

- **Irrigated Rice - Alternate wetting and drying** (AWD)

Alternate wetting and drying is a simple and inexpensive way of reducing water consumption in rice production by 30%, thus, enabling farmers to cut down on production cost without yield penalty. This also means potential overall savings of water in irrigation schemes important in times of reduced water supply due to climate change driven water shortages, and other dry conditions.

In AWD, irrigation water is applied a few days after the disappearance of the ponded water. Hence, the field gets alternately flooded and non-flooded. The number of days of non-flooded soil between irrigations can vary from 1 to more than 10 days depending on the number of factors such as soil type, weather, and crop growth stage.

The AWD technology has also been proven to effectively mitigate greenhouse gas (GHG) emission, specifically methane (CH_4), from rice production by 30-70%, without causing a yield reduction. During the dry phases, the methane-producing bacteria are inhibited, thus, setting a condition to reduce GHG emission.

Corn/Maize - Climate change impacts and adaptation

16. **Main Impacts:** Corn is grown all across the Philippines, and drought and typhoon are the main climate-related impacts. In Luzon, upland corn and vegetable farms are more vulnerable to soil erosion, nutrient leaching, landslides and damaging winds, and suitability for corn is expected to decrease nearly 60% by 2050 from “very high” to “marginally suitable”. In the Eastern Seaboard/Visayas, corn production is highly vulnerable to the impacts of typhoons: seeds wash away and mature plants face rot. During periods of drought, corn develops shorter ears and smaller kernels and plants are more susceptible to pests like armyworm. Stress from drought and typhoon both impair the overall quality of grain. In Mindanao, the extreme phenomena of heavy rains, deforestation and drought affect the majority of corn producers, as they work in rainfed systems. During heavy rain and strong winds, mature crops are often knocked down, while kernels and seedlings are more susceptible to rot and pests, requiring additional inputs from farmers. Whilst drought poses the risk of wiping out entire harvests if occurring during the planting stages, both weather events are capable of altering cropping seasons and reducing overall production volume.

Climate change vulnerabilities across the corn value chain

Value Chain Stage	Impact
Hazard: Typhoon/ Flooding	
Input provision (seed production)	● Additional expenses for fanning seeds to maintain its ideal moisture
Seed planting	● Washing away of seeds during typhoon or flooding
Flowering stage	● Disruption in the pollination activity, resulting to incompletely filled or empty cobs during the harvest.
Production	● Mature plants experienced rotting ● Delays planting due to high incidence of pest, insect attacks, fungus, and diseases ● Higher costs of labor and chemicals due to incidence of pests and diseases
Harvest	● Early harvesting of crop resulting to some kernels not reaching the right physiological maturity and yielding low quality grains ● Difficulty in drying - increases the moisture content that could result to high aflatoxin contamination of grains
Post-harvest	● Longer drying period that may downgrade the quality and market value of corn. ● Worsening of road conditions/ inaccessibility of roads resulting to higher freight/hauling cost
Hazard: Drought	
Inputs	● Unpredictable weather causes uncertainty and delays of critical activities, including the distribution of buffer seeds to affected farmers from DA through the LGU ● Reduction in sales of chemicals and fertilizers
Production	● Non-germination of seeds and those that germinate hardly produce flowers ● Delays/losses during the cropping season. Yellow corn growers were affected more by drought with fifteen consecutive dry days damaging the corn, while drought during the planting stage may result to total crop damage. ● Short corn ears can develop with small grain/kernel size ● Prolonged drought makes soil hard to cultivate

	● Entails additional budget to dig deep wells and acquire water pump to draw out water for irrigation. ● Army worm infestations are more likely to occur
Harvesting, storage and processing	● Worms and rats infestation (long dry period) ● During, drought and typhoon can affect the quality of grains due to interrupted processing or drying. ● Procurement schedules for marketing disrupted

Range of major CRA adaptation for corn

17. On-farm adaptation practices for corn:

Hazard	Adaptation Practices
Drought	● Digging of deep wells to acquire water with the use of water pump. Borrowing and/or hiring of water pump from co-farmers is an initiative to access irrigation water ● Use of small water impounding facility as catchment basin for rainwater during rainy season. ● Adoption of new corn varieties which are more heat tolerant than traditional varieties
Heavy rainfall, typhoon	● Use of small water impounding facility as catchment basin for rainwater for use in dry season ● Adoption of improved on-farm storage infrastructure can protect farmers and their crops against variations in weather or climate, especially related to typhoons
Both drought and heavy rainfall, typhoon	● Early harvest of corn in the form of green corn or silage ● Use of moisture meters to ensure proper moisture content in stored grains ● Intercropping of corn with squash. Broad leaves of squash will serve as soil cover like mulch, decreasing the rate of water evaporation from soil. ● Crop rotation: cassava, vegetables, legumes, and other cash crops to be rotationally cropped with yellow corn ● Contour farming system: Slope Areas Land Technology (SALT), Natural Vegetative Strips (NVS), and Sloping Contour Program for Sustainable Agriculture (SCOPSA) ● Improved management practices like zero-till agriculture and foliar fertilizer ● Water impounding - Impounding of water from rain/rain shelters. Large operators may opt to use ground water pumps as source of irrigation ● Diversified cultivation of crops that would survive drought (e.g. cassava, taro, and banana), growing of cash crops and organic vegetables, agro-forestry, inclusion of value-adding activities ● Integration of poultry and livestock, in crop-livestock systems to diversify production/livelihood ● Alternative livelihood ● Crop insurance

18. Off-farm adaptation actions and options for corn (mainly Mindanao)

Value chain stage/Actors	Adaptation practices
Hazard: Drought	
Processing (Feed millers)	• importation of corn from other countries has become a practice to sustain the supply
Marketing (Marketing actors)	• relying on other processing plants outside of Mindanao which have not been affected by drought
Hazard: Heavy rains	
Input provision (input supplier)	• increase in inventory level to meet the demand for agrochemical inputs by farmers.
Harvest/storage	• as rain may affect the moisture content of corn during storage and the drying, proper storage facility and mechanical dryers are needed. • Putting up Post-harvest facilities (PHF)

Corn/Maize – prioritised CRA/adaption practices

Main Responses:

19. Crop insurance can be purchased to alleviate damages caused by typhoons and droughts. For drought specifically, corn farmers can use (i) groundwater pumps for irrigation at critical times; (ii) heat tolerant varieties and crop diversification (e.g. corn-peanut crop rotation) for smaller farms; and (iii) organic fertilizer as an additional measure to preserve soil fertility and moisture. In Luzon, farmers identified intercropping with rice through IFS, as well as contour farming, as priorities which could maintain topsoil nutrients. In Mindanao, farmers are also considering intercropping and crop rotation with drought-tolerant crops (e.g. cassava, taro and banana) and contour farming (e.g. SALT) to reduce water runoff and erosion while improving infiltration. These responses are detailed below.

- ***Sustainable Corn Production in Sloping Areas (SCoPSA)***
  The practice of Sustainable Corn Production in Sloping Areas (SCoPSA) was established in the Davao region (Mindanao) in 2013 to restore ecological balance in sloping areas through the adoption of different planting strategies, crop rotation, and contouring practices. SCoPSA helps farmers understand the importance of top soil for corn production and includes education on sustainable land use management. It features easily adaptable soil and water conservation technologies focused on soil erosion control and gully stabilization in combination with soil fertilization.

- ***Contour Farming***
  Part of SCoPSA includes contour farming, and there are various contour farming options such as the establishment of contour lines, Sloping Agricultural Land Technologies (**SALT**)[7] (pioneered in Mindanao), rockwalls, simple/double selection of hedgerow species, contour canals, and bench terraces. Contouring can delay and redirect water runoff, improve water infiltration, and reduce

[7] *SALT is also known as contour hedgerow intercropping (agroforestry) technology (CHIAT), and is a system where farmers plant dense hedgerows of fast-growing, nitrogen-fixing, perennial tree or shrub species along contour lines to create a living barrier that traps sediments and gradually transforms the sloping land to terraced land. Nitrogen-fixing hedgerows lining the terrace help improve soil fertility through nitrogen fixation at the roots and incorporation of the hedgerow trimmings into the soil. The hedgerows both markedly reduce soil erosion and contribute to improving and/or maintaining soil fertility.*

oil erosion by as much as 50% compared to upland and downhill farming[8]. For yellow-corn farmers, contouring through SALT and Natural Vegetative Strips (NVS) (naturally occurring grasses and herbs that slow and infiltrate water runoff) were preferred.

- ***Use of Organic Fertilizer***

Application of organic fertilizer significantly increases organic matter in soil, soil pH and total nitrogen. Corn farmers predominantly use organic chicken dung and vermicast fertilizers (also for basal application), and some (like those in Cebu) use combination of organic and inorganic fertilizer in their production. Organic fertilizer can significantly increase plant height, ear length, number of grains per ear, weight per 1000 seeds, fresh stover yield, and grain yield of corn grown, but suppliers are scarce.

- **Corn Mixed Use of Organic and Inorganic Fertilizer**

Through this CRA practice (use of inorganic-organic fertilizer), less inorganic or synthetic chemicals are used since organic fertilizer is added to the production. This practice would help mitigate climate change, as well as provide better soil composition for soil fertility and moisture content.
The initial investment per hectare annually is around PhP 12,600 (USD 237.74). This entails the cost of inorganic (e.g. complete, urea) and organic (e.g. chicken dung) fertilizers. It would take 3 years to recover the CRA investment cost, with an annual incremental benefit of PhP 13,599.52 (USD 255.84). The internal rate of return (IRR) value suggests that adaptation and investment on the CRA per hectare would yield by 65.09% of the invested capital. Furthermore the yield generated from adopting the CRA is on average greater than the conventional practice by 511 kilograms per ha, which also resulted in higher revenue.

To adopt the practice, there must be a good supply of organic fertilizer available to farmers from the government sector and private companies. Also, information on the benefits of using mixed inorganic and organic fertilizer and right application of fertilization rate must be boosted.

- ***Diversified Farming Systems***

Numerous farm practices fall under the definition of "**diversified farming**", including **intercropping** and **rotational cropping** (whereas mono-cropping is considered the conventional and most-used system). While intercropping consists of planting more than one crop in the same area (e.g. coconut, legumes, cassava), rotational cropping involves planting a different crop after harvesting the previous crop (e.g. cassava, vegetables, legumes, peanuts, and/or cash-crops) – Corn-peanut rotation example is given below. Farmers have found that having a diversified farming system improves soil quality, increasing soil porousness after cropping (as in the case with cassava), which is advantageous because the corn roots can penetrate deeper and absorb more nutrients. These practices can also reduce fertilizer input requirements, reduce carbon emissions (as in the case of corn-peanut rotation), fix nitrogen, and assist with pest management.

- ***Corn-Peanut Rotation***

Corn-peanut rotation has shown higher yields than conventional practices as peanut is more suitable for higher temperatures and has natural nitrogen-fixing properties that increase soil fertility, also through mulching, while reducing input costs for fertilizer application. This practice allows the soil to recover the depleted nutrients and also reduces incidence of pests and diseases. Moreover, corn-peanut rotation reduces carbon emission by decreasing the use of synthetic chemicals.

[8] Natural Resources Conservation Practices. (2013)

While the yield generated for corn under this practice is lower compared to the conventional practice, since only one cropping of corn production is replaced with peanut. However, in terms of revenue, the CRA practice generated higher annual revenue compared to the non-CRA practice, since there is additional income generated from the additional peanut produced within the area.

Coconut - Climate change impacts and adaptation options (Eastern areas)

20. **Main Impacts:** Current and projected impacts of climate change have created serious hazards for coconut farmers in the Eastern Seaboard and Visayas. The region has had an increase in the frequency and intensity of droughts, and is the only region to *also* experience higher frequency and intensity of tropical cyclones. Typhoons have been particularly damaging for coconut production in the Eastern Visayas, but also Bicol and parts of coastal Eastern Mindanao. This uncertainty has made planning on-farm activities, like fertilizer application, more challenging. Coconut trees require nearly a decade to grow to full maturity, so heavy winds that uproot or truncate trees cause long-lasting impacts on farmers' livelihoods. Droughts cause trees to produce fewer nuts and smaller fruits, and can increases the risk of pests, diseases, wilting, and button-shedding.

Climate change vulnerabilities for coconut

Value Chain Stage	Impact
Hazard: Typhoons/ heavy rainfall	
Production	● Typhoon is considered to be the most damaging climate hazard for coconut production ● It will take almost a decade for coconut trees to re-grow and for farmers to fully recover their livelihood.
Hazard: Drought	
Production	● Wilting and drying of leaves and button shedding ● More vulnerable to pests and diseases ● Trees bear fewer nuts or much smaller fruits during long dry seasons

On-farm adaptation options for coconut - Droughts and/or typhoons/heavy rain

Value chain stage	Adaptation options
Land preparation/ Production, and harvesting	● Integrated pest management strategies including the use of bio-controls to prevent pest infestations and disease ● Manual spraying of trees, and in some cases, controlled burning of heavily infested or diseases trees may be required ● Seedlings which are not typically watered, may be irrigated to ensure their survival during extreme drought conditions ● Adoption of improved coconut varieties, especially shorter trees that are less prone to damage from high winds ● Early harvest of coconuts during typhoons ● Crop insurance through PCIC

Coconut – CIAT CBA of CRA practice

21. **Main Responses:** The main response currently utilized is crop diversification, typically with banana, as it can increase farm productivity whilst minimizing fertilizer and pesticide inputs. In cases of drought, farmers can adopt integrated management practices to alleviate infestations and pest outbreaks. This can include the use of biocontrol (e.g. insect parasitoids and insect pathogen such as *Metarhizium*). For typhoons, farmers can use dwarf coconut varieties, which can better withstand high winds due to their short stature.

- ***Coconut-Banana Intercropping***
  This CRA practice involves planning banana alongside (or between) coconut trees, maximizing the (typically) unproductive/unplanted space between coconut trees. Since banana and coconut have similar nutrient and climate requirements, they are easily intercropped. Due to the resiliency of coconut to weak and moderate typhoons, and the practical use of banana as food substitute (and alternate source of income), both crops are perfectly suited for the region.
  Alternative crops that could be considered for combination (particularly as they relate to multi-storey cropping) include: papaya, pineapple, coffee, black pepper, cacao, lanzone, durian, taro, upland rice, daisy, sweet potato, banana, ginger, *sayote* (*Sechium edule*), corn, kakawate (gliricidia sepium), shorter fruit trees (e.g. mango), peanut, tuber and root crops (e.g. cassava, potato).[9]

Eastern Viasayas - Coconut - dwarf variety – coping with intense typhoons (CIAT CBA analysis on prioritised CRA/adaption practices)

22. A primary climate resilience for coconut on the eastern parts of the country to deal with the potential increased intensity of typhoons, typified by the devastation to the coconut farming of the Eastern Visayas during Typhoon Haiyan/Yolanda.

23. In response to increased risk of typhoons, alternate coconut varieties must be considered. One such variety is the Tacunan green dwarf (TACD) coconut, which bares its fruits early, often seen with nuts touching the ground. It has a thick stem, robust palm, and well-anchored root system that has been observed to endure strong winds. The average number of nuts harvested per tree per year is between 48 and 84, and the average weight of copra per nut is about 226 grams. The TACD variety is among two outstanding coconut dwarf varieties that passed the international standard for young tender coconut.

24. This requires an initial investment annually of PhP 6,802 (USD 128.34) per hectare. This initial cost pertains to the procurement of seedlings for this coconut variety. The investment will be recovered by the 9th year. Over a 20 year period, farmers can expect a yearly incremental benefit of around PhP 62,160 (USD 1,172.86), with internal rate of return (IRR) of 37.01%. The incremental benefit will be also even greater if estimating the relative lower losses compared to the high losses with traditional variety and an effect of typhoon.

[9] Based on recommendations from the Thematic Analysis of Impacts and Responses on Complex Philippine Agriculture Systems and Gender (including IP)

Upland Potato and Vegetables - Climate impacts and adaptation (Upland Luzon)

25. Upland areas in Luzon face multiple threats of more variable and unpredictable temperatures, greater extreme rainfalls and typhoons, but also dry periods. A range of approaches and technologies are required to address this.

26. **Potato - Main Impacts:** Projections based on climate indicate that production potential and suitability for potato is expected to decrease for most provinces in Luzon. Potato suitability is expected to decrease from very high to marginally suitable in Apayao, Abra, Kalinga and Ifugao provinces by 2050, but remain highly suitable in Benguet and Mountain Province. Key climate risks are droughts and typhoons, with the additional issue of increased disease rates following typhoons.

27. **Cabbage and other vegetables - Main Impacts:** Main climate impacts for cabbage and other vegetable crops in Luzon include drought and typhoons. Like potato, the production potential and suitability for cabbage and vegetable crops is expected to decrease in most provinces of Luzon. By 2050, suitability is projected to fall in Apayao, Abra, Kalinga, Mountain Province and Nueva Vizcaya provinces.

Climate change impact vulnerabilities across cabbage and potato value chains

Value Chain Stage	Impact
Hazard: Typhoon	
Land preparation, planting	• delayed land preparation leading to adjustment in the cropping calendar
Harvesting, transporting	• early harvesting even if they are not yet on maturity because they will rot and crack when not harvested • increase risk of accidents to farmers, difficulty in delivering produce in time to catch good price at trading post
Processing (potato)	• thick fog and cold affects preparation of potato products
Hazard: Drought	
Planting	• Resulted to cabbage producing small heads

Adaptation to climate change for vegetables

Hazard	Adaptation Practices
Rainy season/ typhoon	• Keeping informed of updated on weather forecast through television and radio • Construction, cleaning and maintaining drainage canals of farms to prevent flooding and soil erosion • Increase frequency of spraying fungicides for diseases such as blight on potatoes and leaf spot on cabbage • Planting of Igorota, a blight resistant potato variety during rainy season • Planting of hedgerows such as calla lily in the farm borders for strong wind • Increased use of fertilizers to boost yield • Establishment of crop shelters such as greenhouses to avoid waterclogging and damage on crops during typhoon • Using tunnels made of plastic to prevent moisture from entering. Issue: cost of adoption
Drought	• Construction of on-site water harvesting tank designed to collect rainwater (cost of adoption is a concern). • Wait for rain before planting • Borrowing of hose and water pump to bring water from the river and other water resources to the farm

	● Digging large holes and lining them with large plastic sheets or used tarpaulins to act as water catchments ● Frequent watering of plants using sprinklers or rain burst
Very low temperature	● Putting up rainburst sprinklers to melt the ice (as a mitigating measures)
All	● Establishment of nursery for potato tubers, and diffuse light storage, and seed bank. ● Encourage farmers to acquire recommended quality seeds ● Trainings for farmers on potato tuber seedling production ● Organic farming ● Reforestation such as planting trees like bamboos, to restore denuded mountains, generates water, and prevent landslides ● Establishments of cold and dry storage facilities on-farm and on the market ● Use of food grade packaging materials to maintain the quality of vegetable products ● Establishment of processing center with complete facilities to be managed by a farmer's organization with financial support from the government. ● Recommendation for the policy makers to craft and strictly implement pricing regulation guidelines for vegetables at the trading center.

Upland Vegetables - CIAT CBA analysis on prioritised CRA/adaption practices

28. **Potato - Main Responses:** For drought conditions potato, rainwater-harvesting tanks can help prolong the availability of water resources. To combat increased disease rates related to typhoons and increasingly heavy precipitation, the adoption of blight resistant varieties is also a priority adaptation practice.

- ***Blight Resistant Variety - Potato***
  Igorota is a locally-bred (Philippines) potato variety, more commonly called "LBR" (late blight resistant), which is moderately resistant to late-blight and leaf miner. The variety matures in 110 days, has a potential yield of 25-35 tons per hectare, and is well-suited for both table-use and processing due to its high amount of dry matter content. The variety is typically only planted in areas of higher elevation, where high relative humidity promotes the progress of the late blight infection. It should be noted that some farmers have reported susceptibility to rotting due to mechanical injuries incurred during transport. The incremental initial investment in the first year is relatively low ($400), while the expected incremental benefit gained after 10 years (6,958 USD) large.

29. **Cabbage - Main Responses:** Prioritized adaptation responses include: (i) rain-water harvesting; (ii) protected cultivation (crop shelters); and (iii) organic farming.

- ***Rain Water Harvesting***
  Rainwater harvesters can come in a variety of forms. One farmer-improvised rainwater harvester, called "kwelo", is developed by digging large pits and lining them with plastic sheets or tarpaulins. For those who can afford it, concrete water tanks are preferred. Small water impounding facilities (already described in previous sections) is the most prioritized adaptation response for the CAR region, since it helps protect against drought and against frost (if water is applied through a sprinkler). It also allows for continued cropping and can partially solve water shortages, thus helping to increase production and farm income.
  On-site water harvesting tank designed to collect rainwater during the rainy months, that would enable farmers to have continuous cropping to help solve water shortage during dry months. While good yields are expected i it requires upfront investment in a water harvesting tank for

cabbage production. The initial investment is very high (6680 USD /ha), and the payback period long (7 years).

- ***Protected Vegetable Cultivation*** **(French beans, lettuce)**

Rain shelters protect vegetable crops from erratic and high precipitation, strong winds and reduce the pressure of pests and diseases. Protected cultivation can be done using a microtunnel, macrotunnel, or plastic house to protect crops from heavy rains and strong winds. **Microtunnels** utilizes simple, low tunnels made with bamboo frames and covered with clear plastic films. **Macrotunnels** have metal frames and are covered with clear polyethylene plastics. The most common designs used by farmers are the low-cost microtunnels and **plastic houses** / **rain shelters** that utilize a single layer of clear plastic placed on top of bamboo, wooden, or (sometimes) metal frames. Benguet State University developed an **alternative crop shelter design** that farmers can adapt and replicate. The BSU design is based on: (i) simplicity so that farmers can fabricate and install their own shelters using basic shop tools and equipment; (ii) functionality to offer protection (protecting against rains and helping to regulate climate); (iii) frame sturdiness (to minimize/eliminate damage due to strong winds and typhoons); (iv) cost-effectiveness (it provides almost doubling of yield and IRR 59% in 2 years); and (v) aesthetics.

- ***Organic Farming***

As identified for many cropping systems, organic farming is a top adaptation practice focused on environmentally sustainable practices; improving soil fertility and animal welfare; and increasing biodiversity. Organic farming can include crop rotation, mixed cropping, intercropping, strip cropping, mulching, tillage operations, use of natural predators and biocontrol agents to: (i) help manage pests and diseases; and (ii) lower input costs for vermicompost, bio-fertilizers, botanicals or bio-pesticides. Many farmers who have shifted to organic farming systems have reported continuous and additional sources of income, due to the high demand of organically-produced vegetables.

Upland coffee systems – Impacts and CRA adaptation options

30. **Coffee - Main Impacts:** The vast majority of coffee grown in low-lying areas of Mindanao is at risk, specifically in SOCCSKSARGEN, Caraga, Davao and Zamboanga. Frequent droughts and heavy rains have caused increased mortality rates for both coffee and cacao seedlings, subsequently resulting in increased spending on replanting. They have also caused lower yields and increased instances of pest and disease. The only positive impact resulting from climate change has been that *some* coffee producers have reported increased bean size and faster drying due to the warmer temperatures.

Climate change vulnerabilities across the coffee value chain

Value Chain Stage	Impacts
Hazard: Long rainy periods/ Excessive rain	
Input provision (seed production)	• damage on seedlings resulting in stunted growth • fungus attack and accumulation of water in poly bags of seedlings
Production	• soil erosion due to excessive rain, damage to trees and crops • additional cost for new application of fertilizers/agrochemicals as these were washed out by the rain • occurrence of pest and diseases
Post-harvest/Processing	• high possibility of over fermentation leading to poor quality and lower prices of beans
Hazard: Drought	
Input provision (seed production)	• high mortality rate of seedlings • increased production cost due to the need of frequent watering of seedlings
Harvesting	• decreases supply of coffee which also translates to lesser beans to be harvested and processed • delays in harvest • potential to affect the taste and aroma of coffee
Post-harvest/Processing and Marketing	• decrease in the production of coffee end-products • delay and decrease in volume of coffee harvested results to inability to meet contracts with companies of coffee products

Adaptation options for coffee

31. On-farm adaptation practices for coffee droughts and/or heavy rains (MINDANAO)

Value chain stage	Adaptation practices
Production /Land preparation	• Contouring - planting of Ipil-ipil, Flemingia and Arachis Pintoi to help hold water • Intercropping or diversified farming - planting coffee with other plants such as banana, Abaca, Falcata, and assorted vegetables and root crops

	● Deep hole planting - enables the tree to catch water prolonging its life during drought ● reforestation model/ watershed - to preserve water and holding capacity of soil ● information dissemination on upcoming droughts

32. Off-farm adaptation options for coffee

Value chain stage/Actors	Adaptation practices
Hazard: Drought and heavy rains	
Input provision (seedlings supplier)	● Putting nurseries on rehabilitation (e.g. application of accreditation to the Bureau of Plant Industry)
Harvesting, storage and processing	● Putting up of postharvest and processing facilities and equipment, and ventilation in warehouses ● Using moisture meter to monitor moisture content ● Strengthening linkages with government agencies such as DA and DTI.
Marketing	● Strengthening of market linkages through trade fairs, and expo.

33. **Main Responses:** In order to combat drought and heavy rains, farmers in mountainous areas are utilizing contour farming as an adaptive measure to improve soil stability, reduce surface runoff, and increase nutrient capture. By growing crops in horizontal strips along the natural contours of their land, farmers create natural buffers that conserve soil and improve water retention on sloped areas. One contouring system used in Bukidnon, Arachis, Pintoi, Flemingia and Ipil-Ipil is SALT (previously described in the 'contour farming' section for corn), which includes intercropping nitrogen-fixing trees and plants between rows to enhance soil fertility. While it is being practiced by small percent of farmers, labor requirement in adopting/ maintaining the landscape are considered a constraint to be overcome.

- ***Contour farming***

  Contour farming is the prioritized on-farm CRA practice for coffee. As described previously, contour farming is defined as the tilling of soil and planting of crops in accordance to the natural contour of land. It is also a recommended erosion control measure under the Code of Good Agricultural Practices (GAP) for coffee. Due to improvements in soil, contour farming can also improve the physiological characteristics of coffee, particularly the weight of fresh shoots. Coffee growers in Bukidnon prefer to plant ipil-ipil (*Leucaena leucocephala*), *flemingia macrophylla*, and *arachis pintoi* between coffee rows to prevent erosion and conserve soil fertility, though only 10% of coffee farmers in the area are practicing contour farming.
  Flemingia macrophylla serves as a shade crop, fixes atmospheric nitrogen, provides mulch that improves soil, controls nematode infestation when intercropped with other crops, and controls soil erosion when grown on terraces.
  Arachis pintoi, a herbaceous legume, is a cover crop that prevents soil degradation and controls various pests of plantation crops to maintain crop productivity and a healthy growing environment. It has the capacity for weed and nematode control for coffee, and high potential for nitrogen fixation. It can tolerate heavy grazing, however, it can be dominated by weeds or companion species if established as mixtures. CIAT 22160 and CIAT 18748 species are easily established and drought-tolerant, respectively.

Cacao - Climate impacts and adaptation (Mindanao)

34. **Main Impacts:** Climate change and extreme weather events have affected cacao in several ways. Excessive rains have resulted in rotting cacao pods, whilst droughts have caused pods to wilt or reduce in size. Prolonged dry spells also increase the mortality rates of seedlings, reaching as high as 50 to 70%, posing a significant threat to coffee farms in the region (Mindanao) as they are predominantly rain-fed. Cacao farming in central Mindanao faces potential greater droughts but also possibly more heavy typhoon rainfalls hitting fragile upland areas.

Climate change vulnerabilities across the cacao industry

Value Chain Stage	Impacts
Hazard: Drought	
Input provision (seedlings production)	● increased mortality rate of seedlings ● non-absorption of fertilizers in seedlings especially when it's in maturity stage
Input provision (fertilizer producer)	● decrease income as farmers do not plant cacao during dry season
Production	● flowers fall during flowering stage ● wilted pods during bearing stage ● decrease volume of pods produced per tree and shrinks the size of pods by half of its usual weight. ● pest infestation
Post-harvest/Processing and Marketing	● low yields result to default agreements
Hazard: Long rainy periods/ Excessive rain	
Input provision (seed production)	● impedes drying of beans and fermentation resulting to low quality beans due to development of molds ● difficulty in storing beans since it may lead to increased moisture content resulting in moldy cacao beans
Production	● seven days of continuous rainfall results to pod rot ● beans become defective and relatively lighter
Harvesting	● occurrence of pod rot reduced pods to be harvested
Post-harvest/ Processing	● lower prices and high cost of processing due to the need of re-drying

Adaptation options for cacao

35. On-farm adaptation practices for cacao - Droughts and/or heavy rains

Value chain stage	Adaptation practices
Land preparation/	● establishment of sprinkler system

Production	• mulching using coconut husks • Organic farming or the use organic fertilizers like vermiculture • establishment of impounding facility • reforestation • crop insurance

36. Off-farm adaptation options for cacao

Value chain stage/Actors	Adaptation practices
Hazard: Drought	
Input provision/ nursery operation (input supplier)	• using water drilling facility which uses solar energy and a water reservoir
Postharvest/ marketing	• establishing a storage facility also help actors in the marketing stage to temporarily store beans while waiting for higher prices
Hazard: Heavy rains	
Nursery operation/ seedling production	• putting stickers in seedling to allow absorption of fertilizer/chemicals
Harvesting/ Storage/ post harvest	• using canopy for pod breaking to allow continuous harvest and selling of cacao beans • using sensory facility and bean cut tester to check the quality of beans • consolidation of beans by groups/organizations in the sitio/barangay. • using mechanical dryer for continuous and undisrupted drying • using moisture meter to check moisture
Marketing	• marketing actors recommend to have better access to transportation and a climate-resilient infrastructure in order to ease the delivery of cacao • establishment of trading centers that are able to withstand the impacts of extreme weather would allow continuous and undisrupted trading of cacao

Upland cacao systems - prioritised adaptation practices

37. Main Responses: Farmers have prioritized the following adaptation practices for drought: (i) establishment of an irrigation system (sprinkler or drip); and (ii) small water impounding facilities. Whilst these can improve water and nutrient efficiency, they are not always affordable, thus the following additional practices were also identified as alternative practices for small-scale farmers: (i) organic farming; (ii) mulching. Expanding post-harvest facilities, disease management, crop insurance, reforestation and watershed development are also promising adaptation practices for climatic hazards.

- ***Sprinkler and Drip Irrigation Systems***

  Irrigation systems include surface, sprinkle, and micro-irrigation (e.g. drip) systems. Of these, both sprinkler and micro-irrigation systems are well-suited for cacao production, with high efficiency and uniformity (if correctly designed). They easily control the amount and rate of application, are feasible for light and frequent application, need only a small supply stream size, and can be used for “fertigation” (combined fertilizer application/irrigation).

- ***Small Water Impounding Facility/Water Collection***

Small water impounding facilities (previously described in the 'water harvesting' section for rice) can be used for crops, livestock, and fisheries. The reservoir stores rainfall and run-off water during heavy rains as a source of agricultural water that can be used by a farm with a 0.5-1 hectare area. Responsibility for development of this type of small-scale irrigation lies with the Bureau of Soils and Water Management (also responsible for small diversion dams, shallow tube wells, and small farm reservoirs). Whilst typically used for rice, it could also be an option to reduce the stresses of drought for cacao farmers. Upfront investment in structures and equipment, even if small scale, are required.

- ***Mulching***

Mulching is the application of thin organic material (e.g. shredded grass, weeds, coconut husks) on the soil surface. The decomposed materials conserve soil moisture, reduce soil erosion, improve soil fertility, and reduce weed growth. Cacao farmers would typically use coconut husks and banana leaves as mulch.

- ***Organic Farming***

Organic farming can improve soil fertility, decrease soil erosion, and increase biodiversity – subsequently reducing pest outbreaks, and severity of plant and animal diseases. As part of organic farming, application of organic fertilizer is a good CRA practice, and it is particularly well-suited for cacao production in Davao del Norte. Organic fertilizer is considered by the Philippine National Standard (PNS) to be any decomposed product originating from plants or animals that can supply a total of 5-7% of nitrogen, phosphorus, and/or potassium. Using organic methods like the addition of vermiculture to decomposing organic materials, farmers can increase soil nutrients and moisture retention during periods of drought.

- ***Intercropping of Cacao with Coconut and high value crops***

Intercropping of cacao with coconut can reduce soil erosion and surface run-off, protecting the topsoil. By efficiently utilizing the farm area, it can result in potential production and profitability increases. Intercropping is also known to reduce plant diseases and support integrated pest management (IPM). Planting high-valued crops as reforestation and more structured farm system, for example is intercropping fruit trees and/or wood trees together with cacao, provides greater erosion control, soil complexity, and can also provide greater alternative incomes. It also has very important contribution to ecosystem services overall in a watershed context. Shifting to and succeeding in organic farming, and more complex structured farms, requires intensive knowledge and supply of information, as well increased initial labour.

- ***Seed Nurseries – Cacao and Coffee***

One type of communal support investment for climate change resilience is the development of seed nurseries[10]. Seed nurseries are already used in some areas for cacao and coffee. The Bureau of Plant Industry (BPI) has accredited cacao nurseries and coffee nurseries for the production of certified seedlings, and BPI's Crop Research and Production Support Division is responsible for accreditation of any new nurseries[11]. As with coconut, most certified seedlings are produced for government-funded seedling distribution programmes. Cacao seed varieties (registered since 2009) originated from the University of the Philippines Los Baños (UPLB), the Philippines Industrial

[10] Keep in mind that there are different types of nurseries: private, communal, and government-owned. Most nurseries (in all nursery types) operate at a small scale. Private nurseries and government-owned nurseries are often built near a main road to facilitate distribution and sale. Communal nurseries are typically built on farms in order to cater to smallholder farmers. Private and government-owned nurseries tend to be more stable, when contrasted with communal nurseries reliant on support organizations. (Edralin and Mercado, 2010; URL: http://www.worldagroforestry.org/publication/profiling-tree-nurseries-northern-mindanao-philippines)

[11] See URL: http://bpi.da.gov.ph/bpi/index.php/sample-levels/crop-research-and-production-support-section

Crops Institute (PICRI) within the University of Southern Mindanao (USM), or large farmer cooperatives. Most commercial cacao farmers purchase planting materials from nurseries, whereas smallholder farmers commonly produce their own seedlings. For coffee, all varieties (also registered since 2009) have originated from Nestlé, whereas older registrations were mostly from BPI.

2.2.3 Barriers to adoption as identified by stakeholders – all crops and regions

38. Important to also note the key barriers identified by local stakeholders that are faced in adoption of actual or potential CRA practices. These are based on farmer and other value chain actors' perspectives (CIAT regional CRA profiling), both for some specific farming systems, but also across all systems.

Rice farming systems:

- low awareness of climate smart techniques and the lack of climate information services
- lack of regulatory framework for price regulation
- limited access to credit and financial support or assistance
- lack of technical capacity/ insufficient knowledge on plant pests and diseases management, which leads to dependency on synthetic pesticides

Corn farming systems:

- low institutional support. Farmers appeal for initiatives like dispersal of quality seeds
- lack of technical equipment and facilities (including the poor conditions of irrigation systems and farm-to-market roads)
- Cost of adoption, to afford to buy machines such as water pump
- low awareness of climate smart techniques among corn farmers
- lack of climate information services

Potato and Cabbage farming systems:

- Farmer's goals and objectives are for short term only
- Disinterested to adopt new technologies and contentment rely on traditional farming methods
- Lack of regulatory framework particularly on the price of vegetables
- Lack of human and technical capacity for farmers, they are not also member of any association so it's difficult to access government subsidies and programs.
- Cost of adoption, cannot afford to establish greenhouses and water harvested among other
- Limited access to technical equipment
- Farmers clamour for more credit access and financial support from the government with less documentary requirements

Across all farming systems:

- Informational barriers.
  - Limited information and knowledge on the impact of climate change
  - low awareness of climate smart techniques and lack access to climate information services
  - non awareness of benefits and impacts of climate hazards if adaptation strategies are not adopted
  - lack of geo-spatial planning which may be linked to poor access to or inconsistencies of information such as weather forecasts
- Financial, technical, behavioral, and informational challenges
  - farmers perceived that practices require high capital requirement and still, offer unpromising financial benefits

- limited access to credit
- lack of equipment and technical capacity to adopt/ comply requirements for adoption
- farmers' resistance to new technologies (even mechanization) as there is preference for traditional practices
- lack of capital to enhance production, non-affordability of inputs associated with the practices
- possibility of slow return of investment in the chain
- technical capacity barriers especially if farmers are not trained and skilled to implement practices
- settling for methods with instant results, no long term mindset, thus, overlooking potential long-term benefits of practices
- unwillingness of farmers to change or improve due to ineffectiveness of practices in previous years

● Institutional and Technical constraints.
  - inappropriateness of some government intervention programs to farmers' needs.
  - Limited number of technical persons to provide technical assistance and other supposed services to farmers
  - Lack of regulatory framework specifically on policies related to price
  - inaccessibility of some government subsidies
  - lack of institutional support and weak linkages with the government
  - low institutional support and absence of stakeholders' consultations
  - issues on prioritization (politically driven) within the government

● Financial resources
  - limited funds for production inputs up to harvesting activities
  - access to credit, long payback period and the cost of adoption
  - access to credit, cost of adoption (e.g. high cost of farm inputs), and the lack of financial benefits, requirements for loan application, and lack of incentives for adopting practices
  - issue on the number of requirements and need for collateral to avail loans
  - limited knowledge or misunderstanding of farmers on how to avail insurance
  - lack financial capital to invest for harvesting and storage facilities

2.2.4 Government programs for supporting CRA identified by local stakeholders

39. Local stakeholders (CIAT regional CRA profiling workshops) identified what they perceived as important programs and entry points for support to support their CRA adoption, more generally and also for specific farming systems (table below).

40. It may be worth noting that there may be policy and program challenges which may have to be addressed in medium to longer term to strengthen the effectiveness of Government programs (OECD, 2017, listed in Section 2.4).

Commodity	Off-farm services/service provider
All	Government (DA, ATI, PCIC, and PCA) ● Provision of trainings, workshops, livelihood support program, financial assistance, crop insurance, farm demonstrations, infrastructure provision, equipment and machinery supply, and subsidies and cash incentives. ● ATI conducts 3-day training on Climate Change Awareness, Preparedness, and Adaptation. Government (Mainly PAGASA DOST LGU) ● Provision of extension services by DOST, through the LGU, with regard to disaster risk reduction and disaster mitigation ● DOST-PCARRD program on Farmer's Information Technology Services (FITS) ● Installation of warning systems such as automatic rain gauge, and water-level monitoring system by the DOST ● Information dissemination (e.g. DA and PAG-ASA-DOST forecast information on El Niño are relayed to PAGRA, who in turn disseminates information to the LGUs; government information drive through different communication platforms) Local traders/ private institutions ● Local traders offer farmers inputs for production and harvesting but with 10% interest and deducted upon delivery ● Farmers borrow from formal private institutional financiers such as CARD Bank which offer loan packages with savings and health insurance
Rice	Government (DA) ● Rice Banner Program of DA: distribution of seeds, conduct of consultations, and trainings; provision of market services, organization of farmer field schools; distribution of IEC, construction of small water impounding projects, rice crop manager advisory services, among others. ● Technical demonstrations on featured farms, distribution and subsidies for the purchase of hybrid seeds, farmer field schools for rice intensification systems, and the conservation of plant genetic resources, etc
Corn	Government (DA): ● Corn Banner Program (distribution of materials for soil amelioration and rehabilitation, distribution of earwigs as biological control, farmer education program) ● conduct of workshop on community-based participatory action research on climate resilient agriculture under corn-based farming system ● **P**rovision of trainings and inputs to farmers (e.g. pilot testing of the Sustainable Corn Production in Sloping Areas (SCOPSA) LGUs

	● Also launch programs on microfinance, provision of equipment for land preparation and post-harvest activities
Coconut	Government (mainly PCA) ● replanting incentive program where farmers are given cash incentives to replant coconut trees ● promotion of coconut fertilization project, using agricultural grade salts (AGS), and coir-based organic fertilizer (CBOF) ● seed stocks (corn, rice, and coconut) ready for distribution in case of extreme events LGUs ● weather forecasting services through LGUs with text updates available to some farmers. ● Diversification and intercropping – mainly with DA and LGU
Upland vegetables – (eg Cabbage and potato)	Government (DA, LGUs) ● Hands-on training on the rapid multiplication of quality planting materials of potato blight resistant variety and other recommended varieties (in partnership with the Benguet State University) ● Trainings in the development of vegetable industry in the region and to help farmers adapt to the adverse effects of climate change. ● Benguet Cold Chain Project which provides services to the farmers like rental of refrigerated trucks, modular cold storage and plastic crates
Cacao	Government (DA) ● ATI conducts training on cacao production for trainers and farmers NGOs and private institutions ● Conduct training for cacao farmers
Coffee	NGOs, associations and private institutions ● Will provide processing facilities to farmers (e.g. coffee hauler, coffee fermentation tank, all-weather dryer, and coffee storage)

Appendix 1: Insect Pests and Diseases of Major Crops in the Philippines and Management Measures

Rice		**Management**	**Remarks**
Insect Pests	Brown Planthopper	- Spraying of botanical insecticide - Spraying of Metarhizium - Spraying of Neem - Spraying of specified AI synthetic chemicals	
Insect Pests	Rice Grain bug	- Spraying of Metarhizium	
Diseases	Bug burn	- Same with BPH	The causative agent is BPH
Diseases	Dirty Panicle	- Same with RGB	The causative agent is RGB
Diseases	Brown Spot	- Spraying of fungicide	
Rat		- Aluminum phosphide	Also killed by smoke in the burrow
Corn		**Management**	**Remarks**
Insect Pests	Corn Plant hopper	- Release of Lacewings - Release of Earwigs - Spray of Metarhizium - Spraying of neem oil - Spraying of synthetic insecticide	Rain also helps in the reduction of population
Insect Pests	Mealybug	- Release of Earwigs - Spraying of insecticide	same
Insect Pests	Fall armyworm	- Spinetoram - Emamectin benzoate - Tetraniliprole Cyantraniliprole - Chlorantraniliprole - Chlorantraniliprole + Thiametoxam	Some biopestides-Metarhizium
Diseases	Bacterial Leaf Blight	- Spraying of neem - Spraying of copper-based fungicide	
Diseases	Brown Spot	- Spraying of fungicide	
Cassava		**Management**	**Remarks**
Insect Pests	Red Spider Mites	- Spraying of Metarhizium - Release of Earwigs - Spraying of neem	Rain helps in the reduction of population

Insect Pests	Papaya Mealybug	- Release of Earwigs - Spraying	same
Diseases	Phytoplasma	- Soaking planting materials on Streptomycin	
Potato		**Management**	**Remarks**
Insect Pests	Potato tuber moth	Pheromone traps in the field Neem and other safer compounds	Wood ash and improved storage helps in reduction of the pests
Banana		**Management**	**Remarks**
Insect Pests	Banana skipper	Pheromone traps and safe chemicals	
Vegetables (cabbage, onion)		**Management**	**Remarks**
Insect pests	Diamond back moth	DBM lure, chlorpyrifos, biopesticides	
Insect pests	Cabbage butter fly	Nuvan and chlorpyrifos, biopesticides, sanitation	
Coffee		**Management**	**Remarks**
Insect pests	Stem borer	Lures, neem solutions	
Coconut		**Management**	**Remarks**
Insect pests	Coconut palm tree borer	Chemicals and biopesticides, sanitation	
Mango		**Management**	**Remarks**
Insect Pests	Cecid Fly	- Sanitation - Bagging	Still a big problem. Not all recommended insecticides work, resistance easily developed
Insect Pests	Planthoppers	- Spraying of Metarhizium - Bagging - Spraying of recommended insecticide	
Insect Pests	Mango Pulp Weevil	- Sanitation	Only in Palawan Island, under Quarantine
Storage Pests		**Management**	**Remarks**
Pests	Aflatoxin	- Proper drying	In corn
Pests	Rice Weevil	- Fumigation - Sanitation	

Appendix 2: Climate resilience profiles of Luzon, Mindanao, and Visayas

See the enclosed file in the same folder: 2.2-Appendix_Climate resilience profiles.pdf

Contents:

Section 2.3: Thematic analysis of impacts and responses on complex Philippine agriculture systems and gender

Contents

2.3.1 Coconut Farming Systems and Climate Change

Importance of Coconut Farming in the Philippines

1. Coconut and its derived products have been one of the trademarks of Philippine agriculture, having been established as a colonial enterprise by the Spanish in the 17th century. [12] Coconut trees are in production year around in the Philippines.[13] Small-scale regional trade carried it into the 1800s, which expanded to Europe by the end of the same century and later to the United States. [14] The industry flourished under the preferential export status granted by Europe and the United States until the Second World War. [15]

2. Presently, the Philippine smallholders supply one-quarter of the global production[16] to make the country the second largest coconut producer in the world.[17]. No part of coconut palm is without use, giving rise to hundreds of products such as food, cosmetics, pharmaceuticals, emulsifiers, propellants, paints, insecticides and fuel.[18] Along with sugarcane, coconut oil is a preferred base for biofuel production; coconut meets the biodiesel mandates and sugar the mandatory ethanol content.[19] It was estimated in 2015 that the total coconut producing capacity needed to expand in order to meet the country's increased biodiesel blend targets of 10% by 2020 and 20% by 2030. [20] Boosted by its new status as superfood, the global demand for coconut increased by five-hold in the past decade.[21] In 2015, the sales of coconut water reached $778 million in the US alone and are expected to hit $1.9 billion by 2019. The demand for coconut oil, butter, milk, flour, flakes and sugar is also on the rise globally.

3. According to the Philippine Coconut Authority (PCA) coconut farms are present in 68 of the nation's 81 provinces, occupying a quarter of agricultural land[22] and almost one-third of the cultivated agricultural lands in the country.[23] There are 3.5 million smallholder farmers and 23 million people – nearly a quarter of the population – who depend on coconut for their livelihoods, according to the Grameen Foundation.[24] Many of the coconut farms are owned by wealthier families but managed in smallholdings by tenants or caretakers.[25] The coconut farms were severely damaged by recent super typhoons: farms in the province of Davao Oriental by Pablo and those in the province of Leyte by Haiyan/Yolanda. Both provinces are the leading producers of coconut, and yet are also among the

[12] OECD, 2017. *Agricultural Policies in the Philippines*. OECD Food and Agricultural Reviews. Paris: OECD Publishing.

[13] *ibid.*

[14] *ibid.*

[15] *ibid.*

[16] Gatti, G. and Grani, G., 2017. "Poverty or Plenty for Coconut Growers in the Philippines?" Agrilinks. Feed the Future. https://www.agrilinks.org/blog/poverty-or-plenty-coconut-growers-philippines (accessed July 2019).

[17] FAO, 2019. "Restoring coconut farmers' livelihoods in the Philippines." http://www.fao.org/in-action/restoring-coconut-farmers-livelihoods-in-the-philippines/en/ (accessed July 2019).

[18] *Agricultural Policies in the Philippines*.

[19] *ibid.*

[20] *ibid.*

[21] Sri Lanka Export Development Board, 2017. "Growth of Demand for Coconut in the Global Market." EDB Blog. http://www.srilankabusiness.com/blog/growth-of-global-demand-for-coconut.html (accessed July 2019).

[22] Win, T. L., 2017. "How to milk the coconut boom? Philippine farmers check their phones." Reuters. https://www.reuters.com/article/us-philippines-agriculture-tech/how-to-milk-the-coconut-boom-philippine-farmers-check-their-phones-idUSKBN1860R6 (accessed July 2019).

[23] Pamplona, P. P., 2017. "Transform Coconut Farmers from Poverty to Prosperity by Revising Government Policies, Part 1." Agriculture Monthly.

"Transform Coconut Farmers from Poverty to Prosperity by Revising Government Policies, Part 1."

[24] "How to milk the coconut boom? Philippine farmers check their phones."

[25] *Garrity, D. P., Kummer, D. M. and Guiang, E. S., 1993*. **"The Philippines." In Committee on Sustainable Agriculture and the Environment in the Humid Tropics (ed.),** *Sustainable Agriculture and the Environment in the Humid Tropics by Committee on Sustainable Agriculture and the Environment in the Humid Tropics.* Washington, D.C.: National Academy Press.

provinces with the highest incidence of poverty in the Philippines.[26] The poverty incidence among coconut farmers was 56% in the early 2000s, compared to 48% for all agricultural households.[27] The coconut farmers earn on average USD 2 per day,[28] and 60% of small-scale coconut farmers live on or below the poverty line of 20,000 pesos (around USD 400) per year.[29]

Productivity of Coconut Trees

4. Referred to occasionally as the orphan child of Philippine agriculture, coconut production has been disadvantaged by the government's focus on rice self-sufficiency.[30] The development of the coconut and palm oil industries is the responsibility of the Philippine Coconut Authority (PCA),[31] which enforces the quality standards for coconut products in addition to other regulatory activities.[32] Any export of coconut products requires export commodity clearance from the PCA, through which the authority collects regulatory and laboratory analysis fees.[33]

5. The livelihoods of coconut smallholders depend on the ability to sustainably grow high yielding, high-quality coconuts, but the productivity in the Philippines is among the lowest in the world. A typical smallholder produces 43 nuts per tree in a year, which yield barely three liters of coconut oil. In high-producing countries, nearly 188 nuts per tree are harvested annually.[34] In the period 1990-2013, sugarcane, coconut and cassava showed the least production growth (about 25-30%) in the Philippines compared with banana, rice, mango, pineapples (about 170-250%).[35] Some assert that the PCA restricts its farmer support to expansion of the areas devoted to coconut.[36] It does so by offering traditional seedlings free of charge or by paying an incentive of PhP 35 for each coconut seedling planted on new coconut farms.[37] Others reported in 2015 that the PCA assisted the farmers in tree fertilization, participatory coconut planting program, and maintenance of coconut seed farms and seed gardens for new cultivars. It also assisted in organizing cooperatives among coconut farmers and provided technical assistance for integrating high value crops in coconut farming.[38] In 2018, it was reported that PCA was preparing a coconut replanting programme.[39]

6. Often overlooked in the discussion of coconut farming is its ability to protect soil, although the canopy of coconut trees is not dense, if the ground is covered with grassy or leguminous ground cover.[40] Such an attribute is quite useful, as this cash crop occupies much of the steepest non-arable land at lower elevations.[41]

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26 "Transform Coconut Farmers from Poverty to Prosperity by Revising Government Policies, Part 1."

27 *Agricultural Policies in the Philippines*.

28 "Poverty or Plenty for Coconut Growers in the Philippines?"

29 "How to milk the coconut boom? Philippine farmers check their phones."

30 *Agricultural Policies in the Philippines*.

31 *ibid.*

32 *ibid.*

33 *ibid.*

34 "Poverty or Plenty for Coconut Growers in the Philippines?"

35 *Agricultural Policies in the Philippines*.

36 "Transform Coconut Farmers from Poverty to Prosperity by Revising Government Policies, Part 1."

37 *ibid.*

38 *ibid.*

39 Simeon, L. M., 2018. "Government readies nationwide coconut replanting program." Philstar Global. 4 November 2018. https://www.philstar.com/business/agriculture/2018/11/04/1865581/government-readies-nationwide-coconut-replanting-program (accessed July 2019).

40 **"The Philippines."**

41 *ibid.*

7. Low product quality and yields as well as low income of coconut producers are attributed to poor management of pests and disease, ageing stocks, extreme weather events, low fertilizer application, low technology utilization, limited access to credit and high cost of processing.[42][43] The major culprit of the low productivity is the prevalence of trees that are past their prime and need to be replaced. Farmers do not normally cut old and unproductive trees, due to their values as heritage[44] and Republic Act 8048, the Coconut Preservation Act of 1995, which prohibits coconut farmers from cutting the trees unless the farmers replant the trees at their own expense.[45] Coconut replanting is much less expensive than the irrigation projects for rice production,[46] but most farmers lack the resources to replant.[47] The trees in the Philippines are of inferior quality compared to other countries in Southeast Asia.[48] Some state that the low productivity of the trees is what we should focus on, as it is the very cause of the poverty among the coconut farmers.[49] Some others point out that many of the difficulties that coconut farmers face are structural to the markets and value chains, and hence focusing on farmers alone does not improve their situation. [50]

8. Farmers tend to use any coconut to obtain the incentive pay and lack the capacity to prepare the fields for planting, fertilize the weeded palm trees, and apply other appropriate production practices.[51] The PCA buys and distributes coconut seedlings which are generally low yielding with a long immaturity period of five to seven years, as they are handicapped by inadequate research, production, and distribution of hybrid coconut. [52] Slow implementation of agrarian reform has discouraged investment in tree crops with long gestation periods, including coconut.[53]

Various Coconut Farming Systems

9. The coconut multi-storey cropping systems reported as successful by the PCA include the following combination of cash crops:[54]

- Coconut, papaya and pineapple
- Coconut, coffee, papaya and pineapple
- Coconut, coffee and black pepper
- Coconut, cacao, black pepper and pineapple
- Coconut, banana, and coffee
- Coconut, banana, and black pepper
- Coconut, lanzones and banana
- Coconut, lanzones and pineapple
- Coconut, durian and pineapple
- Coconut, durian and banana

[42] *Agricultural Policies in the Philippines*.

[43] "Poverty or Plenty for Coconut Growers in the Philippines?"

[44] *ibid.*

[45] "Transform Coconut Farmers from Poverty to Prosperity by Revising Government Policies, Part 1."

[46] *Agricultural Policies in the Philippines*.

[47] "Transform Coconut Farmers from Poverty to Prosperity by Revising Government Policies, Part 1."

[48] Personal information during the CIAT workshop for project formulation in Cebu (31 May - 1 June 2018).

[49] "Transform Coconut Farmers from Poverty to Prosperity by Revising Government Policies, Part 1."

[50] "Poverty or Plenty for Coconut Growers in the Philippines?"

[51] "Transform Coconut Farmers from Poverty to Prosperity by Revising Government Policies, Part 1."

[52] *ibid.*

[53] *Agricultural Policies in the Philippines*.

[54] Philippine Coconut Authority, 2005. "Coconut-Papaya-Pineapple-Peanut: Multi-storey Cropping Model." Coconut Intercropping Guide No. 3. http://www.pca.da.gov.ph/coconutrde/images/cig3.pdf (accessed July 2019).

10. Other existing crop combinations include:[55]

- Coconut, papaya, pineapple and taro
- Coconut, upland rice, pineapple, daisy, banana, sweet potato, *sayote* (*Sechium edule*) and ginger
- Coconut, coffee, upland rice, corn, papaya and pineapple
- Coconut, banana, lanzones, coffee and taro
- Coconut, papaya, banana, *kakawate* (*gliricidia sepium*), black pepper, taro and pineapple
- Coconut and three other crops simultaneously grown on one hectare of land
- Coconut, shorter fruit trees (mango, coffee, cacao), and ground-level crops (pineapple, peanut, tuber and root crops, such as cassava and potato).[56]

11. What is known as the Cavite system[57] has several storeys of cultivated plants with coconut occupying the upper layer. Beneath are medium-tall trees such as jackfruit (*Artocarpus heterophyllus*), mango (*Mangifera indica*), avocado (*Persea americana*), santol (*Sandoricum koetjape*), lanzones (*Lansium domesticum*) and guava (*Psidium guajava*). At the lower level, a canopy of leaves is formed by banana (*Musa* spp.), coffee (*Coffea robusta* and *C. arabica*), and papaya (*Carica papaya*) which are the main cash crops.

12. The thinner trunks support twining plants like black pepper (*Piper nigrum*), yam (*Dioscorea alata*), passion fruit (*Passiflora edulis*), *patola* (*Luffa* spp.) and squash. Below these plants grow shade-loving crops such as taro (*Colocasia esculenta*), arrowroot (*Maranta arundinacea*), sweet potato (*Ipomoea batatas*), and cassava (*Manihot esculenta*). These are randomly planted for food and animal feed. Other root crops like ginger are also added as sources of cash. Pineapple (*Ananas comosus*) is one of the main cash crops that occupy the lowest layer. The plant is drought and typhoon tolerant and effectively suppress weeds, reducing labor cost. Multi-purpose trees like *kakawate* (*Gliricidia sepium*) and *ipil-ipil* (*Leucaena leucocephala*) are planted on the border to serve as fence. They are also mixed with fruit trees to provide shade for coffee and black pepper, while the leaves are used as feed for livestock. Fallen leaves and pruned material function as mulch and fertilizer. The common planting sequence of a Cavite system is as follows:[58]

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[55] Parreño-de Guzman, L. E., Zamora, O. B. and Bernardo, D. F. H., 2015. "Diversified and Integrated Farming Systems (DIFS):Philippine Experiences for Improved Livelihood and Nutrition." *Journal of Developments in Sustainable Agriculture*. Vol. 10, No. 1, 19-33.

[56] World Agroforestry, 2016. "Filipino coconut farmers diversify and build resilience through agroforestry." https://www.worldagroforestry.org/news/filipino-coconut-farmers-diversify-and-build-resilience-through-agroforestry (accessed July 2019).

[57] "Diversified and Integrated Farming Systems (DIFS):Philippine Experiences for Improved Livelihood and Nutrition."

[58] Friday, K. S., Drilling, M. E. and Gamty, D. P., 1999. *Imperata Grassland Rehabilitation using Agroforestry and Assisted Natural Regeneration.* Bogor, Indonesia: International Centre for Research in Agroforestry.

Year	Plant	Grow and care for	Harvest
1 (first crop, after land clearing and fertilization)	Papaya Upland rice Pineapple Coffee (under papaya) Coconut		Upland rice
1 (second crop)	Vegetables Peanuts	Papaya Pineapple Coffee Coconut	Vegetables Peanuts
2	Bananas	Pineapple Coffee Coconut	Papaya
3-4		Coconut	Papaya Pineapple Bananas Coffee
5		Coconut	Coffee Bananas
6+			Coffee Bananas Coconut

13. The crop combinations are thought to be site specific, because continuous selection for varieties adapted for local conditions have taken place. Almost all farmers select themselves the material to plant, and many of them have a nursery where the preferred planting materials are propagated, maintained and adapted to the local environment.

14. A paper published in 1983[59] reports that planting of coconuts together with black pepper, pineapple and papaya/cacao increased yield and total profitability of all crops in the area. The income generated was more than double of that from the monoculture system. The coconuts are thought to benefit from fertilizers and weed management given to other crops. Only 30% of land used for coconut farming was intercropped as of around 2015.[60] For coconut,[61] land preparation is mostly carried out by men and harvesting exclusively by men. Planting, cleaning and marketing are equally shared by women and men.

Land Tenure and Coconut Farming

15. The land tenure system is highly fragmented and very complex in the Philippines.[62] As of 2011, land administration and management were governed by nineteen government agencies and numerous land titling and registration laws, some overlapping but none covering the inter-sectorial issues.[63] In 2010, roughly 70% of farmers were landless and 2.9 million smallholders had an average farm size of 2.01 ha, while some 13,000 landholders owned up to 20,000 ha.[64] The average farm size in 2012 was smaller by 0.84 ha than that in 1991,[65] due to conversion of land from agricultural to other

59 Margate, R. Z. and Magat, S. S., 1983. “Coconut-Based Multi-storey Cropping.” *Philippines Journal of Crop Science*. Vol. 8, No. 2, 81-86.

60 *Agricultural Policies in the Philippines*.

61 CIAT Workshop for project formulation in Cebu (31 May - 1 June 2018).

62 *Agricultural Policies in the Philippines*.

63 *ibid.*

64 Elauria, M. M. E., 2015. “**Farm Land Policy and Financing Program for Young Generation in the Philippines.” .FFTC Agricultural Policy Platform. Food and Fertilizer Technology Center for the Asian and Pacific Region.** http://ap.fftc.agnet.org/ap_db.php?id=448&print=1 (accessed July 2019).

65 *Agricultural Policies in the Philippines*.

uses and population growth.[66] The average coconut farm size was reduced from 3.6 ha in 1991 to 2.4 ha in 2002, partly due to the Comprehensive Agrarian Reform Program.[67]

16. Land tenure is often considered the dominant obstacle to more productive land management.[68] The coconut tenancy in Leyte and Samar is based on trees and not on land.[69] In other words, crops grown under the trees are not included in the sharing arrangement.[70] The tenancy arrangement encumbers swift removal of debris to prepare the land for replanting and prevent infestations, because the tenants need to obtain the approval of landowners.[71] Landowners generally do not allow understory cropping to avoid future claims to permanent occupancy[72] and have used the absence of coconut trees as a justification to either remove tenants from the land or convert them into other uses after typhoon Haiyan/Yolanda.[73] Agricultural corporations in the country have manifested their intention to replace coconut by oil palm.[74] Where land rights are secure and agrarian reform has been implemented, coconut farming has recovered from the typhoons.[75]

17. Land tenure is one of the most important factors that hinder farmers to take a long-term view in resources management, but a study in the Philippines has shown that farmers' collaboration with institutions and subsequent participation in resources management at the levels of policy, initiative, research and so on, may be equally critical.[76] Interventions that create market incentives for environmentally destructive crops are likely to be unsustainable, as well as those that may be environmentally sound, but ignore the market forces;[77] farmers and institutions have different knowledge, which together can be holistic and contribute to establishment of sustainable practices. Close relationships between the two also endow farmers with some resilience to changes in local politics.[78]

Coconut Value Chains

18. The usual postharvest treatment for farmers is to extract coconut meat for drying into copra, the main coconut derived product, and sell mature or husked coconuts to village agents who in turn sell to traders.[79] Volume, size or quality is not questioned, and farmers are paid instantly in cash without a written contract.[80] In turn, traders sell copra or husked coconuts to mills for processing, which is usually done locally.[81] Most copra is processed into crude coconut oil for domestic use and

"Farm Land Policy and Financing Program for Young Generation in the Philippines."

66 *Agricultural Policies in the Philippines*.

67 *ibid.*

68 **"The Philippines."**

69 Focus on the Global South, 2015. "Understanding Land Grabbing, Land Rights in the 21st Century." *Policy Review*. Vol. 1 No. 6, January-June. https://focusweb.org/wp-content/uploads/2017/04/PolicyReview2015_Understanding-Land-Rights_Land-Grabbing_21stCentury.pdf (accessed July 2019).

70 *ibid.*

71 *ibid.*

72 **"The Philippines."**

73 "Understanding Land Grabbing, Land Rights in the 21st Century."

74 *ibid.*

75 *ibid.*

76 Tanguilig, H. C. and Tanguilig, V. C., 2009. "Institutional aspects of local participation in natural resource management." *Field Actions Science Reports*. Vol. 3. https://journals.openedition.org/factsreports/pdf/275 (accessed July 2019).

77 *ibid.*

78 *ibid.*

79 *Agricultural Policies in the Philippines*.

80 *ibid.*

81 *ibid.*

exportation. Further refinement is required for obtaining cooking oil and other products.[82] The prices of copra has precipitated of late, and as the experience of Thailand indicates, other coconut products bring much higher revenue.[83]

19. Thanks to the local agents and traders, the costs of transportation to markets do not fall upon the farmers, but it is the traders and millers who control the farm gate prices and benefit from **high marketing margins**.[84] Farmers could benefit by forming cooperatives, and in recognition of this potential, the PCA signed a memorandum of agreement with the Cooperative Development Authority (CDA) to strengthen the development of coconut farmer cooperatives.[85] It is unknown how the PCA has been effective in increasing the bargaining power of the farmers.

Climate Impacts and Coping Strategies: Coconut Farming Systems

20. Droughts result in smaller nuts,[86] and the damage from the 1978-79 drought in Visayas was so high that it took three years to recover. The farmers coped by adopting root crops as major food. The impact from the typhoon Haiyan/Yolanda in 2013 was also large. Half of the coconut trees were damaged in Visayas, an estimated 44 million trees were damaged or destroyed around the country, affecting around 1 million coconut farmers.[87] The inputs distributed by the government to aid recovery were of poor quality, according to the farmers in Visayas,[88] and it took two years to recover. Typhoon Ruby in 2014 caused medium damage.[89] Unpredictable weather under climate change has lowered coconut production and reduced the hours suitable for working in the field because of heat.[90] Climate change has resulted in decrease in coconut supply, leading to shutting down of processing facilities and weakening the whole value chain.[91]

21. Smallholder farmers earn little and are unaware of simple techniques, such as using salt as an organic fertilizer.[92] The famers cope with climate change by trying alternative livelihoods: backyard pig raising; vegetable cultivation with the information obtained from Farmer Field Schools; cultivation of banana and root crops; migration; and praying.[93]

22. FAO implemented the Coconut-Based Farming Systems programme as part of the Organization's USD 39.7 million Typhoon Haiyan Strategic Response Plan, in collaboration with the Department of Agriculture, the PCA, the Department of Agrarian Reform, the Department of Environment and Natural Resources, the National Commission for Indigenous Peoples and local government units. The programme aimed at enabling small-scale coconut farmers to plant short term cash crops and annual crops to provide alternative livelihood sources, while also integrating climate-smart farming technologies. The Department of Agriculture and the International Institute of Rural Reconstruction have been promoting agroforestry, particularly multi-storey cropping, to provide farmers with alternatives.[94] The coconut farmers have been provided with seeds and planting

[82] *ibid.*
[83] "Government readies nationwide coconut replanting program."
[84] *Agricultural Policies in the Philippines*.
[85] *ibid.*
[86] CIAT Workshop for project formulation in Cebu (31 May - 1 June 2018).
[87] "Restoring coconut farmers' livelihoods in the Philippines."
[88] CIAT Workshop for project formulation in Cebu (31 May - 1 June 2018).
[89] *ibid.*
[90] *ibid.*
[91] *ibid.*
[92] "Poverty or Plenty for Coconut Growers in the Philippines?"
[93] CIAT Workshop for project formulation in Cebu (31 May - 1 June 2018).
[94] World Agroforestry, 2016. "Filipino coconut farmers diversify and build resilience through agroforestry."

materials and received training on agroforestry with a focus on the ability of trees to create a microclimate that protects plants from harsh conditions and to prevent soil from losing moisture rapidly. [95]

Approaches and Actions for Strengthening Resilience of Coconut Farming Systems

23. Three possible approaches and actions for strengthening the resilience of coconut farming systems are: increasing the availability of effective inputs; strengthening the capacity of the Philippine Coconut Authority (PCA) and its connection with the farmers and improving the efficiency and equity of coconut value chain.

24. Strengthening the capacity of the Philippine Coconut Authority (PCA) and its connection with the farmers

- Coordination among the Department of Agriculture (DA), the PCA and the Local Government Units (LGUs) will be strengthened to allow planning of synergized programs and activities, especially on diversification opportunities.
- NGOs involved in coconut farming will be part of the above coordination so that they can share the on-ground information with the PCA.
- The main role of the PCA, at least at the beginning, should be in scaling up the good practices and initiating a legal reform to create an environment conducive to adoption of climate resilient agriculture, which includes engaging the landowners and other government institutions.
- The technical and administrative capacities of the PCA will be strengthened through training of existing staff and merit-based hiring.
- The PCA will be extensively trained on multi-storey coconut farming and other climate resilient agriculture for coconut so that their technicians can function as extension officers.
- The PCA, farmers and NGOs will be trained on broader natural resources management to integrate forestry, livestock and landscape.
- The final goal would be to foster collaboration relationships among farmers, the DA, the PCA, the LGUs, the Cooperative Development Authority (CDA), NGOs and academia at the local level and to create a “coconut platform,” which prioritizes ecological and socioeconomic information from the farmers.

25. Increasing the availability of effective inputs: seeds, seedlings and credit

- The platform will search for high quality indigenous varieties fit for each locality.
- Once suitable varieties are identified, the platform will engage in reproduction and distribution of its seeds and seedlings.
- The capacity of the farmers will be strengthened to preserve seeds, identify and select the useful traits, propagate the desirable individual plants and efficiently replant.
- The platform will collaborate with a financial institution, such as Land Bank, to design credit that serve the idiosyncrasies of coconut farmers.

26. Improving the efficiency and equity of coconut value chain

- The platform will strengthen the capacity of farmers to engage in coconut processing, form and self-govern cooperatives, read and respond to market trends, and engage in commercial negotiations.
- The platform will engage in dialogue with traders and millers to identify the most profitable set of coconut products and the farmers’ share of labor and benefits.

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https://www.worldagroforestry.org/news/filipino-coconut-farmers-diversify-and-build-resilience-through-agroforestry (accessed July 2019).

[95] *ibid.*

- The platform will formulate strategies for disaster risk reduction (which forms part of climate resilient agriculture) and post-disaster actions with traders and millers.

2.3.2 Agriculture in the Highlands of the Philippines

27. The mountains, the typhoons and the two monsoon seasons – summer and winter – create microclimates in the Philippines with wide variations in seasonal distribution and amount of precipitation as well as great potential for soil erosion in the mountainous areas.[96] Dry spells are common and monsoons differ yearly in intensity and duration,[97] but 90% of land receives at least 1,780 mm of precipitation per year.[98] Four types of climate are distinguished by rainfall patterns, and all extend throughout the archipelago from north to south, although the type with two pronounced dry and wet seasons is absent in the very south and that with heavy rain in November-January is missing from the northwestern parts.[99]

28. Approximately 55% of the land in the Philippines is highlands with slopes of 18% and more.[100] The soils of sloping upland are of three categories: strongly acidic and infertile soil with little phosphorous ready for uptake; young and relatively fertile volcanic soil; and calcareous soil.[101] The first type is the most dominant, while the young, more fertile volcanic soils cover large areas in the southern Tagalog and Bicol regions, on Negros Island and in some areas of Mindanao. Calcareous soils often contain more than 15% of $CaCO_3$ in various forms – powder, nodule, crust, etc. –[102] and are found in the highlands of Cebu and Bohol in the central Visayas.[103] Calcareous soils may be highly productive if water and nutrients are available, but in case calcium is in the form of impermeable hard pan, deep ploughing and drainage system will be required.[104] The lowland soils are mostly fluvial and the most fertile;[105] it has been proposed that upland environments should be recognized as ecosystems distinct from the lowlands.[106]

29. Upland soils are used for highland and tree crops, and the volcanic soil supports the most developed agriculture in the uplands.[107] Thanks to the abundant springs at high levels, hill and mountain soils support cultivation of rice, corn, sugarcane, fruit trees and vegetables, although erosion and land degradation may limit growth.[108] In the early 1990s, the cultivated land extended over 11.3 million ha, or 38% of the total land area, of which 3.9 million ha was in the uplands, and deforestation was already widespread.[109] Uplands was home to an estimated population of 17.8

[96] ***"The Philippines."***

[97] Wikipedia, 2019. "Climate of the Philippines." https://en.wikipedia.org/wiki/Climate_of_the_Philippines (accessed July 2019).

[98] ***"The Philippines."***

[99] Research team of the project on Bridging the gap between seasonal climate forecasts (SCFs) and decision makers in agriculture, 2005. "Basics on Philippine climatology." *Economic Issue of the Day.* Vol. V, No. 2.

[100] ***"The Philippines."***

[101] *ibid.*

[102] FAO, 2019. "Management of calcareous soils." http://www.fao.org/soils-portal/soil-management/management-of-some-problem-soils/calcareous-soils/en/ (accessed July 2019).

[103] ***"The Philippines."***

[104] "Management of calcareous soils."

[105] *Agricultural Policies in the Philippines*.

[106] ***"The Philippines."***

[107] ***ibid.***

[108] *Agricultural Policies in the Philippines*.

[109] ***"The Philippines."***

million around the same time[110] and about 24 million circa 2010.[111] The present population density in the uplands is likely to be nearly or more than 200 persons per km^2,[112] while the density for the whole country was 337 in 2015.[113] The inhabitants are primarily poor farming families with insecure land tenure.[114] On the elevated flatlands of Benguet, highly commercialized vegetable cultivation by smallholders is most common. Mainly indigenous peoples reside in the steep areas and practice indigenous or non-indigenous modern agriculture, while increasingly more of lowland farmers are migrating to higher elevations due to insufficient agricultural land at lower altitudes.

30. The CRA studies of CIAT examine the climate impacts and adaptation options involving vegetables, coffee and cacao in detail with a focus on farm finance and value chains (see FP Part 2 B (i) and CIAT CIGAR Research Programs for Luzon and Mindanao).

Non-Indigenous Agriculture in the Highlands

Vegetable agriculture system on upland plateaus

31. Benguet province lies at 1,500 m above sea level on top of the Cordillera Mountains[115] with a wide plateau amid sloping terrains and deep valleys.[116] The climate is sub-tropical unlike most of the country, and the original soil is fertile.[117] The history of the so-called Vegetable Belt or Salad Bowl[118] in the Philippines started with an American soldier in the late 19th century, who cultivated cabbage, turnip, rhubarb, lettuce, sugar beet, carrot, celery, parsley, potato, oats and rye, using the seeds from his native Philadelphia on the fertile virgin soil of Benguet.[119] Migrant Chinese, who were among the recruited to help build Kennon Road in the area from 1902 to 1911, followed suit and introduced intensive vegetable farming and new crops, such as cabbages (*pechay* and *wombok*) and broccoli.[120] Farming was basically organic, relying on composting, crop rotation, pest control by insect predators, and irrigation, but it is reported that uses of chemical fertilizers and pesticides were observed during the same period.[121]

32. The local hired hands spread the trade, and today Benguet and some nearby towns of Mountain province together consist the Vegetable Belt, which is estimated to supply 80% of the country's vegetables.[122] The title of Strawberry Country has been recently added, as Benguet began cultivating strawberries, a rarity in the tropics, although its potential for other temperate fruits has

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[110] ***ibid.***

[111] Espiritu, N. O., Casin, C. S. and Camacho, S. C., 2010. "Development Pathways in the Philippine Uplands: Impacts and Influences on Forest Resource Management and Human Well-Being." *Asian Journal of Agriculture and Development*, Vol. 7, No. 2, 27-47.

[112] ***"The Philippines."***

[113] Philippines Statistics Authority, 2016. "Philippine Population Density (Based on the 2015 Census of Population). *https://psa.gov.ph/content/philippine-population-density-based-2015-census-population (accessed November 2019).*

[114] ***"The Philippines."***

[115] Government of Philippines, 2012. "Facts and Figures: Benguet Province at a Glance." http://nap.psa.gov.ph/rucar/fnf_benguet.htm (accessed July 2019).

[116] *ibid.*

[117] *ibid.*

[118] *ibid.*

[119] Malanes. M., 2001. "A Century of Cordillera Vegetable Salad." http://www.travelsmart.net/article/101895/ (accessed July 2019).

[120] *ibid.*

[121] *ibid.*

[122] "A Century of Cordillera Vegetable Salad."

not been exploited so far.[123] The agricultural land claims about 30,000 ha, involving 27,500 farms[124] and tuber-, roots-, bulb-, leafy and stem vegetables as well as flowers.[125] The two major problems associated with the Vegetable Belt are: excessive use of pesticides; and unequal bargaining power between the traders and producers. Some Benguet farmers practice organic farming, but their activities are not widely known.[126]

Vegetable value chain

33. Lack of good quality road and heavy precipitation during the rainy season often cut off the farmers from the markets, especially when landslides are triggered.[127] The vegetable trading posts are few and equipped only for basic deliveries, not for handling harvest overflows, long-term warehousing, large vehicles, or dissemination of timely market information to farmers in the province.[128]

34. Despite the strong interpersonal networks, farmers and traders are connected by rather low level of trust, which necessitates intensive search and negotiation for the farmers and raises transaction costs. Since the traders are more knowledgeable about market prices than farmers, it creates incentives for them to deceive.[129] As the farmers sell at the same trading center year after year, they also become well acquainted with certain traders, which creates social obligation to continue the relationship.[130] The farmers may receive gifts and cash advances from the traders, which reinforces the obligation of the farmers.[131] Most vegetables are sold by consignment, and the trader supplies what the farmer may need in advance.[132] Whatever is provided by the traders are considered loans whose terms are often usurious,[133] and all expenses incurred are deducted from the payment to the farmer during the following harvest.[134] More than a third of the earnings from crop sales goes to payments for inputs: 2% for seeds; 5% for chicken dung; 13% for synthetic fertilizers; and 20% for pesticides.[135] The system exists in many variations, while the prototype system is said to have been passed to the local farmers from the Chinese farmers.[136]

35. A produce auction can lower the high transaction costs and allow farmers to at least partly circumvent the trader-farmer relationship that is unfavorable to them, but the system has not been introduced.[137] The vegetable prices took a nosedive in January 2019, so much so that the farmers

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[123] "Facts and Figures: Benguet Province at a Glance."

[124] Lu, J. L., 2010. "Analysis of Trends of the Types of Pesticide Used, Residues and Related Factors among Farmers in the Largest Vegetable Producing Area in the Philippines." *Journal of Rural Medicine*. Vol. 5, No. 2, 184-189.

[125] "Facts and Figures: Benguet Province at a Glance."

[126] Mission in Benguet (24-25 May 2018).

[127] *Sustainable Poverty Reduction in Less Favoured Areas*.

[128] *ibid.*

[129] *ibid.*

[130] *ibid.*

[131] *ibid.*

[132] Province of Benguet, undated. "The Pride of Benguet: 2. Vegetable Farming and Trading." https://www.benguet.gov.ph/index.php/11-municipalities/374-vegetable-farming-and-trading (accessed July 2019).

[133] Ápit Takó, undated. "The Need to Develop Low-Input Agriculture as an Alternative to Hi-Input Farming among the Peasants of the Northern Luzon Cordillera."
origin.who.int/ifcs/documents/forums/forum5/dammay.pdf (accessed July 2019).

[134] "The Pride of Benguet: 2. Vegetable Farming and Trading."

[135] "The Need to Develop Low-Input Agriculture as an Alternative to Hi-Input Farming among the Peasants of the Northern Luzon Cordillera."

[136] The Pride of Benguet: 2. Vegetable Farming and Trading."

[137] Milagrosa, A., 2001. *Marketing of Vegetables from the Cordillera Region, Philippines: A Transaction Cost Analysis*. Master's Thesis. University of Gent.

simply took their produces back home from the trading post to throw them away.[138] During that period, direct internet sale to consumers in metro Manila came into existence, thanks to connections through social media.[139]

Pesticide application to vegetables

36. **Direct Effects:** Vegetables, banana and rice are the most important crops in Benguet with respect to pesticide application.[140] The major types of pesticides used by the Benguet farmers are: pyrethroids; organophosphates; and carbamates.[141] Exposure to pesticides occurred when the farmers: re-entered recently sprayed area; sprayed against the wind; used a damaged backpack sprayer; allowed spills on their backs; wiped sweat on the face with residue-contaminated piece of fabric; did not label the pesticide container; and let pesticides spill while spraying.[142] The farmers sprayed more frequently at the peak of harvesting, as much as every other day. Some farmers dipped their harvested vegetables in formalin so that they would be greener and crispier.[143]

37. An undated document reported that a large percentage of vegetable farmers suffered diseases attributable to constant exposure to hazardous chemicals: 70% suffered skin diseases; 66% had eye diseases; 50% exhibited the symptoms of gastro-intestinal tract disorder; 38% to 39% exhibited the symptoms of various blood disorders; and 28% suffered cardio-pulmonary diseases.[144] About a quarter of the farmers had experienced acute toxicity while handling pesticides, and 42% had experienced symptoms of nervous systems disorders.[145] In 2010, muscle pain was the most frequently experienced health symptoms of the farmers, followed by fatigue, weakness and eye irritation.[146][147] Miscarriage among households engaged in continuous pesticide application was 4.1%, compared to 0.6% among households that practiced integrated pest management. Birth defects was 3.5% and 0.91%, respectively, for these two types of households.[148] In 2002-2003, the Vegetable Belt was attacked by leaf miner; it is thought that climate change is at least partially responsible.[149]

38. **Indirect Effects:** Pesticide residues were found in crops, soil and water samples in Benguet.[150] Different kinds of pesticide residues – including restricted pesticides, such as DDT – were

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https://www.researchgate.net/publication/40124697_Marketing_of_vegetables_in_the_Cordillera_region_a_transaction_cost_analysis (accessed July 2019).
AvianQuest, 2017. "Bagio City: Vegetable Porters La Trinidad Benguet & Baguio City." AvianQuests.com https://www.avianquests.com/2017/07/vegetable-porters-la-trinidad-benguet.html (accessed July 2019).

[138] Cimatu, F., 2019. "Low prices leave Benguet vegetables rotting." Rappeler. 9 January 2019. https://www.rappler.com/business/220608-low-prices-leave-benguet-vegetables-rotting (accessed July 2019).

[139] Aguilar, K., 2019. "Online store helps Benguet farmers sell their vegetables." Inquirer.net. 24 January 2019. https://newsinfo.inquirer.net/1077048/online-store-helps-benguet-farmers-sell-their-vegetables (accessed July 2019).

[140] "Analysis of Trends of the Types of Pesticide Used, Residues and Related Factors among Farmers in the Largest Vegetable Producing Area in the Philippines."

[141] *ibid.*

[142] *ibid.*

[143] *ibid.*

[144] "The Need to Develop Low-Input Agriculture as an Alternative to Hi-Input Farming among the Peasants of the Northern Luzon Cordillera."

[145] *ibid.*

[146] "Analysis of Trends of the Types of Pesticide Used, Residues and Related Factors among Farmers in the Largest Vegetable Producing Area in the Philippines."

[147] *ibid.*

[148] Lu, J. L, 2010. "Gender Analysis of Women in the Philippine Agriculture and Their Occupational Issues." *Journal of International Women's Studies*. Vol. 11, Issue 4, 73-82.

[149] "The Need to Develop Low-Input Agriculture as an Alternative to Hi-Input Farming among the Peasants of the Northern Luzon Cordillera."

[150] "Analysis of Trends of the Types of Pesticide Used, Residues and Related Factors among Farmers in the Largest Vegetable Producing Area in the Philippines."

simultaneously present in some vegetables.[151] The soil has turned hard, dry and acidic due to pesticide application and other practices of input-intensive agriculture,[152] which is limiting production together with unavailability of irrigation water.[153] Diminishing returns from production has forced farmers to clear forests such that hardly any watershed still survives in the Vegetable Belt. Consequently, numerous springs have vanished, and many rivers have become creeks.[154]

Sloping land agriculture options

39. Steep terrains with slopes of 18% and above occupy more than half of the land surface of the country,[155] and sloping lands are the norm in the uplands outside Benguet. The slopes near lowlands and roads are rapidly being converted into permanent farming for subsistence crops (white corn and upland rice) and cash crops (coconut and hybrid and genetically modified yellow corns, some of which is used as cattle feed).[156] Driven by needs for food and cash, farmers are expanding permanent farming onto the grasslands, which occupy the lands higher and deeper in the mountains, and also turning forests, which are on the steepest slopes at the highest elevations, into grasslands.[157] Compared to swidden agriculture properly practiced (further information in section below on indigenous peoples' farming systems), permanent farming is more conducive to soil nutrient depletion and erosion, both of which are linked to the soil's capacity to hold water.[158]

40. Several systems have been proposed to intercept the soil carried by runoff at certain intervals with the use of intercropping, which results in levelling the ground and forming a terrace structure.[159] Prevention of soil erosion is accompanied by improvements in water infiltration, soil nutrient retention and structure.[160][161] In other words, the intercepting vegetation also has the potential to mitigate chemical pollution downstream.[162] If trees are employed as barriers, more carbon is sequestered than in the cases of other vegetation, such as grass. The systems invariably contain two major elements: contour bunding; and use of vegetation as bunds (which is alley cropping in case of trees and crops). Although not highlighted by the methods of sloping agriculture below, minimum tilling and adequate nutrient supply also constitute important components to mitigate soil erosion and resultant nutrient loss.

Contour Bunding with Hedgerows[163]

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[151] *ibid.*

[152] "The Need to Develop Low-Input Agriculture as an Alternative to Hi-Input Farming among the Peasants of the Northern Luzon Cordillera."

[153] Ruben, R., Pender, J. and Kuyvenhoven, A., 2007. *Sustainable Poverty Reduction in Less Favoured Areas*. Wallingford: CABI.

[154] "The Need to Develop Low-Input Agriculture as an Alternative to Hi-Input Farming among the Peasants of the Northern Luzon Cordillera."

[155] "Diversified and Integrated Farming Systems (DIFS):Philippine Experiences for Improved Livelihood and Nutrition*."*

[156] ***"The Philippines."***

CropLife Philippines, 2013. "Sustainable Corn Production in Sloping Areas." Seeds and Biotech. http://www.croplife.org.ph/sustainable-corn-production-in-sloping-areas.html (accessed July 2019).

Transon, J., 2017. "Corn Crops in Bukidnon, Philippines Synthesis from field survey and literature." LUCID Project –Socialjustice implications of land use change in the Philippine uplands. Académie de recherche et d'enseignement supérieur. https://lucid.essc.org.ph/wp-content/uploads/2017/11/Transon_Julie_Repport_corn_2017.pdf (accessed July 2019).

[157] ***"The Philippines."***

[158] "Sustainable Corn Production in Sloping Areas."

[159] ***"The Philippines."***

[160] Canedo, K. V., 2016. "Preventing runoff thru contouring." SunStar Philippines. 1 February 2016. https://www.sunstar.com.ph/article/55657 (accessed July 2019).

[161] ***"The Philippines."***

[162] *ibid.*

[163] ***"The Philippines."***

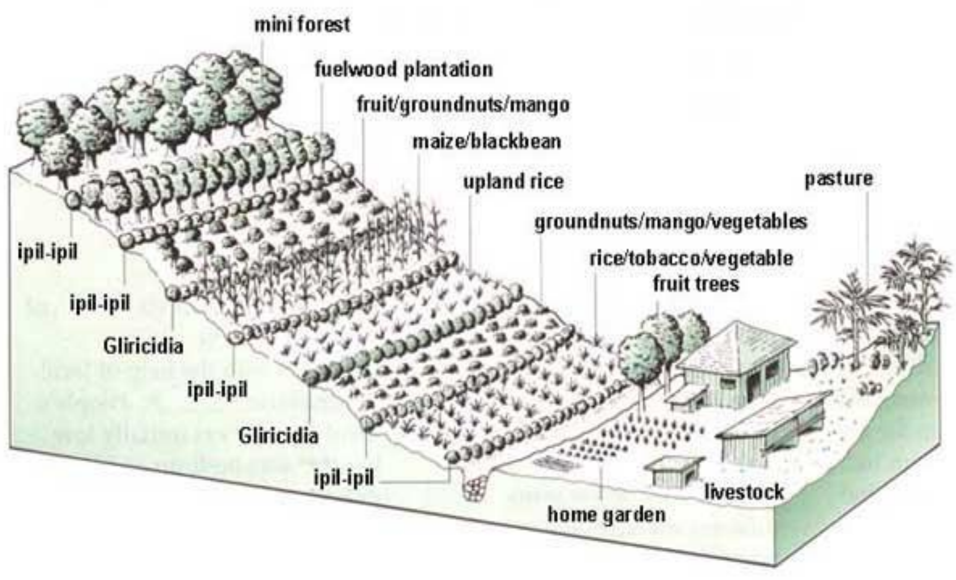
41. Developed by the World Neighbors, an NGO, in collaboration with farmers in the 1980s, contour bunds can be established by double hedgerows of leguminous trees or forage grasses. Terraces were naturally formed three years after application of this method. When upland rice was grown between the hedgerows of *anchoan dilaw* (*Cassia spectabilis),* overall rice production showed a modest increase. The total yields of corn and rice were consistently increased when intercropped with hedgerows of *kakawate* (*Gliricidia sepium)*, known for its nitrogen fixing properties. Since the primary roots of both trees spread laterally into alleyways at shallow depths (20 to 35 cm), which is immediately beneath the plow layer, the crop yields in the rows near the hedges were severely affected.

Alley Cropping

42. The alleys created by hedgerows of trees can be put into good use by cultivating vegetables, forage legumes, grasses or trees (such as fast-growing trees for fuel).[164] The vegetables may be planted parallel or perpendicular to tree rows as boundary planting, or around the trees. The trees may elevate the nutrient use efficiency by recovering the nutrient leached in soil beyond the reach of shallow rooted vegetables.

Sloping Agricultural Land Technology (SALT) [165]

43. In the 1970s, the Mindanao Baptist Rural Life Center, a small church-related non-government organization with a 19-hectare demonstration farm located in Davao del Sur, developed sloping agricultural land technology (SALT).[166] The objectives of SALT are to: control soil erosion through establishment of double hedgerows of leguminous shrubs or trees; help restore soil structure and fertility through crop rotation and frequent pruning (every 30-45 days) whose cuttings are incorporated back into soil; and produce food efficiently.[167] A typical SALT application is as shown in the figure below,[168] with multipurpose trees, such as *kakawate* (*Gliricidia sepium*) and *ipil-ipil* (*Leucaena* spp.).



[164] "Diversified and Integrated Farming Systems (DIFS):Philippine Experiences for Improved Livelihood and Nutrition."

[165] *ibid.*

[166] *Ibid.*

[167] *ibid.*

[168] Mittleman, R., 2012. "A Review of Sloped Agricultural Land Technology (SALT)." A Growing Culture. http://www.agrowingculture.org/a-review-of-sloped-agricultural-land-technology-salt/ (accessed July 2019).

44. The original sloping agricultural land technology is designed for a 1-ha farm with a 25% slope, of which three-fourths are devoted to agricultural crops and the rest to trees. Today, annual crops (legumes, cereals, and vegetables) and perennial crops (cacao, coffee, banana, citrus and fruit trees) are planted in bands of 3-5m width between double rows of nitrogen-fixing shrubs and trees planted along the contour. These shrubs and trees minimize soil erosion and maintain soil fertility, and the crops act as permanent vegetative cover to protect soil and water. Soil and air temperatures are maintained at levels favorable for the growth of crops by the legumes and perennial crops. This system produces 5-6 times more of crops compared to traditional corn (*Zea mays*) farming.

SALT 2[169]

45. SALT 2 (Simple Agro-Livestock Technology) is a variant of SALT, an agroforestry system on a half-hectare of sloping land centered on goat husbandry. Goats were chosen for their high fertility rate, short intervals between kidding, and marketability. Their manure also makes good fertilizer. One version allocates 40% of land to agriculture, other 40% to livestock and 20% to forestry, and another 50% to fodder trees and the rest to subsistence and cash crops.

SALT 3[170]

46. SALT 3 (Sustainable Agroforest Land Technology) is a small-scale reforestation system on 2-ha sloping land with food production. The expected products are food, fruit, animal feed, fertilizer, fuelwood and timber. Around 40% of the land is used for crops and 60% (including the upper 1 ha) for trees. Woody perennials form hedgerows along the contour lines, spaced 4-6 m apart. Hedgerows are trimmed at the height of 2 m, and cut foliage is spread in the alleys as fertilizer. The plants are supposed to have various time horizons in terms of their usefulness.

47. Every first and second alley between the hedgerows is planted with annual crops, such as corn, upland rice, beans, ginger, and pineapple. Crop rotation is practiced for soil fertility and soil formation. In every third alley are fruit trees and other permanent cash crops, such as coffee, cacao (*Theobroma cacao*), banana, calamansi (*Citrofortunella microcarpa*), guava, rambutan (*Nephelium lappaceum*), durian (*Durio zibethinus*), mango, jackfruit, and lanzones. During the initial development phase, short-term cash crops such as cowpea (*Vigna unguiculata*), peanut, mungbean (*Vigna radiata*), eggplant, and tomato may also be planted.

SALT 4[171]

48. SALT 4 (Small Agrofruit Livelihood Technology) focuses on horticulture and plantation crops, based on the realization that commercialization of crops is necessary for economic development. On the slopes of highlands in Cebu, cut flowers are planted in between the hedgerows of nitrogen-fixing trees.

Sustainable Corn Production for Sustainable Agriculture (SCoPSA)

49. The Department of Agriculture started advocating hedgerow cropping in the early 1980s as a technique for sustainable cereal cultivation on sloping lands with minimal to no fertilizer application.[172] It adopted the method by the mid-1980s as the basis for their extension efforts, including training of extension personnel and creation of demonstration plots.[173] It was also used as

169 "Diversified and Integrated Farming Systems (DIFS):Philippine Experiences for Improved Livelihood and Nutrition."

170 *ibid.*

171 *ibid.*

172 **"The Philippines."**

173 *ibid.*

the technical basis for social forestry pilot projects of the Department of Environment and Natural Resources.[174]

50. In 2013, the Bureau of Soils and Water Management (BSWM) of the Department of Agriculture (DA) started implementing in Davao a project entitled, Sustainable Corn Production for Sustainable Agriculture (SCoPSA),[175] which aims to enhance the productivity of corn farming through sustainable land use management, restoring ecological balance in sloped areas.[176] The project now has a national scope with the collaboration of the DA Regional Field Offices, DA Agricultural Training Institute, local government units, CropLife Philippines (an association of companies related to agriculture),[177] and various NGOs.[178] The focus is on soil erosion control and gully stabilization coupled with soil fertility improvement,[179] which are enhanced through contour tillage, crop rotation and crop residue management.[180]

51. The prototype farming system of SCopSA is corn monoculture with contours, lined with double row planting of nitrogen fixing plants, such as legumes, *kakawate* (*Gliricidia sepium*) and *ipil-ipil* (*Leucaena* spp.), and transforms the slopes naturally into terrace-like structures.[181] The system is one of the SALT[182] and considered suited to areas sloped less than 30%.[183] The government assists during the first year of the implementation by providing planting materials along the contours (e.g. pigeon pea, pineapple, banana, coffee, mangosteen and durian[184]), organic fertilizer and corn seeds.[185]

Challenges and opportunities: climate resilient agricultural techniques on sloping lands

52. **Hedgerow Species:** Leguminous tree species, particularly *kakawate* (*Gliricidia sepium*) and *ipil-ipil* (*Leucaena spp.)*, are widely used as forage rich in protein.[186] *Ipil-ipil* was commonly grown in fencerows and intensively investigated in the 1970s and 1980s for its potential as hedgerows which supply nitrogen and organic matters to companion crops.[187] It was reported that they improved crop yields by 23-100% and significantly reduced runoff and soil loss, but a study with a control group concluded no yield increase from leguminous hedgerows.[188] The farmers who adopted leguminous hedgerows were of the opinion that it was a measure to conserve the long-term agricultural potential of their lands.[189]

174 *ibid.*

175 "Preventing runoff thru contouring."

176 Arias, A. P. and Caraga, P. I. A., 2018. "Caring for the Environment the SCoPSA Way." Philippine Information Agency. 5 May 2018. https://pia.gov.ph/news/articles/1007302 (accessed July 2019).

177 CropLife Philippines, 2013. "Representing the Plant Science Industry." http://www.croplife.org.ph/representing-the-plant-science-industry.html (accessed July 2019).

178 "Sustainable Corn Production in Sloping Areas."

179 "Caring for the Environment the SCoPSA Way."

180 "Preventing runoff thru contouring."

181 *ibid.*

182 **"The Philippines."**

183 "Preventing runoff thru contouring."

184 "Caring for the Environment the SCoPSA Way."

185 "Preventing runoff thru contouring."

186 **"The Philippines."**

187 *ibid.*

188 *ibid.*

189 *ibid.*

53. The farmers' interest in *ipil-ipil* hedgerows is not widespread.[190] The labor requirement for hedgerows is very high, whose maintenance involves pruning them three to 10 times each year.[191] The use of pruned material as animal feed increases the value of hedgerows, but depletes soil nutrients more rapidly.[192] The hedgerows may occupy 25% of the farm land, which reduces the areas for crop cultivation and hence income for farmers, contributing to unpopularity among farmers.[193] The lack of secure land tenure was cited as the constraint to implementation of any long-term land improvement system among tenant farmers and occupants of public lands.[194] The obstacles were large for farmers with secure land tenure as well: initial investment of labor; difficulty in obtaining planting materials; and lack of technical information required for sustained implementation.[195]

54. The invasion of psyllid leafhopper (*Heteropsylla cubana*) in the Philippines in 1985 heavily damaged *ipil-ipil* trees and created a turning point in the promotion of *ipil-ipil* hedgerows.[196] *Kakawate* (*Gliricidia sepium*) has been the most common substitute, but is even more labor intensive because it must be propagated from cuttings in most areas.[197] Other promising candidates as hedgerow trees include: *laclay-guinan*/*gewawini*/*malabalatong* (*Flemingia congesta*), *Acacia vellosa*; *anchoan dilaw* (*Cassia spectabilis);* and for acidic soils *Alnus japonica*.[198]

55. **<u>Feasibility of Alley Cropping:</u>** Trees may prevent insufficient light from reaching the vegetables and negatively affect growth. To avoid such situations: plants insensitive to microclimate may be cultivated close to the trees; trees may be pruned to allow sufficient light to penetrate; deep-rooted trees may be used; or trees may be spaced 12-25m apart.[199][200]

56. The strong acidity of soils commonly found in the Philippine uplands appears to trigger intense competition among roots for mineral nutrients near the surface.[201] Nutrient search deeper in the ground is impossible, because the level of exchangeable aluminum is high in acidic soils and inhibits deep tree-rooting.[202] Such competition may be alleviated by spacing the trees at larger intervals.

57. The hedgerow trees are intended to provide nitrogen and organic matter, but in the soils in the upland Philippines, it is phosphorus and other mineral elements that are often in short supply.[203] The pruned materials of *kakawate* (*Gliricidia*) and *anchoan dilaw* (*Cassia spectabilis)* do not supply enough phosphorus to meet the nutrient requirements of cereal crops, and whatever they do supply may have originated in the root zones of the crops in any case.

58. **<u>Grass Strips as Alternatives:</u>** Strips of forage grasses have the ability to greatly reduce erosion and rapidly develop natural terraces on the slopes, just as hedgerows do.[204] On the tilled fields, the

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[190] *ibid.*

[191] *ibid.*

[192] *ibid.*

[193] "Preventing runoff thru contouring."

[194] **"The Philippines."**

[195] *ibid.*

[196] *ibid.*

[197] *ibid.*

[198] *ibid.*

[199] "Diversified and Integrated Farming Systems (DIFS):Philippine Experiences for Improved Livelihood and Nutrition*."*

[200] "Preventing runoff thru contouring."

[201] **"The Philippines."**

[202] *ibid.*

[203] *ibid.*

[204] *ibid.*

soil further gravitates downstream by the act of tilling, and terraces could be formed in a couple of years.[205]

59. Regarding the type of grasses, the focus has been on those that yield significant amount of biomass as ruminant fodder to compensate for the land lost to the grasses: napier grass (*Pennisetum purpureum*), guinea grass (*Panicum maximum*) and others.[206] The high productivity of these grasses, however, is a burden to smallholders; they require frequent trimming so that the nearby crops receive sunlight.[207] The amount of grass is usually above the needs of smallholders, and the rapid growing grasses compete intensely with food crops for water and nutrients.[208]

60. In contrast, natural vegetative strips are narrow contour strips left for native or naturalized grass and other vegetation to grow by themselves.[209] The strip species are usually weedy grasses: *kogon* (*Imperata cylindrical), carabão grass (Paspalum conjugatum), marisekos/amorseko/pangrot or golden false beardgrass (Chrysopogon aciculatus)* and others, depending on the location and the management regime. Compared with the species commonly introduced for the same purpose, they function at least as effectively for reducing soil loss.[210] In addition, they are less competitive with food crops than hedgerow species, well adapted to local ecosystems and resilient.[211] The growth of these grasses can be easily controlled by cattle grazing, mowing or mulching with crop residues.[212] The system is very easy to implement and can be used as a transition to contour bunding with hedgerows.[213] Some indigenous communities in Ifugao use this system in swidden fields.[214]

61. **Strips of Other Vegetation as Alternatives:** As hedgerow trees and exotic forage grasses compete with the crops and reduce their yields, it has been suggested to focus more on the primary objective of intercepting soil and water runoffs and to use "inert" species with a short stature and slow growth as the substance for interception.[215] *Vetivier (Vetiveria zizanioides)* found throughout the Philippines forms a dense barrier and has been identified as a candidate.[216] It does not self-propagate to become a weed in cultivated fields, which means that it requires labor for propagation, in this case by vegetative tillers.[217] The strips could also be constructed by income generating plants, e.g., pineapple, black pepper, citrus trees, asparagus, or rose.[218]

62. **Climate Change:** All of the above systems are adapted to climate change to the extent that they enhance water retention and could be further based on local agroecology. For countering the destructive forces of floods and droughts caused by climate change, additional features will be required to the SALT, involving floodwater storage as well as a means to dissipate the energy from floods and storms. Wherever feasible, extreme weather events should be used to the advantage of farming systems.

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205 *ibid.*

206 *ibid.*

207 *ibid.*

208 *ibid.*

209 ***"The Philippines."***

210 *ibid.*

211 *ibid.*

212 *ibid.*

213 *ibid.*

214 Dulay, M. P., 2015. "Indigenous Agroforestry Systems of Ifugao, Philippines." *Resources and Environment*. Vol. 5, No. 1, 45-51.

215 ***"The Philippines."***

216 *ibid.*

217 *ibid.*

218 "Preventing runoff thru contouring."

Land tenure in upland areas

63. Lack of secure land tenure is one of the prominent factors that drive farmers to engage in unsustainable resources management, all the while understanding the unsustainability of their actions.[219] In case of highlands, it is not only the tenure on agricultural lands that matter, but also that of forests. The most distinctive natural assets of the uplands in the Philippines are the forests and their biodiversity and ecosystem services, which are not only crucial for agriculture and survival of the population in the uplands but also for the lowlands.

64. A**gricultural land is very scarce** in the Philippines at mere 0.13 ha per capita. Primarily by deforestation, agricultural land could increase by 11% during 1990-2013 to cover 12.4 million ha, or 42% of overall land area.[220] An OECD document in 2017 reported that, although 15.8 million ha is considered **forest land**, only 7.6 million ha is in fact forested, accounting for 25% of the country's land.[221] Less than 0.9 million ha is primary forest.[222] The country has proportionally the smallest forest cover in Southeast Asia after Singapore.[223] It is estimated that around 90% of land was covered in forest, when the Spanish colonized the country in the 16th century, but reduced to 50% by 1950.[224] Total **forest cover** has diminished by roughly 70% since the turn of the 19th century.[225] After the Second World War, deforestation has been driven by inadequate and corrupt regulation of logging, growing population density, urbanization and uncertain land user rights.[226] Mining activities have recently joined the force.

65. Expansion of agriculture at the expense of forests is unsustainable, as the activity depends on forests, above all for water and nutrients. The economic forces are in favor of crop agriculture rather than forests; the highest rate of poverty incidence, at 68% in 2009 in the Philippines, is found in forestry.[227] In addition, tenure on forest lands appears more dominated by the state than that of agricultural lands.[228] The 1987 Constitution of the Republic of the Philippines stipulates that forested lands, mineral lands and national parks are reserved for the public domain and can be leased only under certain conditions, but agricultural lands are considered suitable for private ownership.[229] Community management of forests is further disadvantaged by: Republic Act 7942, the Philippine Mining Act of 1996; Presidential Decree 705, the Revised Forestry Code of the Philippines; and Republic Act 11038, the Expanded National Integrated Protected Areas System Act.[230]

66. A study in the Philippines has shown that the farmers' collaboration with institutions and participation in resources management at the levels of policy, initiative, research and so on, may be as important as land tenure in terms of sustainable resources management.[231] Farmers and institutions have complementary knowledge and roles, both of which are required for sustainable management; interventions that create market incentives for environmentally destructive crops

[219] "Institutional aspects of local participation in natural resource management."
[220] *Agricultural Policies in the Philippines*.
[221] *ibid.*
[222] *ibid.*
[223] *ibid.*
[224] *ibid.*
[225] *ibid.*
[226] *ibid.*
[227] *ibid.*
[228] *ibid.*
[229] *ibid.*
[230] Cariño, J. K., 2012. *Country Technical Notes on Indigenous Peoples' Issues: Republic of the Philippines*. Rome: IFAD.
[231] "Institutional aspects of local participation in natural resource management."

would be unsustainable, as much as those that ignore the market forces.[232] Farmers also benefit from their relationships with the government, which allow them to prepare for changes in politics.[233]

Approaches and actions for adaptation in upland farming systems areas

67. Four possible approaches and actions for strengthening the resilience of upland farming systems are: strengthening the capacity of the Department of Agriculture (DA) and its connection with the farmers; adapting the technologies for agriculture on the slopes to local conditions and climate change; increasing the availability of effective inputs: seeds, seedlings, water, weather information and credit; and improving the efficiency and equity of value chains.

68. Strengthening the capacity of the Department of Agriculture (DA) and its connection with the farmers

- The DA will reach out to NGOs involved in upland farming so that they can share on-the-ground information with the DA and also with the Department of Environment and Natural Resources (DENR), which is in charge of forests.
- The main role of the DA, at least at the beginning, will be in scaling up the good practices and initiating a legal reform to create an environment conducive to adoption of climate resilient agriculture, engaging the landowners and other government institutions.
- The technical and administrative capacities of the DA, the DENR and the Local Government Units (LGUs) will be strengthened through training of existing staff and merit-based hiring.
- The DA will be extensively trained on sustainable agriculture on the slopes and other climate resilient agriculture so that their technicians could function as extension officers, if need be, as well as the LGUs, to which the extension officers belong.
- The DA, the DENR, the LGUs, research institutions, farmers and NGOs will be trained on broader natural resources management to integrate forestry, livestock raising and landscape.
- A collaborative relationship will be fostered to create a platform involving farmers, government institutions (including the Cooperative Development Authority and Philippine Atmospheric, Geophysical and Astronomical Services Administration, or PAGASA), NGOs and academia on a local scale to facilitate farmers' contribution and to remain relevant to local ecosystems and socioeconomics.

69. Adapting the technologies for agriculture on the slopes to local conditions and climate change

- Farmers' awareness will be raised on the benefits of sloping land agriculture technologies, especially under climate change.
- The platform created above will collaborate to find the elements in sloping land agriculture concept (vegetation for interception strips, distance between hedgerow trees, crops in alleys, etc.) that build on the diverse environmental and socioeconomic conditions of the country (changing climate, soil, water, farm size, labor availability, market demand and accessibility, farmers' priorities, etc.), instead of promoting a package of elements.
- The platform will ensure that any farming system promoted will assure availability of both subsistence and cash crops all year around as well as employment for tenant female and male farmers.
- The platform will add features to mitigate the effects of typhoons and droughts caused by climate change, and where possible to the advantage of farming: control (or use) of flood and typhoon energy; and storage of water.

[232] *ibid.*

[233] *ibid.*

- The platform will work to integrate the elements of food production system (including livestock raising and fishery) with each other and into local ecosystems, which boosts the resilience of food production systems.

70. Increasing the availability of effective inputs: seeds, seedlings, water, weather information and credit

- The awareness of the farmers will be raised on climate change adaptation that it must be more comprehensive than obtaining the best seeds or pesticides and be based on agroecology.
- The platform will search for high quality indigenous varieties and neglected edible plants fit for each locality in uplands; the DA does not presently engage seed growers for upland varieties.[234]
- Once suitable varieties and plants are identified, the platform will engage in reproduction and distribution of its seeds and seedlings.
- The capacity of the farmers will be strengthened to preserve seeds, identify and select the useful traits, propagate the desirable individual plants and efficiently replant.
- The platform will explore ways to strengthen the capacity of farmers to understand the changes in weather and climate under climate change.
- The platform will collaborate with a financial institution, such as Land Bank, to design credit systems that serve the idiosyncrasies of upland farmers in each locality.

71. Improving the efficiency and equity of value chains

- The platform will strengthen the capacity of farmers to engage in processing, form and self-govern cooperatives (it will be necessary as farmers produce multiple crops, each of which in smaller quantities than under monocropping), read and respond to market trends, and engage in commercial negotiations.
- The platform will engage in dialogue with various value chain actors to identify the most profitable set of products and the farmers' share of labor and benefits.
- The farmers will be encouraged to look into other ways of selling their products, such as direct sale to consumers in Manila and other urban centres.

[234] Farmer Consultations in Bicol and Cordillera (28 January-6 February 2019).

Indigenous Food Production in Cordillera Autonomous Region and Climate Change

72. The Philippines is home to an estimated 14- 17 million indigenous peoples, belonging to 110 ethno-linguistic groups.[235] They reside mostly in Northern Luzon (Cordillera Administrative Region or CAR, 33%) and Mindanao (61%),[236] while some groups live in the Visayas.[237] Mindanao has the largest number of indigenous population, but publicly available information on indigenous food production is rare, hindered by armed conflicts and focus on large-scale plantations. Moreover, many farmers in the region appear to have abandoned indigenous agriculture, lured by the profit prospects presented by the promoters of the modern agriculture.[238] In the northern highlands of CAR, which is one of the target regions of the proposed project, close to half of the households are believed to practice indigenous agriculture.[239] The region consists of six provinces (Abra, Apayao, Benguet, Ifugao, Kalinga and Mountain Province), but research and documentation have been concentrated almost exclusively on Ifugao with some attention to Benguet and Kalinga. Given the similarity among the systems of these three provinces, we believe that the description based mostly on Ifugao system below is sufficiently representative of the region.

Ecological foundations of indigenous food production systems

73. Indigenous food production systems around the world are composed of several subsystems. The most common ones are: swidden agriculture, forest, backyard agriculture, and pasture. Without access to inputs available in modern societies, the focus is on design and management to enhance the ecosystem services. Planting is organized so that diverse crops are available at one time and around the year. Diversification in crops and animals is also used as biological barriers to species specific diseases. The indigenous peoples propagate selected individuals with higher resistance to local diseases and other preferred traits. Forestry involves hundreds of plant species in tropical zones, even in the highlands, and known uses have been reported for most species. Harvesting is conducted so as to preserve the ecosystem balance and not to concentrate on one or very few species, especially in one location. Nutrient recycling is actively pursued, and minimum exploitation is a must. The rule is to share both the responsibilities and benefits among the community members.

74. A typical food production system in CAR consists of swidden farm (0.3-1.5 ha), private forest (0.5-3 ha), rice terrace, and backyard farm, which are connected by irrigation canals and located from upland to lowland in this order.[240] The management unit is the landscape, including smaller areas of grassland and public forest.[241] Pasture is used for cattle raising, but documented details are

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[235] UNDP Philippines, 2013. "Fast Facts LAGOM: Indigenous People in the Philippines." http://www.ph.undp.org/content/philippines/en/home/library/democratic_governance/FastFacts-IPs.html (accessed July 2019).

[236] *ibid.*

[237] *ibid.*

[238] IPDEV project (Recognition of the Rights of the Indigenous Peoples in the Autonomous Region in Muslim Mindanao for Empowerment and Sustainable Development), 2013. "Breathing Life into IP farming practices." *Kêtindêg*. Vol. 2, Issue 7. https://www.kas.de/c/document_library/get_file?uuid=6ca8cba2-0467-c0a2-2e31-0878a63ca1ce&groupId=252038 (accessed July 2019).

[239] "The Need to Develop Low-Input Agriculture as an Alternative to Hi-Input Farming among the Peasants of the Northern Luzon Cordillera."

[240] Anon, undated. "Ifugao Rice Terraces Agricultural Heritage Agricultural Heritage Systems: Dynamic Conservation and Practice." http://www.fao.org/fileadmin/templates/giahs/Presentations/Presentation_5.pdf (accessed July 2019).
Charette-Castonguay, A., 2014. *Assessment of resilience and adaptability of social-ecological systems: a case study of the Banaue rice terraces*. Master's Thesis. Christian-Albrechts Universität zu Kiel. http://www.legato-project.net/files/DOWNLOAD2/D38_Thesis%20Adam%20Castonguay.pdf (accessed July 2019).

[241] *Assessment of resilience and adaptability of social-ecological systems: a case study of the Banaue rice terraces*.

unavailable.[242] Indigenous plants from the forests are used as pesticides and veterinary medicine, and removal of pests and insects are done manually.[243]

75. **Swidden Agriculture:** About 60% of Cordillera is sloped 45^{o} or more, thus highly erosive[244] and has thin topsoil.[245] The lot for swidden farm is at the highest altitude to make use of the steepest sloped terrain not suited for terracing.[246] In Mountain province, terracing in swidden fields is also reported for the purpose of reducing soil erosion.[247] As only one crop of indigenous rice per year is possible in the highlands, swidden farm with a fallow period of 7-8 years[248] plays an important role by supplying sweet potatoes.[249] In the same spirit as SALT, grasses are planted across in broad strips to control water flow and soil erosion in the swidden fields.[250] Weeds removed are left on the soil for mulching.[251] Agricultural wastes are buried as fertilizer in a contour trench which is dug across the fields. These bunds also prevent soil erosion.[252]

76. *Kaingin* (the name for swidden agriculture in the Philippines) has been given a bad name lately as the very cause of deforestation and biodiversity loss. No widely-agreed definition of swidden, or slash-and-burn, agriculture exists, and the effects of traditional methods have not been distinguished from those of modern monocropping on the lands cleared by slashing and burning.[253] The traditional swidden agriculture in the tropics involves: conversion (forest slashing, drying and burning); cropping (settling familial farming for several years); and fallow (vegetation and soil organic content regeneration).[254] These actions have been identified as causes of deforestation and forest degradation, mineral nutrient and soil biota community loss, air pollution and heavy metal contamination.[255] Tropical forest clearing changes the forest's flammability, as intensive use makes it much easier to catch fire.[256] Repeated burning also alters the composition of plant species, eliminating trees in favor of grasses.[257]

77. When the population size was much smaller, cleared areas were negligible and enough time was given to the fallow stage so that the cultivated land was reverted to forests.[258] If well maintained, traditional swidden agriculture enhances biodiversity and is overall suited to upland ecology which

[242] "The Need to Develop Low-Input Agriculture as an Alternative to Hi-Input Farming among the Peasants of the Northern Luzon Cordillera."

[243] "Ifugao Rice Terraces Agricultural Heritage Agricultural Heritage Systems: Dynamic Conservation and Practice."
Assessment of resilience and adaptability of social-ecological systems: a case study of the Banaue rice terraces.
"The Need to Develop Low-Input Agriculture as an Alternative to Hi-Input Farming among the Peasants of the Northern Luzon Cordillera."

[244] "The Need to Develop Low-Input Agriculture as an Alternative to Hi-Input Farming among the Peasants of the Northern Luzon Cordillera."

[245] *ibid.*

[246] *Assessment of resilience and adaptability of social-ecological systems: a case study of the Banaue rice terraces*.

[247] Magcale-Macandog, D. and Ocampo, L. J. M., 2005. "Indigenous Strategies of Sustainable Farming Systems in the Highlands of Northern Philippines." *Journal of Sustainable Agriculture*. Vol. 26, No. 2, 117-138.

[248] *Assessment of resilience and adaptability of social-ecological systems: a case study of the Banaue rice terraces*.

[249] *ibid.*

[250] "Indigenous Agroforestry Systems of Ifugao, Philippines."

[251] *ibid.*

[252] *ibid.*

[253] Li, P. *et al.*, 2014. "A Review of Swidden Agriculture in Southeast Asia." *Remote Sensing*. Vol. 6, 1654-1683.

[254] *ibid.*

[255] *ibid.*

[256] **"The Philippines."**

[257] *ibid.*

[258] "A Review of Swidden Agriculture in Southeast Asia."

cannot tolerate much of tilling.[259] Population growth, influx of lowland farmers,[260] and economic and resources management policies[261] have led to insufficient land per person and consequently shorter fallow periods. Some fallow plots in the Philippines have been allowed to be grazed intensively against the objective of fallowing.[262]

78. Outside the indigenous communities, their agricultural system is labelled primitive and considered something that needs to be abolished.[263] The negative impacts of the system due to its inappropriate implementation of late are taken as a rationale for its eradication. So are the impacts of slash-and-burn techniques used for monoculture of cash crops, such as oil palm, rubber, eucalyptus, teak, cassava and sugar;[264] they diminish biodiversity and leave the slopes bare when the land is exhausted and subject to erosion,[265] landslides[266] and flashfloods. Fallow lands are often actively maintained by the indigenous peoples and are not left denuded.[267]

79. **Upstream Forests**: The forests upstream the fields in CAR are the most important elements in supplying water to the rice terraces. As an upland region, it also supplies water to the rest of Northern Luzon through six major rivers, the most extensive being the Chico River.[268]The total drainage area in the region is 5,447,500 ha, and the groundwater stored amounts to about 150 million m^3.[269] The forests can be characterized as a multi-story agroforestry with 2-5 layers of canopies, where woody perennials are found above and crops and animals below.[270] These forests generate steady supply of food, medicine, fuel and other materials needed in everyday life; they contain nearly 300 species with known uses, belonging to 71 plant families, including banana, coffee, cacao, citrus, rattan, betel palm, citrus and *ikmo* (*Piper* spp.) and other fruit bearing trees.[271] The root crops in the forests also serve as a lifeline during disasters.[272] All plants are harvested only when needed,[273] and plant parts such as twigs and leaves[274] as well as overripe fruits on the ground are left to decompose in the forests.[275] The forest owners and non-owner beneficiaries[276] engage in silvicultural practices, such as pruning, thinning and vine cutting, to stimulate tree growth.[277] Non-plant forest foods include: honey; wild pig;

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[259] *ibid.*

[260] Rengam, S. V. *et al*., 2005. "Chapter 2: Philippines: The Role of Indigenous Women in Traditional Agriculture." In Mourin, J. and Nair, P. (eds.), *Women's Wisdom: Documentation of Women's Knowledge on Ecological Agriculture in the Philippines, Indonesia and Pakistan.* Penang, Malaysia: Pesticide Action Network Asia and the Pacific.

[261] "A Review of Swidden Agriculture in Southeast Asia."

[262] ***"The Philippines."***

[263] "A Review of Swidden Agriculture in Southeast Asia."

[264] *Ibid.*

[265] "Caring for the Environment the SCoPSA Way."

[266] *ibid.*

[267] Cairns, M., 2017. "Chapter A4. Indigenous Fallow Management: Property rights and other dimensions of official misunderstanding." In Cairns, M. (ed.), *Shifting Cultivation Policies: Balancing Environmental and Social Sustainability*. Boston: CABI.

[268] Cordillera Peoples Alliance, 2004. "Cordillera's River Systems." Water Resources. http://www.cpaphils.org/cordillera/watersources.htm (accessed July 2019).

[269] *ibid.*

[270] "Indigenous Agroforestry Systems of Ifugao, Philippines."

[271] Peñafiel, S., undated. "Ifugao Rice Terraces: Agricultural Heritage System: Dynamic conservation and practices." http://www.fao.org/3/aj006e/aj006e21.pdf (accessed July 2019).

[272] Province of Benguet, undated. "Municipality of Tuba: Indigenous Knowledge." https://www.benguet.gov.ph/index.php/municipalities/municipality-of-tuba/indigenous-knowledge (accessed July 2019).

[273] "Ifugao Rice Terraces: Agricultural Heritage System: Dynamic conservation and practices."

[274] *ibid.*

[275] Province of Benguet, undated. "Municipality of Kabayan: Indigenous Knowledge." https://www.benguet.gov.ph/index.php/municipalities/municipality-of-kabayan/indigenous-knowledge (accessed July 2019).

[276] Serrano, R.C. and Cadaweng, E.A., 2005. "The Ifugao muyong: sustaining water, culture and life." In Durst, B. *et al*. (eds.) *In search of excellence: exemplary forest management in Asia and the Pacific*. Bangkok: Food and Agriculture Organization of the United Nations.

[277] "Ifugao Rice Terraces: Agricultural Heritage System: Dynamic conservation and practices."

deer; monkey; fowl;[278] and rodents.[279] For further information on forests as watersheds, see 4.7.2-4.7.4 of the Gender Assessment.

80. **Irrigated Agriculture**: The terrace structure ensures that water and nutrients are reused subsequently by the lower terraces.[280] It also stabilizes slopes, and soil erosion is minimized[281] as long as the fields are flooded for cultivating rice or for preventing cracks in walls and dikes.[282] The flooding creates an anaerobic condition and averts denitrification and leaching of organic nitrogen.[283] Weeds on the bunds and rice straws are added to the soil, or left in the flooded fields, as fertilizer.[284] The annual yield of native rice varieties on average is 2 metric tons per hectare, although exceptionally fertile fields may attain 6 metric tons. Non-native high-yielding varieties may average 2.4 metric tons, but such varieties can be grown only at lower elevations. Nearly 150 traditional, all of different trait combination, and about 20 modern varieties may be planted during one cropping season in Ifugao province alone.[285] It is the norm among the indigenous peoples that many varieties of any crop are planted at the same time.[286]

81. **Backyard Farm and Crop Diversification:** Fruit trees, coffee,[287] banana, bean, legume, squash (*chayote*),[288] root crops, medicinal herbs and spices[289] are cultivated in backyard farms, and domesticated pigs and chickens are raised in the same space.[290] Further crop diversification is achieved in the rice fields, terrace dikes, bunds and walls. Intercropping is practiced by constructing small mounds of composting rice straw, aquatic ferns and grasses covered with mud in the rice paddies alongside rice.[291] The same may be done after harvesting while the water in the rice pond is maintained.[292] Chinese cabbage and onions are grown on these mounds, whose inedible parts act as nutrients for the next cropping season.[293] On terrace dikes, bunds and walls, the farmers plant grains, legumes and root crops such as sweet potato, taro and ginger.[294] The flooded fields also support freshwater fish and shellfish for food.[295] Some terraces have very high diversity of aquatic species, more than 100, which is above the average among wetland ecosystems in the world.[296] Relay cropping, which involves planting a crop while another is still growing in the same plot, is also practiced.[297]

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[278] "Municipality of Tuba: Indigenous Knowledge."

[279] Hays, J., 2015. "Ifugao." Facts and Details.
http://factsanddetails.com/southeast-asia/Philippines/sub5_6d/entry-3880.html (accessed July 2019).

[280] *Assessment of resilience and adaptability of social-ecological systems: a case study of the Banaue rice terraces*.

[281] "Ifugao Rice Terraces Agricultural Heritage Agricultural Heritage Systems: Dynamic Conservation and Practice."

[282] *Assessment of resilience and adaptability of social-ecological systems: a case study of the Banaue rice terraces*.

[283] *ibid.*

[284] "Ifugao Rice Terraces Agricultural Heritage Agricultural Heritage Systems: Dynamic Conservation and Practice."
Assessment of resilience and adaptability of social-ecological systems: a case study of the Banaue rice terraces.

[285] *Assessment of resilience and adaptability of social-ecological systems: a case study of the Banaue rice terraces*.

[286] "Diversified and Integrated Farming Systems (DIFS): Philippine Experiences for Improved Livelihood and Nutrition."

[287] "Municipality of Kabayan: Indigenous Knowledge."

[288] *ibid.*

[289] *ibid.*

[290] *ibid.*

[291] *Assessment of resilience and adaptability of social-ecological systems: a case study of the Banaue rice terraces*.

[292] *ibid.*

[293] *ibid.*

[294] *ibid.*

[295] "Ifugao Rice Terraces Agricultural Heritage Agricultural Heritage Systems: Dynamic Conservation and Practice."
Assessment of resilience and adaptability of social-ecological systems: a case study of the Banaue rice terraces.

[296] *Assessment of resilience and adaptability of social-ecological systems: a case study of the Banaue rice terraces*.

[297] "Indigenous Agroforestry Systems of Ifugao, Philippines."

Socioeconomic and cultural foundations of indigenous communities

82. Indigenous ecological knowledge systems are comprised of beliefs, cognition and practices, which interact with each other to produce cohesive and meaningful decisions on food production and natural resources management. Nature is sacred for the indigenous peoples, and its elements, both animate and inanimate, are endowed with life force. All living organisms are kindred and interdependent, and hence, human beings are without the right to control and exploit nature for their own interests and at the expense of other members of the universe.

83. This sacredness is the very core of sustainable natural resources management, as it translates into minimum exploitation ("take only what you need to sustain yourself") and prohibition of destructive practices (built into the culture as taboos or obligatory rituals associated with natural resources use). Avoiding overexploitation of resources is particularly emphasized for minerals, which are non-renewable. In one municipality in Benguet, many taboos are associated with mining,[298] and in another, it is believed that a god owns gold and that abuse of the resource will result in retribution to people.[299]

84. Forests contain high biodiversity and are considered sacred[300] in CAR, as in many pre-modern cultures. So is water, which is essential for life.[301] Many sprits live in the forests,[302] which are not to be disturbed or hurt; people should not throw a stone far away, set fire or fell a tree.[303] Similar acts, including urinating and trashing,[304] are prohibited wherever spirts may be staying, such as ravines[305] and other water resources. Trees near water are not to be cut, [306] timber is solely for constructing the houses of the residents and not for sale,[307] and hunters must offer part of the meat to the spirits, especially if the catch is big.[308] If trees needed to be cut down, animals hunted[309] or grounds disturbed,[310] permission is required from the unseen spirits or gods residing in and protecting the forests and water resources.[311] If the spirits are disturbed or hurt, divine punishment, usually in the form of sickness, will fall on the perpetrator.[312] Fouling water sources could also cause them to dry

[298] Province of Benguet, undated. "Municipality of Mankayan: Indigenous Knowledge." https://www.benguet.gov.ph/index.php/municipalities/municipality-of-mankayan/indigenous-knowledge (accessed July 2019).

[299] "Municipality of Tuba: Indigenous Knowledge."

[300] Srikantha, H. *et al*., 2015. *Overview of Rice Terrace Farming Systems in Hani and Ifugao: Water Management and Current Threats*. Rice Terrace Farming Systems Working Paper Series No. 01. Tokyo: United Nations University.

[301] Acabado, S. and Martin, M., 2016. "The Sacred and the Secular: Practical Applications of Water Rituals in the Ifugao Agricultural System." *TRaNS: Trans -Regional and -National Studies of Southeast Asia.* Vol. 4, Issue 2, 307-327.

[302] "Municipality of Kabayan: Indigenous Knowledge."
Province of Benguet, undated. "Municipality of Buguias: Indigenous Knowledge."
https://www.benguet.gov.ph/index.php/municipalities/municipality-of-buguias/indigenous-knowledge (accessed July 2019).
Province of Benguet, undated. "Municipality of Kapangan: Indigenous Knowledge."
https://www.benguet.gov.ph/index.php/municipalities/municipality-of-kapangan/indigenous-knowledge (accessed July 2019).

[303] "Municipality of Kabayan: Indigenous Knowledge."

[304] "Municipality of Tuba: Indigenous Knowledge."

[305] "Municipality of Kabayan: Indigenous Knowledge."

[306] "Municipality of Tuba: Indigenous Knowledge."

[307] "Municipality of Kabayan: Indigenous Knowledge."

[308] "Municipality of Tuba: Indigenous Knowledge."

[309] "Municipality of Kabayan: Indigenous Knowledge."

[310] "Municipality of Buguias: Indigenous Knowledge."

[311] "Municipality of Kabayan: Indigenous Knowledge."

[312] "Municipality of Kabayan: Indigenous Knowledge."
"Municipality of Buguias: Indigenous Knowledge."
"Municipality of Kapangan: Indigenous Knowledge."
"Municipality of Tuba: Indigenous Knowledge."

up.[313] These rules and others are often reinforced by stories of someone perpetuating the forbidden acts and concomitant punishments.[314]

85. Rituals for farming activities are obligatory; they coordinate the activities in the community to maximize the yields.[315] Synchronized planting disperses the pests and reduces total pest damage, while synchronized harvesting deprives rats of constant food supply, causing them to either starve or migrate.[316]

86. It is said that indigenous food production systems have advantages over monoculture in: productivity; efficient use of photosynthetically active radiation and other resources; pest resistance; variation and nutrition of foods produced; contribution to economic stability and social equality; farmers' direct participation in decision making; and resilience to large uncertainties introduced by climate change. The indigenous tradition is to produce diverse food and to sell only the excess production; food and nutritional security exists. However, the virtues of indigenous agriculture are not completely recognized by the indigenous or non-indigenous peoples.

Socioeconomic changes in indigenous communities

87. Indigenous mechanisms have adapted to changes for many generations, but evolutions in socioeconomics and climate are taking place at unprecedented speeds. Owing to population growth and non-agricultural interests, such as mining and tourism, agricultural lands per person are smaller and are less suited to the traditional management practices. Where water supply has become inefficient, the rice fields have been abandoned.[317] Most of the rituals appear forgotten, especially in areas where non-agriculture employment is available.[318]

88. Despite the attachment to traditional farming strongly expressed by some farmers, the adoption of modern agriculture seems to be the trend.[319] Unable to produce enough for the family, many farmers have switched to high-input modern agriculture.[320] The shorter period to maturity of the modern varieties has allowed farmers to participate in the growing tourism industry**.** The modern rice cultivars do not require year-round flooding, which has caused proliferation of *Polypheretima elongata*,[321] a large earthworm which weakens the terrace walls by digging tunnels through them.[322] The natural forests in the ridges are the habitats of the striped shrew rat (*Chrotomys whitebeadi*) which feeds on these earthworms and also on golden apple snails,[323] an invasive species that damages rice plants. However, such forests are in decline as are agricultural lands, as the younger generation prefers other livelihoods.[324] Some of the plant and animal species that functioned as indicators have also become locally extinct, and dependency on modern technology is growing.

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313 "Municipality of Tuba: Indigenous Knowledge."

314 Province of Benguet, undated. "Municipality of Sablan: Indigenous Knowledge." https://www.benguet.gov.ph/index.php/municipalities/municipality-of-sablan/indigenous-knowledge (accessed July 2019).

315 "The Sacred and the Secular: Practical Applications of Water Rituals in the Ifugao Agricultural System."

316 "Ifugao Rice Terraces: Agricultural Heritage System: Dynamic conservation and practices."

317 Mission in Ifugao (4-6 February 2019).

318 *ibid.*

319 Farmer Consultations in Bicol and Cordillera (28 January-6 February 2019).

320 "The Need to Develop Low-Input Agriculture as an Alternative to Hi-Input Farming among the Peasants of the Northern Luzon Cordillera."

321 Charette-Castonguay, A., 2014 Assessment of resilience and adaptability of social-ecological systems: a case study of the Banaue rice terraces. Master Thesis. Christian-Albrechts Universität zu Kiel.

322 Farmer Consultations in Bicol and Cordillera (28 January-6 February 2019).

323 "Ifugao Rice Terraces : Agricultural Heritage Systems dynamic conservation and practices."

324 Camacho, L. D. *et al.*, 2016. "Indigenous knowledge and practices for the sustainable management of Ifugao forests in Cordillera, Philippines." *International Journal of Biodiversity Science, Ecosystem Services & Management*. Vol. 12, Issues 1-2, 5-13.

89. The spread of individualism and consumerism has urged reckless exploitation for cash income; communal forests were supposed to be used for timber harvesting only for houses in the community, but commercial logging is now condoned because of the demand for woodcarving products outside the villages. Strict enforcement of the rules on community resource management has become difficult, as much of the judicial power has been shifted away from the villages to the modern state. Many indigenous people are not documented, hence ineligible for government loans.[325] The seeds of upland rice varieties are not part of the seed programme run by the Department of Agriculture.[326]

Land tenure and indigenous peoples

90. The foundation of present-day land tenure was laid during the Spanish colonization, when the Regalian Doctrine, or *jura regalia*, was introduced to the country. It is a feudal principle, under which private titles to land must emanate, directly or indirectly, from the Spanish crown who retains the titles.[327] The term, *jura regalia*, refers to the royal rights, or the rights which the King enjoys by virtue of his prerogatives.[328] Lands and resources not granted to individuals by the crown remain part of the public domain, over which none but the sovereign holds the rights.[329] The succeeding colonizing power, the Americans, maintained the framework and reinforced the State's control over land by passing laws that bolstered the system, such as the Public Land Act, Land Registration Act and Mining Acts.[330] It was further inherited by the 1987 Constitution of the Philippine Republic. which states in Section 2, Article XII that all "lands of the public domain, waters, minerals, coal, petroleum and other mineral oils, all forces of potential energy, fisheries, forests or timber, wildlife, flora and fauna and other natural resources are owned by the State." [331]

91. Under this concept, private titles to land must be traced to grant, express or implied, from the Spanish crown or its successors, presently the Philippine Republic,[332] and hence, the Philippine legal system consists of contradictory parts.[333] On the one hand, Republic Act 8371, Indigenous Peoples' Rights Act states that "[p]roperty rights within ancestral domains already existing and/or vested shall be recognized and respected,"[334] establishing the rights of indigenous peoples to their ancestral domains and land and natural resources found therein.[335] The act recognizes the indigenous concept of ownership of ancestral domains, which includes lands, inland waters, coastal areas and other natural resources associated with the space,[336] and ancestral lands. The act further details that "[t]he indigenous concept of ownership generally holds that ancestral domains are the ICC's/IP's[337] private but community property which belongs to all generations and therefore cannot be sold, disposed or destroyed. It likewise covers sustainable traditional resource rights."[338] The right is manifested in IP

[325] Mission in Ifugao (4-6 February 2019).

[326] *ibid.*

[327] Anon, 2015. "The Regalian Doctrine." and Elsewhere: Anything and Everything about Laws and Jurisprudence. http://phjuris.blogspot.com/2015/08/the-regalian-doctrine.html (accessed July 2019).

[328] *ibid.*

[329] *ibid.*

[330] *Country Technical Notes on Indigenous Peoples' Issues: Republic of the Philippines*.

[331] *ibid.*

[332] "The Regalian Doctrine"

[333] *Country Technical Notes on Indigenous Peoples' Issues: Republic of the Philippines*.

[334] Government of Philippines, undated. "Republic Act No. 8371." http://extwprlegs1.fao.org/docs/pdf/phi13930.pdf (accessed July 2019).

[335] *Country Technical Notes on Indigenous Peoples' Issues: Republic of the Philippines*.

[336] Philippines Commission of Women, 2009. "Republic Act No. 8371." https://www.pcw.gov.ph/law/republic-act-8371 (accessed July 2019).

[337] Indigenous Cultural Communities/Indigenous Peoples

[338] "Republic Act No. 8371."

groups getting a Certificate of Ancestral Domain Title (CADT). On the other hand, Republic Act 7942, the Philippine Mining Act of 1996; Presidential Decree 705, the Revised Forestry Code of the Philippines and Republic Act 11038, the Expanded National Integrated Protected Areas System Act[339] can threaten the indigenous peoples of their ancestral land and traditional livelihoods – swidden farming, hunting and gathering in forests and small-scale mining – and allow the state to exercise greater control and to access indigenous peoples' territories and resources.[340]

92. The indigenous peoples have a clearer notion of their lands and resources as well as much longer history of governing their use than non-indigenous peoples who are likely to have migrated to the current residence in the uplands relatively recently. The indigenous peoples have stronger attachment to the land, regardless of the legal status given by the government, which appears to have contributed to their willingness to engage in long-term investment much more than the non-indigenous people.[341] At the same time, some indigenous people are said to be anticipating conferment of the ancestral lands title only to make use of the loophole in the Indigenous Peoples' Rights Act and sell the land to private interests.[342]

Indigenous observations on climate change

93. The farmers have observed that the temperature has been rising, the sun is becoming more intense and winds stronger, and the arrival of the rainy season has changed.[343] Due to climate change, the indigenous agriculture calendar is less reliable than before, and rice development is no longer in sync with seasonal water availability. Because of the long period required for maturity (5-6 months), traditional rice under irrigation needs to be planted in January-February, but already in March the weather becomes too dry for the rice. Rainfall is no longer even, and hence unsuited for growing coffee organically.[344] This has led to its replacement by GMO corn, which can be harvested multiple times a year but requires agrochemicals.[345] It is believed that the use of synthetic products is causing serious health effects on the residents.[346] Climate change, combined with deforestation and earthquakes have resulted in changes in hydrology, and consequently water distribution. Deforestation itself has been caused by forest resources overexploitation, swidden cultivation expansion, modern infrastructure construction, weak governance, changed attitude toward forests, needs for cash under limited livelihood options, and so on, many of which stem from the diminishing returns from production on the existing croplands.[347]

Indigenous coping mechanisms for climate change

94. In Ifugao, some indigenous people have switched to modern rice varieties, presumably to cope with water shortage; they grow without year-round flooding, creating a favorable environment for large earthworms that destroy the terrace walls.[348] Climate change has increased the incidences of pests, which has been dealt with increased application of pesticides by the tenant farmers,[349] while

[339] *Country Technical Notes on Indigenous Peoples' Issues: Republic of the Philippines*.

[340] *ibid.*

[341] Mission in Ifugao (4-6 February 2019).

[342] Cabreza, V. "Gov't sees flaw in IPRA to speed up sale of titled ancestral lands." Inquirer.net. 9 April 2012. https://newsinfo.inquirer.net/173591/gov%E2%80%99t-sees-flaw-in-ipra-to-speed-up-sale-of-titled-ancestral-lands (accessed July 2019).

[343] Mission in Ifugao (4-6 February 2019).

[344] *ibid.*

[345] *ibid.*

[346] *ibid.*

[347] "The Need to Develop Low-Input Agriculture as an Alternative to Hi-Input Farming among the Peasants of the Northern Luzon Cordillera."

[348] "Ifugao Rice Terraces: Agricultural Heritage System: Dynamic conservation and practices."

[349] Farmer Consultations in Bicol and Cordillera (28 January-6 February 2019).

other farmers have been in search of organic pesticides.[350] Where there are sufficient off-farm opportunities for income generation, the lack of sufficient water has resulted in many abandoned rice fields.[351] Some female farmers are giving more efforts to backyard vegetable gardens for additional cash income.[352] Use of natural vegetation on the slopes to prevent soil erosion has been reported among some indigenous communities.[353]

95. The indigenous communities are less dependent than non-indigenous peoples on government programmes, initiatives and assistance, as they traditionally have not been the focus of the government.[354] Nearly 7.5 million persons remain unregistered in the country, most of whom are Muslims and indigenous peoples;[355] Ifugao is one of the indigenous regions that are better off, but does not appear immune to the problem.[356] Without civil registration, it is impossible to benefit from government assistance or credit/insurance schemes provided by formal and private financial institutions. Government extension activities that do exist in the indigenous communities are not meant to build on the strength of their agriculture; in Agta areas, for example, the greatest efforts have been to replace it with settled agriculture as practiced in the lowlands.[357]

96. The indigenous peoples have been increasingly exposed to the non-indigenous ways of agriculture, and many in Ifugao are adopting the modern agriculture as many in Mindanao seem to have done.[358] Some indigenous farmers would like to maintain their agriculture, but are at a loss under the woes of changing climate and land use into non-agricultural purposes.[359] The indigenous peoples are not aware that their "traditional knowledge, which cuts across numerous aspects of sustainability and resilience – from forecasting weather patterns, improving agricultural practices, to customary institutions for improved management of natural resources – has increasingly gained recognition at the international level as a vital way forward"[360] and that their traditional agriculture provides the very foundation for climate resilience agriculture for its agroecological base, holistic nature, and self-sufficiency.

Approaches and actions for strengthening resilience in indigenous farming systems

97. Five possible approaches and actions for strengthening the resilience of indigenous farming systems are: strengthening the awareness of farmers on the adaptation capability of traditional indigenous food production and weather/climate knowledge systems; the capacity of the Department of Agriculture (DA) and its connection with indigenous farmers; strengthening the capacity of the Department of Agriculture (DA) and its connection with indigenous farmers; highlighting the relevance of indigenous agriculture to climate change adaptation and mitigation; strengthening the capacity of the Department of Agriculture (DA) and its connection with indigenous farmers and improving the efficiency and equity of value chains with respect to indigenous products.

[350] Mission in Ifugao (4-6 February 2019).

[351] *ibid.*

[352] *ibid.*

[353] ***"The Philippines."***

[354] Mission in Ifugao (4-6 February 2019).

[355] Philippine News Agency, 2019. "Digitization of birth registration pushed." Manila Bulletin. 28 February 2019. https://news.mb.com.ph/2019/02/28/digitization-of-birth-registration-pushed/ (accessed July 2019).

[356] *ibid.*

[357] Farmer Consultations in Bicol and Cordillera (28 January-6 February 2019).

[358] Mission in Ifugao (4-6 February 2019).

[359] *ibid.*

[360] International Labour Organization, 2019. *Indigenous Peoples and Climate Change: Emerging Research on Traditional Knowledge and Livelihoods*. Geneva: ILO

98. Strengthening the awareness among farmers on indigenous food production systems and indigenous weather/climate knowledge systems

- The awareness of indigenous farmers on the adaptability of the traditional food production and weather/climate knowledge systems to climate change will be raised through the Theater of the Oppressed or similar methods.
- The awareness of non-indigenous farmers on the adaptability of the traditional food production and weather/climate knowledge systems to climate change will be strengthened.
- Easily observable weather/climate indicators will be included in various CIS products to be generated.

99. Strengthening the capacity of the Department of Agriculture (DA) and its connection with indigenous farmers

- The DA will reach out to NGOs involved in indigenous farming so that they can share on-the-ground information with the DA and also with the Department of Environment and Natural Resources (DENR), which is in charge of forests, as well as National Commission on Indigenous Peoples (NCIP).
- The main role of the DA will be assessing with the indigenous peoples the strength and value of indigenous food production systems, identifying the necessary modifications to suit the diminishing area per person and climate change, and finding elements that could be used outside the indigenous communities for building resilience to climate change.
- The technical and administrative capacities of the DA, the DENR, the Local Government Units (LGUs) and the NCIP will be strengthened through training of existing staff and merit-based hiring.
- The DA will be extensively trained on sustainable agriculture on the slopes and other climate resilient agriculture so that their technicians could function as extension officers, if need be, as well as the LGUs, to which the extension officers belong.
- The DA, the DENR, the LGUs, NCIP, research institutions, farmers and NGOs will be trained on indigenous natural resources management that integrate forestry, livestock raising, mining and landscape as well as on how to augment traditional management systems with modern knowledge so that the farmers would thrive under climate change and maintain autonomy.
- A collaborative relationship will be fostered to create a platform involving farmers, government institutions (including the Cooperative Development Authority and Philippine Atmospheric, Geophysical and Astronomical Services Administration, or PAGASA), NGOs and academia on a local scale to facilitate farmers' contribution and to remain relevant to local ecosystems and socioeconomics.

100. Increasing the availability of effective inputs: seeds, seedlings, water, weather information and credit

- The awareness of the farmers will be raised on climate change adaptation that it must be more comprehensive than obtaining the best seeds or pesticides and be based on agroecology.
- The platform will search for high quality indigenous varieties and neglected edible plants fit for each locality in uplands; the DA does not presently engage seed growers for upland varieties.[361]
- Once suitable varieties and plants are identified, the platform will engage in reproduction and distribution of its seeds and seedlings.

[361] Farmer Consultations in Bicol and Cordillera (28 January-6 February 2019).

- The capacity of the farmers will be strengthened to preserve seeds, identify and select the useful traits, propagate the desirable individual plants and efficiently replant, and raise funds among themselves, based on the indigenous methods.
- The platform will explore ways to strengthen the capacity of farmers to read the changes in weather and climate under climate change.

101. Highlighting the relevance of indigenous agriculture to climate change adaptation and mitigation
  - The DA will build confidence in the indigenous peoples so that they recognize better the advantages of their knowledge systems, articulate what they know and search for what has been lost, and effectively communicate to outsiders the resilience of their systems based on the intimate knowledge of the local ecosystems.
  - The DA will raise awareness among the indigenous peoples that the new practices to be adopted must be technologically and financially sustainable by themselves.
  - The DA will promote indigenous agroforestry and food production system as a whole, emphasizing its role as sources of: food free of toxic chemicals all year around (“food forest”); water; nutrition; disaster/famine food; medicinal plants; and socioeconomic equality and autonomy. It is further characterized by high productivity (*not* compared with a single crop in a monoculture field), low costs and local availability of required inputs, and resilience to ecological and economic shocks.
  - The DA will raise awareness among the population that indigenous food production system is environmentally sustainable if their principles are followed, but are not particularly suited to modern cash economy (for example, if one of the indigenous vegetables becomes superfood and overexploited, it will have negative impacts on the community).
  - The DA and NCIP will raise awareness among the indigenous peoples that thriving indigenous culture (including cuisine and societal organization) supports indigenous food production systems.
  - The platform will identify and promote features of indigenous natural resources management that mitigate the effects of typhoons and droughts caused by climate change, where possible to the advantage of farming: control (or use) of flood and typhoon energy; and storage of water.
  - Indigenous watershed management will be promoted alongside indigenous food production systems.

102. Improving the efficiency and equity of value chains of indigenous products
  - The platform will strengthen the capacity of farmers to engage in processing, form and self-govern cooperatives (which will be necessary when farmers produce multiple crops each of which in smaller quantities than under monocropping), read and respond to market trends, and engage in commercial negotiations.
  - The platform will engage in dialogue with various value chain actors to identify the most profitable set of products and the farmers’ share of labor and benefits.
  - The platform will raise awareness among urban customers that indigenous agriculture is the most climate resilient agriculture and the safest for human consumption and the environment, but that it cannot produce a massive amount of one item.
  - The farmers will be encouraged to look into other ways of selling their products, such as direct sale to consumers in Manila and other urban centres.

2.3.3 Analysis of Gender in Agriculture and relative impacts of Climate Change

Gender Parity in the Philippines

103. The Philippines has been classified as one of the top ten countries in the world in terms of gender parity in recent years. Its laws and policies aspire to attain gender equality. Literacy rates are high at over 96% for both women and men. With respect to education, net enrolment and cohort survival rates are higher for women than for men. The positions of legislators, senior officials and managers are equally divided between women and men. Proportionately more women have access to the internet than men. On the other hand, government policies on agriculture and livestock, which affect the livelihoods of the rural people, have not shown great interest in gender. Climate change policies pay a fair amount of attention to social inclusion issues, but without practical guidance on addressing the concerns. Gender mainstreaming in development has been overseen by the Philippine Commission of Women, but the efficacy of the efforts is yet to be analyzed.

104. Country rankings are dependent on a small set of officially and widely available national statistics, which are not well suited to measuring the lives of the underprivileged whose existence may be entirely informal. What they highlight is the parity at each social stratum, in particular the upper crust, which may be higher than the overall equality in the society. The same problems affect the gender parity on political empowerment. Net income and wealth equalities are quite high, suggesting a bigger inequality among women than between women and men of the same socioeconomic circumstances.

105. The role and status of women differ greatly among the indigenous peoples in the Philippines: from the egalitarian Agta, slightly more gender differentiated peoples throughout Cordillera plus some in Mindanao, to substantially gender unequal tribes in Mindanao. In terms of gender parity, the non-indigenous Filipinos in the rural areas today could be said roughly on par with the people in Cordillera, who used to assign traditional and prestigious roles to women.

106. The Philippine women overall participate well in decision making at the household level. The norm is to pool the incomes and decide on the spending jointly, non-indigenous households in the rural areas and indigenous households in Cordillera alike. When there is disagreement about spending that cannot be resolved, it is the husband's opinion that prevails, according to the farmers who were interviewed for project formulation. Household work and caregiving are entirely on the women's shoulders, and the women are the sole decision makers when it comes to day-to-day matters.

107. Marriage, reproduction and gender-based violence constitute the incongruent elements of the Philippines, which ranks high in gender parity. Formal divorce is not permitted, except for Muslims, and the system penalizes Christian women more than Christian men because of social stigma. The country is the 12th highest in the world in absolute number of child brides. The population growth was high at 1.4 % in 2019, likely because of poor access to reproductive information. Early childbearing is more pronounced in the rural than in urban areas. Slightly less than a third of births among teenage mothers were reported as unplanned. More than one in ten Philippine women considered it just that their husbands hit or beat them if they neglected the children. Acceptance of violence was higher in the rural areas and decreased with wealth. Sixteen percent of the poorest women thought it just that their husbands resorted to violence when the women neglected their children.

108. The Philippine government spends somewhat less than what the World and Health Organization recommends as the proportion of GDP for public health. The incidences of tuberculosis and hepatitis B are as high as in the neighboring island countries with much lower GDP per capita, as are rates of maternal mortality (114 per 100,000 live births) and of mortality from unsafe water,

sanitation and health practices (4.2 per 100,000), although Philippine women are well educated and in charge of family health issues.

109. Women have somewhat higher access to all forms of mass media, including the internet. Every female farmer in the rural area has a mobile phone, which is 2G or of later standards. Each rural family has at least one 3G phone, and the poor engage nearly twice as much as the better-off in social interaction using the internet. Television was the major source of entertainment, and the radio for the news. The source of news may be shifting to the internet, as many farmers interviewed referred to Facebook for the latest information on natural disasters. The problem with the internet is its affordability, lack of information on reproductive health that women would find most useful, and lack of telecommunication coverage of any kind in the remote areas.

110. The official statistics imply that the managing responsibilities in agriculture lie with men, while more women are engaged in farming than men. For non-indigenous households in the rural areas and indigenous households in Cordillera, the division of agricultural work is not very strict, although any task involving machines and physically demanding work are carried out by men. Women in these communities are considered more adept than men at negotiating and managing finances and are given corresponding responsibilities. It is also women who principally participate in trainings, although in more patriarchal societies in Mindanao men are the ones who participate. Women are generally more open to new ideas than men; men need to be convinced of the utility of the new knowledge so that the joint decisions reflect the information. Women have good technical knowledge of the crops and animals that they take care of, irrespective of participation in trainings. Female farmers are active in both female-only and mixed farmer organizations and have been given the positions of president, treasurer and the like.

111. Indigenous varieties and breeds are endowed with characteristics that make them hardy under the local climate, even with climate change. They also do well, or even better, without synthetic inputs. It is the indigenous peoples who have considerable knowledge on indigenous plants and animals. Women tend to have vast knowledge of plants because of their role as cooks, gatherers, gardeners, herbalists, plant breeders and seed custodians: functions all performed by rural women in the Philippines. Women are recognized worldwide as better caregivers to animals, except for when taking large animals to the pastures. In the Philippines, indigenous women’s knowledge in farming is also strongly associated with traditional rice varieties and farming systems. The status of elder female farmers in Cordillera has declined with the introduction of non-traditional rice varieties and accompanying change in practices, which eroded the role of women as seed selectors. Where there is enough construction work for men, agriculture has become mostly work of women. Overall the indigenous food production is in decline, although attachment to traditional rice and organic farming are still fairly strong among the people in Cordillera Administrative Region.

112. The young are competent in digital technology, the skills that are considered indispensable in agriculture for efficient communication and cash income generation, but the parents discourage them from taking up agriculture as they consider the livelihood synonymous with poverty. On the other hand, slightly less than one-third of the country’s population is composed of youth and their unemployment rate is several times higher than that for the total population of working age. The rate for female youth is much higher than that for male youth. Similarly to indigenous peoples, the society is not investing enough in youth, in particular female indigenous peoples and female youth, while they have the knowledge and skills that complement those of the mainstream society. The latest pandemic has raised awareness among the indigenous peoples and youth on the importance of agriculture and indigenous food production systems.

Women and Climate Change in Agriculture

113. The female and male farmers interviewed by the project formulation mission team have noticed that: seasonal rainfall patterns have become irregular and extreme; average ambient and water temperatures are higher; water is in short supply, except during typhoons; and floods and landslides are now more frequent. They observed: higher mortality and lower quality of crops; higher number of familiar pests; emergence of new pests; impossibility of fallow in some areas because of change in rainfall patterns; need for shades for the animals; and higher animal mortality from disease. Indigenous ways of life require great skills in foreseeing the changes in natural conditions, which will be useful if applicable to climate change. Climate perception may well differ between women and men in details. As coping strategies, the farmers listed: application of increased amounts of pesticides and fertilizers; planting of coconut trees as windbreakers and for shade; early planting of rice if drought is expected; vegetable cultivation for food security; and collection of solid waste to prevent clogging of irrigation canals.

114. Other on-farm coping strategies in the Philippines include: planting of root crops and others around the homestead; foraging of root crops and other indigenous food items; animal raising in the backyard; and vegetable cultivation on the upper bund portion of the rice field. These are mainly tasks considered women's, perhaps except for fruit gathering by Agta men. Craft making by both non-indigenous and indigenous women provided supplementary income. Some indigenous farmers in Cordillera engage in reforestation of watershed and riverine areas as well as synchronized rice planting as part of integrated pest management.

115. Due to the custom of registering family land under a man's name, women are at a great disadvantage when it comes to taking out formal credit or insurance, whose importance is expected to grow considerably as the effects of climate change is increasingly felt. Moreover, the husband's signature or co-signature is usually demanded for financial transactions, which makes female-headed households, already one of the poorest in the rural areas, even more vulnerable.

116. Microfinance institutions are flourishing in the Philippines, but little analysis is available on the accessibility of women to credit and insurance. The social protection system and the subsidies on fertilizer and seeds can be used to encourage adoption of climate change adaptation strategies, but their targeting of and effects on women are unknown. The most preferred coping strategy in the times of economic difficulties was borrowing money from the so-called 5-6s, the village money lenders who charge 20% interest per year. Some farmers consulted made use of microfinance schemes, which only required participating in an interview, submitting a photo and purchasing an insurance.

Women and Adapting Agriculture to Changing Climate

117. Women on average better educated and more open to changes than men. Indigenous women have the knowledge and skills that would form the foundation of climate resilient agriculture, while young women possess digital skills that allow efficient communication of agrometeorological and commercial information necessary for integrating climate resilient agriculture in livelihoods. Although women participate in various decision making processes, the ultimate decisions are made by men, especially the strategic ones which would include adoption of new agricultural methods.

Roles and Climate Change Impacts: Stakeholder Perception of Women, Youth and Children[362]

118. Children and youth are generally perceived to have low importance in the whole value chain since they perform lighter tasks than other actors, while women's involvement is perceived to be of moderate importance.

119. When climate hazards occur, men are still perceived to be more affected, since they are more involved in farm production activities. Women are perceived to experience emotional stress when hazards impact their families due to low income.

120. Impacts of climate change on women in upland and eastern areas of Luzon:

- Men are more exposed to climate risks and hazards since they are responsible in restoring eroded farms during and after typhoon.
- Men also go out and check the farm/s during typhoon exposing them to strong winds and heavy rains.
- In some cases, women and men have to work together in the farm even during typhoon. Women are more vulnerable to climate hazard since they are physically weaker compared to men.

121. Roles of women and climate change impacts on them in Visayas:

- Women are active along the production and value chains for corn, rice and coconut.
- Women typically undertake less labor intensive activities like price negotiation for goods and services and marketing activities.
- There are exceptions, however, for separated, widowed, or single mothers who often undertake all value chain tasks including more labor intensive work.
- In the event of a failed harvest due to, for example, drought, wives typically seek off-farm employment such as domestic helpers.

122. Role of women, youth and children in the value chain of yellow corn in Mindanao:

- Women, youth, and children in Mindanao are involved in various agricultural value chain activities, from production to processing.
- Women are part of all stages in the chain, although they are particularly involved in furrowing, weeding, and dehusking.
- Younger farmers and women perform furrowing during land preparation.
- Women and young farmers aged between 12 to 18 years old also do dehusking during harvest where they remove the outer layer of the corn.
- In the on-farm production, women and young farmers are involved in crop management particularly, the removal of weeds.
- They are also involved in securing the inputs for production, fertilizer application, planting, bagging, and marketing of yellow corn.
- The youth also perform planting, fertilizer application, hauling and drying.
- Women are engaged and recognized in input provision, on-farm production, product marketing, and harvesting, storage, and processing.

[362] CIAT stakeholder workshops in each island region (May - June 2018).

123. Role of women and youth in the coffee industry in Mindanao:
- Women in the coffee industry are involved in all stages of the chain such as nursery operation, crop maintenance and processing. They are prominent in harvesting/ handpicking, sorting of beans, roasting, and marketing.
- Children and youth perform tasks, which are part of planting, crop maintenance, and harvesting. They are involved in chemical spraying, land plowing, plant watering and weeding.

124. Role of women and youth in the cacao industry in Mindanao:
- Women mostly undertake harvesting related tasks, such as picking of ripe cacaos, bagging, washing of pods, sorting and processing of cacao products.
- Children and youth perform tasks such as pest control and bagging.

Section 2.4: Policies, Programs and Projects on climate resilience in agriculture and for mainstreaming

Contents

2.4.1 Policies related to climate change adaptation in agriculture

Policy framework for Adaptation in Agriculture

1. The national framework strategy on climate change (NFSCC) provides directly guidance to the adaptation options and needs for building climate resilient agriculture identified by local stakeholders, and for the common concerns arising in different farming systems (see Box).

Adaptation framework- national strategic priorities NFSCC

Under the Philippines National Framework Strategy on Climate Change 2010-2022 (NFSCC, Govt of the Philippines 2014, referenced in [WG2 5.7]) http://www.neda.gov.ph/wp-content/uploads/2013/10/nfscc_sgd.pdf (and http://www.asialeds.org/resource/philippines-national-framework-strategy-on-climate-change-2010-2022/), the strategic priorities are:

(i) reduce climate change risks and vulnerability of natural ecosystems and biodiversity through ecosystem-based management approaches, conservation efforts, and sustainable environment and natural resources (ENR)-based economic endeavors such as ecotourism;

(ii) increase the resilience of agriculture communities through the development of climate change-sensitive technologies, establishment of climate-proof agricultural infrastructure and climate-responsive food production systems, and provision of support services to the most vulnerable communities;

(iii) improve climate change resilience of fisheries through the restoration of fishing grounds, stocks, and habitats and investment in sustainable and climate change-responsive fishing technologies and products;

(iv) expand investments in aquaculture and in other food production areas;

(v) strengthen the crop insurance system as an important risk sharing mechanism to implement weather-based insurance system; and

vi) strengthen sustainable, multi-sectoral, and community-based resource management mechanisms (Government of the Philippines, 2014).

To be able to manage climate and climate change-related risks, agricultural communities require at minimum:

(i) awareness that weather and climate extremes and climate change will impact on their operations;

(ii) understanding of weather climate, including knowledge of historical weather and climate variability where they are located;

(iii) tools by which they can describe extremes and variability; and

(iv) access to early warning/forecasts and the ability to apply these to decision making

2. Also under recent review of agriculture sector in the Philippines the OECD outlined some of the policy coherence challenges and recommendations to support adaptation in agriculture.

Recommended Policy coherence to support adaptation (OECD 2017):

- On research and knowledge generation, important that it is more encompassing beyond rice, and make sure it reaches the farmers and responds to their needs.
- Rice self sufficiency policy may distort for example the efforts towards greater diversification and livelihoods by farmers, greater water efficiency, but also keeping prices higher than they need to be including for urban poor.
- Extension approach needs to be less commodity and topic focus, to be more holistic and include more on business development.
- More systematic approach to risk management and insurance and disaster damage recovery, also with subsidized insurance (again largely favouring rice), where more adaptation oriented subsidy could be more useful, with appropriate institutional role of PCIC. Slow claims systems may also disincentivise farmers in the proper use of insurance.
- Land tenure is important for farmers to be confident to invest in land use changes, especially important for upland agroforestry systems, in sloping lands.
- Water policies and infrastructure are important but larger challenge, in terms of the extensive investments required, and institutional coordination required between national agencies (for irrigation, drinking and sanitation, urban and industrial needs, basin level to local government, etc), and weak incentives for greater water use efficiency (at present water user fees following use have been suspended).

The Philippines Agriculture and Fisheries Modernization Plan (AFMP), and National Agriculture and Fisheries Modernization and Industrialization Plan (NAFMIP 2020-2025)

3. **Plan Vision, Goals and Outcomes: A nation of prosperous farmers and fisherfolk.** This is the vision for the AFMP 2018-2023. Since 2020 with a new DA administration it is slightly updated as the National Agriculture and Fisheries Modernization and Industrialization Plan (NAFMIP 2020-2025). It calls for a concerted effort of all stakeholders to reinvigorate, reinforce and promote a responsible agriculture that is competitive, inclusive and resilient.

4. The Plan adopts the following goals that are espoused in the Philippine Development Plan 2017-2022:

(i) **To expand economic opportunities for those engaged in producing agriculture, fishery and forestry (AFF) products**, measured via: (a) growth in Gross Value Added in Agriculture of 2.5% to 3.5% per year over the plan period; (b) growth in value of fisheries production of 2.5%, 1%, and 5% per year for commercial, municipal, and aquaculture fisheries, respectively; and (c) growth of value of agri-fishery exports of 9% per year by end of plan period.

(ii) **To increase access of small and subsistence farmers and fisherfolk to economic opportunities**, measured via growth of labor productivity of farmers and fisherfolk of 5% to 6% per year over the plan period.

5. The agri-fishery sector aims to increase its contribution to the national economy, and to have more small and subsistence farmers and fisherfolk share in the sector's growth.

6. Three key sectoral outcomes will serve as major pathways of the agri-fishery sector in contributing to the achievement of the sector goals. These outcomes further focus the Plan and prioritize the many possible interventions and investments related to the sector goals.

1. **Increased adaptive capacities of fishing and farming communities and resilience of ecosystems.** Foundational to achieving the economic goals of the sector is the ability of the AF communities to adapt to the changing climate, respond to natural, human-induced, and economic risks. Increasing adaptive capacities is seen to reduce socio-economic and environmental vulnerabilities. Ensuring the resilience of ecosystems that support the production base is also crucial to responsiveness and adaptation. Five sub-outcomes have been identified towards this outcome:

   (i) Improved decision making through access to and utilization of reliable and timely scientific, social, environmental, political, and economic information;
   (ii) Increased access to adaptive technologies and adoption of climate resilient and sustainable agricultural and fishery practices;
   (iii) Increased access to social protection and risk insurance and financial services;
   (iv) Diversified income base of farmers and fisherfolk; and
   (v) Improved adaptive capacities of institutions, ability to respond (including procurement) and deliver services in times of calamities.

   The changing trends in climate and weather necessitate that all stakeholders have access to appropriate information and advisory to support their decision-making processes for production and other value chain activities, as well as access to technologies that are climate resilient and tailored to the local conditions and preferences. Ensuring a diversified income base for the most vulnerable farming and fishing households and enhancing their access to social and financial services on top of relief and aid, improves their ability to cope and thrive in times of disaster. Most plans for regions in the Philippines reflected in the AFMP, prioritise the scaling up of AMIA experiences (see FS Part 2A Programs and projects).

2. **Enhanced competitiveness of agri-fishery products, both for import and export.** Markets create the income from production and competitiveness determines share of markets, both for exports and imports. As share of markets expand, economic opportunities for production and related services expand. This pathway particularly addresses the first goal, which is to expand economic opportunities in the sector. Three sub-outcomes that would lead to enhanced competitiveness are:

(i) Improved agri-fishery productivity and production efficiency within ecological limits and comparable to global standards;
(ii) Ensured safe and quality agri-fishery products at all times; and
(iii) Expanded market access

Cost-efficiency or productivity and product quality consistency determine competitiveness in the market. But the regulatory and institutional environment of both the exporting and importing countries ultimately determines the possibility for produce to access markets. Thus, achieving all three sub-outcomes would ensure competitiveness and opportunity for the sector to supply the import and export markets.

3. **Broadened farmers and fisherfolk access and participation in value chain development.** Value chains, which include production, processing, packaging and transport, deliver the final product to the markets. It is important for farmers and fisherfolk to be able to participate fully in these chains, which is to mean that they get a good share of the incomes, not only as they optimize production and receive good prices but also as they themselves add value to produce. This pathway directly addresses the second goal, which is increase the access opportunities for small farmers and fisherfolk. The five sub-outcomes under this sectoral outcome are:

(i) Intensified market and industry linkage (export and domestic) with farmers and fisherfolk intensified;
(ii) Increased access to innovative financing of value chain players;
(iii) Increased physical access to value chains (mainly farm-to-market roads);
(iv) Facilitated and generated agribusiness investments; and
(v) Increased small farmers and fisherfolk engaged in agripreneurship.

To fully participate in value chains, farmers and fisherfolk need to be linked up to these value chains by way of marketing agreements or tie-ups. They should also have the resources – financial capacity and technical know-how – to produce the volume and quality the value chains require. Investments are also needed to grow and multiply the value chains while market infrastructure are needed for the value chains to absorb and market more produce. Finally, farmers and fisherfolk need to acquire the capability for entrepreneurship to be able to take over a bigger part of the value chain. Achieving these sub-outcomes would mean farmers and fisherfolk can participate in regularly supplying products, through the chains, to the markets. Farmers and fisherfolk can benefit from the increased capacity of the chains to monitor markets and respond innovatively to changing conditions and requirements.

7. The three key sectoral outcomes are interrelated and mutually reinforcing. Increasing adaptive capacities is seen as the foundation that will both enhance the sector's competitiveness (and vice versa) and broaden access and participation of farmers and fisherfolk in value chain activities. Increased adaptive capacities is important to achieve the long term goal of resilience amidst climate risks, human-induced and natural and economic risks. These outcomes are also identified and

consistent with the climate adaptation theory of change[363].

[363] These are consistent with two of three long-term outcomes identified in the climate adaptation results chain drafted by the AMIA project, namely, (i) Increased sustainability of agri-fishery sector productivity; and (ii) Improved upward and downward integration of agri-fishery operators in their respective value chains.

2.4.2 Relevant Projects and initiatives addressing CRA

Department of Agriculture - Adaptation and Mitigation Initiatives in Agriculture (AMIA)

Overview of AMIA and its phases and elements

8. The Adaptation and Mitigation Initiative in Agriculture **(AMIA)**[364], which is the DA's national program on climate change, is comprised of different phases of implementation beginning with AMIA1 and is followed by AMIA phases 2, 2+ and 2++.

a. AMIA 1 - Mainstreaming AMIA in DA (2015-2016)

● In 2014, the DA-SWCCO developed AMIA Project 1 "Strengthening Implementation of Adaptation and Mitigation Initiative Agriculture", with the purpose of strengthening the enabling environment within the DA to mainstream climate change in DA organization, plans and budgets. The AMIA project 1 consists of policy studies that serve as bases for executive issuance to facilitate Climate Change (CC) mainstreaming in DA functions and operations. An important output under this stage was the National Color-Coded Agricultural Guide (NACCAG) Map, which shows the natural suitability of 20 economically important crops that are key to food security in the Philippines, overlaid on the areas' exposure to 8 climate change-induced multi-hazards with data available down to the barangay level. Within the past years, additional layers on groundwater availability and rice fertility (for selected areas) were added to the map.

b. AMIA 2 Project

● After the initial phase of the program (AMIA 1), the second phase (AMIA 2) focused on the assessment, targeting, and prioritization for climate resilient agri-fisheries communities through the conduct of the following activities: (i) regional level assessment and targeting for CRA in 10 regions; (ii) climate-risk vulnerability assessment (CRVA); (iii) developing CRA decision-support platform (CRA-DS); (iv) climate information services (CIS) approaches and models; (v) building climate-resilient communities: approaches and models; (vi) knowledge management support; and (vii) institutional and policy innovations in AMIA program management.

● Other outputs developed under the AMIA2 include briefer on Climate Risk Vulnerability Assessment (CRVA) which establishes CRVA profile of 294 municipalities in 10 provinces (9 regions); and a briefer on climate resilient agriculture (CRA). Moreover, AMIA 2 has produced climate-resilient agri-fisheries investment prioritization-decision support platform (CRA-DS) which is composed of integrated knowledge products providing customized information and tools for decision-makers and planners in building climate resilient agri-fisheries communities. Specific project outputs are as follows: cost-benefit analysis (CBA) tool;

[364] DA SWCCO Annex B information needs for FY 2019 Plan and Budget Deliberations

CRA country profile for the Philippines; CRA knowledge hub portal; and CRA investment and policy briefs.

c. AMIA 2+ Project (CRA Community Action)

- AMIA 2+ project includes the introduction of CRA innovations and services to the first nine (9) regions (10 provinces) and provision of relevant agriculture and fisheries support services based on the location-specific assessment of their needs with regard to their adaptive capacity to climate change. Model communities called AMIA villages were established to serve as lighthouses or go-to places for other communities to learn from and emulate, and where technological and institutional innovations are introduced so that these villages may have access to climate-relevant support services.

d. **AMIA 2++ Ongoing Projects** (Expanding network of AMIA villages (AMIA 2 and AMIA 2+) in the remaining regions.

- Using the lessons gathered from the model AMIA 2 and 2+, CRA options is expanded in the remaining seven (7) regions with the following ongoing projects: (i) community participatory action research for CRA; (ii) regional-level assessment and targeting for CRA; (iii) policy study towards the institutionalization of CIS in Philippine agri-fishery high-risk communities; documentation and assessment of current efforts; (iv) climate-risk vulnerability assessment (CRVA) expansion; and (v) developing CRA decision-support platform (CRA-DS) expansion.

9. **Climate Smart Villages (CSV)**

- The International Institute of Rural Reconstruction (IIRR) together with the CGIAR Research Program on Climate Change, Agriculture, and Food Security (CCAFS), initiated a local government-level platform, through the Climate-Smart Villages (CSVs), also with support from DA AMIA, not only for developing a proof-of-concept site of how to facilitate community-based adaptation and livelihood resilience building but also for scaling and sustaining CSA. Through this project, 1,000 farmers from 15 villages in Guinayangan were reached. Twelve CRA/CSA options were tested by 241 farmers through 12 farmer learning groups: (a) rice-based technological options, (b) coconut-based technological options, (c) livestock and poultry-based technological options, (d) technological options for coastal communities, and (e) corn and upland rice in sparsely vegetated uplands. CSAs and CSV platforms proved beneficial to the farmers, increasing their profits and helping them become self-sufficient[365].

- The pioneering work in establishing the Guinayangan CSV in Quezon served the wider community, including the DA-RFOs, in planning the operationalization of the DA AMIA framework to establish AMIA villages. The DA recognized IIRR's work of testing CSV

[365] https://iirr.org/climate-smart-villages-in-the-philippines-scalable-platforms-for-local-adaptation-initiatives/

approached in the Philippines, thus tapping IIRR as an implementing partner in its AMIA program[366].

DA-AMIA lessons learning

10. The summarized learnings[367] from the implementation of the Adaptation and Mitigation Initiative in Agriculture (AMIA) program of the Philippine Department of Agriculture (DA) processed during two knowledge sharing workshops conducted in May and June 2019 with representatives from the Department of Agriculture – Regional Field Offices (DA-RFOs) providing the materials.

Key learnings:

- The Adaptation and Mitigation Initiative in Agriculture (AMIA) Program of the Philippine Department of Agriculture (DA) aims to respond to the challenges of climate change in agriculture and fisheries communities by enabling and capacitating local communities to manage climate risks while pursuing sustainable livelihoods.
- Climate resilient agri-fisheries (CRA) technologies and practices are implemented within an AMIA village, which serves both as a laboratory to generate learnings and a showcase of outcomes and impact to the farming and fishing communities.
- Each AMIA village takes its own holistic approach, and relevant interventions are appropriately targeted based on the village's context.
- Various tools and methodologies have been developed through the AMIA program to understand climate risk vulnerabilities at the national, sub-national and community levels.
- Men and women have different levels of vulnerability to climate risks, hence appropriate approaches and technologies that addresses gender-related issues should be considered.
- Tools and methodologies to assess and understand climate risk vulnerabilities should be usable in the DA, and the staff's capacity to continuously use and develop these tools and methodologies should be part of a sustainability program.
- The sustainability program should also consider bringing in the potential implementers of the tools and methodologies early on to develop their capacity.
- Part of the sustainability program is increasing the investments on climate resilient infrastructures, support facilities, and mechanization.
- Diversification is a cross-cutting strategy in the management of the impacts of climate change in agriculture (see figures below of samples of emerging CRA, including diversification).
- Livelihood diversification provides alternative livelihood to farmers in case of crop failure due to climate crises.
- Commodity and livelihood diversifications should be made explicit in the implementation of the DA banner programs.

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[366] Ibid

[367] DA-AMIA IIRR CCAFS workshops Lessons on a program towards a climate resilient Philippine agri-fisheries. Rene R. Vidallo, Ruvicyn S. Bayot, Magnolia M. Rosimo, Perla G. Baltazar, Julian F. Gonsalves (International Institute of Rural Reconstruction (IIRR), Silang, Cavite, Philippines) U-Nichols A. Manalo (Department of Agriculture System-wide Climate Change Office (DA-SWCCO), Diliman, Quezon City, Philippines)

- There is already an extensive number of available, mature and scalable CRA technologies and practices that are being implemented on the ground.
- There is a potential to enhance research output utilization in the promotion of farming innovations to adapt to climate crises.
- The extension service should take into consideration the inherent coping mechanism and traditional practices of farmers when promoting new technologies and practices.
- The promotion of CRA technologies and practices should take into consideration the market potential of the commodity being promoted.
- The extension system is below the required capacity in terms of number of agents and level of understanding on CRA tools and practices.
- The LGU is the direct link of the DA to the farmers, hence the DA should provide the needed support to the LGU to effectively and efficiently perform its mandate.
- Throughout the implementation of the AMIA program, some champions have been identified who were able to help in advocacy, and in establishing linkages to policy and investments.

Figures: Examples of DA-AMIA IIRR CCAFS workshop outputs on Emerging and best-bet CRA technologies and practices from different DA regional field offices. Samples from regions being targeted under GCF project.

Cordillera Autonomous Region

Region II – Cagayan Valley

Region V Bicol

Region XII SOCCSKSARGEN

Other projects relevant to climate change and agriculture

FAO projects in Philippines with DA and PAGASA on climate change, risk and agriculture

Assessment of Climate Change Impacts and Mapping of Vulnerability to Food Insecurity under Climate Change to Strengthen Household Food Security with Livelihoods' Adaptation Approaches (AMICAF)[368] - FAO with DA and PAGASA

- The project aimed to improve the food security of vulnerable household groups through a comprehensive framework bridging climate change impact assessment and livelihood adaptation approaches in the countries of Peru and Philippines. The project was comprised of four components, namely, climate change impact assessment, food insecurity vulnerability analysis and mapping, livelihood adaptations to climate change, and guidance in support of adaptation planning.

- Recommended major actions identified in the study in the case of the Philippines are as follows: (i) climate downscaling using new set of scenarios in the fifth assessment report of the IPCC; (ii) exploring hydrology modelling using PAGASA data with focus on rice and a crop model implemented using annual, rather than six-month yield values; (iii) conduct of vulnerability analysis in all provinces; (iv)climate-smart integrated rice and corn system should be developed or packaged together with livestock and/or aquaculture.; and (v) modules developed for LGUs, planners and policy-makers should be tested and refined, while the DRR and CCA components should be linked. Overall, the study recommends that high-quality data should be collected, consolidated, and managed by institutions from different sectors or ministries and that link between agrarian data and meteorological information should be mainstreamed.

Development of an Enhanced Production and Risk Management in Agriculture Integrated Decision Support System (EPRiMA) (TCP/PHI/3604) – DA with FAO

- As one follow up to AMICAF experiences, this project is expected to increase resilience against multiple threats to the agriculture sector by facilitating the Development of an Integrated Decision Support System for Enhanced Production and Risk Management in Agriculture which will allow key actors in the Department of Agriculture to make more effective and timely decisions through more comprehensive and near-real time access to crop production, and risk and damage assessment information and tools. The project will support three important dimensions of disaster risk reduction (DRR):
    - Reducing existing risks,
    - Avoiding new risks, and
    - Addressing underlying vulnerabilities.

[368] AMICAF Project Findings and Recommendations (2015)

- The proposed action includes an Integrated Decision Support System consisting of new and existing tools related to enhancing crop production and disaster risk reduction and management in agriculture. This will include the development of:
    - dynamic cropping (planting and harvesting) calendars;
    - rapid Production Support and Risk and Damage Assessment Methodology and
    - acquisition and analysis protocols involving freely available high-resolution satellite imagery to support risk and damage assessment planning.
- The development of a dynamic cropping calendar entails the development of the country's technical capacity on sub-seasonal to seasonal (S2S) forecasting. It addresses the forecast gap between 10-day and monthly forecasts, which could prove critical in medium-term risk management decisions in agriculture, water management, as well as when ascertaining sudden shifts in hydro-met conditions that should trigger time-sensitive, live-saving preparatory and response-activities.

Social Protection. Strengthen capacity of ASEAN Member States (AMS) to develop social protection systems for resilience (OSRO/RAS/701/EC). - FAO with DA.

- Partly building on FAO’s ongoing initiatives with DA on the poverty targeted SAAD (see below), the study aims to help in reducing vulnerabilities of at-risk populations, strengthen their capacity to cope with, respond to and recover from shocks and, thus, enhance households’ resilience in order to mitigate the effects of shocks and improve preparedness for further crises. Specific outputs for the work in the Philippines include: Assessment of the “readiness” of existing national social protection programmes to scale-up and be informed by risk variables based on an up-to-date stock-taking of (i) National social protection system, (ii) Disaster Risk Management (DRM) framework, (iii) available Early Warning Systems (EWS) and related Early Actions and Standard Operating Procedures (SOPs); Identified operational options and ways forward to make selected social protection programmes risk-informed and shock-responsive in terms of (i) targeting, (ii) financing, (iii) scale-up triggers and (iv) delivery modalities; and Identified operational options and ways forward to make selected social protection programmes risk-informed and shock-responsive in terms of (i) targeting, (ii) financing, (iii) scale-up triggers and (iv) delivery modalities .
- Other climate change, and climate risk initiatives (please note that climate related farmer field school experiences are analyzed and compared in further detail in Annex 2.7) :

Philippine Climate Change Adaptation Project (PhilCCAP)[369]

- PhilCCAP was a grant agreement between the WorldBanl and the government of the Republic of the Philippines. The grant, which amounted to US$4.974 million, was sourced from the Special Climate Change Fund through the Global Environment Facility (GEF). The objective of the project was to develop and demonstrate approaches that would enable targeted communities to adapt to the impacts of climate variability and change. To achieve this objective, activities were implemented under the following components: (1) strengthening the enabling environment for climate change adaptation; (2) demonstrating

[369] Philippines Climate Change Adaptation Project Completion Report
http://faspselib.denr.gov.ph/sites/default/files//Publication%20Files/PhilCCAP%20PCR2017.pdf

climate change adaptation strategies in the environment and natural resources; (3) enhancing the delivery of information for climate risk management; and (4) project management. The project was done in in Cagayan (Region 2), Iloilo (Region 6), and Surigao del Norte (Region 13), all of which were noted for their susceptibility to extreme weather.

- In terms of results, the project has contributed to a wide array of initiatives intended for institutional development. This includes the development of the Climate-Smart Decision Support System (CS-DSS), the completion of the operations manual and guidelines of the National Irrigation Administration (NIA) on redesigning irrigation infrastructure, development of manuals for government programs, (e.g Enhanced Climate Smart Farmer Field School (ECS-FFS), manual on climate-proofing irrigation infrastructure, among others) training materials on technologies for the processing of climate information as well as a knowledge management system for climate information and adaptation practices. The project also contributed in the conduct of capacity building activities to relevant government personnel and users of climate information, including the municipal agriculture officers and extension workers. Relatedly, PhilCCAP outputs on seasonal climate forecasts and climate change projects have been utilized in decision-making by various sectors. Also as part of the project, a weather index-based crop was developed and pilot-tested under the project. With regard to environmental impacts, the project directly enhances the local environment, particularly of the Penablanca Protected Landscape and Seascape (PPLS) and the Siargao Island Protected Landscape and Seascape (SIPLAS), through enhancement in the protected area management, implementation of agroforestry and mangrove rehabilitation programs, as well as the introduction of livelihood programs.

- Under Component 3: Enhancing the Delivery of Information for Climate Risk Management, automatic weather stations (AWS) were established for each of the three project sites (Regions 2, 6 and 13). During the project's duration, data produced by the AWS were processed and became the basis in generating hazard maps, climate projections and seasonal climate forecasts. In addition, the installed weather stations supply the LGUs with the forecast data needed to determine disaster risks. These stations, while maintained by PAGASA, remain available for use by the LGUs. Trainings by PAGASA for municipal agricultural office staff on the physical maintenance of the equipment and use of data were conducted after installation. Some concerns were raised during the process of GCF project design as to the sustained O&M of the AWS. BSWM involvement in the project are as follows:
    - The BSWM tapped the expertise of the IRRI in developing a climate-smart decision support tool (CS-DSS) as part of the Enhanced Climate Smart Farmers' Field School. The CS-DSS is designed for use by extension workers, crop advisers and service providers whose collective task is to assist farmers in making planting decisions
    - A manual compiled by the BSWM on the ECS FFS was also completed. The manual is a compilation of the lessons taught during the program, including modules on crop management, integrated farming and disaster response. It was institutionalized in the DA for use by extension workers with the issuance of a memorandum circular. Another manual, focusing on entrepreneurship, was developed based on the ECS FFS. The ECS FBS manual—FBS is an acronym for "farm business school"—is an improved version of the regular farmer business school program previously developed by the FAO for ATI.
    - An AWS Investment Plan was also crafted by the BSWM, in coordination with PAGASA, in which standard parameters for the acquisition, installation and

maintenance of such equipment are laid out. The investment plan consists of directives on identifying set-up locations, as well as guides on the technical specifications appropriate for each identified site and use.

limate Resiliency Field Schools (CRFS)

- CRFS is the flagship program of the Rice Watch Action Network (RWAN) where farmers are given the opportunity to learn risk management and sustainable farming strategies through experimentation and experience. [370] Farmer members receive a season-long training programme with a focus on sustainable, agro-ecologically based, climate resilient agriculture. The groups learn from on-farm experimentation with improved local rice varieties. Through training on a wide variety of issues, they bring their own substantial knowledge as experienced farmers to the process[371]. Other notable partnerships on CRFS are the following:

- Christian Aid partnered with RWAN, who provides technical advice and training, and PAGSA for forecasts, advice, and training to farmers/LGUs. LGUs who participated (Irosin and Santa Magdalena) set up an automatic weather station which links PAGASA and become part of their expanded network of climate measuring points, thereby improving weather forecasting for the nation as well as the local area. The municipality votes a budget to enable the LGU to implement the approach. An impact assessment was conducted in these areas where results have shown that forecasts, advice, and training brought about by CRFS have substantially improved productivity, reduced costs and has shown indication that damage has been avoided for crop production activities.[372]

- Similarly, Greenpeace also partnered with RWAN in the implementation of CRFS. The project involves setting up localized and "automatic" weather stations, staffed by government-trained local people, who interpret and post the data and farming advice to publicly-accessible central collection points. Additionally, an SMS service has been set up to send this weather data and advisory directly to farmers' mobile phones. Alongside the provision of weather forecasts, RWAN has established local CRFS where farmers are trained in eco-agriculture methods to better equip them in dealing with adverse short and long-term weather patterns, and ultimately climate change. The climate resiliency field schools are now in 33 municipalities in 17 of the Philippines' 81 provinces, including those worst affected by Typhoon Haiyan.[373]

- As of December 2017, the DA has trained 54 weather observers from participating LGUs and DA RFOs in partnership with PAGASA and RWAN. [374]

[370] https://www.gmanetwork.com/news/scitech/science/627967/steps-toward-independent-climate-financing-in-the-phl/story/
[371] https://www.christianaid.org.uk/sites/default/files/2017-09/Climate-Services-Philippines-research-impact-summary%20-May2017.pdf
[372] Ibid
[373] http://www.greenpeace.org/seasia/ph/What-we-do/Food-for-Life/building-climate-resiliency/
[374] http://swcco.da.gov.ph/index.php/amia-villages/

Relevant projects of USAID

- *Buy-in to the National Oceanic and Atmospheric Administration (NOAA) Mission Support Participating Agency Partnership Agreement.* Building on its earlier regional work on the Coral Triangle Initiative, NOAA partnered with USAID to help the Philippine government strengthen its scientific, technical and management capacity and improve environmental and human resilience. NOAA works with the Department of Science and Technology and local universities to exchange knowledge on priority concerns and partners with other stakeholders to support vulnerability assessments; conduct climate and ocean change modeling for fisheries; and address illegal, unregulated and unreported fishing[375].

- *Water Security Under Climate Risks: A Philippine Climate Change Adaptation Strategy for the Agriculture Sector.* The Bicol River Basin is highly vulnerable to the impacts of floods, droughts and typhoons. Inequitable distribution and an inadequate supply of irrigation water has affected rice production and sharing of water resources. The Bicol Agri-Water Project (BAWP) improves water security to enhance agricultural development in the region. BAWP strengthens capacity of farmers to apply and adopt climate-resilient farming practices, develops tools to support decision-making and improves watershed governance. These activities help increase the resilience of farming communities to the impacts of natural disasters. As a result of the project's assistance, close to 800 stakeholders have been trained on ways to better to adapt to the impacts of climate change and variability, as well as in the use of climate information and implementing risk-reducing actions in FY 2017[376].

- *Increasing Disaster Resilience through Livelihoods Strengthening.* USAID works with CRS to increase the capacity of vulnerable communities to prepare for and recover from frequent typhoons. The program supports and trains local authorities to develop comprehensive disaster management plans, as well as trains coconut farming and fishing households to implement diversification and savings strategies to increase their resilience to disasters. With USAID/OFDA support, CRS is bolstering livelihoods and mitigating disaster risk through household-, community-, district- and municipal-level interventions[377].

- *Strengthening Disaster Preparedness and Response Climate Change Adaptation Capacity.* Through USAID/OFDA funding, the UN World Food Program is increasing the ability of national and local governments, academic institutions and nongovernment organizations to effectively prepare for, and respond to, disasters and climate change. The program builds the institutional capacity of the Philippine government to respond to disasters; enhances the country's logistics response capabilities; and improves vulnerability assessment and mapping techniques. The program also strengthens national and local disaster preparedness and mitigation plans by incorporating climate change adaptation activities into risk reduction planning.[378]

[375] https://www.usaid.gov/philippines/energy-and-environment
[376] Ibid
[377] https://www.usaid.gov/philippines/humanitarian-assistance
[378] Ibid

Asian Development Bank (ADB) Philippines: Climate Resilience and Green Growth in Critical Watersheds[379]. This technical assistance of ADB aimed to enhance capacity of nine LGUs in integrating climate change issues into their development plans.

- The LGUs were from three critical watersheds in Camarines Sur, Davao Oriental, and the Lower Marikina River Basin. These watersheds were chosen based on (i) high vulnerability to climate change; (ii) high levels of urban poverty and population density with settlements in vulnerable locations; and (iii) high demonstration potential in integrating climate resilience and green growth into local development. The outputs of the TA were: (i) current and future vulnerabilities to climate change assessed and greenhouse gas (GHG) inventory prepared; (ii) gender-responsive and locally appropriate adaptation and GHG mitigation measures identified and prioritized; (iii) gender-responsive priority climate change actions demonstrated; and (iv) knowledge products disseminated, and stakeholder capacities strengthened.

- Major Lessons. LGUs need long-term support to address data gaps, georeferencing, GHG inventory preparation, natural resource accounting, and cost-benefit analysis of climate actions. Piloting climate actions in the context of other pressing needs in various LGUs remains a challenge. The issues such as lack of basic climate change data, technical knowhow, qualified local staff and other factors require that some of the processes, especially baseline studies, vulnerability assessments, and cost benefit analysis of climate actions, be adjusted to reflect ground realities. Adoption of multi-criteria approach for prioritization of climate actions and development of LCCAPs worked well in all LGUs.

Japan International Cooperation Agency

- As part of the JICA-PAGASA PROJECT “Enhancing the Capacity on Weather Observation, Forecasting and Warning (J-POW Project)”, capacity building on weather observation and forecasting were conducted to students of the Sorsogon Pilot Elementary School. In Southern Luzon, JICA’s grant aid assistance helped establish the Virac weather radar station which aids PAGASA in deriving detailed rainfall distribution by calibrating radar data through rain gauge stations and by establishing rainfall warning criteria. Under the said project, JICA also provided assistance to PAGASA in the establishment of a guideline in producing and training in calibrating and maintaining weather observation instruments, weather radar maintenance, and trainings to enhance weather forecast and warning capacity.

- Since 1973, JICA has implemented several ODA projects with PAGASA, namely the Flood Forecasting and Warning System for Dam Operations Project or FFWS (1973-1986) covering five major dams in Luzon, as well as capacity building projects such as Strengthening Flood Forecasting and Warning Administration (2004-2006), Improvement of Meteorological Radar System (2009), Flood Forecasting and Warning System for Dam Operations (2010-2012) and Strengthening of Flood Forecasting and Warning System in Pampanga and Agno River Basins (2011)[380].

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[379] https://www.adb.org/projects/documents/phi-46441-001-tcr. Technical assistance completion report.
[380] https://www.jica.go.jp/philippine/english/office/topics/news/130822.html

2.4.3 Other relevant FAO projects in the Philippines

- FAO implemented the **Coconut-Based Farming Systems Programme** as part of the organization's Typhoon Haiyan Strategic Response Plan to address the recovery needs of affected farming families. FAO and its partners established 129 Sloping Agricultural Land Technology (SALT) sites to enable coconut-based farming communities to plant short term vegetable cash crops and annual crops to provide alternative livelihood sources, while also integrating climate-smart farming technologies. Through the same program, FAO established 68 climate-smart farmer field schools and conducted several capacity building and training sessions. [381]

- In response to the impacts of droughts brought about by El Niño to the country's poorest and most vulnerable communities, FAO is currently piloting **"Early Action to protect livelihood of rice farmers in selected vulnerable areas of Mindanao against potential extreme dry conditions brought by El Niño"** (OSRO/PHI/806/BEL), to protect the livelihood of rice farmers in selected areas of Mindanao with support from the Government of the Kingdom of Belgium. The project intends to protect rice production by providing irrigation systems and inputs, and by offering alternative livelihoods such as livestock farming and high-value commercial crops to prevent asset depletion and increase resilience. This initiative focuses on Mindanao, particularly the provinces of Maguindanao and North Cotabato, which have high vulnerability rating and high exposure to drought.

- Other relevant projects
    a. Supporting Developing Countries to Integrate the Agricultural Sectors into National Adaptation Plans (NAPs) (UNFA/GLO/616/UND)
    b. Emergency assistance to restore food security and enhance agricultural production and resilience in typhoon-affected communities in Lanao del Norte (Region X) and Lanao del Sur (ARMM), Mindanao (TCP/PHI/3701)
    c. Enhancing Farmers Information System for Disaster Risk Reduction and Management (DRRM) in Agriculture and Fisheries (TCP/PHI/3605, ongoing, initial stage)
    d. There are a number of completed/ongoing emergency projects implemented that aims to restore food security and enhance agricultural production and resilience in typhoon-affected communities.
    e. Technical Support in Developing Climate Resilient Coconut-based Farming Systems (TCP/PHI/3708, ongoing, initial stage)
    f. Development of a Sustainable Integrated Pest Management (IPM) Programme on Coconut Scale Insect (CSI) Aspidiotus rigidus Reyne (completed project)
    g. Institutionalization of FAO's Rural Invest Package to enhance national stakeholders' investment planning and monitoring capacities (TCP/INT/3703)

[381] http://www.fao.org/in-action/restoring-coconut-farmers-livelihoods-in-the-philippines/en/

Relevant FAO fishery projects with BFAR

- Building Capacities for a Climate Resilient Tilapia Farming in the Philippines (TCP/PHI/3502, completed). The project, implemented in partnership with PAGASA, PCIC, and the Caraga State University, was able to enhance the capacities of national and local government counterparts/extension workers through the conduct of activities such as the collation of evidence-based scientific information that was used in developing a series of technology bulletins which advise farmers when best to farm, plan or harvest and fishermen, when to fish. The project also installed automatic weather stations (AWS) to monitor local conditions in real-time, providing farmers with simple statistical analyses and early-warning messages through ICT-based applications. The project explored the introduction of innovative crop insurance and other financial products to enhance resilience.
- Building on the outcomes and documented practices of the TCP/PHI/3501, a follow through regional project "Promoting scaling-up of innovative rice-fish farming and climate resilient Tilapia pond culture practices for blue growth in Asia" (TCP/RAS/3603, ongoing) was implemented by BFAR in 2018. The project aimed to improve capacity of tilapia farmers and strengthen enabling environment for adopting climate resilient tilapia pond culture practices. Three key outputs were achieved namely 1) development and dissemination of knowledge products and training materials; 2) conduct of farm technical demonstration; and 3) development of the national strategy and program for scaling up climate resilient tilapia farming practices.

2.4.4 DA Agriculture Programs for Mainstreaming

Government Large Scale Agriculture Programs

1. **National Rice Program (NRP)**
   - The DA's national rice program is designed to address the challenges of the rice sector on the declining yield per unit area caused by climate change and high cost of production, poor irrigation system; inadequate post-harvest facilities and farm-to market roads; and inefficient extension delivery system[382]

   - The Philippine Rice Industry Roadmap (PRIR) 2030 aims to achieve three major targets: (i) improved competitiveness; (ii) enhanced resiliency to disasters and climate risks; and (iii) ensure access to safe and nutritious rice. PRIR aims to target 57 priority provinces which were identified based on criteria covering yield, area harvested, cost of production, and percentage of irrigated harvested. With reference to enhancing resiliency to disasters and climate risks, the target is that by 2026 farm adaptability for disasters and climate risks should be increased with the following specific objectives, intervention and core support[383]:

Strategic Target	Strategic Intervention	Core Support
At least 60% of rice farms covered by crop insurance	Provision of crop insurance support in all target provinces from 2023-2026	● Provision of crop insurance support in high-risk provinces from 2019-2022
100% of rice farmers adopting climate resilient technologies		● Use of climate risk vulnerability map to focus adaptation strategies ● Extension support on localized climate information service, dynamic cropping calendar, and climate resilient technologies ● R&D on climate-resilient production and post-production technologies
100% of rice farms affected by calamities provided with		● Increase seed reserves to cover expected areas to be affected by climate change.

[382] http://rfo4a.da.gov.ph/rice-program/#
[383] Philippine Rice Industry Roadmap (PRIR) 2030

seeds for quick
turn-around

- Challenges confronting the industry are the following: a) low productivity compared to some ASEAN countries; b) productivity is continuously being challenged by lack of irrigation in almost one-third of the total area devoted to rice, and is exacerbated by competing demand for power generation; c) low production efficiency; d) farm mechanization is limited only to land preparation and post-harvest handling; e) climate change which exacerbates soil erosion, siltation of fertile lowland, lakes and irrigation canals, pests, and declining soil fertility; f) declining number of rice farm workers and ageing farmers.[384]

- For 2017, the rice program has a total of 101,846 beneficiaries (919 groups) and has successfully distributed 2,677,070kg of palay seeds. The top 3 sees recipient regions are SOCCSKSARGEN (35%), Ilocos Region (20%), and Caraga Region (11%). A total of 84,276ha of palay areas were also provided with technical and support services by DA. Meanwhile, the DA's NRP is implementing the Corporate Rice Farming Program (CRFP) as a strategic model that will integrate and consolidate small and medium rice enterprises from production to marketing activities through institutional marketing systems. The NRP aims to address the lack of accessibility and availability of rice especially among marginalized sectors of the society[385].

- With regard to financial appropriations, the NRP has a total budget of Php 7,062,293 for FY 2016 and Php 9,735,779 for FY 2017[386]. The former constitutes 14.43% of DA's total FY2016 budget while the latter accounts to 21.19% of the FY2017 budget.

2. National Corn Program

- The National Corn Program supports the development of white and yellow corn and cassava through various interventions such as production support, provision of farm machinery and postharvest facilities, irrigation and extension support.[387]

- The corn industry is faced with productivity problems brought about by poor growing conditions, which could be due to either poor choice of site or non-adoption of cultural management practices. Productivity is also challenged by high post-harvest losses and erratic changes in weather. The archipelagic nature of the country and inadequate infrastructure also affect marketing and distribution, which increases marketing cost.[388]

[384] Draft AFMP 2018-2023
[385] 2017 DA Annual Report
[386] Ibid
[387] 2016 DA Annual Report
[388] Draft 2018 -2023 AFMP Report

- For FY 2017, the program has a total of 35,190 beneficiaries (570 groups) and has successfully distributed 211,921kg of bufferstock seeds. Top 3 seed recipients are Zamboanga Peninsula, Caraga Region, and CALABARZON. DA has also provided technical and support services to 676,585ha of yellow corn, 181,435ha of white corn, and 119,357ha of cassava.

- With regard to financial appropriations, the program has a total budget of Php 2,249,424 for FY 2016 and Php 2,286,854 for FY 2017.[389] The former constitutes 4.6& of the agency's total budget while the latter account to 6.15% of DA's FY 2017 budget.

3. National High Value Crops Development Program (HVCDP)

- HVCDP promotes the production, processing, marketing, and distribution of high-value crops to increase farmers' income, create livelihood opportunities, and ultimately contribute to agricultural development[390]. Specifically, HVCDP has the following objectives: (i) facilitate and harmonize development intervention in the strategic production areas/zones; (ii) delivery of appropriate development support services; (iii) facilitate and promote access to local and international market; (iv) proactive management actions on demand and supply situation. Priority commodities under this program are vegetables (highland, lowland, spices, and legumes); fruits (mango, banana, pineapple, others), industrial crops (coffee, cacao, and rubber); alternative food staple crops (saba-cardaba, soybean, rootcrops)[391].

- HVCDP identified areas are the following: (i) convergence areas – areas identified by the convergence initiatives of the DA, DAR, and DENR; (ii) strategic production zones – key production areas in the country with a significant contribution to overall gross regional production and areas/zones in which agro-climatic condition is conducive to production; and (iii) farm households which include backyard farms and areas which are not more than 5 hectares (for fruits and plantation crops) and less than 1 hectare (for vegetables)[392].

- The income-generating potential of high value crops remains undertapped because of lower government investment for the sub-sector. Spending for R&D and support programs have not matched those for sub-sectors that directly relate to increasing food supplies in the country. [393] Specific challenges confronting HVC are also presented in the draft AFMP.

- For FY2017, a total of 1.17M kg of vegetable seeds were distributed with the MIMORAPA region being the top recipient, followed by the Central Luzon. A total of 23.86M pcs of planting materials were also distributed, which are mostly for cacao, sweet potato, and coffee. Northern Mindanao, Cagayan Valley, and Davao Region are the top recipients of these planting materials. Technical and support services were provided to 6,267ha (coffee), 14,387ha (cacao); 4,789ha (rubber), among others.

[389] 2017 DA Annual Report
[390] 2015 DA Annual Report
[391] http://bpi.da.gov.ph/bpi/index.php/hvcdp
[392] Ibid.
[393] Draft 2018 -2023 AFMP Report

- With regard to financial appropriations, the program has a total budget allocation Php 2,918,639 for FY2016 and Php 3,968,179 FY2017. The former consists 5.94% of the agency's FY2016 total budget while the latter pertains to 8.64% for the DA's FY 2017 budget[394].

4. National Organic Agriculture Program (NOAP)

- The signing of the Organic Agriculture Act of 2010 (RA10068) paved the way for the creation of the National Organic Agriculture Board (NOAB) as the policy-making body responsible for providing directions and general guidelines for the implementation of the National Organic Agriculture Program (NOAP)[395]. The NOAP envisions the organic agriculture sector contributing to the country's over-all agricultural growth and development, in terms of sustainability, competitiveness and food security, where at least five percent (5%) of the Philippine agricultural land practice organic farming; and, where consumers both national and international increasingly support Philippine organic food products[396].

- Organic agriculture is continuously beset by low productivity, lack of awareness and full understanding, lack of planting materials and other production support. While raw organic fertilizer materials are readily available, processing them into compost is expensive by farmer's standards. Composting in places close to farms is recommended. Producing organic materials for pest control is also a limiting factor. Expanding the market for organic products depends on supply availability and stability.[397]

- For 2017, a total area of 400,804 ha are under the organic agriculture cultivation, which corresponds to about 80% of the program's target. The program has distributed 64,014kg of seeds, with Western Visayas, Central Visayas, and Cagayan Valley being the major recipients of the organic seeds. Beneficiaries of the program reached to 12,812 individuals (1,237 groups). Including also in the program is the distribution of planting materials, fertilizers and soil ameliorants, biocontrol agents, among others[398]. Recent data also indicates that there are 39 certified farms and close to 118,900 farms (not certified) but are already adopting organic agriculture practices. Of 39 certified farms, 20 are in CAR, 8 in Bicol and 7 in SOCCSARGEN.[399]

- The Philippines is one of the top ten countries in Asia with the most organic agricultural land or the largest share of organic farms to the total agricultural land. At present, the country maintains a total of 402,319 ha of organic farm or 5.61% of the total agricultural land. It produces a total 559,063 mt organic products. This will further increase with the growing awareness of the population on the health benefits

[394] 2017 DA Annual Report
[395] 2015 DA Annual Report
[396] Ibid
[397] Ibid
[398] 2017 DA Annual Report
[399] Draft 2018-2023 AFMP Report

of organic products and sustainable production system. Organic products include among others coco sugar, coco amino sauce, coco sap sugar, virgin coconut oil, coco chips, ginger candy and tea, organic brown rice, red rice, black rice and herbal food supplements[400].

- Organic agriculture has budget allocation of Php 634,998 and Php 817,936, for FY2016 and 2017, respectively. The former constitutes 1.30% of the DA's FY2016 budget while the latter pertains to 1.78% of the agency's total FY2017 budget[401].

5. **Special Area for Agriculture Development (SAAD)**
   - The SAAD, which is a locally-funded program of DA, will last for six years (2017-2022) in its implementation in the poorest provinces of the country through the provision of both social preparation and livelihood interventions. SAAD intends to alleviate poverty through increased food production, and productivity in the target areas by providing the appropriate technology, financing, marketing, and other support services to farmers and fisherfolk[402].

   - Target beneficiaries of the program are the following: (a) poor households or groups earning below the poverty threshold per province who would like to engage, or are already engaged, in agriculture and fisheries; (b) farmers listed either in the updated Registry System for Basic Sectors in Agriculture (RBSA), DA's database, farmers' registry of the Municipal Agriculture Office (MAO), 4Ps beneficiaries, Indigenous People's group, or members of accredited farmer organization and cooperatives. For those not formally organized, the group will be assisted by SAAD to be formally registered or accredited by the appropriate government authority, provided that these groups undergo training courses; (c) preferably those who did not receive similar interventions from DA in the last two years upon completion[403].

   - Through the SAAD program, a total of 30 provinces have been given assistance in both agriculture and fisheries. Currently, areas covered by the program are the following: CAR (Apayao); Region V (Catanduanes); Region VII (Negros Oriental); Region VIII (Eastern Samar); Region IX (Zamboanga del Norte); Region X (Bukidnon); Region XI (Compostella Valley); Region XII (Maguindanao).[404]

Philippine Coconut Authority Projects [405]

6. Kaanib Enterprise Development Project (KEDP) showcased coconut-based enterprise in organized clusters of coconut farms in selected areas owned and operated by the coconut farmers. The project involves the establishments of coco-based enterprises which may be coconut farmer's organization (CFOs) or cooperative and establishing start-ups or

[400] Draft 2018-2023 AFMP Report
[401] Ibid
[402] http://saad.da.gov.ph/about-us/#about and 2017 DA Annual Report
[403] 2017 DA Annual Report
[404] http://saad.da.gov.ph/about-us/#about
[405] http://www.pca.da.gov.ph/index.php/2015-10-23-06-25-48/programs#

expanding mature community-based enterprise engaged in coconut processing, inter cropping and livestock raising.

7. Kaanib Coco Agro-industrial Hub (KCAHP) project intends to establish "coco hub" in different coconut provinces of the country. It is composed of Central Business Unit (CBU) that will act as primary or secondary processor of coconut products into value added products, integrator, consolidator, market, as well as source of technology and information; and the "spokes" which shall form the base for entrepreneurial business operations of the CBU.

8. Accelerated Coconut Planting and Replanting (ACPRP) which promotes coconut planting in open and suitable areas and replanting of senile and unproductive coconut trees and those damaged by natural calamities using farmer's preferred variety such as tall and dwarf varieties sourced within the locality.

9. Maintenance of Coconut Seed Farm/Seed Garden are also continuously being operated and undertaken in support of the long-term coconut planting and replanting program of the PCA.

10. Yolanda Rehabilitation and Recovery Program (YRRP) implementation in affected provinces in Region 6, 7, and 8. The program has four components: coconut planting/replanting; coconut intercropping; coconut fertilization; and integrated pest management.

11. On the coconut levy fund, a refiled bill was approved on second reading by the House of Representatives. The refiled coco levy fund bill (HB No.9197) seeks to create a P10 billion "jumpstart fund" to be used exclusively for the benefit of coconut farmers and the coconut industry[406].

Grant and Loan Agricultural Programs

12. **Philippine Rural Development Project (PRDP)**
    - PRDP is a six year project, funded by World Bank, which aims to establish a government platform for a modern, climate-smart and market-oriented agri-fishery sector. PRDP will partner with the LGUs and the private sector in improving key infrastructure, facilities, technology, and information that will raise income, productivity, and competitiveness in the countryside. Within the six year period, it is expected to provide the following outcomes: (i) at least five percent increase in annual real farm incomes of PRDP in household beneficiaries; (ii) 30% increase in income for targeted beneficiaries of enterprise development; (iii) seven percent increase in value of annual marketed output; and 20% increase in number of farmers and fishers with improved access to DA services[407]

[406] https://newsinfo.inquirer.net/1122190/house-oks-refiled-coco-levy-fund-bill-on-2nd-reading
[407] http://prdp.da.gov.ph/about-us/overview/

- PRDP has been supporting provincial planning, rural infrastructure and agriculture enterprise development. It has been using tools such as geotagging, value chain analysis and expanded vulnerability and suitability assessments to help guide public investments toward a modern, value-chain oriented, and climate-resilient agriculture and fisheries sector. Since its implementation in 2015, PRDP has helped improve provincial planning for priority commodities in all 81 provinces of the country. A total of 320 km of rural road improvements was completed with an additional 1,000 km being improved and 1,000 km in improvement design stages, benefiting 500,000 households. A total of 120,000 beneficiaries received support through 585 agriculture enterprise sub-projects. Improved provincial planning further resulted in provinces being able to mobilize additional US$ 400 million of funds for identified priority investments in agriculture[408].

- For the second financing of the Department of Agriculture's Philippine Rural Development Project (PRDP), the WorldBank has approved $280 million (P13.5billion) to increase rural incomes and enhance farm productivity in the country by building on the gains of PRDP which was started in 20214. The project also received a grant from the European Union amounting 18. 3 million euros (P1.05billion) to co-finance and provide incentives for local government units in Mindanao that experience poverty and conflict. The PRDP is expected to benefit over 300,000 rural residents in selected areas in the country, by supporting 267 climate resilient rural infrastructure and 287 enterprise development subprojects to boost rural incomes, strengthen planning implementation capacities among local government units and producer organizations.[409]

13. **Promoting Competitiveness and Enhancing Resilience to Natural Disasters Sub-program 2 Development Policy Loan (WB -IBRD loan)**
    - This program intends to support the government of the Philippines' recovery effort from the social and economic impact of the COVID-19 pandemic while advancing structural reforms on competitiveness and resilience. This is the second in a series of three operations designed to support critical policy and institutional reforms, and their implementation to achieve the government's development objectives by: (i) promoting competitiveness through lowering trade cost and ease of doing business, lowering entry barrier in telecom sector, liberalizing rice importation; and (iii) enhancing country's fiscal, social, and financial resilience to shocks through increasing revenue collection, strengthening resilience of payment systems, introducing national ID, and institutionalizing under risk finance strategy.[410]

14. **Climate Change Policy Program, Subprogram 1 (ADB – loan)**
    - The proposed Climate Change Policy Program will support policy and institutional reforms for implementing the Government of the Philippines' Nationally Determined Contribution (NDC) under the Paris Agreement. The program expected outcome will be the accelerated implementation of (i) gender responsive NDC and (ii) enhanced emissions reduction and adaptation plans and targets across sectors including energy, agriculture and natural resources, urban and transport. The policy reforms

[408] http://www.worldbank.org/en/country/philippines/overview#3
[409] https://www.philstar.com/business/2021/06/19/2106454/world-bank-oks-p135-billion-loan-philippines-rural-development
[410] https://ewsdata.rightsindevelopment.org/files/documents/14/WB-P170914.pdf

included in the program intend to support the delivery of NDC targets, while the program as a whole will help accelerate its implementation, leading to increased ambition of climate actions to be reflected in future NDCs. The programmatic approach is estimated to cost $800 million comprising of policy-based loans for two subprograms of $400 million each.[411]

15. Mindanao Irrigation Development Project, Phase I

- The proposed Mindanao Development Project will support the Government of the Philippines to increase productivity and resilience of irrigated agriculture in Mindanao by (i) strengthening irrigation planning, design, and management capacities; (ii) developing efficient and climate resilient irrigation systems; and (iii) adopting climate resilient irrigated farming systems.[412]

[411] https://www.adb.org/sites/default/files/project-documents/55268/55268-001-cp-en.pdf

[412] https://www.adb.org/projects/53272-001/main#:~:text=The%20Mindanao%20Irrigation%20Development%20Project,climate%20resilient%20irrigation%20systems%3B%20and%20(

Section 2.5: Technical and financial analysis of available and tested adaptation practices and technologies in Philippine Agriculture (with Cost-Benefit Analysis - CBA)

Contents

2.5.1 Introduction

1. The agriculture sector plays a substantial role in the Philippines in terms of employment, economic growth and poverty reduction. It is therefore crucial to fully understand the current and potential impacts of climate change and extreme weather phenomena, and identify the best practices for meeting these challenges. By 2050, climate change is projected to increase average temperatures as well as the variability and intensity of rainfall throughout the Philippines. Due to the country's proximity to the Pacific Ocean basin, the Philippines experiences at least 15 typhoons each year, or 57% of the total global typhoons (NOAA, 2013), making it the second most exposed country in the world to tropical storms and typhoons according to the National Oceanic and Atmospheric Administration (PSA, 2014). Out of the total economic damages caused by typhoons from 2006-2013, 95 percent were agricultural losses (FAO, 2015). To highlight the severity of climate-induced phenomena, between 2000 and 2010 the total economic cost resulting from typhoons, flooding, and drought was estimated to be over USD $2.2 billion, with rice and maize losses amounting to roughly $1.6 billion alone (Israel and Briones, 2013). By 2050, the total financial cost is expected to reach $2.7 billion per year (Rosegrant, M.W et al., 2016). Because of these impacts, adaptation to climate change through climate-resilient agriculture has become vital for sustaining production in the Philippines.

2. The purpose of this study is to review available and tested climate resilient agriculture (CRA) practices and technologies suitable for major agriculture systems in the three island regions of the Philippines. CRA embodies practices and technologies that have significant potential to enhance agricultural productivity and help farmers mitigate and adapt to the principal effects of climate change. The study was done in conjunction with the Climate Resilience Profiling (see Appendix of Annex 2.2).

3. This study is based on key informant interviews, focus group discussions, and three stakeholders workshops with farmers and agriculture experts conducted from April to June 2018 to identify and prioritize CRA practices for six commodities in six regions across Luzon, Visayas, and Mindanao. Cabbage, potato, rice and corn were investigated in the Cordillera Administrative Region (CAR) in Luzon; cacao, coffee, and yellow corn in Northern Mindanao and Davao Region in Mindanao; rice, coconut and corn in Central and Eastern Visayas in Visayas. From September to October 2018 Farmers Surveys were conducted on-site to collect input data for a cost-benefit analysis (CBA) of selected prioritized CRA practices. This report also builds on the CBA work undertaken by SUCs and CIAT in the framework of Philippine's Department of Agriculture (DA)'s Adaptation and Mitigation Initiative in Agriculture (AMIA) program.

2.5.2 Study area and prioritized agricultural commodities.

Luzon

4. The Cordillera Administrative Region (CAR) is endowed with abundant natural resources and contributes highly to the Philippines' agriculture sector. In 2017, CAR contributed 1.7 % to the country's Gross Domestic Product, and from the total regional output, 8.8 % came from agriculture and related sectors. For this analysis, cabbage, potato, rice and yellow corn were selected for detailed analysis. This selection was informed by the large contribution these crops make to total agricultural production and exports from the island group (and the country more broadly), as well as their vulnerability to the impacts of climate change. Rice, corn and cabbage are the major crops produced in CAR, contributing 40.18 % to the region's agricultural output. CAR is also the country's top producer of cabbage (Philippine Statistics Authority, 2018). Rice and corn were identified as key to food security and livelihoods by the Philippines' Climate-Resilient Agriculture Profile.

5. The Province of Benguet remains the region's largest producer of semi-temperate vegetables, supplying almost 80 % of the regional market. In terms of production area and volume, Benguet has the largest area with 21,040 ha devoted to upland vegetables. Vegetables are produced intensively using crop rotation for different kinds of semi-temperate vegetables including cabbage, Chinese cabbage, potato, carrots, broccoli, cauliflower, lettuce, snap beans, tomato, cucumber, garden pea, radish, bell pepper, and celery. Benguet is by far the largest producer of potato and cabbage, with more than 11,000 ha of land dedicated to their production in 2017 (OPAG, 2018). The province of Benguet was selected for both cabbage and potato due to high levels of production and vulnerability to drought, heavy rains and landslide.

6. On the other hand, the region's palay production in 2016 was 382,848 MT harvested on 110,640 hectares. Current production is about 4.51 % lower than the 2015 production levels and there was a 0.76 % reduction in area harvested. For corn, 199,355 MT were harvested on 61,045 ha. However, corn production is also down by 16.18 % from 2016 output and has declined in area by 5.23 % (PSA, 2017). For rice and corn, the provinces of Abra, Ifugao, Kalinga, Mountain Province and Apayao from CAR region were chosen due to the impact of typhoons and drought on their production.

Visayas

7. Visayas Island is one of the top producers of major agricultural and fishery products in the country and contains an estimated 1.20 million ha of agricultural land area (National Economic and Development Authority, 2017). Coconut, rice, corn, sugarcane and banana are the top agricultural crops in the region. In 2016, the island accounted for 16.9 % of the country's gross value added in agriculture, forestry and fishing sector (Philippine Statistics Authority, 2017).

8. For this study, rice, white corn and coconut were selected. This selection was informed by these crops' large contributions to total agricultural production as well as their vulnerability to the impacts of climate change. These three crops were identified as key to food security and livelihoods by the Philippines' Climate-Resilient Agriculture Profile. In 2015, 3.3 million MT of rice were produced on the island. In fact, the so-called "Sugar bowl of the Philippines", which is Negros Occidental, is found in the region. For corn, an estimated 86,517 MT was produced using coconut intercropping systems (Philippine Statistics Authority, 2014). In Cebu province, 29 % of the total 61,998 ha of agricultural area was planted with corn (Cebu Provincial Agricultural Profile, 2016). Eastern Visayas, which is a region of Visayas Island, ranked 7th nationally among top coconut producers in 2016. The Leyte province in Eastern Visayas has a total area of 345,067 ha of agricultural land, of which 49 % is planted with coconut (Leyte Provincial Agricultural Profile, 2016).

Mindanao

9. The island of Mindanao is the agriculture breadbasket of the Philippines. Its agriculture, forestry and fishing sectors contributed approximately 37% of the country's Gross Value Added [1] (Philippine Statistics Authority, 2018). For this study, corn, coffee, and cacao were selected for detailed analysis. This selection was informed by these crops' large contributions to total agricultural production and exports from the island group, as well as their vulnerability to the impacts of climate change. These three crops were identified as key to food security and livelihoods by the Philippines' Climate-Resilient Agriculture Profile[413]. In the current study, two provinces were selected where these crops play an important role in the local economy and where climate change is likely to affect production: Bukidnon (Region 10) for corn and coffee and Davao del Norte (Region 11) for cacao.

10. Bukidnon is a highland province in Northern Mindanao characterized by rugged topography with rolling hills and flatlands. In 2017, the agriculture sector of Northern Mindanao contributed 21.9% to the region's Gross Regional Product (GRP). The sector employed over 2 million people, accounting for 36.4% of the region's total employment. The region's top commodities are banana, pineapple, corn, chick, and hog[414] . Other crops such as coffee, cassava, rubber, and rice are also produced in Northern Mindanao. Among its provinces, Bukidnon is one of the top producers of corn and coffee. The variety predominantly grown in the province is yellow corn. Data show that the province produces 700,000 MT of corn annually. Bukidnon also has the 2nd largest coffee area in Mindanao and is the 4th largest coffee-producing province in the country[415].

11. Davao del Norte, meanwhile, is located in the south-eastern part of the island of Mindanao, with terrain that is generally low-lying. In 2016, the agricultural sector accounted for 12.2% of Davao Region's GRP and employed 34.5% of its work force[416]. Although the top commodities are banana, rice, coconut, chicken, and hog, the Davao Region is the major cacao producer in the Philippines, contributing approximately 80% to total national cacao production[417]. The province contains roughly 33% of the region's production areas[418]. However, the province also faces climate change hazards including drought and heavy rains. In 2012, for example, it was one of the provinces devastated by Typhoon Bopha [419].

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2.5.3 Cost-benefit analysis of prioritized climate resilience agriculture technologies and practices

12. The CIAT- Cost-Benefit Analysis (CBA) tool was used in analyzing the profitability associated with the different CSA practices. CBA was carried out by comparing the differences in the flow of net benefits – the difference of flow of benefits and the costs – over the life cycle of a CSA practice. For the current study CBA were computed for a 10 year periods. The two main economic assessment indicators are the net present value (NPV) and the internal rate of return (IRR). The NPV embodies the incremental flow of the differences in the flow of benefits and the costs generated by the different CSA practices compared over their life cycles and was calculated as shown in Eq. 1.

$$NPV = \sum_{t=1}^{n} \frac{B_t - C_t}{1+r^t} \quad (1)$$

where: B_t represents the benefits at the time t, C_t represents investment and recurrent cost at time t, t represents the life cycle, and r represents the discount rate.

13. The IRR is the discount rate that makes the present value of the flow of future net benefits equal to nil and is calculated as shown in Eq. 2. To assess how profitable a practice is, the IRR was compared with a range of possible values across different scenarios. An investment in a practice is therefore considered profitable if its IRR is higher than the discount rate. The IRR was computed using the average values obtained from the household survey.

$$\sum_{t=1}^{n} \frac{B_t - C_t}{1+r^t} = 0 \; when \; IRR > r: NPV > 0 \quad (2)$$

where: B_t represents the benefits at time t, C_t represents investment and recurrent cost at time t, t represents the life cycle, r represents the discount rate, and IRR represents internal rate of return.

14. The discount rates used in the calculations were derived from the interest rates payable by farmers in the different provinces. Consequently, the discount rates used in this study for the different CSA practices ranged from 7% to 15%. For the CBA analysis a period of 10 and 20 years were applied for annual crops and perennial crops.

Luzon

Potato

Use of Blight-Resistant Potato Variety

15. The Igorota (LBR PO3), known to farmers as Late Blight Resistant (LBR), is a locally-bred potato variety, moderately resistant to late blight and leaf miner. It has a high dry matter content suited for both table and processing use. It matures in 110 days and has a potential yield of 25-35 tons per hectare. The other variety, Solibao (LBR PO4), has high levels of resistance to late blight showing negligible infection of 1% compared to other potato varieties. It has a maturity of 90-120 days, with an actual yield of 18-40 tons per hectare. Yield: BAU: 16 335 kg/ha, CRA: 18 897 kg/ha

16. Costs and returns of potato production per hectare in the municipality of Buguias, Benguet were compared between traditional and CRA practice. The CRA practice considered in this analysis is the use of blight-resistant potato variety, while the traditional users are those who do not use this variety.

17. Seeds take up the bulk of the cash costs incurred by both CRA and traditional users. In potato production, the quality of seeds is essential for ensuring higher productivity. Wang (n.d.) noted that the use of good quality seeds can increase yields by 30 to 50%, as compared to using farmers' seeds. Among the labor costs paid by the farmer-respondents, payment for harvesting is the biggest cash cost item, accounting for almost half of the total labor cash costs paid for by both CRA and traditional users. There exists a significant difference in the irrigation labor expense of traditional and CRA users. This is mainly because traditional users rely on rain, while CRA users have more access to small-scale irrigation systems, hence needing to hire labor to irrigate their farms.

18. The use of blight-resistant potato variety such as Igorota (LBR PO3) is an appropriate practice to address increased disease rates related to typhoons. The incremental initial investment in the first year is relatively low ($474), while the expected incremental benefit gained after 10 years (6438 USD) large.

CBA analysis

Change in yield (%)	**Incremental NPV (PHP)**	**Internal rate of return (IRR)**	**Payback Period**	**Incremental Initial investment (PHP)**	**Annual Incremental cost (PHP)**	**Annual Incremental net benefit (PHP)**
+ 16 %	330270 (6438 USD)	222	1	24316 (474 USD)	22213 (433 USD)	53754 (1054 USD)

Cabbage

Rain Water Harvesting

19. The on-site water harvesting tank described in this practice is a cemented tank structure, designed to collect rainwater during the rainy months that would enable farmers to have continuous cropping to help solve water shortage during dry months. Yield**:** BAU: 11 300 kg/ha, CRA: 16 400 kg/ha

20. Investment in a water harvesting tank for cabbage production might be a risky investment. The initial investment is very high (6680 USD /ha), and the payback period long (7 years). The water impounding system alone was estimated to cost PHP 288 000.

CBA analysis

Change in yield (%)	**Incremental NPV (PHP)**	**Internal rate of return (IRR)**	**Payback Period**	**Incremental Initial investment (PHP)**	**Annual Incremental cost (PHP)**	**Annual Incremental net benefit (PHP)**
+ 45 %	14310 (280 USD)	9 %	7	342684 (6680 USD)	23650 (461 USD)	52840 (1030 USD)

***Vegetable** (French beans, lettuce)*

Protected Vegetable

21. Rain shelters protect vegetable crops from erratic and high precipitation, strong winds and reduce the pressure of pests and diseases. Although there is no definite ideal size of rain shelters, this analysis was based on protected structures that measure approximately 1.5 meters in height, 2.5 meters in width and 20 meters in length. Since data were only available for a superficies 150 sq.m, profitability indicators presented below are representative for a 150 sq.m structure. The frame is

made of round steel pipes and is covered with polyethylene plastic. It can last more than ten years but the plastic cover, which costs PhP 5,000 on the average, is replaced every three (3) years.

CBA analysis

Change in yield (%)	Incremental NPV (PHP)	Internal rate of return (IRR)	Payback Period	Incremental Initial investment (PHP)	Incremental annual cost (PHP)	Annual Incremental net benefit (PHP)
+ 92 %	62405 (1150 USD)	59 %	2 years	27650 (540 USD)	- 3380 (- 66 USD)	14159 (276 USD)

Rice

22. Two CRA practices were identified in Oriental Mindoro in both irrigated and rain fed areas based on the identified climate risks in the area. Flooding caused by prolonged heavy rainfall and frequent occurrence of typhoon was the climate risk identified in rice production in Naujan, Oriental Mindoro, while prolonged dry periods even during the wet season in Bulalacao, Oriental Mindoro. As a result of the FGD with the farmers, the use of early maturing rice variety is adopted for flooded condition while rice-onion crop rotation during the prolonged dry season.

Rice-Onion Crop Rotation

23. Rice-onion crop rotation aims to utilize remaining nutrients from the rice field for onion production while disrupting the cycle of pests and diseases. The farmers traditionally plant rice for only one season and leave their rice fields unplanted for the next season, while the one applying the CRA practice grow rice during the first season and onion in the next cropping season.

24. In a rice-based system, crop rotation is practiced to minimize production risks and losses in areas identified as drought-prone and/or rainfed. About 3% of farmers in the municipality of Bulalacao adopted this practice to intensify land use and optimize production inputs throughout the year. Yield: BAU: Rice 4347 kg/ha, CRA: Rice 4484 kg/ha; Onion 4940 kg/ha

25. For both the traditional users and CRA users, fertilizer expenses take up bulk of their cash costs. Fertilizer expense contributes about 38% to the total cash costs incurred by the traditional users, and 24% of the total cash costs of the CRA users. Meanwhile, seed cost is the second major cash cost item paid for by all the farmer-respondents, taking up 11% of the total cash costs of those who do not practice crop rotation and 18% of the total cash costs of those who practice crop rotation. Payment for planting and harvesting are the top two largest labor cost items of the traditional users, while land preparation and planting are the two major labor cost items paid for by the CRA users. The hired labor expenses incurred for land preparation, planting, and harvesting by CRA users is significantly higher by Php 6170.98, Php 4969.59, and Php 2348.9, respectively, than that of the traditional users. It was

also found out that the CRA users spend more on material and labor cash cost items compared to the traditional users, and this can be explained by the cash costs incurred in the planting of onion by the CRA users.

26. The total cash cost incurred by the CRA users is higher by Php 69870 compared to the traditional users. The cash returns of the traditional users are Php 113 500 (2200 USD)/ha less than that of the CRA users. This is heavily driven by the returns received from selling onion, which is considered a high value crop. The returns above total costs of the CRA users are higher than that of their counterparts, by Php 43 600 (850 USD). The positive incremental NPV of US$ 4099 and an IRR of 57% indicate that the adoption of the rice-onion rotation is profitable.

Change in yield (%)	Incremental NPV (PHP)	Internal rate of return (IRR)	Payback Period	Incremental Initial investment (PHP)	Incremental annual cost (PHP)	Annual Incremental net benefit (PHP)
+ 100 %	210361 (4099 USD)	57 %	2 years	75924 (1480 USD)	69870 (1362 USD)	43605 (850 USD)

Use of Early-Maturing Rice Variety

27. Two early-maturing rice varieties are used by farmers in Naujan. The PSB Rc10 (Pagsanjan) which has an average yield of 4.8MT/ha and can be harvested 106 days after seeding. Farmers prefer to use this variety in order to cover the shortened season due to flooding. The second variety PSB Rc18 (Ala) can survive in complete submergence for 5 to 7 days and can be harvested 123 days after seeding. This long grain variety is preferred by farmers due to its high yielding property with an average yield of 5.1MT/ha. Yield: BAU: 3254 kg/ha, CRA: 4426 kg/ha

Change in yield (%)	Incremental NPV (PHP)	Internal rate of return (IRR)	Payback Period	Incremental Initial investment (PHP)	Incremental annual cost (PHP)	Annual Incremental net benefit (PHP)
+ 36 %	219350 (4,276 USD)	57 %	1	- 13851 (-270 USD)	- 11542 (- 225 USD)	31 293 (610 USD)

Visayas

Corn

Mixed Use of Organic and Inorganic Fertilizer

28. Application of organic fertilizer increases organic matter in soil, soil pH and total nitrogen. Chicken dung and vermicast are the most common organic fertilizers used by corn farmers. Organic fertilizers are also used for basal application. Corn farmers in Cebu use a combined application of organic and inorganic fertilizer in their production. Through the Mixed Use of Organic and Inorganic Fertilizer less inorganic or synthetic chemicals are used. Yield: BAU:1200 kg/ha, CRA: 1711 kg/ha

Change in yield (%)	Incremental NPV (PHP)	Internal rate of return (IRR)	Payback Period	Incremental Initial investment (PHP)	Incremental annual cost (PHP)	Annual Incremental net benefit (PHP)
+ 42 %	101420 (1977 USD)	NA	NA	- 4309 (- 84 USD)	- 3899 (- 76 USD)	17186 (335 USD)

Corn-Peanut Rotation

29. Corn-Peanut rotation is highly feasible in upland and hilly areas. This practice is done by planting peanuts after the corn is harvested. Peanuts can fix atmospheric Nitrogen through the aid of the N-fixing bacteria called rhizobia. This improve soil fertility for the succeeding cropping. Furthermore, this CRA practice lowers the incidence of pest and diseases by breaking the cycle of pests under monocropping. Therefore, reducing material costs as well as labor costs for fertilization and pest management. Yield: BAU: Corn 769 kg/ha, CRA: corn 529 kg/ha

30. The total corn production under this practice is lower compared to the conventional practice, since in a whole year production, one cropping of corn is replaced with peanut. However, in terms of yield, the CRA practice shows a 37% increase in corn yield and generates in overall higher annual revenue compared to corn mono-cropping, since there is additional revenue from peanuts. The

current adoption rate within the province of Cebu is 10%, and the projected adoption rate is 30% (Loreto et al, 2018).

Change in yield (%)	Incremental NPV (PHP)	Internal rate of return (IRR)	Payback Period	Incremental Initial investment (PHP)	Incremental annual cost (PHP)	Annual Incremental net benefit (PHP)
+ 37 %	86102 (1659 USD)	87%	2	22 109 (426 USD)	- 5864 (- 113 USD)	19203 (370 USD)

Rice

Small Water Impounding

31. The small water impounding system (SWIP) is a water harvesting and storage structure designed for water conservation and flood control consisting of an earth embankment spillway, outlet works and canal facilities. Yield: BAU 6080 Kg/Ha, CRA: 11850 Kg/Ha

32. The rice farm with SWIP access had greater yields which resulted in greater revenue compared to those farm areas without access. Farmers that do not have access to SWIP mostly rely on rain water for their farm irrigation. The result shows that rice farms who adopt the CRA would have greater yields by 5,700 kilograms per hectare compared to those rice farms that do not have access with the CRA. The current adoption rate of the SWIP in Bohol is 5%, with a projected adoption rate of 12%. Total land area for rice production in Bohol is around 72 589 hectares.

Change in yield (%)	Incremental NPV (PHP)	Internal rate of return (IRR)	Payback Period	Incremental Initial investment (PHP)	Incremental annual cost (PHP)	Annual Incremental net benefit (PHP)
+ 95 %	321339 (6063 USD)	33%	3	280158 (5286 USD)	6095 (115 USD)	97838 (1846 USD)

33. Those who did not adopt the CRA practice are willing to access the project only if there is a small water impounding project established in their area (Key Informant Interview, 2018). Therefore, government and private sectors interventions are needed mostly by the rice farmers in Bohol. This water saving technology, would not only give advantage to farm production, especially during dry seasons, but it would also help with adaptation or addressing the impacts of climate change.

Organic Red Rice Production

34. Organic red rice production advocates the production of transplanted red rice using organic inputs. It adopts the protocol of Pastor Jerry Dionson, 2016 National Gawad Saka Outstanding Organic Agriculture Farmer from Bago City, Negros Occidental. It also promotes proper repair and cleaning of dikes as well as weed and water management. Yield: BAU 6251Kg/Ha, CRA 8554 Kg/Ha

35. This CRA practice requires a total investment of about 1513 USD per hectare. Incremental costs are incurred for organic inputs and labor due to shifting from direct seeding to transplanting. Due to the transition of production, positive incremental benefits can be realized starting the second year, which achieved an annual incremental benefit of USD 388. The total investment was recovered on the 4th year. The estimated net present value (NPV) of the investment in 10 years is valued at around USD 1121.

36. Negros Occidental, being regarded as the organic food bowl of Asia currently has a 15% adoption rate of the CRA practice, and 37% of projected adoption rate within the province (Loreto et al., 2018). Production of organic red rice can solve food security issues and also address the pressing concerns of carbon emission in agriculture.

Change in yield (%)	Incremental NPV (PHP)	Internal rate of return (IRR)	Payback Period	Incremental Initial investment (PHP)	Incremental annual cost (PHP)	Annual Incremental net benefit (PHP)
+ 37 %	54593 (1121 USD)	25%	4	73683 (1513 USD)	66963 (1375 USD)	18896 (388 USD)

<u>Coconut</u>

Use of Tacunan Green Dwarf Coconut Variety (Improve Variety of Coconut)

37. Tacunan green dwarf is a variety of coconut that is early bearing, and known for its good quality coconut. This dwarf coconut variety has a thick stem, robust palm and well-anchored root system, which enable it to better withstand typhoon or cyclone. In a 1-hectare land area, approximately 179 tacunan dwarf coconut seedlings can be planted. The period of analysis for this CRA practice is 20 years since adoption would require replanting. The investment will be recovered by the 19th year. The current analysis assume that a typhoon would hit the coconut farm area on the 9th year, and most of the devastated coconut varieties are the traditional coconut variety due to tall and thinner stems compared to the tacunan green dwarf which is shorter and thicker. After the destruction, the expected outcome would be more tacunan green dwarf varieties are left than the traditional ones. Location of the study used for this analysis is in Leyte Province, with a current CRA adoption rate of 20% and a projected adoption rate of 75%. The area planted for coconut production in the province is 685,464 hectares. Yield (copra): BAU: 3000 Kg/Ha, CRA: 3500 Kg/Ha

38. Dwarf coconut varieties are not new to coconut farmers in Visayas (Key Informant Interview, 2018). The factor that limits the adoption of the CRA practice is that farmers are not fully aware of the advantages of growing dwarf coconut varieties especially in the typhoon prone areas. Public and private institutions' support is needed in the adoption of the practice. To compensate revenue lost until the new established coconuts reach maturity, intercropping with faster growing crops such as banana should be promoted.

Change in yield (%)	Incremental NPV (PHP)	Internal rate of return (IRR)	Payback Period	Incremental Initial investment (PHP)	Incremental annual cost (PHP)	Annual Incremental net benefit (PHP)
+ 17%	- 239878 (- 4526 USD)	1%	19	4664 (88 USD)	36305 (-685USD)	4028 (76 USD)

Coconut-Banana Intercropping

39. According to the study conducted by Seriño et al (2018), adoption of the CRA requires an initial investment amounting Php 7,890. Payback period would start after 4 years after implementing the CRA practice, with an annual incremental benefit of Php 3,348.9. At 10% market interest rate, the value of the incremental NPV is Php 148,465 in 10 years' time. The value of internal rate of return suggest that adoption and investment on the CRA per hectare would yield 80.70% of the invested capital. The location of the study is within the province of Leyte, with a study period spanning the years of 2016 to 2018.

40. In terms of productivity, through the intercropping of banana in areas planted with coconut, farm productivity significantly increases. Result shows that on average, farm income of farmers adopting the CRA is higher by 50%.

Farm production for mono-cropping and coconut banana intercropping

Non-CRA Practice		**CRA Practice**	
Yield/hectare (kg)	Value (PhP)	Yield/hectare (kg)	Value (PhP)
Coconut	67,500.00	Coconut	67,500.00
Banana	-	Banana	70,000.00
Revenue (In PhP)	67,500.00	Revenue (In PhP)	137,500.00

41. The little-to-no fertilizer and pesticide input requirement of coconut and banana intercropping makes the CRA a perfect solution to reduce agricultural emission and food security issues. The adaptation practice fit in the three pillars of identifying CRA practices. The current adaptation rate within the province of Leyte is 10%, and the projected adaptation rate is 45% (Seriño et al., 2018).

Mindanao

<u>Yellow corn</u>

Intercropping yellow corn with cassava

42. In Bukidnon, yellow corn is commonly intercropped with cassava during the second cropping season in the dry season. In addition to preventing losses due to drought, farmers believed that this production system improves soil quality through increased soil porousness, which favor corn roots as they penetrate deeper in soils and absorb more nutrients. Yield for 2 seasons: BAU: corn 11 000kg/Ha, CRA: corn 9 000 kg/Ha; cassava 20 000 kg/Ha.

Change in yield (%)	Incremental NPV (PHP)	Internal rate of return (IRR)	Payback Period	Incremental Initial investment (PHP)	Incremental annual cost (PHP)	Annual Incremental net benefit (PHP)
	57200 (1100 USD)	570%	1	1820 (35 USD)	1664 (32 USD)	10400 (200 USD)

<u>Cacao</u>

Intercropping cacao with coconut

43. Intercropping cacao will reduce soil erosion and surface run-off hence protecting the topsoil. It reduces plant diseases and attracts more beneficial insects resulting to reduced insect pest population. Thus, intercropping maximizes land use potential and labor. Yield: BAU: coconut 10 000 Kg/Ha, CRA: coconut 15 000Kg/Ha; cacao 1600 Kg/Ha

Change in yield (%)	Incremental NPV (PHP)	Internal rate of return (IRR)	Payback Period	Incremental Initial investment (PHP)	Incremental annual cost (PHP)	Annual Incremental net benefit (PHP)*
+ 50% Coconut	970590 (12930 USD)	30%	4	74803 (1536 USD)	60290 (1284 USD)	184 000 (3780 USD)

* When cacao reach production pick

Organic Fertilizer

44. Organic fertilizer increases moisture retention of the soil. Application of this practice has various benefits relating to climate change adaptation. Organic agricultural practices help preserve and restore soil structure, soil organic matter, and improves water holding capacity. Utilizing organic fertilizer practice also improves soil fertility and decreases soil erosion. Yield: BAU 800 Kg/Ha, CRA: 700 Kg/Ha

Change in yield (%)	Incremental NPV (PHP)	Internal rate of return (IRR)	Payback Period	Incremental Initial investment (PHP)	Incremental annual cost (PHP)	Annual Incremental net benefit (PHP)
-13%	- 75036 (-1443 USD)	Na	> 20	208 (4 USD)	728 (14 USD)	-12 688 (-244 USD)

2.5.4 Conclusion and recommendation

45. For farmers in Luzon, one of the most important resources for continued crop production is the availability of water for irrigation. According to respondents, interventions along the provision of water pump and establishment of water reservoirs is needed to increase resiliency and farmers' incomes. Practice such as deep wells with the use of water pump, as identified by some stakeholder are not recommend given the high cost to use ground water for irrigation. Furthermore, this practice is not sustainable for crop requiring a large quantity of water. Promoting the use of integrated and low input farming systems is a more sustainable adaptation strategy option, however farmers need guidance and assistance in the transition from conventional farming to organic farming systems. Seminars and trainings (especially hands-on) should be conducted on climate-smart technologies and included in the plans and programs of government agency. Moreover, there should be continued support of efficient technology transfer to improve crop productivity and adaptation in order to increase farmer awareness on the current hazards and challenges faced by the agriculture sector. The collaboration and partnership with farmers in planning and implementing programs should also be enhanced and strengthened for a more extensive and widespread adoption of technological interventions.

46. In Visayas, the prioritized climate resilient agriculture practices are corn-peanut rotation and use of organic fertilizer for corn; water harvesting and organic farming for rice and use of dwarf variety of coconut**.** Results show that these practices generate higher farm revenues compared to the conventional practices of the three commodities. The little-to-no use of synthetic fertilizer and pesticide input requirements makes these CRA practices good solutions to reduce agricultural emission and food security issue. These practices conform to the three pillars of CRA practices which are enhance productivity, adaptation or mitigation to climate change. Replacement of the conventional tall coconut variety by the dwarf variety, although profitable on the long term implies no revenue for the first 7 years. Here intercropping with faster growing crops such as banana should be promoted. Through the mixed use of organic and inorganic fertilizer less synthetic chemicals are used. However, according to farmer the scarcity of available organic fertilizer in the area is a barrier to the implementation of this practice (Key Informant Interview, 2018). Therefore, policy should support access to organic fertilizer from the government sector (e.g. municipal agriculture offices) and private companies or stores (e.g. agrivet stores). Different institutions (e.g. government, academic, private sector) must conduct seminars on the benefit of using mixed inorganic and organic fertilizer in their corn production. In order to increase adoption rate, further seminars and trainings should be conducted with farmers on the benefits of this CRA practices. It should be emphasized to farmers that these practices, do not only increases farm productivity, but also contribute in mitigating climate change.

47. In Mindanao crop diversification in corn production system, contour farming for coffee, and use of organic fertilizer for cacao are the recommended CRA practices. These practices were developed to help farmers overcome or reduce the impacts of climate variabilities such as drought and heavy rainfall which significantly impact production. These practices are also designed to have beneficial impacts to the environment, particularly on soil conservation, and water and nutrient retention. However, labor requirements associated with these CRA practices may deter farmers to adopt them. As an extension to the private cost benefit analysis, properly quantifying the environmental benefits of intercropping, contour faming, and use of organic fertilizer would provide a more holistic and appealing results to farmers and other stakeholders. Different barriers are faced by the stakeholders in adopting CRA practices such as lack of financial and technical resources. Therefore, support from different institutions, either from the government or private sector, should

take proactive steps towards helping the farmers adopt these CRA practices. Various agencies (e.g. Department of Agriculture, academe) who are knowledgeable in these prioritized CRA practices should conduct trainings and workshops on how to efficiently adapt these practices. Also, concerned government agencies partnered with LGUs should support the farmers through the provision of seed subsidies establishment of small water impounding projects and development of improved varieties. Farmers should form organizations to manage the overall crop production and post-production undertakings to improve easy access to agri-input suppliers, financing and lending entities, trainings and marketing experts.

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NEDA DETAILS ECONOMIC PROSPECTS FOR VISAYAN REGION

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Appendix: Climate resilient agriculture technologies and practices

Climate resilient agriculture (CRA) practices were identified and prioritized through a literature review, interviews with key informants, and a series of workshops. The identified practices are considered CRA practices as they enhance the productivity of farmers' production systems and support climate change mitigation and adaptation. During the stakeholder workshops participants were asked to list all existing adaptation options practiced in their localities that addresses the key climate hazards in their region. Afterwards, participants were encouraged to vote for the adaptation practices across the value chain that they believed have the highest potential to address climate hazards. The on-farm adaptation practices that received the most votes for each commodity were prioritized, whereas practices that did not receive a high enough score but were selected in the frame of AMIA were also considered for prioritization.[420]

The following tables (1-3) detail the identified CRA practices for key production systems by stakeholders during the CRP workshop, literature review and key informant interviews. The tables also list the current rates of adoption and the hazards each practice addresses. The current adoption rates presented are based on ratings given by stakeholders during the CRP workshop. The scores represent the total number of votes by stakeholders which, in combination with the literature review, determined the prioritized practices for each production system by region.

Climate change and adaptation practices in CAR region (Luzon)

The topography of CAR makes it susceptible to climate change related hazards and risks such as landslides and soil erosion caused by heavy rainfall and typhoons. Changes in rainfall patterns have exacerbated the region's vulnerability to drought and the intensifying occurrences of climate hazards have greatly affected agricultural activities and farmers' livelihoods.

[420] The AMIA CRA prioritization framework uses a step process approach to guide stakeholders through the process of filtering a long list of applicable CRA practices into portfolios of priority practices. The three-step process approach includes: assessing the status of CRA in the country via developing national and sub-national CRA profiles; 2) prioritizing locally appropriate CSA practices and analyze costs and benefits of investment, with regional partners receiving training and technical backstopping from CIAT. The first step includes the selection of CRA practices for production systems key for food security in the country based on literature review and national experts. During the second step, participatory workshops were conducted by regional partners (i.e., state universities and colleges) in 17 regions with DA's regional field offices and local government units to select at least two best-bet practices based on the results of the previous step and their own criteria (e.g., climate risk and crops affected in the area).

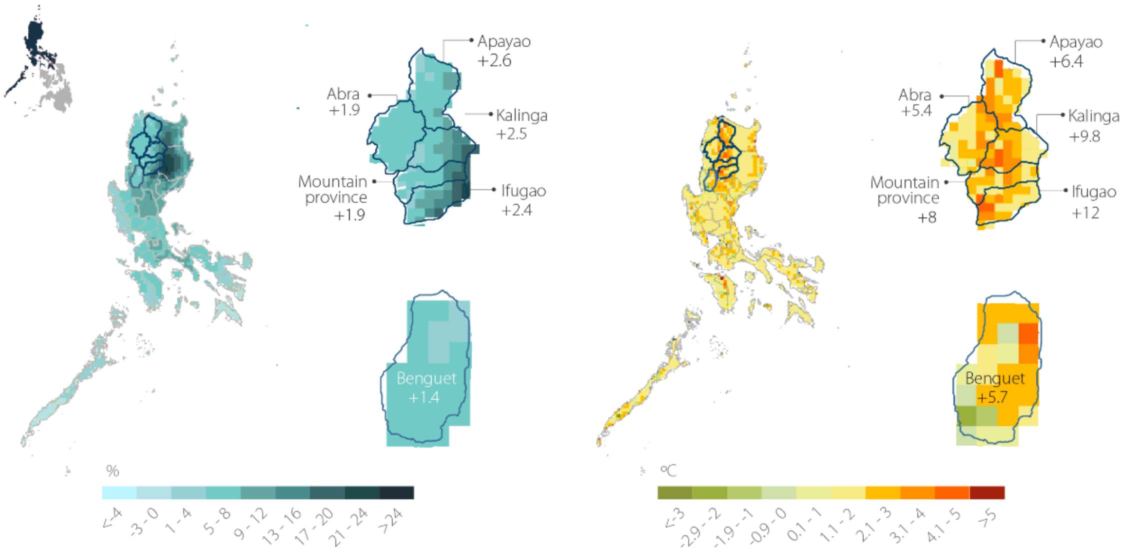

Figure 1: Rainfall and temperature changes by 2050 in Luzon

The climatic projections for Luzon predict higher rainfall variability throughout the year and an increase in extreme rainfall events. The major extreme weather challenges to Luzon's agriculture are typhoons and drought. These disturbances put farmers at risk for crop damage, soil erosion, higher pest incidence, post-harvest losses and ultimately lower incomes. Regional farmers noted during consultations that crops had wilted and required more frequent watering due to increased temperatures and rates of evaporation. Farmers also attributed leaf rusting, clubroot, leaf miner and other diseases to the erratic rainfall patterns.

In lowland areas, rice farmers are most susceptible to flooding caused by the tropical storms whereas upland corn and vegetable farms are more vulnerable to soil erosion, landslides and damaging winds. Droughts on the other hand impact all crops as the majority of farmers in the region use rain-fed production systems. While the severity of drought depends on the El Niño Southern Oscillation (ENSO), during these periods, farmers may strain available water resources and compromise their planting calendar to improve the probability of crop survival. Under these conditions, crops are also more vulnerable to blight, wilting, pests and postharvest losses.

Through interviews, workshops and consultations, farmers identified existing adaptation strategies including the indigenous adaptation practices, as well as further potential technological interventions and management practices to adapt to the changing climate.

Table 1. Description and prioritization of identified climate resilient agriculture practices (KII and FGD, 2018)

CRA Practice	Description	Hazard	Current adoption rate	Score [1]
CABBAGE AND POTATO				
Protected cultivation	Waterlogging and damage on crops during typhoon can be avoided through the use of crop shelter which serves as protective structure against strong winds and helps to control plant pest and diseases.	Typhoon /Drought	0-30%	12
Use of blight resistant variety (only potato)[#]	Planting of potato blight resistant variety (Igorota variety)	Typhoon	30-60%	9
Rain water harvesting[#]	Rain water collected during rainy season for irrigation during dry season.	Drought	0-30%	7
Organic farming	Organic farming can contribute to reducing soil erosion and increasing soil water retention capacity through improved physical, chemical, and biological properties of soil.	Typhoon /Drought	0-30%	6
Reforestation program (planting of trees, bamboo)	Planting of trees may restore the denuded mountains, generate water, and prevent landslides.	Typhoon /Drought	60-100%	3
Wind break	Planting cut flower (e.g.Calalily) as protection to the crops from strong winds.	Typhoon	30-60%	2
RICE				
Integrated Farming System (IFS) (Crop Rotation: Rice onion)[#]	IFS promotes the maximum utilization of land, integrating livestock and several crops to avoid total production loss due to adverse impacts from climate change or other external shocks. (Crop Rotation: Rice onion)	Typhoon /Drought	0-30%	16
Use of Stress-Tolerant Rice Varieties[#]	Use of drought resistant varieties developed and recommended by IRRI.	Typhon /Drought	30-60%	2
Small Water Impounding Practice (SWIP)	Establishment of water harvesting facilities will help farmers overcome the effects of drought. Water impounding facilities will serve as catchment basins during rainy seasons.	Drought	0-30%	11
Climate advisory	Regular awareness on weather updates would allow farmers to harvest crops or produce if possible before the occurrence of extreme weather events.	Typhoon	60-100%	9
Seasonal calendar and programming	Farmers adjust their traditional planting calendar due to changes in rainfall pattern.	Typhoon /Drought	60-100%	8

Integrated pest management (e.g. botanical attractants)	Use of biological control such as papaya plant, sweet potato vine, and banana leaves to attract golden apple snail is practiced by the respondents. The snails are then gathered and crushed. This practiced is considered indigenous, safe to the environment, and low cost.	Typhoon	30-60%	7
Use of water pumps	Lending and provision of water pumps to farmers group to draw out water from ground water	Drought	0-30%	10
CORN				
Seasonal calendar and programming	The proper timing of planting will reduce losses of farmers' yields.	Typhoon /Drought	60-100%	12
Sloping Agricultural Land Technology (SALT) #	A soil conservation technology for the uplands and mountainous areas.	Typhoon	0-30%	9
Integrated Farming System (IFS)	IFS promotes the maximum utilization of land, integrating livestock and several crops to avoid total production loss due to adverse impacts from climate change.	Typhoon /Drought	0-30%	8
Establishment of rain water harvester/water impounding facility	Establishment of water harvester will help farmers overcome the effects of drought.	Drought	60-100%	5

#: CRA practices which were also previously selected based on consultation with DA's regional field offices and local government units (AMIA).

Prioritized CRA practices for potato

The production potential and suitability for potato is expected to decrease in the majority of provinces in Luzon. By 2050, potato suitability is expected to decrease from very high to marginally suitable in Apayao, Abra, Kalinga and Ifugao provinces, but remain highly suitable in Benguet and Mountain Province.

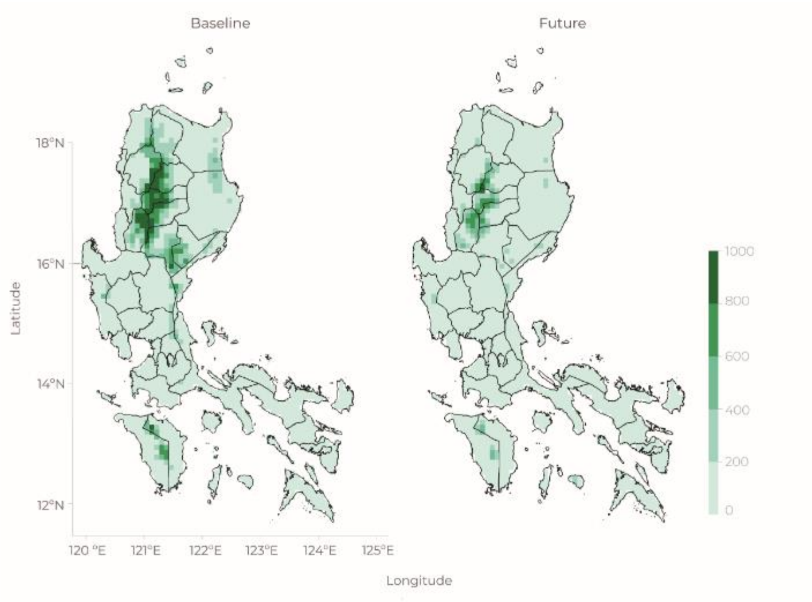

Figure 2: Luzon crop suitability for potato[421]

To mitigate the effects of drought potato farmers identified rain-water harvesting tanks as technique to prolong the available water resources. Due to increased disease rates related to typhoons, farmers also identified adopting blight resistant varieties as a prioritized practice.

Blight Resistant Variety

Igorota is a locally-bred (Philippines) potato variety, which is moderately resistant to late blight and leaf miner. Farmers commonly call this variety LBR which stands for late blight resistant. This variety has a high dry matter content suited for both table use and processing. In addition, igorota matures in 110 days and has a potential yield of 25-35 tons per hectare. However, the variety is only planted in the higher elevation areas of the municipality where high relative humidity promotes the progress of the late blight infection. Farmers also claim the variety is susceptible to rotting due to mechanical injuries incurred during transport, which leads to higher postharvest losses (NPRCRTC-BSU, 2018).

Prioritized CRA practices for cabbage

The production potential and suitability for cabbage is also expected to decrease in the majority of provinces in Luzon. By 2050, cabbage suitability is projected to fall in Apayao, Abra, Kalinga, Mountain Province and Nueva Vizcaya provinces.

[421] *The climate suitability maps represent how well the crop will thrive in an area based on climatic factors such as temperature and rainfall. The suitability ranges from 0–100 percent with an interval of 20: 100 - very high, 80 - high, 60 - moderate, 40 - marginal, and 20 - very marginal.*

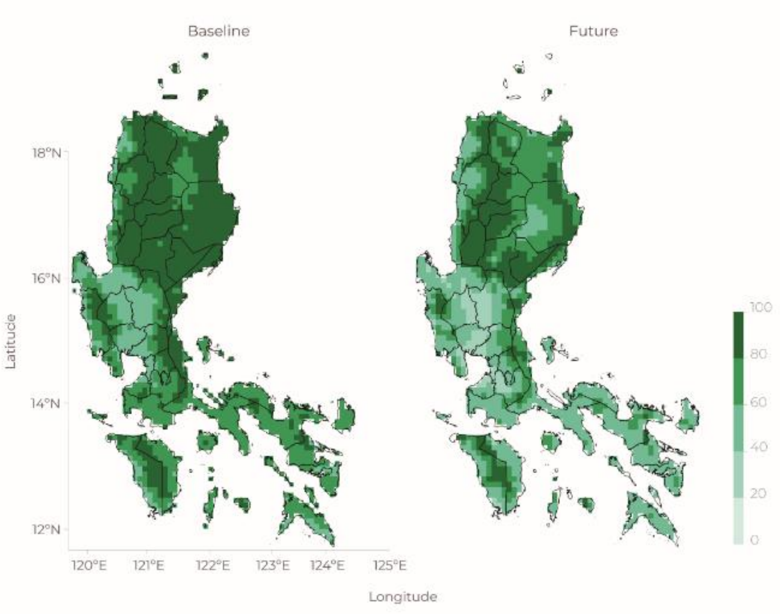

Figure 3: Luzon crop suitability for cabbage

Cabbage farmers identified rain-water harvesting and crop shelters as the prioritized mitigation measure to ensure the availability of water resources and protect crops from typhoons, which are especially vulnerable during seedling stages. Farmers also prioritized the adoption of organic practices to improve soil health and environmental conditions.

Rain Water Harvesting

The establishment of a rain water harvester can be done in different structures. Farmers improvised rainwater harvesters, called “kwelo”, an improvised catchment basin, by digging large pits lined with large plastic sheets or tarpaulins. Concrete water tanks are also built by some farmers who can afford the cost of construction (SUPANGCO-DELA PAZ et al. 2018). The water impounding facility is the top priority for CRA intervention since irrigated water is not only needed during drought but can also be used to protect plants against frost if water is applied through a sprinkler. The availability of such a facility enhances the resilience of vegetable farmers as it was claimed to be an effective strategy to cope with climate change in vegetable-producing areas. This practice would enable farmers to have continued cropping and may partially solve water shortages during longer drought periods and irregular rainfall, thus, helping to increase production and farm income.

Protected Cultivation

Protected cultivation using either a microtunnel, macrotunnel or plastic house to protect crops from heavy rains and strong winds. The microtunnel is a crop shelter design that utilizes simple low tunnels made with bamboo frames and covered with clear plastic films, while the macrotunnels have metal frames and are covered with polyethylene clear plastics. The most common designs utilized by farmers are the low-cost microtunnels and plastic houses or rain shelters that utilize a single layer of clear plastic placed on top of bamboo, wooden, or sometimes metal frames (Malamug et al., 2017; ALAMUG NPRCRTC-BSU, 2018). [5].

The College of Engineering and Agriculture at Benguet State University developed an alternative crop shelter design that can be adapted and replicated by farmers. The design considers criteria such as simplicity so that farmers can fabricate and install their own shelters using basic shop tools and equipment; functionality to offer protection not only against torrential rains but also provide some degree of climate regulation; frame sturdiness to minimize/eliminate damage due to strong winds and typhoons; cost-effectiveness to maximize benefits from the investment and; a "Modern look" to provide the necessary aesthetics. The cost of one module was estimated to be about Php1,200.00/m2 for the materials and labor (Malamug et al. 2017).

Organic Farming

Another prioritized CRA practice is organic farming. Basic practices include crop rotation, mixed cropping, intercropping, strip cropping, mulching, tillage operations, use of natural predators and biocontrol agents to help manage the problem of pests and diseases and lower input costs for vermicompost, bio-fertilizers, botanicals or bio-pesticides. Organic farming aims to achieve environmentally sustainable practices; improve soil fertility and animal welfare; and increase biodiversity (Kudan, S. 2016). Thus, farmers recognized organic farming as matured technology and CRA practice in mitigating climate change. Most farmers practicing conventional farming who shifted to organic farming systems also attested to the continuous and additional income source due to the high demand of organically-produced vegetables. More importantly, they recognized the value of human food safety and the value of a healthy environment (Kudan, S. 2016).

Prioritized CRA practices for corn and rice

The suitability for corn is expected to decrease nearly 60% by 2050 in northern Luzon from very high to marginally suitable. As a result of heavy rainfall, corn farmers experience soil erosion, nutrient leaching, and even landslides. In order to maintain the topsoil nutrients, corn farmers identified the utilization of intercropping with rice through IFS, as well as contour farming.

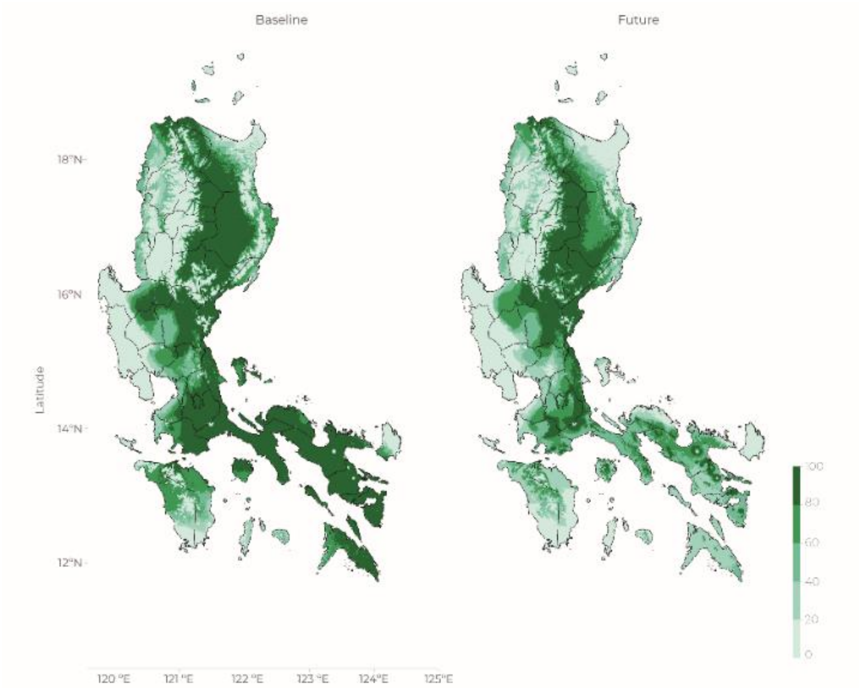

Figure 4: Luzon crop suitability for corn

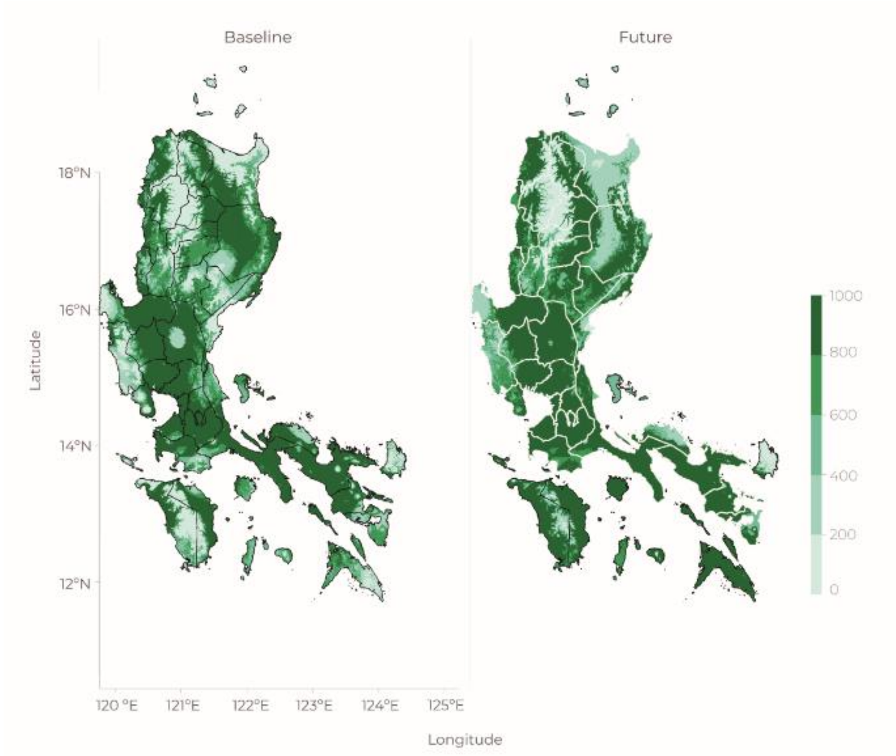

Figure 5: Luzon crop suitability for Rice

Integrated Farming System (IFS) (Rice-onion crop rotation)

For centuries, farming communities have developed resilient and bountiful agricultural systems based on biodiversity, and expanded their knowledge of how to utilize them in equally complex biophysical and socio-cultural settings. Farmers have used diversity for food and economic security through a complex array of home garden designs, agroforestry systems and diversified and integrated lowland farming systems. IFS differs substantially from conventional modern agriculture in that its focus is the establishment of functional diversity in the farm rather than monoculture farming systems (Zamora et. al, 2015[7]). Principles to be considered in the practice of IFS are nutrient cycling and management, appropriate pest management, adapted animal breeds or crop varieties, and soil and water management (Zamora et. al, 2015).

The practice of rice-onion crop rotation has been prioritized because it is a cropping scheme that aims to utilize remaining nutrients from the rice field for onion production while disrupting the cycle of pests and diseases. Onion grows in friable and well-drained soil, which is similar to the type of soil in Bulalacao. The dry climate and moderately high temperature are also suitable for growing onion since the crop's water requirement is low. Moreover, rice and onion have the same periods of maturity, which adheres to the cropping seasons. The traditional users plant rice for only one season and leave their rice fields unplanted for the next season, while the CRA users plant rice during the first season and onion in the next cropping season. Seasonal rotation of onion in rice fields can significantly intensify land use during prolonged dry seasons. It can optimize production by enhancing soil fertility and preserving the productive integrity of the soil. This practice can deliver higher income to farmers annually as it is proven to be cost-efficient through reduced input cost from irrigation, chemical fertilizers and pesticides.

Use of Stress-Tolerant Rice Varieties

The Philippines has a wide range of rice varieties developed to address the impacts of climate change. These include submergence-tolerant, drought-tolerant and early-maturing varieties. One of the early-maturing rice varieties is PSB Rc10 (Pagsanjan), which yields an average of 4.8MT per hectare. Farmers prefer to use this variety to shorten the planting season in periods of high flood risk. PSB Rc10 can be harvested as early as 106 days after seeding. It also has a good milling recovery of 66.62%. The other variety that can withstand flooding is PSB Rc18 (Ala). It can survive in complete submergence for 5-7 days and can be harvested 123 days after seeding. This long grain variety produces an average yield of 5.1MT per hectare. Both rice varieties reduce the risk of production losses during flooding (CRA Technical Brief, 2018) increasing the resilience of the farmer to the adverse effects of climate change.

Sustainable Corn Production in Sloping Areas (SCoPSA)

The practice of Sustainable Corn Production in Sloping Areas (SCoPSA) was crafted and developed by the Department of Agriculture to help farmers understand the importance of top soil for corn production. This governmental effort also included educating farmers on sustainable land use management. SCoPSA features easily adaptable soil and water conservation technologies focused on soil erosion control and gully stabilization in combination with soil fertilization. Established in Davao region in 2013, SCoPSA is anchored on restoring ecological balance in sloping areas by adapting different planting strategies, crop rotation, and contouring practices in the sloping areas. SCoPSA mainly targets corn mono-cropping and the use of contouring in sloping areas (Canedo, 2016). The technology is being piloted in similar mountainous and sloping areas growing corn.

Climate change and adaptation practices in Central and Eastern Visayas (Visayas)

The projections for Visayas illustrate a startling climatic trend and pessimistic outlook for regional farmers. In Bohol, Cebu and Leyte, the total number of hot days (days over 35 °C) are expected to increase 15-,100-, and 50-fold respectively, while the total number of dry days is expected to uniformly decrease 20% by 2050 from the 30-year baseline. In addition, the number of days with excessive rainfall (over 100mm) is also expected to increase in both Bohol and Cebu. These conditions have created serious hazards for regional farmers growing rice, maize and coconut, as the rising mean temperatures and hot days have increased the frequency and intensity of droughts (Cruz et al. 2017). Moreover, Visayas is the only region of the three island groups that has also experienced higher frequency and intensity of tropical cyclones (PAGASA, 2011).

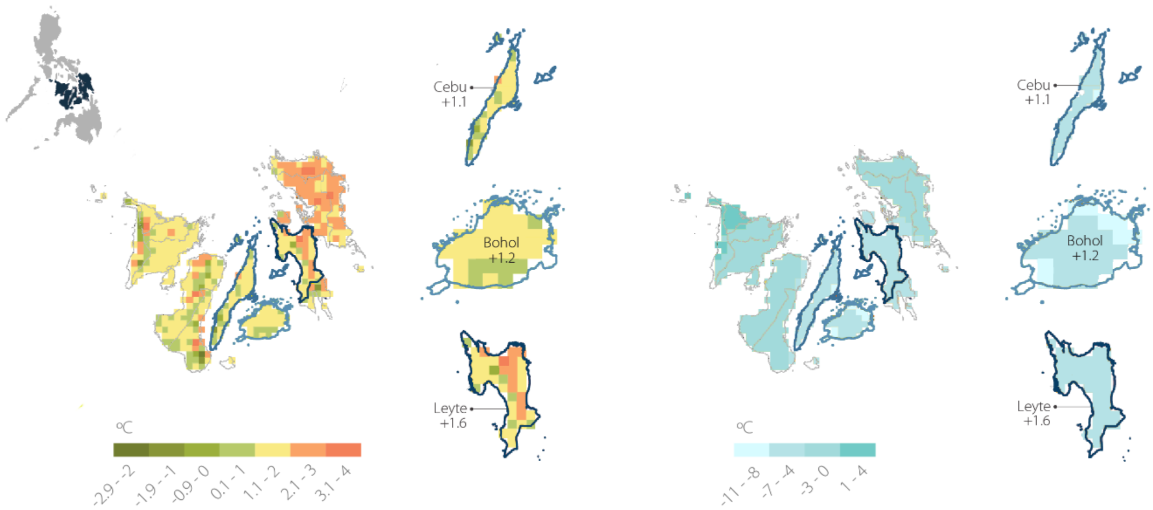

Figure 6: Rainfall and temperature changes by 2050 in Visayas

Due to its geographical location, the island is especially vulnerable to natural disasters, putting the region's agricultural sector particularly at risk. According to Yusuf and Francisco (2009) the most vulnerable regions identified in the Visayas area include Central Visayas, where Cebu and Bohol are located, and Eastern Visayas in which Leyte is situated. Based on the risk matrix from DA-RFO consultation in Central Visayas, corn and rice are the main commodities affected by drought. In Eastern Visayas, coconut is one of the major crops severely damaged by typhoons, such as the 2013 super typhoon, Haiyan. Considering this, adoption of climate resilient agriculture (CRA) practices is crucial in this region.

As weather conditions become more extreme and forecasts less reliable or available, planning on-farm activities, like fertilizer application, has become more challenging. The overall effects of climate change in Visayas has resulted in failed harvests, damaged plants, reduced yields and livestock reproduction rates, fertilizer waste from runoff and flooding, and ultimately lower household income (Focus Group Discussion, 2018).

Table 2. Description and prioritization of identified climate resilient agriculture practices

CRA Practice	Description	Hazard	Current adoption rate %	Score
Corn				
Use of organic fertilizer	Use of chicken manure for basal application to increase organic matter content in soil and therefore water-holding capacity.	Drought	60-100	7
SMS-generated early warning system/advisory	Agromet/stations send data to LGU and LGU's will provide early warnings/ advisory to farmers through text.	Drought & Typhoon	0-30	5
Crop-livestock integration and crop diversification (Corn-peanut rotation [#])	Integration of crop and livestock/ practice of crop rotation or diversification to have alternative livelihood or increase income. Corn is replaced by peanut in the second cropping season, allowing the soil to recover the depleted nutrients and reduces incidence of pests and diseases.	Drought & Typhoon	60-100 (10% Corn-peanut rotation)	3
Insurance system	Avail of crop insurance (e.g. PCIC) and farmers insurance	Typhoon	60-100	4
Use of improved varieties of corn	Use of improved varieties that can tolerate heat better than other varieties	Drought	0-30	0
No weeding	No weeding to retain soil moisture	Drought	0-30	0
Rice				
Integrated farming system	Raising different crops and animals. Utilization of farm waste and recycling.	Drought & Typhoon	30-60	4

Organic farming #	Utilization of locally available inputs or use of organic inputs	Drought & Typhoon	0-30	0
Water harvesting	Constructions of impounding (SWIP), dam, rain water collector.	Drought	0-30	4
Insurance system	Farmers provision of insurance system support	Drought & Typhoon	0-30	3
Used of improved variety of rice	Use of developed rice varieties such as flood or submergence, drought and saline tolerant rice varieties.	Drought & Typhoon	0-30	0
Alley cropping	Planting of leguminous, trap crops along the boundary / paddy	Drought &Typhoon	0-30	0
Coconut				
Use dwarf variety of coconut	Dwarf coconut varieties have a thick stem, robust palm and well-anchored root system that can withstand typhoon.	Typhoon	0-30	4
Bio-control	Use of bio-control parasitoid/ mitarissium.	Drought	0-30	4
Crop diversification (Coconut-Banana intercropping)	Banana is planted alongside or between the coconut trees.	Drought	60-100	1
Sanitation	Cutting of the affected parts due to pest infestation and burning it to avoid spread of pest.	Drought	0-30	0

#: CRA practices selected based on consultation with DA's regional field offices and local government units (AMIA).

Prioritized CRA practices for corn

Corn production is highly vulnerable to the impacts of typhoons as seeds are washed away and mature plants face rot. Typhoon Haiyan alone damaged USD$ 5 million worth of maize and 21,699 ha (Verzani. W, 2013). During periods of drought, corn develops shorter ears and smaller kernels and plants are more susceptible to pests like army worm. Stress from drought and typhoon both impair the overall quality of grain.

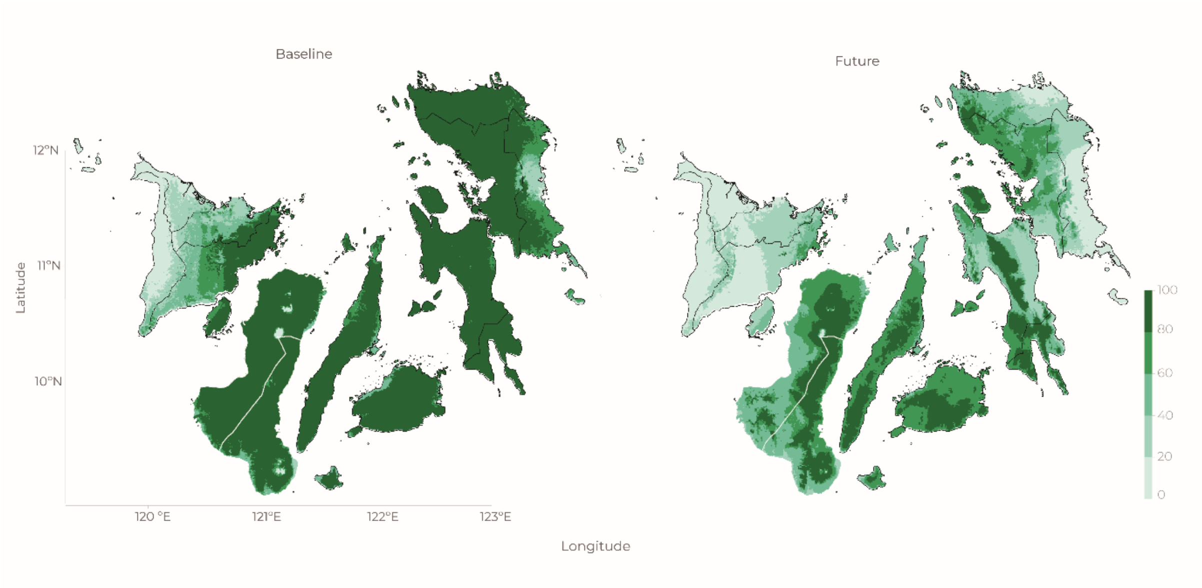

Figure 7: Visayas crop suitability for corn

To alleviate damages caused by typhoon and drought, farmers may opt to buy crop insurance provided by the Philippines Crop Insurance Corporation (PCIC). For drought, maize farmers have several additional options. While groundwater pumps may be used by larger operations, heat tolerant varieties or corn-peanut rotation are more viable measures for smaller farms and were selected as the prioritized practices. Crop diversification, like corn-peanut rotation, is a recommended adaptation practice by the Department of Agriculture for Region 7, which has shown higher yields than conventional practices as peanut is more suitable for higher temperatures and has natural nitrogen-fixing properties that increase soil fertility while reducing input costs for fertilizer application. Farmers determined organic fertilizer be prioritized as an additional measure to preserve soil fertility and moisture content.

Use of Organic Fertilizer

The use of organic fertilizer is the top CRA practice prioritized by the farm across the chain during the CRP workshop. Application of organic fertilizer significantly increases organic matter in soil, soil pH and total nitrogen (Lina et al., 2014). Chicken dung and vermicast are the most common organic fertilizers used by corn farmers. Organic fertilizers are also used for basal application.

Corn farmers in Cebu use a combined application of organic and inorganic fertilizer in their production. Lina et al (2014) conducted experiments using combined inorganic and organic fertilizer application and found there was significant increase in plant height, ear length, number of grains per ear, weight of 1000 seeds, fresh stover yield, and grain yield of corn grown. However, supply of organic fertilizers, especially chicken dung which is commonly used by corn farmers in Cebu are scarce (Key Informant Interview, 2018). The current adoption rate of mixed inorganic and organic fertilizer for corn production in Cebu is 20%, with a projected adoption rate of 30% in 10 years. Total land area for corn production in Cebu is around 85,613 hectares (Philippine Statistics Authority, 2017).

Corn-Peanut Rotation

Another prioritized CRA practice for corn production is corn-peanut rotation. Corn-peanut rotation is a cropping process where corn is replaced by peanut in the following cropping season. This practice allows the soil to recover the depleted nutrients and also reduces incidence of pests and diseases. This in effect reduces fertilizer input requirements, cutting production costs and resulting in higher profitability for farmers. Moreover, corn-peanut rotation reduces carbon emission by decreasing the use of synthetic chemicals. The main purpose of planting peanut after corn is to utilize the organic matter of peanut which contains nitrogen fixing properties as natural fertilizer.

Prioritized CRA practices for rice

The climate suitability of rice is expected to decrease throughout Visayas through 2050. The two major challenges are drought and typhoons. The unsustainably high temperatures and prolonged dry spells have lowered rice yields in the region, even for irrigated rice, and increased vulnerability to armyworm and brownspot. Studies have found that a 1°C increase during the growing season can reduce rice yields by as much as 10% (Peng et al., 2004). Agricultural labor and man-hours are also reduced as a result of the heat. The impacts of tropical storms and intense rainfall on rice production affect multiple stages including harvesting, storage and processing. In 2013, the damage caused by typhoon Haiyan (Yolanda) amounted to USD $44 million and impacted 77,719 ha of rice (Verzani. W, 2013).

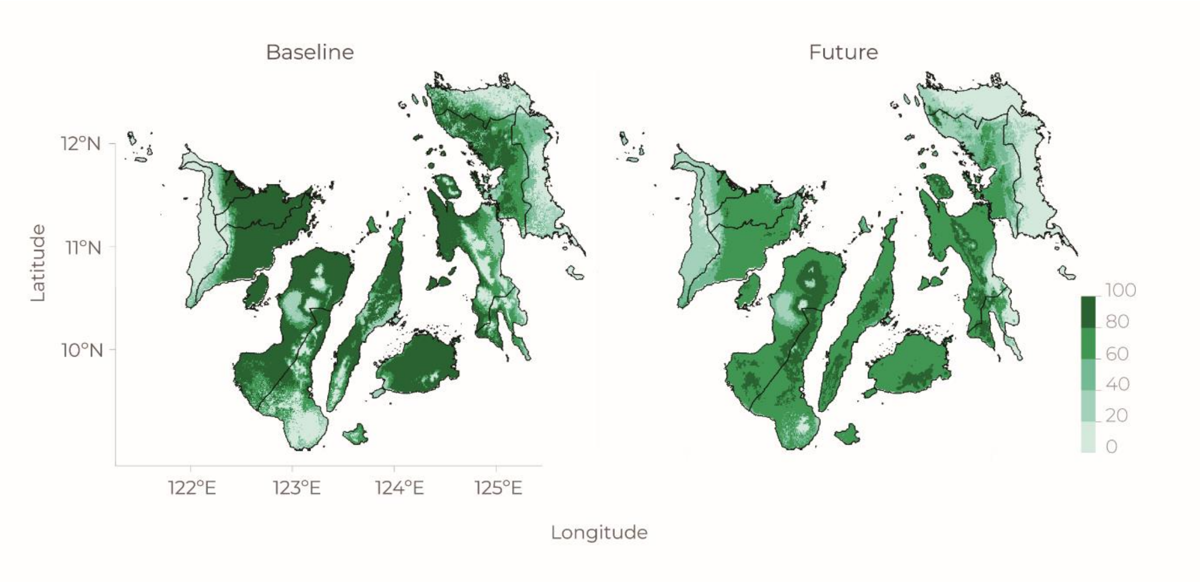

Figure 8: Visayas crop suitability for rice

To counter these threats, Visayas farmers have prioritized the expansion of water harvesting techniques and impoundment facilities and alley cropping using nitrogen-fixing leguminous or organic crops along the paddy boundaries. Farmers also selected integrated farm systems as a prioritized measure and identified the adoption of drought-tolerant varieties, agroforestry techniques and crop insurance as promising practices.

Water Harvesting

For rice production, among the identified practices, establishment of water saving technology is the top prioritized CRA practice. Rice production requires substantial amounts of water. However, in Bohol, rice areas equipped with irrigation systems are scarce. The majority of farm areas in the province rely on rain water for irrigation (Key Informant Interview, 2018). Another factor that adds to the difficulty of rice farming is that drought is prevalent in the area.

Different water saving technologies are established in the province. One of which is the small water impounding project (SWIP). SWIP is a water harvesting and storage structure designed for soil and water conservation and flood control consisting of an earth embankment spillway, outlet works and canal facilities (Bureau of Soil and Water Management, n.d.). The storage structures are typically concrete water canals constructed in the middle of the rice fields that distribute water to surrounding farms (Department of Agriculture Regional Field Office No. 7, 2014). In the province, SWIPs are managed by farmers' associations. In order to have access to the water saving technology, farmers have to register as a member of the farmers' association responsible for the management of the technology. For the maintenance of the dam and other expenses, farmers pay kilos of grains (depending on the size of farm) directly to the association.

Organic Red Rice Production

Another prioritized CRA practice for rice production is organic red rice production. Organic red rice production advocates the production of transplanted red rice using organic inputs (Loreto et al.,2018). Organic agriculture is identified as one of the strategies for climate change mitigation and adaptation. Using organic inputs such as fertilizer contributes to the improvement of air quality by reducing carbon dioxide emission and providing soil carbon sequestration. Organic red rice production is part of DA-NIR's Promotion and Development of Organic Agriculture Program. This practice also has strong support from the Negros Island Organic Producers' Association (NIOPA) and is recommended by the Municipal and City Agriculture Office and validated by the Regional Director of Department of Agriculture.

Prioritized CRA practices for coconut

The largest threat to Visayas' coconut farmers is from tropical storms, whose heavy winds can uproot or truncate trees causing long-lasting effects on farmers' livelihoods as coconut trees require nearly a decade to grow to full maturity. Drought also has adverse effects on coconut trees and puts them at higher risk of pests and disease, as well as wilting and button shedding. During longer periods of drought, trees produce fewer nuts or bare smaller fruits.

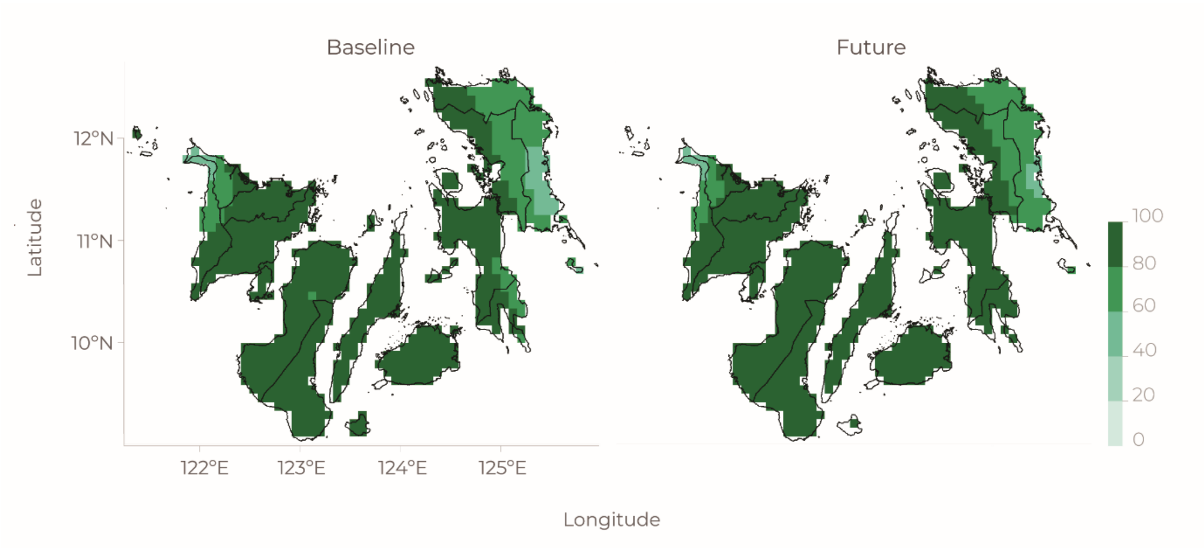

Figure 9: Visayas crop suitability for coconut

To prevent infestations and outbreaks, farmers may adopt integrated management practices using bio-controls to deter or alleviate pest pressure. For drought, diversified farming systems, such as coconut-banana alley cropping, were identified as a prioritized practice to increase farm productivity while minimizing fertilizer and pesticide use (Serino et al, 2018). In the event of typhoons, improved varieties were prioritized. Dwarf varieties which are available in the region are less prone to damages caused by high winds given their shorter features.

Use Dwarf Variety of Coconut

One of the top prioritized practices for coconut production by stakeholders is the use of improved varieties. Due to their vulnerability to typhoon, coconut farmers seek to gain knowledge on what variety of coconut can withstand typhoons (KII, 2018). Tacunan green dwarf (TACD) is a variety of coconut that is early bearing with the first bunches, often seen with nuts touching the ground. The average number of nuts harvested per tree per year is between 48 and 84 (National Coconut Research Center, 2018). From 1985 to 1993, the average weight of copra per nut was around 226 grams. This variety was among the identified two outstanding coconut dwarf varieties that passed the international standard for young tender coconut. The dwarf coconut variety has a thick stem, robust palm and well-anchored root system. Tacunan palm established in typhoon or cyclone prone areas were observed to endure strong winds (Philippine Coconut Authority, n.d.).

Coconut-Banana Intercropping

Coconut-Banana intercropping is a CRA practice where banana is planted alongside or between coconut trees. This practice maximizes the unproductive spaces between the coconuts that is left unplanted. Since banana and coconut have similar nutrient and climate requirements, they make a perfect crop for intercropping. Another factor considered in the prioritization of this CRA is the agricultural profile of Eastern Visayas. The majority of farmers in the region are engaged into coconut farming, any intervention through knowledge transfer by the government would therefore have greater impacts. In addition, due to the resiliency of coconut to weak and moderate typhoons and the practical use of banana as food substitute both crops are perfectly suited for the region.

Climate change and adaptation practices in Davao and Northern Mindanao (Mindanao)

Compared to the other island groups, Mindanao has the lowest level of development in terms of water infrastructure. Only 43% of its irrigable land is actually irrigated, putting the rain-dependent region at significant risk of extreme weather phenomena. Similar to Visayas, the regional climate in Mindanao is projected to undergo a drastic transformation. For example, by 2050, the number of hot days in Bukidnon and Davao del Norte are expected to increase 55-fold. Within the same time period the number of dry days will fall by nearly a third while the days with rain in excess of 150mm will double. Under these climatic conditions, crop yields are expected to show downward trends and experience increased incidence rates of disease and pest (Cruz, R. V. O et al. 2017). Drought has also been identified as a serious problem, but more pronounced in the Mindanao and Bukidnon provinces, where the quality and quantity of farmers' yields have been devastated in recent years as a result of El Niño droughts (Oxfam, 2016).

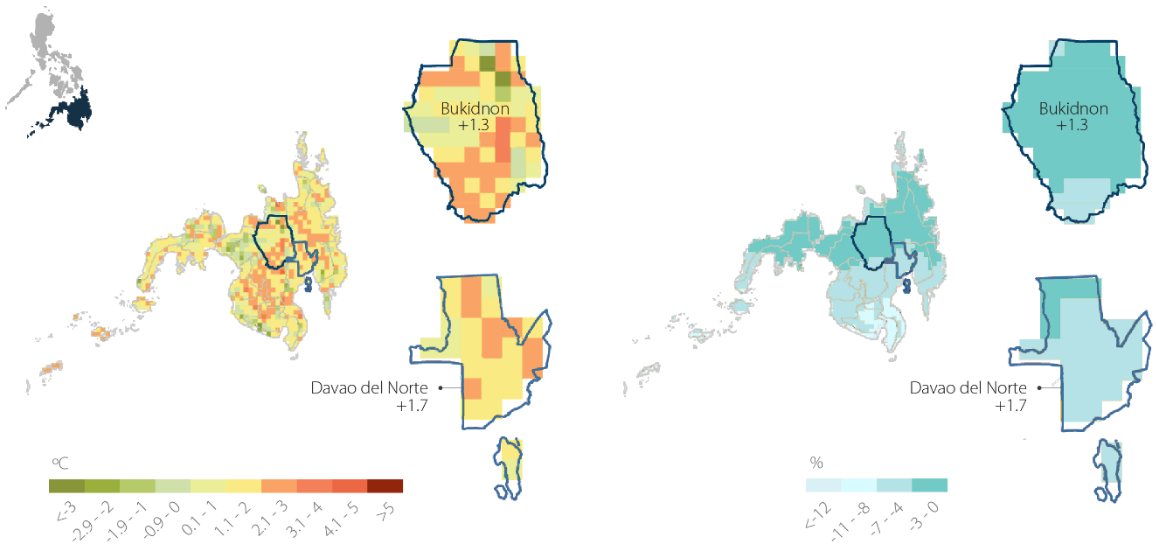

Figure 10: Rainfall and temperature changes by 2050 in Mindanao

While typhoons and storm surges are less frequent in Mindanao, mining and deforestation activities within the region are exacerbating the effects of climate change and heightening the risk of flash floods. Studies have also demonstrated these effects have on drought. In Caraga in North Mindanao, drought conditions worsened as a result of the soil's decreased water holding capacity which had been significantly reduced by surface runoff and flash floods following heavy rainfall in deforested areas.

Since these impacts are experienced by all actors across the value chains of key commodities, adopting Climate-Resilient Agricultural practices will help farmers and stakeholders ensure productivity and reduce the severity of impacts caused by climate change and extreme weather events. Therefore, adaptation to these changes has become essential in the region. The practices identified by corn, coffee and cacao farmers include diversified farming, intercropping, crop rotation, deep hole planting, contour farming and terracing, water impounding, reforestation and watershed management.

Table 3. Description and prioritization of identified climate resilient agriculture practices

CRA Practice	Description	Hazard	Current adoption rate	Score
Yellow Corn				
Diversified farming	A farming practice that produces various crops or animals in a single farm to improve soil fertility, reduce pest and disease, and increase water use efficiency [422].	Drought	30-60	8
Crop rotation	The production of different crops in succession within the same area to preserve soil[423] fertility.	Drought	30-60	5
Water harvesting	Reservoir to store rainfall and run-off water during heavy rains as a source of water. The structure can store up to 50 million	Drought	60-100	3

[422] Kremen, C., Iles, A., & Bacon, C. (2012). Diversified Farming Systems: An Agroecological, Systems-based Alternative to Modern Industrial Agriculture. doi:https://www.ecologyandsociety.org/vol17/iss4/art44/
[423] Francis, C. (2005). Crop Rotations.

	cubic meters capacity, which can irrigate approximately 25 to 250 hectares of land[424].			
Contour Farming	Planting across the slope by following the contour of land to delay and redirect water runoff, improves water infiltration, and reduce oil erosion.	Heavy Rains	60-100	3
Coffee				
Contour Farming	Planting across the slope by following the contour of land to delay and redirect water runoff, improves water infiltration, and reduce oil erosion.	Heavy Rains	0-30	8
Diversified farming	A farming practice that produces various crops or animals in a single farm in order to maintains soil fertility, control pest and disease and improve water use efficiency.[425]. Coffee farmers define diversified farming as planting assorted vegetables, root crops, and/or other tree crops together with coffee particularly banana, abaca, and falcata[9]. Most of the farmers in Bukidnon plant banana in between rows of coffee.	Drought	30-60	2
Rainforestation model	Planting native tree species in rehabilitation denuded forests and restore biodiversity (Rain Forest Restoration Initiative, 2010) (Rain Forest Restoration Initiative, 2010). Coffee farmers may plant coffee trees alternately with endemic tree species[9]	Drought and Heavy Rains	0-30	1
Deep Hole Planting	Deep-hole planting, allows to catch more water that could allow the coffee plants to sustain a prolonged drought period. The prescribed dimension of the hole is 50 cm long, 50 cm wide, and 50 cm deep (Food and Agriculture Organization, 1977).	Drought	0-30	0
Information Dissemination/Training	Sharing forecasted climatic variations such as drought to help in farmers' decision making	Drought	30-60	0
Mini-forest/ Watershed	Planting mini-forests preserve water sources and improve water holding capacity (Food and Agriculture Organization, 2003).. Farmers explicitly identified planting Balete trees in buffer zones and bamboo beside creeks[9].	Drought and Heavy Rains	0-30	0
Cacao				
Establish irrigation system	Irrigation systems are categorized into surface, sprinkle, and micro irrigation to reduce the effects of drought through sufficient water supply.	Drought		7

[424] PSA. (n.d.). D1_Irrigation Facility Code2. Retrieved from http://psa.gov.ph/psada/index.php/catalog/81/variable/V332?pdf=1

[425] Kremen, C., Iles, A., & Bacon, C. (2012). Diversified Farming Systems: An Agroecological, Systems-based Alternative to Modern Industrial Agriculture. doi:https://www.ecologyandsociety.org/vol17/iss4/art44/

Intercropping Cacao-Coconut #	Intercropping reduce soil erosion and surface run-off hence protecting the topsoil. It also utilizes the farm area efficiently resulting to potential increase in total production and farm profitability. It reduces plant diseases and attracts more beneficial insects resulting to reduced insect pest population.	Drought	0-30	Na
Water harvesting	Reservoir to store rainfall and run-off water during heavy rains as a source of agricultural water	Drought		1
Organic Fertilizer #	The use of fertilizer made from decomposed products originated from plants or animals that can supply nitrogen, phosphorus, and/or potassium	Drought		0
Mulching	The application of thin organic material on the soil surface to conserve soil moisture, reduce soil erosion, improve soil fertility, and reduce weed growth	Drought		0
Reforestation/ Watershed Development	Reforestation plays an important role in the hydrologic behavior of watersheds (FAO, 2003). Farmers consider planting high-valued crops as reforestation[13]. An example is intercropping fruit trees and/or wood trees together with cacao.	Drought		0
Use of disease resistant variety	The utilization of variety of cacao with a better resistance to heavy rain induced diseases.	Heavy Rains		0
Increase capacity to manage diseases brought by heavy rains	Trainings that enable farmers to manage diseases and properly implement farm sanitation. These include early removal of rotten pods caused by the black pod rot of cacao. The incidence and severity of the disease increases during rainy seasons (Vanegtern, Rogers, & Nelson, 2015).	Heavy Rains		0

#: CRA practices selected based on consultation with DA's regional field offices and local government units (AMIA).

Prioritized CRA practices for yellow corn

The Provincial Agriculture Office in Mindanao reported that over 52,000 ha and 53,000 corn farmers in Bukidnon alone have been affected by the extreme phenomena of heavy rains, deforestation and drought. The majority of corn producers in the region are vulnerable to these hazards as rainfed systems are predominantly used. During heavy rain and strong winds, mature crops can be knocked down while kernels and seedlings are more susceptible to rot and pests, requiring additional inputs from farmers. Whereas drought poses the risk of wiping out entire harvests if they occur during the planting stages. Both weather events are capable of altering cropping seasons and reducing overall production volume.

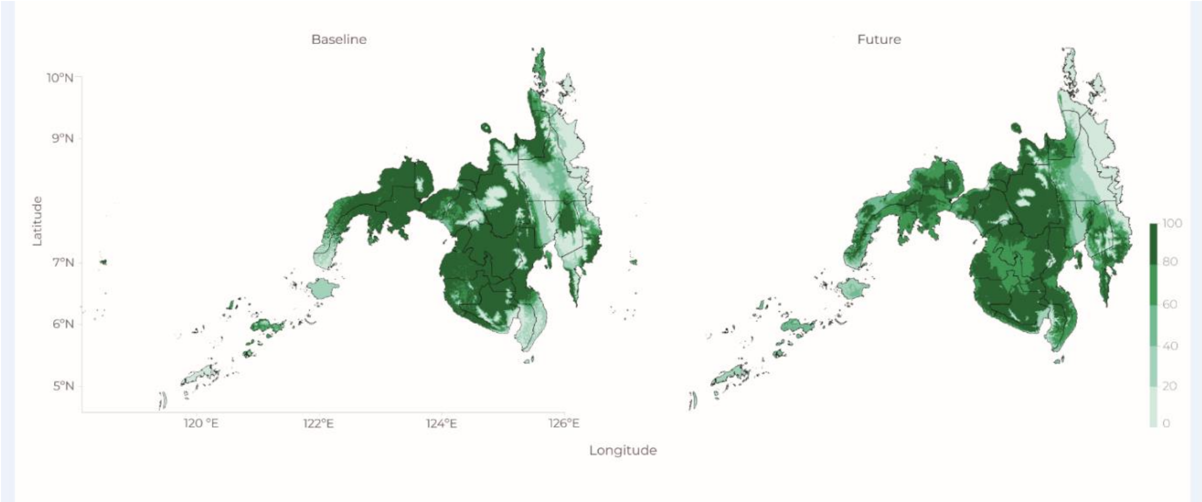

Figure 11: Mindanao crop suitability for corn

Diversified farming systems were identified as a prioritized adaptation strategy for yellow corn farmers. By intercropping or rotating with drought-tolerant crops such as cassava, taro and banana, farmers in Bukidnon have been able to reduce the risks of drought by diversifying their incomes while simultaneously growing less vulnerable crops. A study on diversified cropping has also shown the practice produces identical yields, weed suppression abilities, and economic performance as less diverse systems while requiring fewer synthetic inputs (Davis, Hill, Chase, Johanns, & Liebman, 2012). SALT was also identified as a prioritized contour farming technique to reduce water runoff and improve infiltration. SALT can also reduce soil erosion by as much 50% (Natural Resources Conservation Practices, 2013).

Diversified Farming System

Yellow corn stakeholders identified four CRA practices which are mainly relevant to soil and water management, and minimize possible effects of drought. All of these objectives could be addressed by diversified farming system, thus the practice was prioritized by farmers above other CRA practices.

For yellow corn farmers in Bukidnon, diversified farming is a system that includes raising poultry and livestock; cultivation of drought-resistant crops; growing of perennial crops that have the ability to survive heavy rains; cultivation of cash crops and vegetables; inclusion of agroforestry; and value adding of products. Specifically, stakeholders mentioned intercropping of yellow corn, which is highly vulnerable to drought during planting and vegetative stages, with relatively more drought-resistant cassava[426].

Numerous farm practices fall under the definition of diversified farming including intercropping and rotational cropping. Mono-cropping is considered as the conventional farming system in which corn is cultivated in the same area year round. Meanwhile, the remaining corn farmers adopt intercropping

[426] Workshop. (2018). Stakeholder's Workshop 2018. Davao City.

and rotational cropping. The former consists of planting more than one crop systematically arranged in the same area, while rotational cropping is planting a different crop after harvesting the previous crop (Food and Agriculture Organization, 1995).

Farmers commonly intercrop yellow corn with coconut, legumes, and cassava. Some of them are farmers from Manolo Fortich, one of the province's municipalities, who currently intercrop yellow corn with cassava, especially during dry seasons. According to key informant interviews, cassava, unlike corn, can endure three to four months of drought, therefore it is intercropped with yellow corn. Despite lower income than corn monoculture, farmers opt to diversify production on the second cropping season, which falls during dry season, rather than risk the investment in mono-cropping yellow corn. In addition to preventing losses, farmers believed that this production system improves soil quality increasing soil porousness after cassava cropping, which is advantageous to corn roots as they penetrate deeper and absorb more nutrients.

A number of cost and benefit analyses have proven that intercropping or diverse cropping systems offer provide higher profitability than mono-cropping, some have even extended to attribute ecological benefits. Other benefits that intercropping offers are improved productivity and economic returns, pest and disease management, and efficient utilization of nutrients (Akello, 2012) (Gebru, 2015), social benefits, and stability in yields (Gebru, 2015). However, intercropping corn with other crops received an adoption rate of only 20%, the lowest rate compared to the other cropping systems which both received 40% (Workshop). This conveys a challenge to give attention to intercropping specifically on yellow corn-cassava.

Crop Rotation

Crop rotation can be considered as a diverse cropping system. It is defined as the production of different crops in succession within the same area to preserve the productive capacity of the soil[427]. Stakeholders suggested cassava, vegetables, legumes, and cash crops be rotationally cropped with yellow corn.

Contour Farming

There are various contour farming options such as the establishment of contour lines, Sloping Agricultural Land Technologies (SALT), rockwalls, simple/double selection of hedgerow species, contour canals, and bench terraces[428]. Contouring delays and redirects water runoff, improves water infiltration, and reduces oil erosion by as much as 50% compared to upland and down hill farming[429]. Yellow corn farmers specifically mentioned SALT and Natural Vegetative Strips (NVS). NVS are naturally occurring grasses and herbs that slows and infiltrates run-off water (World Overview of Conservation Approaches and Technologies, 2015).

[427] Francis, C. (2005). Crop Rotations.

[428] DENR and IIRR. (1992). Soil and Water Conservation (SWC) Technologies and Agroforestry Systems.

[429] Natural Resources Conservation Practices. (2013)

Prioritized CRA practices for coffee

Based on suitability models, the gross portion of coffee grown in low lying areas of Mindanao are currently at risk, specifically in SOCCSKSARGEN, Caraga, Davao and Zamboanga. The mortality rates for both coffee and cacao seedlings have increased as a result of frequent droughts and heavy rains, requiring more spending for replanting. Farmers in Bukidnon observed that coffee produced lower yields following periods of drought or heavy rain and was also subject to higher incidence of pest and disease. However, some coffee producers in the region have allocated increased bean size and faster drying to the warmer temperatures.

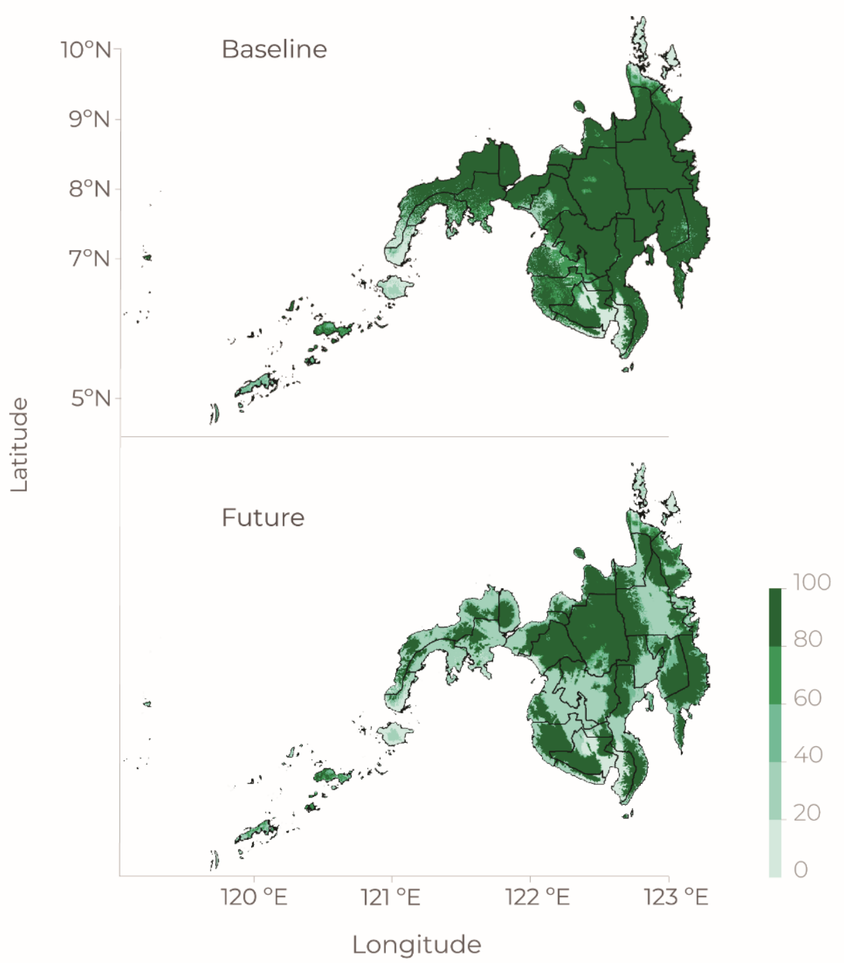

Figure 12: Mindanao crop suitability for coffee

As a strategy for drought and heavy rains, farmers in the mountainous parts of Mindanao use contour farming as an adaptive measure to improve soil stability, reduce surface runoff and increase nutrient capture (Garrity, 1999). By growing crops in horizontal strips along the natural contours of their land, farmers create natural buffers that conserve soil and improve water retention on sloped areas. One such system used in Bukidnon, Arachis, Pintoi, Flemingia and Ipil-Ipil is Sloping Agricultural Land Technology (SALT) which includes intercropping nitrogen-fixing trees and plants between rows to enhance soil fertility.

Contour farming

Contour farming is the prioritized on-farm CRA practice identified by the stakeholders during the workshop for coffee. It received the highest points after the smart assessment test. This practice was also identified during key informant interviews as a practice already used by farmers. Contour farming is technically defined as tilling the soil and planting crops in accordance to the natural contour of land (Pennsylvania Envirothon Inc., 2013). This is one of the recommended erosion control measure under the Code of Good Agricultural Practices for coffee (DA-BAFS, 2015).

Numerous studies have ascertained the benefits of contour farming, although not specific to coffee farming. Research on sloping areas in Claveria, Bukidnon revealed that contour farming using vegetative buffer strips conserves and sustains soils without intensive labor requirement (Garrity, 1999). In La Libertad, Negros Oriental in Philippines, contouring using napier grass, banana, and coconut had the following results: an increased crop yield, fodder production and quality, farm income, and product diversification; and improved the ecological aspects such as soil cover, biomass above ground, nutrient cycling, soil organic matter, plant diversity, and soil retention (World Overview of Conservation Approaches and Technologies, 2015). Due to improvements in soil, contour farming also improved the physiological characteristics of coffee, particularly the weight of fresh shoots (Iijima, Izumi, Yuliadi, Sunyoto, & Utomo, 2003).

Despite the benefits offered by contour farming, some farmers have failed to maintain the practice or did not adopt it in the first place. One of the reasons that emerged during interviews is the labor requirement in adopting/maintaining the landscape, which is contradictory to the claims of Garrity (1999).

Coffee stakeholders in Bukidnon particularly identified that planting of ipil-ipil (*Leucaena leucocephala*), flemingia, and *arachis pintoi* between coffee rows prevent erosion and conserve soil fertility. Only 10% of coffee farmers in Bukidnon are practicing contour farming.

Flemingia macrophylla serves as cover or a shade crop, fixes atmospheric nitrogen, provides mulch that improves soil, controls nematode infestation when intercropped with other crops, and controls soil erosion when grown on terraces (Orwa, 2009).

Arachis pintoi, an herbaceous legume, is a cover crop that prevents soil degradation and controls various pests of plantation crops to maintain crop productivity and healthy environment. It has the capacity for weed and nematode control for coffee, and high potential for nitrogen fixation (Dela Cruz, Suarez, & Ferguson, 1994). Arachis pintoi can tolerate heavy grazing, however, it can be dominated by weeds or companion species if established as mixtures. CIAT 22160 and CIAT 18748 species are easily established and drought-tolerant, respectively (Gabunada, et al.).

An experiment done in Minsatla, Veracruz, Mexico assessed the soil quality and economic benefits of planting arachis pintoi in orange-coffee farm. There was a significant increase in primary nutrients - nitrogen, phosphorus, and potassium, however, organic matter decreased. In terms of cost, establishment requires US$294 to $396 per hectare if fertilizer is not applied, otherwise, costs range from US$356 to $473 (Valles-Dela et al, 2012).

Most of the research on contour farming focused on the practice's impact to soil. Although few studies include discussions on profitability, the emphasis is directed to soil fertility. There are also an insufficient number of studies that specifically assess the economic impact of the combination of coffee, Flemingia, and *Arachis pintoi*, which is the adopted contour farming system of coffee farmers in Bukidnon.

Prioritized CRA practices for cacao

From consultations and interviews with regional farmers, extreme weather events and changes in climate have impacted cacao in several ways. Excessive rains can result in rotting cacao pods while during periods of drought, pods wilt or are reduced in size. For seedlings, prolonged dry spells increase mortality rates which can reach as high as 50 to 70%, posing a significant threat as coffee farms in the region are predominantly rainfed

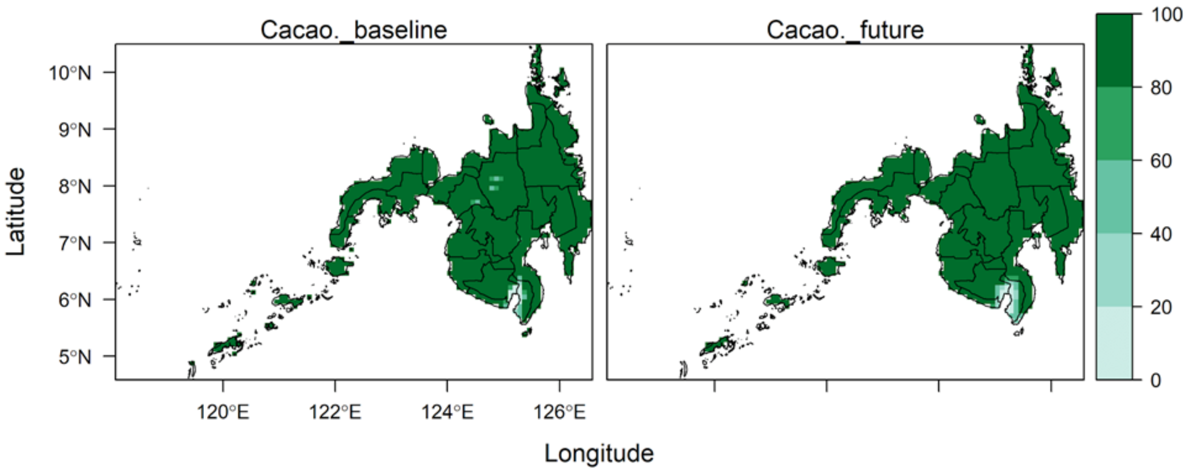

Figure 13: Mindanao crop suitability for cacao

Farmers have prioritized several adaptation practices to be deployed during drought, including the establishment of sprinkler systems, drip irrigation and water impounding. While utilizing these practices improves water and nutrient efficiency, most farmers do not have the resources or credit access to implement them, making them financially infeasible. Therefore, organic farming and mulching were identified as alternative practices for small-scale farmers. By using coconut husks, which is readily available throughout the Philippines, and organic methods like vermiculture, farmers can increase soil nutrients and moisture retention for periods of drought. Expanding post-harvest facilities, disease management, crop insurance, reforestation and watershed development were also identified as promising practices for climatic hazards.

Irrigation System

Irrigation systems are categorized into surface, sprinkle, and micro irrigation. In terms of initial capital, surface irrigation is the cheapest option, with little-to-no mechanical equipment involved, low energy cost, and low maintenance cost. However, the method is only suitable for areas with a 3% slope at most (Evans, n.d), which is not appealing for some cacao farms located in steeper areas. Additional limitations of the technology are the need for a large water supply stream, difficulty in obtaining uniform water distribution, high labor requirements, and unsuitability for crops sensitive to steam, crown wetting, and lack of root aeration. Meanwhile, both sprinkler and micro-irrigation systems have high efficiency and uniformity if correctly designed. Moreover, they easily control the amount and rate of application, are feasible for light and frequent application, need only a small supply stream size, and can be used for fertigation. However, in terms of capital and yearly costs, the two are relatively more expensive than surface irrigation *(Evans, n.d).*

Establish Impounding Water Facility/Water Collection

Small water impounding facilities intended for farming communities can be used for crops, livestock, and fisheries. The reservoir stores rainfall and run-off water during heavy rains as a source of agricultural water that can be used by a farm with half to 1 hectare area (DA-BSWM, 2014). In the Philippines, the National Irrigation Administration is responsible for constructing, improving, rehabilitating, and administering national irrigation systems (National Irrigation Administration, n.d.). Meanwhile, the Bureau of Soils and Water Management is mandated to develop small-scale irrigation projects that include impounding projects, small diversion dams, shallow tube wells, and small farm reservoir(DA-BSWM, n.d.). However, most of these projects focus mainly on rice production. Stakeholders expressed the need to improve access to these water services. Establishing water impounding/collection facilities was also mentioned. Although these concerns were not prioritized as both received only a single vote.

The prioritized practices during the workshops for cacao (Establish Sprinkler/Drip System, Water harvesting, Improve services/access to water) focused mainly on reducing the effects of drought through sufficient water supply. However, irrigation systems are not common in cacao farms in the province. The remaining practices that were identified to address production issues due to drought are reforestation, mulching and organic fertilizer application.

Mulching

Mulching is the application of thin organic material on the soil surface. Organic materials could be shredded grass and weeds. The decomposed materials conserve soil moisture, reduce soil erosion, improve soil fertility, and reduce weed growth (World Overview of Conservation Approaches and Technologies, 2016). Cacao farmers has been using coconut husks and banana leaves in mulching[9].

Organic Fertilizer

According to the Philippine National Standard (PNS), organic fertilizer is any decomposed product originated from plants or animals that can supply a total of five to seven % of nitrogen, phosphorus, and/or potassium (Department of Agriculture, 2013). Cacao farmers believe that organic fertilizer increases moisture retention of the soil. Some farmers apply vermi-culture in decomposing organic materials[9]. Application of this has various benefits relating to climate change adaptation. Soils that are rich in organic matter can sustain a supply of water during dry periods and provide greater resilience from water scarcity (IFOAM, 2012). Moreover, organic agricultural practices help preserve and restore soil structure, soil organic matter, and improves water holding capacity. The high organic matter content and soil cover results in a more effective usage of nutrients and water for agricultural production, hence, less water is needed (International Federation of Organic Agriculture Movements, 2009). Because of this characteristic, farm productivity can still be maintained even in the event of drought. Utilizing organic farming practices also improves soil fertility, decreases soil erosion, and increases biodiversity which also reduces pest outbreaks, and severity of plant and animal diseases (IFOAM, 2009). Additionally, organic farming also reduces the financial risks for farmers. Since organic farming avoids the use of synthetic fertilizers and pesticides, the dependence on external inputs is limited and farmers do not have to borrow money to buy these inputs. Therefore, farmers are financially less affected in case of crop failure (IFOAM, 2009). The offices of the Provincial Agriculturist of Davao del Norte and Municipal Agriculturist of San Isidro have also acknowledged the benefits of organic farming in minimizing effects of drought.

Various financial and economic studies for organic cacao farming are available. However, related studies in the Philippine context are limited. In Ghana, cacao production is categorized into four systems namely traditional, conventional, organic, and high-tech practices. Cacao farming is considered traditional if little or no agrochemical is used; conventional farming utilizes agro-chemicals; organic farms use organic matters; and high-tech farms, like conventional farming, applies agro-chemicals but at relatively higher quantity. The study revealed that high-tech production is best for cacao farmers in terms of yield and profit with 12 bags and US$470 net income per acre, while organic production systems only produced 5 bags and gained US$287 (Table 4) per acre. However, the former involves intensive input, labor, and capital requirements, which may lead farmers to recourse to credit, hence, higher risks. Also, the assessment did not account for the environmental impacts such as less erosion, biodiversity conservation, water detention, lower pest infestation, and carbon sequestration which characterizes organic production system. Additional benefits of the practice include less variations on yields and acquisition of premium prices which is usually an additional 10% of the farm gate price (International Cacao Organization, 2010).

Table 4. Cost-benefit comparison of cacao production systems in Ghana

Production System	Yield (bags per acre)	Gross Income (USD)	Costs (USD)	Net Income (USD)
Traditional	1.5	84.45	2	82.45
Conventional	3	168.90	65.63	103.27
Organic	5	393.75	106.92	286.83

High-input	12	675.60	205.78	469.82

Source: International Cacao Organization, 2010

Given the documented studies and validation interviews with local government institutions, application of organic fertilizer was chosen as a good CRA practice for cacao production in Davao del Norte that farmers may adopt. However, shifting to and succeeding in organic farming requires intensive knowledge and supply of information (IFOAM, 2012).

According to the Provincial Agriculturist Office of Davao del Norte, adoption of organic farming is low in the province because it demands too much labor and farmers chose to keep the traditional practices which are characterized by weak farm management.

Intercropping cacao with coconut

This CRA practice prioritized in the frame of AMIA in Davao province is one of the ways to reduce soil erosion and surface run-off hence protecting the topsoil. Intercropping also utilizes the farm area efficiently resulting to potential increase in total production and farm profitability. It reduces plant diseases and attracts more beneficial insects resulting to reduced insect pest population because of the diversity of the crops grown. Thus, intercropping maximizes land use potential and labor. Davao region ranks first in the production of coconuts, cacao, durian, and banana. Hence, intercropping cacao with the established bearing coconuts are considered as priority climate resilient agriculture practice in the region.

Appendix: CBA input data

Use of Blight-Resistant Potato Variety

			Quantities/HA		
	Units	price (PHP)	Farmer practice	CSA practice	year when cost occur
Yield		30	16335	18,897	
Machinery and equipment					
Inputs					
Seedling		45.5	1768	2000	1 to 20
Urea	50 kg bag	1440	6.9	5.74	1 to 20
Ammophos	kg	116.92	150	96.67	1 to 20
Pesticde 1	l	663.64	5.7	4.6	1 to 20
Pesticde 2	l	513.85	3	3.4	1 to 20
Pesticde 3	l	208.46	2	1	1 to 20
Fuel	lump sum		2732.5	2732.5	1 to 20
Service					
Food cost	lump sum		17700	21667	1 to 20
Transportation	lump sum		10700	13334	1 to 20
Labor					
Land preparation	man day	200	12	13	1 to 20
Planting	man day	200	12	16	1 to 20
Weeding	man day	200	9	3	1 to 20
Irrigation	man day	200	0	24	1 to 20
Pesticide application	man day	200	12	16	1 to 20
Fertilizer Application	man day	200	6.4	8	1 to 20

Harvesting and Hauling	man day	200	19	20	1 to 20

Rain Water Harvesting

			Quantities/Ha		year when cost occur
	Units	price (PHP)	Farmer practice	CSA practice	
Yield	kg	15	11300	16400	
MACHINARY AND EQUIPMENT					
Water impounding system		288000	0	1	1
INPUTS	Units		Farmer practice	CSA practice	
Seedling	KG	14000	0.5	0.5	1 to 20
Fertilizer (Nitrogen)	50 kg bag	1400	6	8	1 to 20
other Fertilizer	kg	120	100	140	1 to 20
Pesticide	l	600	7.2	7.8	1 to 20
Fuel Conventional	cost in PhP	2000	2000	2600	1 to 20
					1 to 20
SERVICES	Units		Farmer practice	CSA practice	1 to 20
Provision of food for worker	cost in PhP		25000	25000	1 to 20
Transportation	cost in PhP		15600	25700	1 to 20
LABOR	Units		Farmer practice	CSA practice	1 to 20
Land Preparation	md	250	15	15	1 to 20

Seedbed Preparation	md	250	8	8	1 to 20
Seedbed Sowing	md	250	3	3	1 to 20
Seedling Care and Maintenance	md	250	6	6	1 to 20
Irrigation of Crop	md	250	0	10	1 to 20
Fertilizer Application	md	250	14	14	1 to 20
Pesticide Application	md	250	15	15	1 to 20
Weeding	md	250	8	12	1 to 20
Harvesting and Hauling	md	250	14	20	1 to 20

Protected Vegetable

			Quantities/UA		year when cost occur
	Units	price (PHP)	Farmer practice	CSA practice	
Yield					
Lettuce	kg	100	43	105	
French beans	kg	90	80	131	
MACHINARY AND EQUIPMENT					
Protected structure	structure	25000	0	1	1 and 10
Pick mattock	piece	250	1	1	1 to 20
Shovel	piece	200	1	1	1 and 10

Scythe	piece	160	2	2	1 and 10
Plow	piece	1200	1	0	1 and 10
Sprinkler	piece	80	1	1	1 to 20
Bolo	piece	150	2	2	1 to 20
Pail	piece	100	2	2	1
pail	piece	100	1	1	2 to 20
Sprayer	piece	925	1	1	1 and 10
Crate	piece	330	3	5	1
Crate	piece	330	1	2	2 to 20
Basket	piece	150	4	6	1
Basket	piece	150	2	2	2 to 20
Plastic cover	piece	5000	0	1	every 5 year
INPUTS					
Lettuce seeds	can	200	2	2	1 to 20
French Beans	pack	1200	1	1	1 to 20
Vermicompost	sack	300	1	1	1 to 20
Complete fertilizer	sack	1200	0.75	0.75	1 to 20
Urea	sack	1050	0.5	0.5	1 to 20
Ammonium sulfate	pack	120	10	10	1 to 20
Potassium sulfate	pack	135	2	1	1 to 20
Herbicide	bottle	330	2	1	1 to 20
Insecticide	bottle	175	2	1	1 to 20
Fungicide	bottle	300	2	0	1 to 20
Nematicide	pack	40	2	1	1 to 20
Sack	piece	15	8	4	1 to 20
SERVICES					
Inputs trucking	sack	50	4	3	1 to 20
Carabao rental	animal day	200	10	0	1 to 20
Hauling of harvest	sack	20	8	8	1 to 20
Trucking of harvest	sack	20	0	8	1 to 20

Trucking of platic covers	lump sum	100	0	1	every 5 year
LABOR					
Clearing	man day	200	3	2	1
Land cultivation	man day	200	2.5	2	1 to 20
Planting	man day	200	2	4	1 to 20
Fertilizer application	man day	200	3	4	1 to 20
Herbicide application	man day	200	4.5	1.5	1 to 20
Watering of plants	man day	200	30	10	1 to 20
Food for hired labor	person	50	20	15	1 to 20
Maintenance weeding	man day	200	4.5	2	1 to 20
Harvesting	man day	200	10	20	1 to 20
Food for hired labor	person	50	10	20	1 to 20
Installation of plastic cover	man day	200	0	3	every 5 year

Use of Tacunan Green Dwarf Coconut Variety

			Quantities/Ha		year when cost occur
	Units	price (PHP)	Farmer practice	CRA practice	
Copra Yield	kg	28	3000	3500	
MACHINARY AND EQUIPMENT					
Pick mattock	piece	450	2	2	1 to 20
Sharp bolo	piece	350	3	3	1 to 20
Scythe	piece	150	2	2	1 to 20
Shovel	piece	350	1	1	1 to 20
Bara / Dehusker	piece	500	2	2	1 to 20
Lugit / Meat Remover	piece	50	3	3	1 to 20
INPUTS					

seedlling	piece	38	0	179	1
sack for input	piece	10	5	5	1 to 20
Sack for harvest	piece	10	20	0	1 to 20
Sack for harvest improved variety	piece	10	0	20	7 to 20
SERVICES					
inputs hauling	piece	10	50	71	1 to 20
Tapahan / Dryer Rental	days	350	20	0	1 to 20
Harvesting / picking of coconuts	tree	5	100	0	1 to 20
Dehusking of coconut	per hundred nuts	25	205	0	1 to 20
Hauling of copra	sack	30	10	0	1 to 20
Trucking of copra	sack	20	10	0	1 to 20
Tapahan / Dryer Rental	days	350	0	20	7 to 20
Harvesting / picking of coconuts	tree	5	0	100	7 to 20
Dehusking of coconut	per hundred nuts	25	0	205	7 to 20
Hauling of copra	sack	30	0	10	7 to 20
Trucking of copra	sack	20	0	10	7 to 20
LABOR					
Clearing for coconut	md	250	0	6	1
Food for hired labor	person	50	14	28	1
Planting for coconut	md	250	0	8	1
maintenance, manual weeding/clearing]	md	250	14	14	1 to20
food for hired labor	person	50	14	14	2 to20
Deshelling of coconut	md	200	2	2	1 to 20
Hauling of picked of coconuts	md	200	1	1	1 to 20
Deshelling of coconut impoved	md	200	2	2	7 to 20

Hauling of picked of coconuts improved	md	200	1	1	7 to 20

Intercropping cacao with coconut

	Units	price (PHP)	Quantities/Ha		year when cost occur
			Farmer practice	CSA practice	
Yield	kg		11300		
cacao		120	0	1500	
coconut		11	10000	15000	
MACHINARY AND EQUIPMENT					
knapsack sprayer	piece	3000	0	1	1 and 10
hose power spray	piece	5000	0	1	1 and 10
bolo	piece	210	0	2	1 to 20
pruning shear	piece	250	0	1	2 to 20
INPUTS					
seedlings	piece	25	0	600	1
complete (14-14-14)	bag	1100	0	5	1
Urea	bag	930	0	3	1
Muriate of Potash	bag	870	0	4	1
Complete (16-16-16)	bag	1400	0	6	1
complete (14-14-14)	bag	1100	0	9	2 to 20
Urea	bag	930	0	6	2 to 20
Muriate of Potash	bag	870	0	8	2 to 20
Complete (16-16-16)	bag	1400	0	7	2 to 20
Chemicals: Herbicide(Decis)	L	1000	0	1	1 to 20
Herbicide 2(prebaton)	bottle	840	0	6.2	1 to 20
Herbicide 3(Round up)	gal	960	0	1.7	1 to 20
Fungicide	kg	650	0	0.7	1 to 20

SERVICES					
transport inputs	count	300	0	5	1 to 20
transport harvest cacao	count	300	0	0	2 to 20
transport harvest coconut	count	300	4	4	1 to 20
LABOR cacao	Units				
clearing	md	212	0	10	1
digging	md	212	0	10	1
planting	md	212	0	30	1
fertilizing	md	212	0	6	1 to 20
spraying	md	212	0	8	1 to 20
Pruning	md	212	0	10	2 to 20
harvesting cacao lean period	md	212	0	7.5	2 to 20
harvesting cacao peak period	md	212	0	10.5	2 to 20
hauling	md	212	0	15.8	2 to 20
breaking	md	212	0	23.2	2 to 20
drying	md	212	0	1	2 to 20
LABOR coconut					
sungkit	pakyaw	300	2	3	1 to 20
tapok	pakyaw	200	5	7	1 to 20
hauling	pakyaw	200	4.5	6	1 to 20

Section 2.6: Analysis of Communication Channels in the Network of Climate Information Services in Philippines

Contents

Analysis of Communication Channels in the Network of Climate Information Services in Philippines

1. The objective of this assessment is to assess existing information network used by PAGASA to deliver climate information services (CIS). We carried out interviews with key actors in the CIS value chain at the national, regional and local levels to assess the climate services network and its communication channels. We interviewed 7 actors at the central level (see Appendix) and 34 key informants (from 13 different stakeholder types) across the regions of Luzon, Visayas and Mindanao (see Appendix).
2. We present a summary of the analysis in two sections with supporting material in the Appendixes. The first focuses on weather and climate data generation, sharing and uses across stakeholders at the national level. The second section is focused on characterizing the knowledge network for CIS in terms of its salience, legitimacy, credibility, equity, integration, accessibility and communication channels from national to local level.

2.6.1 National Level Stakeholders: Data Generation, Sharing and Uses

3. We identified 5 primary climate information producers in the sample of interviews at national level: the project NOAH, BSWM, RWAN, WeatherPh and PAGASA. Each of these actors operates or co-manages their own network of weather stations (including automatic weather stations, agro-meteorological stations, rain gauges, etc.) and have a functional system to transmit meteorological-hydrological data to a central system for data processing.

Climate Information Producers

4. All climate service providers (defined as those have ownership or access to the raw hydrological metrological data) interviewed (Project NOAH, WeatherPh, PAGASA, RWAN, BSWM) operate rather independently:

- Direct links between primary climate information producers exist only between PAGASA and BSWM, and PAGASA and RWAN. These links are a result of 2 channels of communication:
    - The climate outlook forum that is organized monthly by PAGASA with open invitation to all relevant actors in the country.
    - All BSWM's and RWAN's stations were installed and calibrated under a collaboration project implemented with PAGASA. PAGASA also provides support to the maintenance of these stations after the projects ended. Data from project RWAN's stations are automatically sent to and managed by PAGASA while data from BSWM's stations are sent to and managed by ASTI (under DOST). It remains unclear how and to what extent ASTI and PAGASA collaborate to make use of data from these stations.
- Project NOAH manages their own system of stations and conduct in-house data analysis. All modelling and forecasting are conducted by the staff of project NOAH without a strong collaboration with other actors in the network. Project NOAH used to be part of the NDRRMC until mid-2017. NDRRMC is a council consisting of all actors relevant to the management of natural disasters, including producer and disseminators of climate information. In the past when NOAH was part of NDRRMC, NOAH had connection to PAGASA through this platform, via meetings and other formal channels. Since NOAH was removed from NDRRMC, this primary producer appeared to have lost its channel of communication to other actors. However, the stations are now under the management of ASTI and the stations data are open

(data is uploaded to open Application Programming Interface which anyone can have access to).

- WeatherPh is part of Aboliz, which is a private company. Unlike the rest of the producers, this actor is not part of the public sector and thus does not have mandated connection with other producers. However, WeatherPh has had past collaboration with project NOAH and the PhiVolcs.

5. According to its mandate, PAGASA is responsible for the collection, processing, dissemination of atmospheric information relevant to the agricultural sector. It is also responsible for coordinating with other agencies in the generation of climate information, and providing them with the necessary training facilities. However, it remained unclear how PAGASA assists BSWM in generating climate information beyond the support provided to maintain BSWM's observation network. It's also unclear how PAGASA uses the information generated by BSWM's network. Results from a discussion between representatives of PAGASA and DA (Section 3.1) suggest that work must be done to assure that BSWM's observation network is fully compliant with PAGASA's standards.

6. Potential areas for improvement in the communication efforts between the climate information providers interviewed described as follows: 1) Communication channels amongst them occur through bilateral channels between PAGASA and BSWM, and PAGASA and RWAN. However, an integrated data-sharing approach is missing and even within bilateral collaborations, the strength and scope of these communication channels could be strengthened, 2) It seems important to better understand how ASTI works with PAGASA in the management of stations data. ASTI appears to be able to play a facilitative role in the sharing of data from different producers, which needs to be further explored, 3) there also appears to be an opportunity to share capacities to process data and generate weather forecasts where complementarities can be identified. There are 3 producers (NOAH, WeatherPh, PAGASA) that have their own modelling capacity to create climate information products but a mechanism to collaborate technically seems to be lacking.

Information Transfer from Producers

7. There is a variety of ways for producers to communicate climate information products. The most popular channel is by meetings and workshops. This channel could be recurring (such as part of the mandate of the producers like climate outlook forum by PAGASA) or project-based. This channel is used by RWAN to transmit CIS to the MAOs and by PAGASA to other actors (MAO, FPOPD, RWAN, DA-RFO, NWRB). There are 3 other channels that are equally popular, that are training programs, sender-initiated channels (email, fax) and receiver-initiated channels (send request for information, access website). The 3 climate information producers that has analysis capacity (NOAH, PAGASA, WeatherPh) also send weather forecast to public media (printed news or TV stations, radio stations).

Perception at National level on the Use of climate information

8. We were only able to collect and assess information quality from FPOPD and BSWM who are not primary producers of information. National level stakeholders found that CIS is highly relevant (average score 1.75, on a scale from 1 to 5 with 1 being most positive quality), applicable (1.75/5), and comprehensible (1.5/5) (see details in Table F.1). However, there is no process for users and disseminators to provide feedback to the producers therefore bias on these perceptions across scales is further explored in Section 2.

Table F.1 Perceptions in information products use by national level stakeholders on a scale from 1 to 5 with 1 being most positive quality.

ANSWER FROM	FPOPD	BSWM

ABOUT	PAGASA	PhiVolcs	ASTI	PAGASA
INFORMATION USE	1	1	3	2
RELEVANCE OF THE CONTENT RELATED TO NEEDS	1	2	2	2
TIMING	NA	NA	NA	1
UNDERSTAND INFORMATION	1	1	3	1
RELIABILITY AND ACCURACY	2.5	2	2	2
CO-DESIGN	NA	NA	NA	NA
FEEDBACK PROCESS	1 (for drought) and 5 (for cyclone)	5	5	5

2.6.2 CIS Knowledge Network: from National to Local Level

Legitimacy

9. Climate services legitimacy builds on positive perceptions on stakeholders' values and beliefs, fair treatment of each other's views and interests, and un-biased co-production of information products where knowledge on the use, barriers for adoption and end-user's feedback on the information products are key. Key findings on this aspect are summarized as follows:

- Information products follow a top-down approach: while regional and municipal stakeholders are at the local level interacting with end-users (LGUs, farmer's and barangay level officers), their role on the information product generation is focused on maintaining the observational network and providing data to PAGASA regional and national offices;
- As a result of the top-down approach the current uses of information by farmers are usually not assessed, anecdotal (when reported) and related to farmers' emergency responses (i.e. early harvest due to storm advisory or school class suspension). No formal process to systematize information use was reported and barriers for this were reported in very few cases (lack of man-power and inappropriate communication channels were reported);
- A strong disagreement was found between PAGASA and other stakeholders' perception on their involvement in designing the information products. Regional farmers and stakeholders perceive that they are not involved in the design of the information products while PAGASA has a positive view on their involvement. This agrees with responses about institutional partnerships for creating the information products. Perceptions on feedback processes from end-users to information providers shows a similar pattern;
- Interactions between end-users and data generators occur in a few cases through formal mechanisms, for example by participating in Barangays assemblies or with extension services, however, in most cases interactions are informal and with limited scope in number of people;
- All reported mechanisms for systematizing feedback on information products were passive, for example as availability of feedback forms or info-lines, and not as an active feedback collection process;
- Interactions between PAGASA regional offices and local institutions (MDRRMOs, CMU, PCA) were reported in some cases related to supporting the observation network but not systematic;
- All institutional stakeholders identified delivery of information products to farmers as part of their institutional mandates indicating clarity in their roles.

Credibility

- In Mindanao, only farmers were interviewed for perceptions on information reliability and accuracy. Although there was a strong agreement on information understanding the reliability of the information provided received a lower score (agreement on its reliability). In general, wind-related information received a low score. A number of responses were correlated with the reliability and accuracy, indicating that farmers know about products they can rely on. Weather information related to winds is the less reliable, which likely explains few answers. Information on floods information is the most reliable. There is an agreement on the reliability of information related to precipitation, temperature, typhoons, wet/dry season (onset). There was an agreement-strong agreement on information understanding, except during the *Habagat* (Summer Monsoon);
- In Luzon, a more diverse set of stakeholders were involved in the interview. Evaluated collectively, the information was mostly about early warning of extreme events. In general, PAGASA's perception was more positive than for the rest of stakeholders, reflected in their strong agreement on information reliability and accuracy, in contrast with the perception of the rest of stakeholders.

Access

- In the three islands, in general, all institutional stakeholders, and farmers in Mindanao, agreed on timely delivery of information products. However, farmers' responses in Luzon showed higher divergence with some indicating agreement/disagreement with the statement;
- Farmers interviewed in Compostela Valley (Mindanao) expressed strong agreement with the statement that the information that they received is needed and used in their decision-making. Most of the farmers agreed that the timing of information delivery is adjusted to their needs.

Saliency

- In the three islands, all stakeholders agreed, in general, the information provided addresses farmer's needs. This, however, did not hold for rainfall, onset of dry/wet season or wind in Mindanao. Seemingly, the relative negative perception of the stakeholders regarding their involvement in the design of climate information products does not impact their perception on the suitability of these products to their needs.

Communications – Channels and Formats

- In Benguet Province in Luzon, PAGASA transmits weather information through face-to-face interaction by the form of trainings (including tables and maps) and IEC campaigns, mobile and electronic channels through SMS/text messaging and emails and computer software. Meanwhile, in Baguio City, PAGASA utilizes broadcast media through radio programs to disseminate weather-related information. At the municipal level MDRRMO, MENRO and MAO make use of face-to-face interaction through trainings programs and regular meetings and assemblies. This is supported by print (e.g. leaflets, brochures) and radio broadcast as well as mobile communications such as text messaging;
- In Baybay, Leyte, in Visayas, PAGASA and CDRRMO make use of broadcast media to convey weather-related messages through radio programs and local warning announcements roaming around the city/municipality. However, the release of specific weather information is contingent with written request letter from the agency or individual requiring the data;
- In Mindanao, it is common to have face-to-face interaction as a pathway to disseminate weather information through quarterly meetings at the municipal level as well as the

conducting FFSs and municipal and barangay level training programs, among others. In San Isidro, Davao del Norte, broadcast media is used through the radio communication systems existing in the municipality compounded with mobile communications through text messaging.

- In all three islands, some farmers manifested preference for TV as the channel to receive information, given the delays when the information comes from the barangay or via text messages due to the limited communication network. Some farmers, though, expressed they preferred receiving the information from the LGUs, in the form of training, lectures, climate information in general.

Information Products

10. Although rather arbitrarily, climate information products reported by key informants (see Appendix) can be roughly classified as:

- Weather forecasts;
- Atmospheric conditions;
- Early warning;
- Disaster risk reduction information;
- Decadal weather;
- Climate change information;
- Crop reports;
- Advisories.

11. Our interviews indicate that weather forecasts, ranging from seasonal predictions to forecasts with lead times of 1-3/7-10 days do reach the farmers and address some of the farmers' needs (Section 2.4). In some instances, however, farmers expressed their need for long-term forecasts. The main demand from these forecasts is higher accuracy. Farmers also manifested the need for more immediate information, in the form of a warning system, with equipment on-site that inform them on adverse conditions. In this regard, farmers are concerned with climate hazards—both because it affects their production and for safety reasons—and early warnings are issued in the face of extreme events like typhoon, winds, dry and wet spells, thunderstorms and floods. Farmers, however, do not express demand for information on climate change, and they do not receive this information on a regular basis.

12. Information on atmospheric conditions and decadal weather circulates between information producers and disseminators. This information does not reach the farmers. This may be so, given that this information, is likely too technical to be useful for farmers.

13. Crop reports and advisories, in general, are likely more specific to agriculture, rather than focused on the atmospheric conditions. Government agencies at provincial and regional level reported disseminating crop reports but did not provide details about their content or function. Since these reports do not reach farmers, this information is likely oriented to planning offices. As to the advisories, farmers reported they receive them but did not provide details about the content. Farmers admit that they need more information on what to do when climate hazards affect them but did not provide specific details on their exact needs.

2.6.3 Strengths and Gaps of the CIS Network

14. We mapped the relations between the different actors—central and regional level together—their roles in the CIS value chain and their scope of action as reported during the interviews. The network (Figure F.1) illustrates that although we interviewed a total of 20 actors, many more came up

during the interviews (a total of 62 actors). Therefore, our findings rely on a partial picture of a network that includes potentially more actors and more interactions between them.

15. We analyzed the network using different metrics (adjacency; actor in- and out-degree; connectivity; reachability; distance; maximum flow) (See Appendix) aimed at identifying the most influential actors in the production and dissemination of information, gaps in the communication of CIS, the efficiency in the transmission of the information, and the overall strength of the network to deliver climate information to different actors across the country.

16. The main findings are summarized in the following.

Most relevant actors in production and distribution of climate information: Central PAGASA and Automatic Weather Stations

17. The network of actors in the climate services value chain shows Central PAGASA as the most influential actor. AWS and stations administered by PAGASA, either synoptic, radar, agro-meteorological, also are important centers delivering information directly to actors at municipal, barangay and national level. According to the interviews, some AWS managed by PAGASA, but others are operated by the BSWM and others are directly managed by DA through the MAOs. The network suggests that information from AWS managed by BSWM and MAOs is shared with PAGASA through PAGASAs Regional Offices, and likely automatically transmitted. However, a list of priorities (see Appendix) elaborated during a workshop organized in May 2018, between the DA (SWCCO, FPOPD and BSWM) and PAGASA, indicated data from DA observation network is not fully compliant with—and therefore not fully exploited by—PAGASA. Work must be done to assure that equipment and data comply with the standard of PAGASA. This is required to ensure the harmonization of the strategies of DA and PAGASA, and therefore strengthening the communication between these two actors.

Most relevant receivers of climate information: Farmers, Municipal Agricultural Offices, and Municipal Disaster Risk Reduction Management Organizations (MDRRMOs)

18. Farmers, MAOs and MDRRMOs stand out as 'sinks' of information—they exhibit more direct connections than any other in the network. All three actors are highly reachable—information from any given actor reaches them through different pathways—and, in general, information arrives to them relatively fast—information from any other actor will require one intermediary at most. Nevertheless, despite the numerous direct connections and high reachability, a deeper analysis of the information products reaching these actors is required, to ensure that actors are neither overloaded with information nor receive contradictory messages.

Missing links between farmers, MAOs, MDRRMOs and private sector and organizations at municipal level

19. MAOs, farmers and MDRRMOs are not directly reached by the private sector, agricultural cooperatives, or even by barangay organizations (except the BDRRMOs). The interviewees were not very specific when referring to government agencies, but the network analysis suggests these organizations do not reach the farmers. In fact, the analysis suggests that feedbacks regarding the information products, or specific needs from the farmers do not reach any of the actors in the network. This is coherent with the perception of the farmers, reflected in the interviews, regarding the different institutions not taking into account their specific needs or requests.

National and regional actors not strongly linked

20. Unlike PAGASA, Weather Philippines or NOAH, important national and regional actors remain relatively loose in the network. This is the case for the regional and central Offices of DOST; regional and central offices of BSWM; DENR, and other government agencies.

Weak contribution from academic institutions

21. SUCs, and academic institutions in general, are fundamentally disconnected from the network. They work closely with the farmers, but do not share information with other actors above the municipal level.

Slow, vulnerable communication across the network

22. The different actors in the value chain of climate services are not fully connected. Therefore, even though any given actor is reachable by any other actor—thanks to multiple pathways—the information rarely flows directly between the actors. In more than 50% of cases, the flow information between the source and the target actors requires three or more exchanges before reaching the final destination. Consequently, information might not reach all the actors, and when it does, the transfer may be relatively slow. Furthermore, most of the potential exchanges between actors rely on one single pathway, suggesting the network is relatively vulnerable if one or more actors fail to deliver information along that pathway.

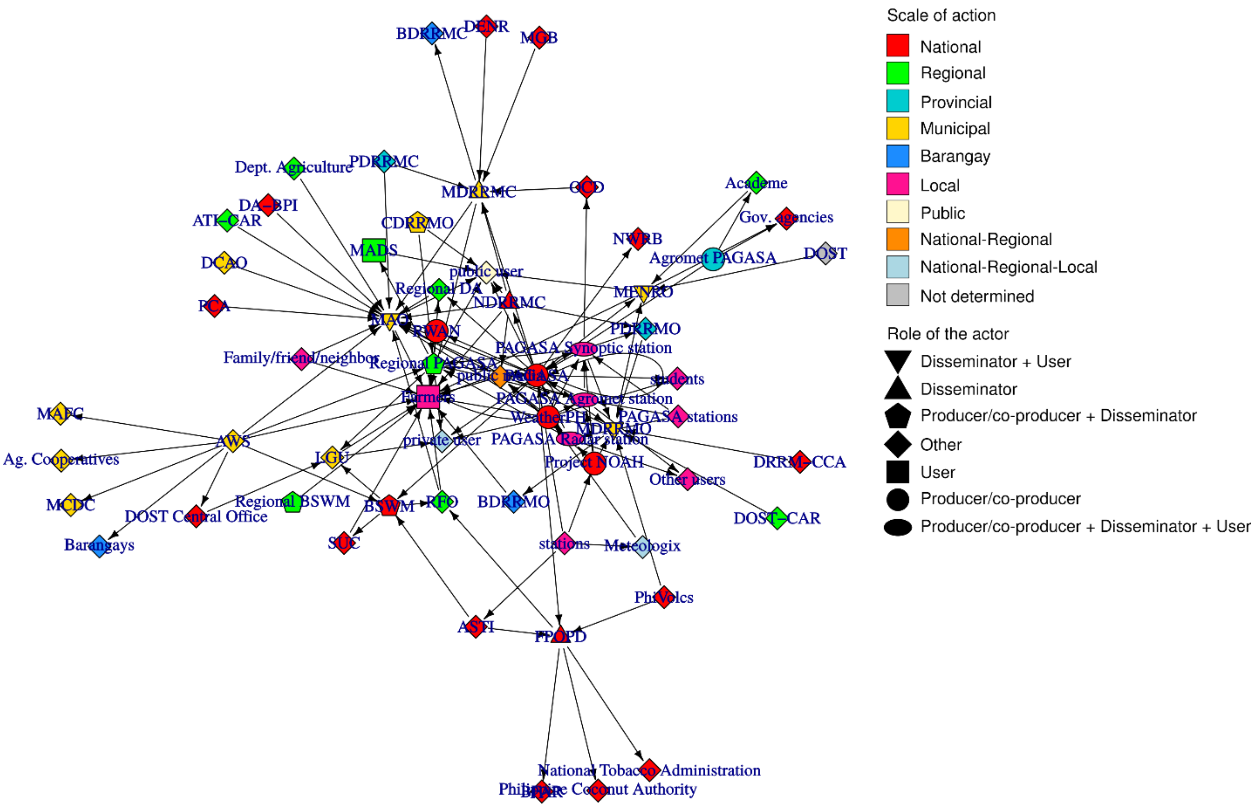

Figure F.1. Network of actors and their relations in the climate services value chain in Philippines. The different shapes in the diagram represent the roles played by different actors. Colors indicate the scope of the action of the actor. Arrows indicate the direction of the flow of information between source and target. See Appendix for a full list of the acronyms in the diagram.

Appendix

Table F.A.1. List of key actors interviewed at central level

Key informant	Acronym
Nationwide Operational Assessment of Hazards	NOAH
Field Programs Operations Planning Division	FPOPD
Bureau of Soils and Water Management	BSWM
Rice Watch and Action Network	RWAN
Weather Philippines	WeatherPH
National Disaster Risk Reduction and Management Council	NDRRMC
Philippine Atmospheric, Geophysical and Astronomical Services Administration	PAGASA

Table F.A.2. List of key informants interviewed at regional level

Key informant	Acronym
Region: Visayas	
Philippine Atmospheric, Geophysical and Astronomical Services Administration Visayas Region	Regional PAGASA
City Disaster Risk Reduction & Management Office Baybay	CDRRMO
Agrometeorological PAGASA	Agromet PAGASA
Merida Agricultural Diversified Services	MADS
Region: Luzon	
PAGASA Weather Surveillance Radar Station, Tuba, Benguet	PAGASA Radar Station
PAGASA Synoptic Station, Baguio City	PAGASA Synoptic
PAGASA Agromet Station, BSU, La Trinidad, Benguet	PAGASA Agroment Station
Municipal Disaster Risks Reduction Management Organization, La Trinidad, Benguet	MDRRMO
Municipal Environment and Natural Resources Office, La Trinidad, Benguet	MENRO
Municipal Agriculture Office, Atok, Benguet	MAO
Vegetable farmers (4)	
Municipal Disaster Risks Reduction Management Organization, Conner, Apayao	MDRRMO
Municipal Agriculture Office, Conner, Apayao	MAO
Rice farmers (4)	
Region: Mindanao	
Department of Agriculture - Bureau of Soils and Water Management, Region XI	DA-BSWM
Philippine Atmospheric, Geophysical and Astronomical Services Administration, Region XI	Regional PAGASA
Municipal Disaster Risk Reduction Management Council, San Isidro	MDRRMC
Municipal Agriculturist Office, San Isidro	MAO

Municipal Agriculturist Office, Tugbok District	MAO
Farmers (crops and livestock)	
Farmers (high value crops)	
Farmers (high value crops and vegetables)	
Farmers (crops and livestock)	
Municipal Agriculturist Office, Maragusan	MAO
Farmers (Coffee, 4)	

Table F.A.3. Priority activities for harmonizing the weather observation networks of the Department of Agriculture (DA) and the Philippine Atmospheric, Geophysical and Astronomic Services Administration (PAGASA) to support the development of Climate Information Services for agriculture. Elaborated during a workshop on May 11, 2018

Main activity	**Objectives**	**Information needs**	**Specific tasks**	**Lead**
BSWM data validation by PAGASA	Implement a road-map for progressive validation of the Agromet network of DA-BSWM by PAGASA	List of criteria/indicators needed to validate: a) Weather-station site exposure based on CIMO b) Data assessment c) Comparison of observations on extremes d) Station infrastructure and sensors history e) Criteria and indicators systematized for each station	a) Joint site visit b) Data inter-comparison c) Performance assessment based on validation criteria d) The criteria will be provided by PAGASA a) PAGASA will categorize the site according to WMO standards adapted by PAGASA	PAGASA will join in initial visit to be led by BSWM BSWM and PAGASA will collaborate on assessing each site and data comparison
PAGASA assists DA in sensors adjustment and calibration	Sensors are adjusted and calibrated in BSWM observation network	a) List of sensors per station to be collected by BSWM b) Inventory of data-logger algorithms for each sensor	a) Inventory of sensors and algorithms b) Sensor data inter-comparison c) Provision of guidelines for sensors calibration	BSWM and DOST-ASTI for sensors inventory and algorithms PAGASA supports inter-comparison and guidelines sharing
Agreement for upgrading 20 stations of PAGASA	Maximize the utilization of the additional sensors installed	a) Check status of added sensors	• Validate data from the new sensors • Determine if the new sensors can be integrated to existing PAGASA data loggers	PAGASA

Harmonization of data management	BSWM data characteristics are appropriate for PAGASA standards	TBD	TBD a) Explore the possibility of harmonizing time of measurements	TBD
MOA between PAGASA and DA-RFOs to use PAGASA products to support FFS modules development and implementation	FFS modules will be updated with new PAGASA modules	TBD	TBD a) Include PAGASA trainers into FFS	TBD

Table F.A.4. Summary of information products. Obtained from interviews to producers/co-producers, disseminators and end-users of climate information.

Category	Product	Frequency	Geographic coverage
Weather forecast	1 – 3 days	Daily and sub-daily	Regional, municipal, barangay
	7 – 10 days		
	Seasonal		
	Daily		
	Hourly		
Atmospheric conditions	Precipitation	Daily and sub-daily; as requested/needed	Regional, provincial, municipal, barangay
	Temperature		
	Wind speed and direction		
	Atmospheric pressure		
	Evaporation		
	Cloud cover		
	Visibility		
	Solar radiation		
	Soil temperature		
	Soil moisture		
Early warning	Typhoon	Eventuality; as needed	Municipal; regional; barangay and location specific.
	Monsoon		
	Rainfall		
	Landslides		
	Low pressure		
	Flood		
	Temperature		
	Thunderstorm		
	Drought/dry spell		
	Wet season onset		
Decadal weather	No details	Monthly; every 10 days	Regional; provincial
Crop report	No details	10 days	Provincial
Climate change	Awareness	Not periodical	National, Provincial, municipal, barangay
	Other (no details)		
Disaster risk reduction	Risk maps	As requested/needed	Provincial; Regional; National; municipal; barangay
	Other (no details)		
Advisory	Farm weather	As requested/needed	Regional; Provincial; National

Table F.A.5. List of acronyms

CIS	Climate Information Services
AWS	Automated weather stations

PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PDRRMC	Provincial Disaster Risk Reduction Management Council
NDRRMC	National Disaster Risk Reduction Management Council
DOST	Department of Science and Technology
LGU	Local government unit
BSWM	Bureau of Soils and Water Management
DENR	Department of Environment and Natural Resources
OCD	Office of Civil Defense
MGB	Mines and Geosciences Bureau
MDRRMC	Municipal Disaster Risk Reduction Management Council
DCAO	Davao City Agriculturist Office
PCA	Philippine Coconut Association
BPI	Bureau of Plant Industry
MAO	Municipal Agricultural Office
MCDC	Municipal Cooperative Development Council
MAFC	Municipal Agriculture and Fisheries Council
DA	Department of Agriculture
BDRRMC	Barangay Disaster Risk Reduction Management Council
WeatherPH	Weather Philippines
NOAH	Nationwide Operational Assessment of Hazard
PhiVolcs	Philippine Institute of Volcanology and Seismology
DOST-CAR	Department of Science and Technology of the Cordillera Administrative Division
MDRRMO	Municipal Disaster Risk Reduction Management Office
MENRO	Municipal Environment and Natural Resources Office
DRRM-CCA	Disaster Risk Reduction Management – Climate Change Adaptation
ATI-CAR	Agricultural Training Institute – Cordillera Administrative Division
BDRRMO	Barangay Disaster Risk Reduction Management Office
PDRRMO	Provincial Disaster Risk Reduction Management Office
CDRRMO	City Disaster Risk Reduction Management Office
MADS	Merida Agricultural Diversified Services
ASTI	Advanced Science and Technology Institute
BFAR	Bureau of Fisheries and Aquatic Resources
FPOPD	Field Programs Operations Planning Division
NWRB	National Water Resources Board
PCA	Philippine Coconut Authority
RFO-DA	Regional Field Office of the Department of Agriculture
RWAN	Rice Watch and Action Network
CMU	Central Mindanao University
FFS	Farmer Field Schools
SWCCO	Systems-Wide Climate Change Office
SUC	State university and colleges

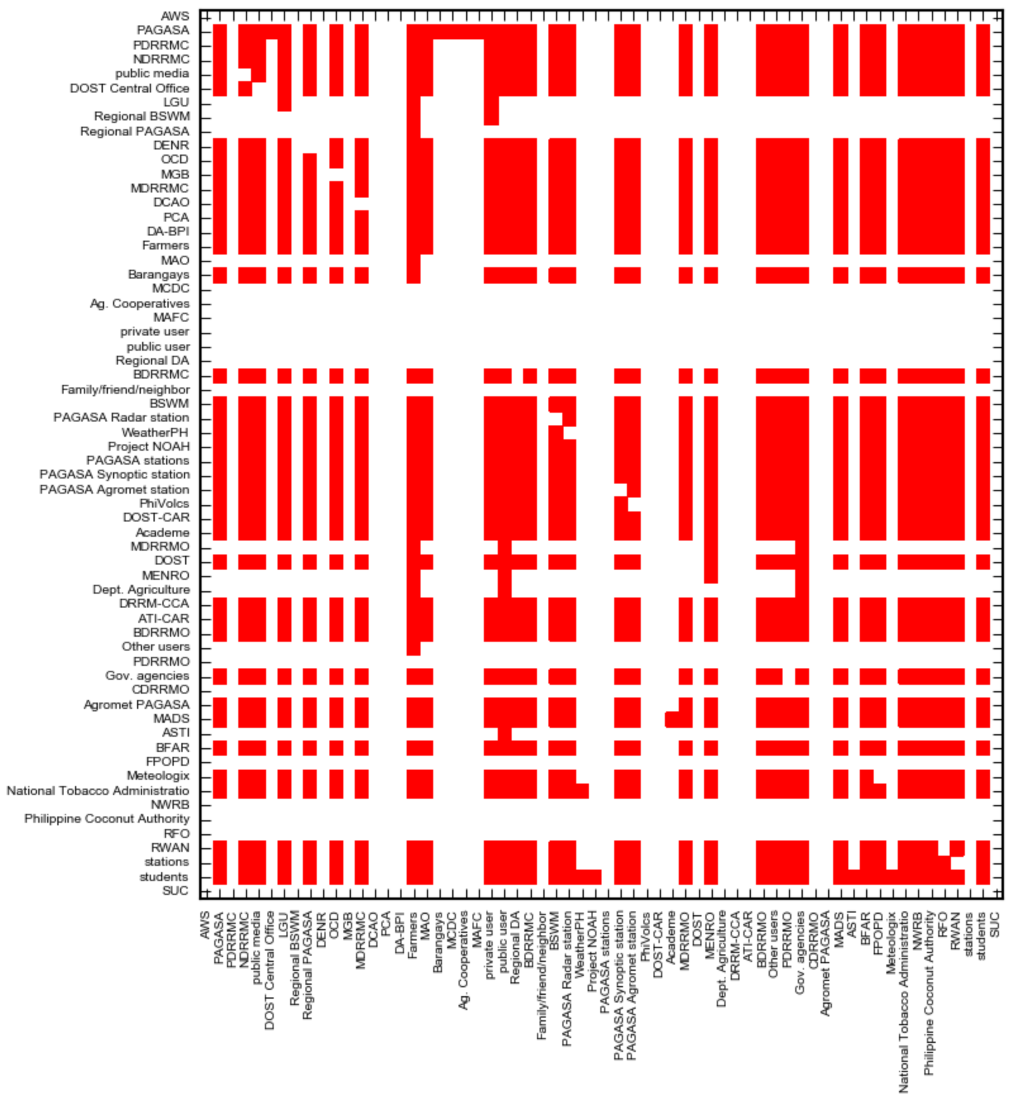

Figure F.A.1. Actor reachability. Row-wise, red cells in the matrix represent all the actors reached by the actor in the *i*-th row, following any possible pathway across the network. Column-size, red cells indicate all the actors that reach the target actor in the j-th column. White areas represent actors that are disconnected from the network (e.g. an actor that provides information to other actors but that does not receive information from any other actor).

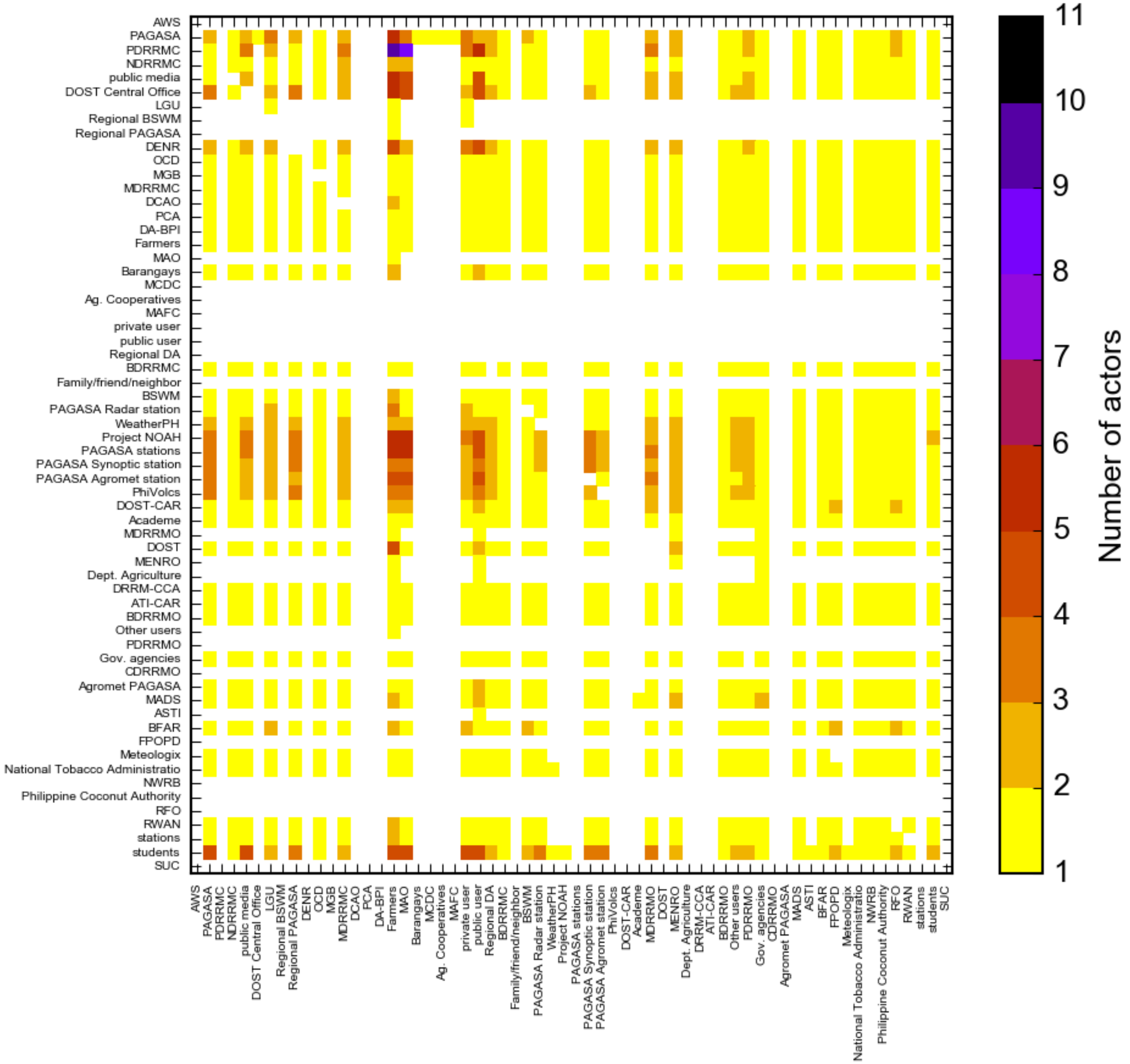

Figure F.A.2. Network connectivity: Number of actors that have to be removed so that information from any actor does not reach any other actor in the network. White areas represent actors that are disconnected from the network (e.g. an actor that provides information to other actors but that does not receive information from any other actor).

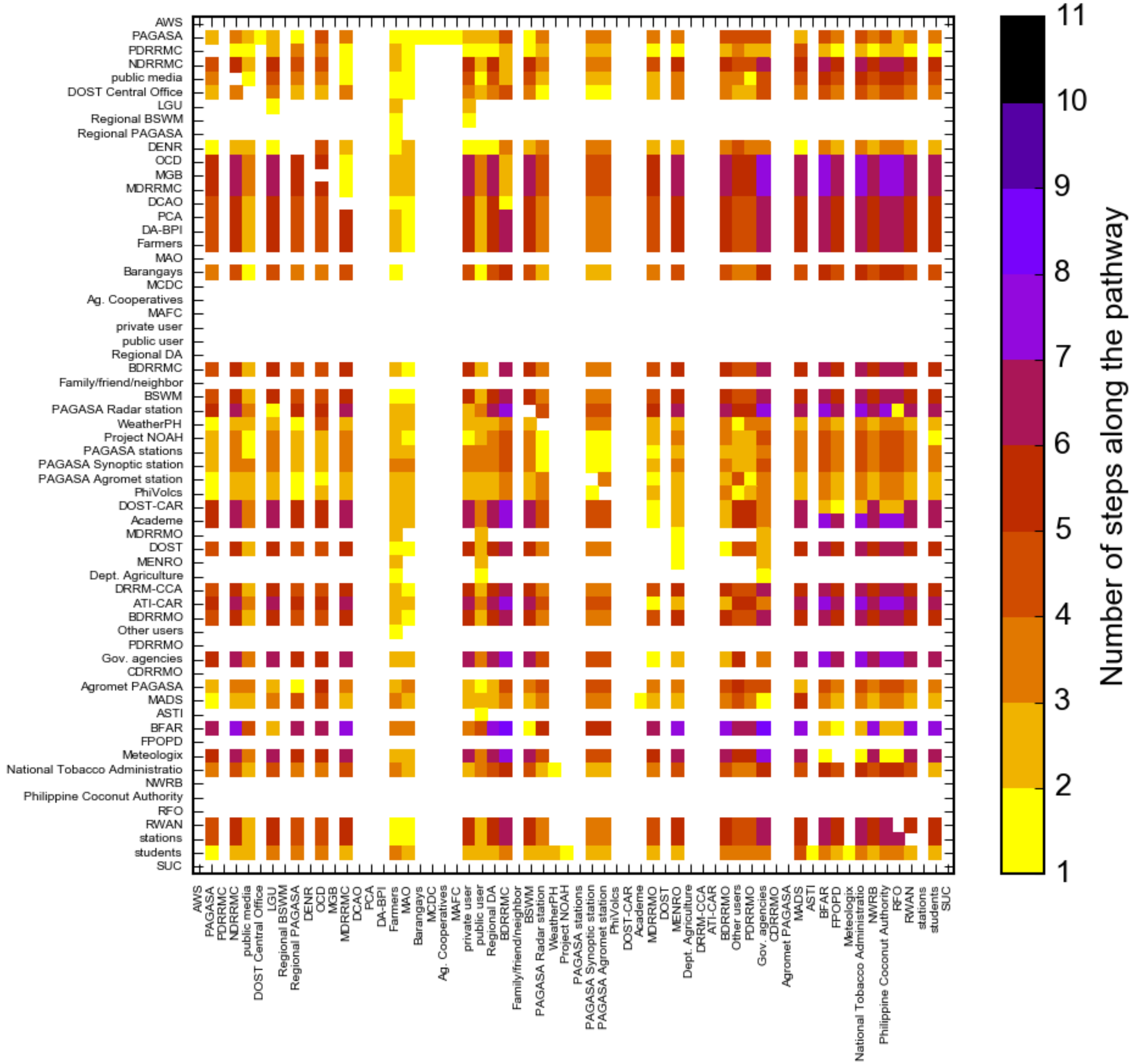

Figure F.A.3. Distance between actors along the most efficient (shortest) pathway connecting any two actors. Distance is expressed in terms of the number of exchanges (steps) required for the information from a source actor to reach all other target actors. White areas represent actors that are disconnected from the network (e.g. an actor that provides information to other actors but that does not receive information from any other actor).

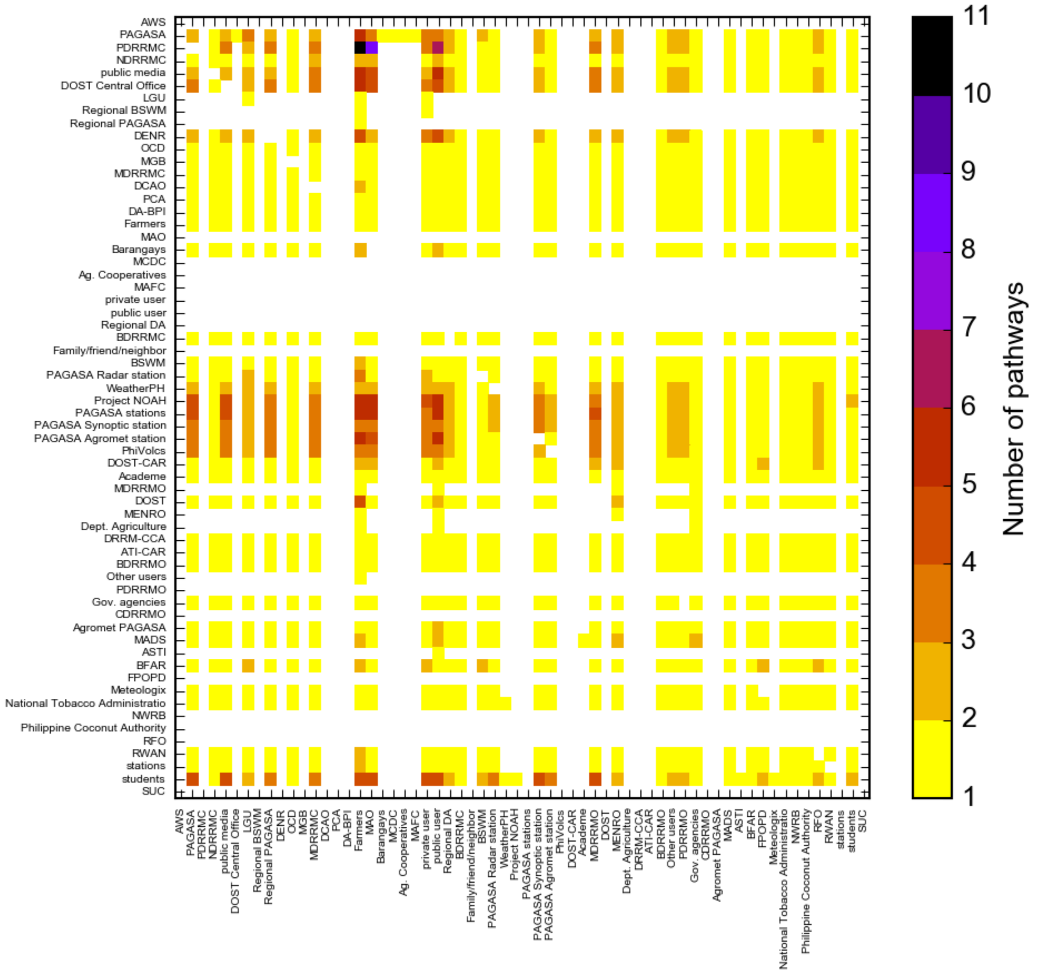

Figure F.A.4. Maximum flow: Number of possible pathways through which an actor can reach (rows), or can be reached by (columns), any other actor in the network. White areas represent actors that are disconnected from the network (e.g. an actor that provides information to other actors but that does not receive information from any other actor).

Section 2.7: Farmer Field School Approaches and their Use in Scaling Up Climate Change Adaptation in Philippine Agriculture

Contents

Abbreviations

ABS	Aqua-Business School
AESE	Agro-ecosystem Analysis
AMIA	Adaptation and Mitigation Initiative in Agriculture

ATI	Agriculture Training Institute
AWS	Automatic Weather System
BDS	Business Development Services
BINDS	Building Resilient and Adaptive Communities and Institutions
BSWM	Bureau of Soil and Water Management
CBO	Community-Based Organization
CCAFS	Climate Change, Agriculture, and Food Security [CGIAR research group]
CFS	Climate Field School
CIP	International Potato Center
CIS	Climate Information Services
CRA	Climate Resilient Agriculture
CRBS	Climate Resiliency Business School
CrFS	Climate-resilient Field School
DA	Department of Agriculture
DA-AMAS	DA – Agribusiness and Marketing Assistance Service
DAR	Department of Agrarian Reform
DRR	Disaster Risk Reduction
EWS	Early Warning System
FBS	Farmer Business School
FFS	Farmer Field School
FGD	Focus Group Discussion
IPM	Integrated Pest Management
LCIC	Local Climate Information Center
LTF	Local Farmer Technician
MLGU	Municipal Local Government Unit
PMCA	Participatory Market Chain Approach
PRA	Participatory Rural Appraisal
PAGASA	Philippine Atmosphere and Geophysical Astronomical Services Administration
PhilRice	Philippines Rice Research Institute
PLGU	Provincial Local Government Unit
R1	Rice Action Watch Network
SRI	System of Rice Intensification
SWOT	Strengths, Weaknesses, Opportunities, Threats [vulnerability/capacity analysis]

Executive Summary

In the face of anthropogenic climate change and its impacts, there is a timely need to build the resilience and sustainability of the Philippine agricultural sector. As an archipelago, the Philippines is one of the more vulnerable countries to climate change due to an increase in incidence of extreme weather events (Garschagen et al 2014). Climate-induced disasters, such as increased flooding, extreme temperatures, and typhoons, cause major disruptions in Philippine agriculture and livelihoods (Mohanty et al 2013). As such, the Philippine agricultural sector must adapt and build resilience to such impacts, which occur with increasing frequency (Garschagen et al 2014). The Farmer Field School (FFS) model is a promising approach to improve resilience in the agricultural sector, particularly among small-scale producers across the Philippines, that builds farmer capacity and empowerment, while improving productivity (Pontius et al 2002). Farmer Field Schools (FFS) originated in the late 1980's in response to pest-management issues in Indonesian rice fields, and quickly diffused across Southeast Asian – and then global – agricultural sectors as a means of a decentralized approach to improve sustainable and productive agriculture (Pontius et al 2002; Phillips et al 2014). The FFS model has since been adopted, adapted, and expanded to address many issues relating to the ecological, social, and economic health of small-scale agricultural settings. It has since expanded to have graduated millions of individuals from a Farmer Field School with knowledge, skills, and capacities to serve as local experts in their own communities. Building resilience implies farmer behavior change, which the FFS model has proven efficacy in diffusing new practices, techniques, and skills to improve productivity (Pontius et al 2002). Therefore, it is important to review the models of FFS as this is a key mechanism to induce change.

This report provides an overall stocktaking of the types of FFS models employed across the Philippines, and to identify best practices in improving farmer productivity and livelihoods, drawing from data collected from April to August 2018 and a review of the relevant literature. Best practices and areas for improvement are synthesized and discussed to provide further recommendations for appropriate models to improve farmer productivity and livelihoods in the face of climate change.

2.7.1 Introduction

1. The purpose of this study[430] is to review the use of Farmer Field Schools (FFS) and similar approaches to the provision of advisory services to farmers in the Philippines with an eye to determining the feasibility of the use of such approaches in the proposed project for Scaling Up Climate Change Adaptation in Agriculture in the Philippines.

2. The study will take stock of which models have been employed across the Philippines and how various actors have been involved. It will critically examine the extent to which these models integrate climate information services (CIS) delivery and a gender-sensitive/socially-inclusive approach. Best practices and overall challenges are discussed and synthesized to make recommendations for an ideal model on which to focus at the national level.

3. This study is based on data collected from April to August 2018. Ten in-depth key informant interviews were conducted with representatives of national offices involved in farmer training models as well as those with expert experience with these models. An additional 27 key informant interviews were conducted with regional representatives and implementors of farming training models across Luzon, Visayas, and Mindanao. Finally, 12 focus group discussions were held with a total of 117 men and women farmers who have participated in prioritized farmer training models. Summaries and key insights gained from these multiple data sources and the literature form the basis of the study findings and conclusions. Four different farmer training models were identified at the national level as currently employed across the Philippines. They are the Farmer Field School (FFS), Farmer Business School (FBS), Climate-resilient Field School (CrFS), and Climate Resilient Business School (CRBS). These models, overall, aim to increase farmers' productivity and livelihoods, albeit each taking a different approach.

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[430] The study was prepared by Sarah Eissler, Paula Macandog, Vanya Slavchsevska, Godefroy Grosjean, International Centre for Tropical Agriculture (CIAT)

2.7.2 What is the Farmer Field School Approach?

4. The Farmer Field School (FFS) model was developed in the late 1980's as a tool to increase farmer capacity, skills, and knowledge in a participatory and localized fashion. The genesis of the FFS training model came from issues with pest management on Javanese rice farms, where farmers were overusing and abusing heavily promoted and toxic pesticides and chemicals, resulting in harmful outcomes to the fields and the farmers' health. The Indonesian government, in collaboration with the FAO and USAID, developed a decentralized training program (the FFS) to graduate farmers as local experts in managing their own field's ecology, yielding better productivity, increased profits, fewer problems, and reduced risk to their own health and environment (Pontius et al 2002; Phillips et al 2014). Overall, the FFS approach draws from informal adult educational principles, whereas it enables each participant to master their own knowledge and co-produce the knowledge during each training, facilitates a setting where participants work collaboratively in groups and establish collective action mechanisms, and graduates each participant with the skills, knowledge, and capacities to diffuse their knowledge gained to help others within and outside their community (Phillips et al 2014).

5. Also, the decentralized approach of the FFS model enabled the diffusion of *localized recommendations* appropriate to the community- and field-level. Prior to the FFS model, a major challenge in agricultural development was the tendency to give generalized recommendations to a large swath of farmers across highly heterogeneous ecological and socially categorized areas, resulting in poor uptake and results. Large ecological heterogeneity also limited governments' ability to effectively monitor and forecast systems, resulting in even poorer recommendations or lack of knowledge. The decentralized approach to the FFS model addresses this major issue in that it co-develops knowledge and localized solutions/recommendations with the farmers who are most knowledgeable about their fields, placing the control of small-scale agro-ecosystems in the hands of the people who manage them (Pontius et al 2002; Phillips et al 2014).

6. Since its inception in the late 1980's for purposes of IPM on Javanese rice fields, this model has evolved and adapted to apply in many other contexts and has expanded to serve many other purposes beyond IPM (and even agriculture). FFS models (and adapted versions) have been employed to multiple contexts in Asia and globally, reaching over 15 million people in over 90 countries (Phillips et al 2014). For example, FFS-like models have been used across Southeast Asia, sub-Saharan Africa, the Caribbean, Latin America, MENA, Central and Eastern Europe to address cropping systems for a variety of crops, fisheries, forestry, livestock, soil management, groundwater management, agroforestry, and more (Ooi 2003; CIP-UPWARD 2003; Miagostovich 2004; Ochoa 2003). FFS has also been adapted to improve facets of livelihood wellbeing and capacity building, such as illiteracy and health and HIV/AIDS (Vuthang 2003; Rahadi & Widagdo 2003). The FFS has proved to be an efficient approach in improving farm productivity (Rola et al 2002; Zuger Caceres 2004; Tsiboe et al 2016) and has expanded to improve other dimensions of crop management, livelihoods, and community life as well (CIP-UPWARD 2003).

7. In the Philippines, the Department of Agriculture (DA) and other governmental and non-governmental agencies have adopted and expanded the FFS model (and its adaptation) across the country to empower farmers as field experts with localized knowledge and to improve productivity and profits at the farm-gate.

How do Farmer Field Schools function?

8. The fundamental structure of an FFS model is based on several key guiding principles. As per Braun et al (2005), these main principles include:

- Learner-centered, field-based, experiential learning

- Observation, analysis, assessment, and experimentation over a sufficient time period to understand dynamics of agro- and socio-ecological relationships
- Peer-reviewed and joint decision-making based on learning outcomes
- Individual and group capacity building

9. These principles guide the design of the curriculum, training, conduction, and evaluation of each FFS model to ensure maximum efficiency in building capacity for each participant. Several key components are needed to successfully run each FFS model (as described by Braun et al 2005; Gallagher 2003). It is important to note these are the essential components, whereas adaptations of the model may include and elaborate additional components.

10. Essentially, an FFS model is run with a group of people on a regular basis to study the 'how and why' of a particular topic. First, it is essential to have a group of people with a common interest – a certain topic, crop, issue, etc. – who are brought together to be the participants of the FFS model. Second, participants must need to meet in a field or common space, where the hands-on, experiential learning can take place. Field situations provide a much more comfortable learning environment than classrooms for most small-scale farmers. Third, a technically competent facilitator is needed to guide discussion and lead participants through the hands-on learning exercises. The facilitator needs to be comfortable and trained in the FFS model approach, as well as be someone who can be (or already is) trusted within the community. Facilitators have specific training on facilitation, technical, and organizational skills. Fourth, the training uses the FFS curriculum, which follows the natural cycle of the subject/topic studied (ie., seed to seed), allowing all topics of a season to be covered during the training. The most important part of the curriculum is that there are no lectures and they follow experiential, hands-on learning exercises that focus on both the *how* and the *why*.

11. An agroecosystem analysis activity (AESA) is incorporated throughout FFS trainings to encourage participants to view their farms/systems as a dynamic, ecological system influenced by many factors (Gallagher 2003). Often this FFS curriculum is combined with exercises to address the main focus, e.g rice production, but also incorporates other topics, such as literacy, deemed important by the selection group. Fifth, and finally, each FFS model is situated as part of a larger organization or agency, and there needs to be a program leader who coordinates all logistics and components of the FFS model. This person is also likely for the M&E of each model implementation. And within this organization, financing is a critical component of each FFS model implementation. Budgets for FFS implementation range widely from place to place, depending on transportation costs, group learning and training costs, and the organization and coordination of the trainings.

12. In summary, the five main components of an FFS model are:

- A group of participants gathered around a common interest (crop, issue, technique, etc.)
- A common space or field to hold the training activities
- A facilitator who is trusted within the target community and trained in the FFS approach
- A curriculum to guide the season-long trainings, based in hands-on, experiential-learning
- Host organization that takes responsibility for financing, program leader, and M&E

2.7.3 What have been the Strengths and Weaknesses of the FFS Approach?

13. **Strengths.** In general, the FFS approach has had many strengths and advantages to improve productivity and livelihoods for small-scale agricultural settings around the world. Conventional extension has fallen short of providing farmers with the needed, localized, and appropriate recommendations to solve or ameliorate the complex challenges they are experiencing, often resulting in a lack of trust between the farmer and the extension agent (Braun et al 2005). Extension

agents have not had the capacity, resources, training, or time to serve all the needs for their represented farmers and often result to blanket recommendations, which rarely work. Hands-on, knowledge intensive, and localized education has been needed to improve farmers' knowledge, skills, and capacity to handle issues that arise. The FFS model has facilitated this kind of learning, where issues and topics are decided in tandem. That is, farmers and extension decide together and discover solutions through hands-on, experiential, reflective, and co-produced learning (Schmidt et al 1997). This has provided farmers with skills and built their capacity. It has fostered farmer-to-farmer extension models where skills gained during the FFS trainings could be transferred by the participants to others who did not attend.

14. The FFS approach has enabled participants to conduct experiments, do self-reflection, and work together to come up with effective and localized solutions to challenges. Not only has this allowed for farmers to address issues, but also to develop the skills needed to adapt and respond to issues as they arise in the future. It has taught the *process* of identifying an issue, collaborating on possible solutions, conducting experiments and agroecosystem analyses, and reflecting on their actions and the results. The FFS model has built human capacity and empowerment, providing a venue for farmers to come together and work collaboratively on issues that they all experience. Leadership and collaborative skills have been fostered during the FFS training period. It has provided an opportunity for farmers to formally organize and establish leadership positions, which can further strengthen their individual capacity as well as their community's capacity for adapting and responding to challenges as they arise (Duveskog & Friis-Hansen 2008; Friis-Hansen & Duveskog 2011). These trainings also have been able to increase individual confidence (particularly for women) and foster opportunities for farmers to utilize their voice and have it heard in decision-making processes (Friis-Hansen & Duveskog 2011).

15. The informal nature of the FFS approach has also made a comfortable environment for other issues of livelihood importance, such as HIV/AIDS or family planning, to be raised and identify solutions, such as breaking down social barriers. While not directly related to agricultural productivity, these issues impact livelihoods and individual health, which in turn will have impacts on household productivity and well-being. In summary, the FFS model has provided an important forum for building human capacity, empowerment, and social capital, which in turn can ensure successful procurement of services for the community at large (Braun et al 2005; Duveskog & Friis-Hansen 2008; Hagman & Chuma 1999).

16. **Weaknesses**. While the FFS approach has shown to be a very effective model to improve farmers' capacity, empowerment, and skill-building, and to address complex challenges needing localized solutions, it does have several weaknesses. These have hindered its overall success or efficacy. The FFS model is costly to develop and implement. With national agricultural budgets tightening, it can be challenging to find stable sources of funding within national budget lines or from external sources to sustain the success of the FFS implementation. It requires appropriately trained and sufficient numbers of extension agents to facilitate the trainings. One proposed solution has been to train graduates of the FFS to lead additional FFS trainings, whereby instilling farmer-led FFS trainings. This approach shifts a chunk of costs to the farming community, however experiences with this approach suggests this is not as effective in maintaining the rigor and training necessary for an FFS (Quizon et al 2001).

17. While the model has standardized procedures, the decentralized nature of the training model makes it vulnerable to poor quality extension staff or poor implementation, varying from FFS to FFS. The quality of the FFS training, as with any teaching or training situation, greatly depends on and fluctuates with the quality of its trainers and facilitators. Ideally, the agency or organization implementing the FFS has the necessary supports available – like agents on staff for continued learning and follow up questions, necessary inputs, follow up visits – and the budget to conduct monitoring and evaluation (M&E) to improve. However, this is not always the case as it greatly depends on available resources, staff, time, and priorities of the implementing agency.

18. There is little evidence of long-term impacts of FFS on productivity or livelihoods indicators. All M&E conducted on existing models provide evidence of positive short-term impacts, but scarcely address longer term impacts, or even how to measure those impacts (Braun et al 2005). This has great implications for how and where to obtain financial support for FFS implementation, whether as an educational investment or as an extension activity (Braun et al 2005). Additionally, with regard to M&E, many of the positive results of FFS trainings are increases in empowerment and capacity levels of individuals. It has been a challenge to develop a quantifiable scale for which to measure these impacts. Overall, costs and lack of sufficient M&E have been cited as major challenges for FFS implementation across the literature (Braun et al 2005).

19. While the FFS model yields positive results for productivity and livelihood wellbeing, it does not address issues of profitability and overcoming market access barriers faced by so many in rural areas (Braun et al 2005). Infrastructure challenges, such as poor communication, means of transportation, or roads challenge and hinder farmers' ability to bring their increased production to market. While the FFS model does foster collaborative action and instill strong organizational and managerial skills, it does not provide training or exercises specific to the business or entrepreneurial components of a production scheme. This is largely viewed as a weakness of the FFS model, and other models have used Farmer Business Schools (FBS), where the entire curriculum focuses on aspects of marketing and business skills (FAO 2015).

20. Finally, lack of gender-sensitivity and social-inclusion have been weaknesses in FFS implementation. Often, the most vulnerable, marginalized, or disaffected populations are those that do not benefit from FFS trainings as they are generally time-poor or do not have the necessary resources to attend the trainings. And across the literature, indicators for FFS targeting are not always equity-based, which often results in the poorest and most marginalized being overlooked from being invited or able to attend (Phillips et al 2014). Short-term needs are priorities for the poorest of the poor, and they would generally need to be spending their time looking for employment opportunities rather than at a training (van de Pol 2003; Phillips et al 2014). Marginalized groups or people may also not have the self-confidence to join the training or feel comfortable speaking publicly and participation (van de Pol 2003).

21. There may also be less visible barriers to participation, such as timing and location of the FFS trainings, and if they conflict with daily responsibilities. For example, women may be targeted and invited to attend FFS trainings, but FFS often are not effective in actually reaching women participants. Women sometimes are overlooked based on selection criteria (ie., do not own land, have a high enough education level, or participate in a formal farmer group) (Danida 2011; Najjar 2009) or are limited in their involvement due to other factors, such as lack of time (need to care for children or prepare meals) or lack of male support (Najjar 2009; Tracy 2007). Efforts should be concerted to reduce barriers for all people to attend the trainings, as well as an evaluation of targeting criteria used to ensure that inequalities are not reinforced. The major strengths and weaknesses of the FFS approach are summarized in Table 1.

Table 1. Strengths and Weaknesses of FFS

Strengths of the FFS Approach
• Localized recommendations, geographically-specific solutions • Human capacity building and empowerment • Builds self-confidence • Facilitates collaboration and collective action • Enables farmer-to-farmer extension

Weaknesses of the FFS Approach
• Costs are high; each training needs a sustainable source of funding • Requires highly trained and sufficient number of extension agents • Decentralization results in a fluctuation of quality for each FFS • Lack of resources for post-FFS support or M&E • FFS does not involve issues relating to marketing and value-added; focus on productivity but not profitability • Little focus on gender/social inclusion integration

2.7.4 Overview of Farmer Training and Climate Advisory Models in the Philippines

22. Four different types of farmer training models were identified at the national level as currently employed across the Philippines, highlighted in Table 2. Figure 1 demonstrates a network of actors at the national level who are involved in the development and implementation of these different farmer training models. The Department of Agricultural Research (DAR) runs the CRFPSP, a widely implemented climate-related support system and program. While not a farmer training model, it is an important source of information and support to implementing climate-related activities across the Philippines. The individual farmer training models employed across the Philippines include the Farmer Field School (FFS – focused on production), the Farmer Business School (FBS – focused on market orientation, access, and entrepreneurship), Climate Field School (CFS – focused on climate change awareness and integration), Climate-Resilient Business School (CRBS – integrating aspects of climate change awareness and business practices), and the Climate-Resilient Field School (CrFS – integrating aspects of production, business, and climate awareness).

23. The FFS model has been employed across the Philippines by the Department of Agriculture at the national and regional levels. The overall objectives of the FFS in the Philippines have been to: 1) increase adoption of technology with the aim of increasing income and resilience for farmers and 2) to increase farm production and competitiveness. These FFS models have been generally crop specific.

Table 2. Description of National Models Employed in the Philippines

Model	**Who Runs It**	**Description**	**Crop Focus**
FFS	Department of Agriculture ATI (entity of the DA) PhilRice (entity of the DA)	Increasing farmer production and competitiveness	Depends on region and priority (Commodity Neutral)
FBS	ATI CIP DA	Increasing farmer production, market-orientation, and entrepreneurship	Commodity Neutral

CFS | CRBS	DA ATI BSWM	Increasing farmer and extension agent awareness of climate change and its impacts on agriculture	Commodity Neutral; in this study – focused on rice only
CrFS	R1 [collaboration with many NGO partners, as well as LGUs]	Build farmer capacity in the face of climate change across agriculture and livelihood impacts	Depends on the needs and priority of the community [does promote organic and diversified farming systems]

24. The FBS model aims to enhance the capacity of farmers in farm business management and market-oriented production and overall household food security by contributing to improved market access and increased farm incomes. Overall objectives of the FBS are to: 1) form and strengthen farmer groups for marketing-oriented learning and action; 2) to identify and describe key actors and their roles in agriculture value chains; 3) analyze and prioritize value chain opportunities towards increasing business profitability of farmer groups and their individuals members; 4) introduce technological, commercial and institutional innovations in collaboration with other chain actors and stakeholders to respond to market opportunities; 5) develop a business plan to make use of new market opportunity by building on innovations; and 6) develop strategies for enhancing farmers' access and use of business development support services. By the end of the FBS training, farmers should have developed a strong business plan for their farm and have initiated these business practices. Additionally, there is no particular crop focus in the FBS model; the FBS operates on value chains identified by the needs and priorities of the communities.

25. The CFS model aims to enhance adaptive capacity of small-scale producers, and address poverty, vulnerability and their root causes. The CFS model was first implemented in 2007, in response to poor local advisories for rice farmers in Western Visayas. With support of USAID and PAGASA, the LGU in Dumangas developed the CFS model to increase knowledge of localized weather information for more accurate and effective advisories. The goal of implementing the CFS was to reduce disaster risks and enhance the capacity of farmers, extension workers, rural women and other stakeholders to understand the role of climate in plants propagation, growth and development as well as its relationship to plant pests and diseases. Running three separate training models (FFS, FBS, CFS) [each requiring four months and 2 extension staff] proved inefficient, exhausting, and challenging for the farmers/participants to attend. The DA mandated ATI streamline the three models in one model that incorporates all three topics. ATI developed the CRBS training curriculum and implementation model. Both the CFS and CRBS models operate based on any crop focus, depending on the priority and needs of the participant group.

26. Modeled after FFS and CFS training programs, the CrFS model was developed in 2010 and piloted in 2011 towards a climate-informed, sustainable and resilient agriculture training model for farmers. The overall, unique objective of the CrFS model is to liaise with PAGASA in establishing localized AWS/EWS for agriculture, utilizing local weather data to better inform climate advisories and short-term forecasts. After the devastating Typhoon Haiyan in 2015, R1 received a significant increase in funding and was able to adapt the CrFS model to incorporate a livelihoods approach, focused on more diversified systems and sources of income to increase overall livelihoods as well as production. There is no specific crop focus of the CrFS model, but it does promote organic farming and diversified agricultural systems as best practices for climate-resiliency.

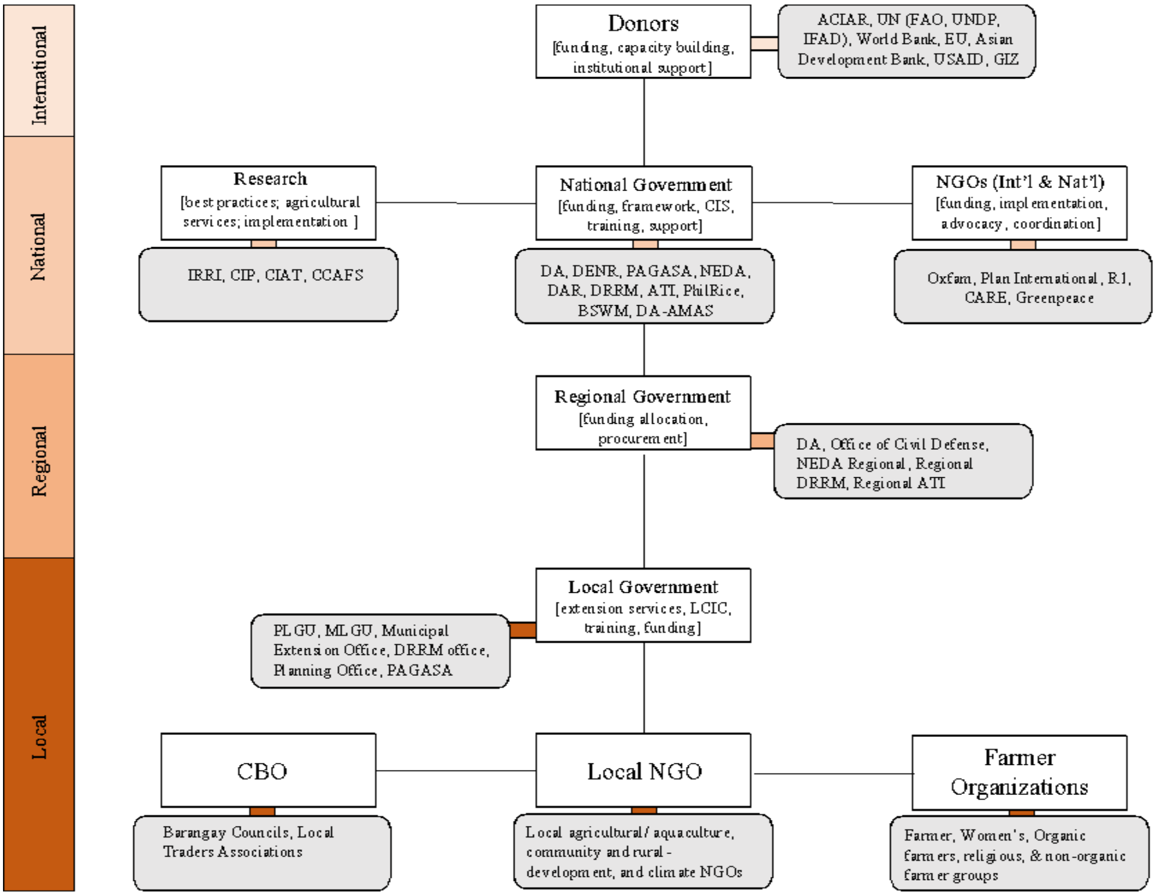
27. Further comprehensive descriptions of each model are presented in the Appendix.

Key FFS Stakeholders

28. Figure 1 shows the institutions that have been involved with Farmer Field School approaches at various levels. This constellation of institutions is focused at the national level, whereas the region- and local-specific network depend on the type of model implemented. Agency interaction, cooperation, and dynamics are discussed below as they relate to the specific models that are run. Further discussion is included in the comprehensive descriptions of each model employed below.

29. The FFS is facilitated and implemented by the Department of Agriculture (DA) in collaboration with many partners such as government agencies, NGOs, and other entities. The National DA develops the national framework and curriculum, which is then disseminated to the regional DA offices who hold autonomy in their respective region. At the regional level, the provincial and municipal DA offices, LGUs, State Universities and Colleges, Municipal Agricultural Office (MAO), and Farmers Associations are engaged with the facilitation and implementation of the FFS. The DA also serves as a major funding mechanism to fund the implementation of the FFS model at the regional level; the DA also serves as a critical funding source for several other operational models (FBS, CrFS, CRBS). The DA houses the Agriculture Training Institute (ATI), which is responsible for developing curricula, training materials, and training the trainers at national and regional levels for the FFS and other models. PhilRice is also an entity attached to the DA since 1985. It is entirely focused on improving the competitiveness of Filipino rice farmers via high-yielding and cost-reducing technologies. The institute coordinates with a network of 57 agencies and 70 seed centers nationwide. FFS focused on rice production are implemented by PhilRice agents and experts who coordinate and run the FFS trainings.

Figure 1: Stakeholder Map of Institutions Working with FFS



30. The Climate-Resilient Field School, implemented by the NGO Rice Watch Action Network that is referred to as R1. It focuses on building capacity in the face of climate change across agriculture and livelihood impacts. R1's mission is to improve sustainable rice production and livelihoods for rice farmers, through action and policy changes, working closely and heavily with many different partners across all governmental levels in the Philippines, as well as NGOs and major international donors. The CrFS model began in 2011 and is orchestrated by this network of partnerships, including R1 (implementor), PAGASA, national government agencies including DA, international donors such as Oxfam, LGUs, and additional NGO partners. The model promotes organic farming and diversification as resilient strategies and runs on any crop, depending on the needs and priorities of the community.

31. The Farmer Business School (FBS) model was developed by the International Potato Center (CIP) in 2008 in response to findings that farmers participating in the FFS models lacked critical skills to effectively engage with markets. The FBS model combines a Participatory Market Chain Approach (PMCA) with the FFS model and engages farmers in a participatory action learning process focused on improving agricultural value chains. The PMCA approach "facilitates participatory processes among different market chain actors to stimulate joint innovations based on shared ideas and trust" (CIP 2017). It was first piloted in Indonesia from 2008-2010 with funding from ACIAR to improve linking West Javanese vegetable farmers to markets. In 2012, the FBS model was adapted to the Philippines context. CIP partnered with the DA-CHARMP program, and with funding from IFAD and CCAFS, the FBS model was piloted in 6 communities and then scaled to 32. After a mid-project M&E, climate change and gender focus components were integrated into the model in 2014.

32. DAR is mandated to conduct climate change mainstreaming under the Climate Change Act of 2009. Their areas of focus include DRR, reducing vulnerability and increasing resilience to climate

change, and monitoring all impacts of climate change. Through the CRFPSP, DAR mainstreams support services, increases machinery support and farm mechanization, and provides tools for maximizing farm production. All areas of their approach include climate change preparation, mitigation, and adaptation components. In their capacity, DAR's essential functions are to provide a framework, distribution network, and support services to the farmers, as well as to assist in training and curriculum development to agencies conducting farmer training models.

Key Logistical Information

33. **FFS & FBS**. At the regional level, the logistics of organizing an FFS and FBS are similar and explained as follows. The regional ATI and DA offices conduct the training of trainers for Agriculture Extension Workers (AEW) or Agricultural Technicians (AT) and fund these trainings. FFS/FBS models are run crop-specifically, under 'banner programs' in the DA office that focus totally on one crop or type of crops. For example, the DA office in the Luzon CAR region has banner programs for rice, corn, high value crops, livestock, and others. Each banner program has a Field Operation Division that processes all administrative activities for any program run under their banner. Provincial and municipal LGUs work together with the MAO to identify AEWS and ATs to attend the training of trainers, write proposals for an FFS/FBS in their locality, identify target areas for implementation, and work with the Barangay council to identify farmer participants. AEWs serve as facilitators of FFS. The Barangay council works closely with farmer organizations and cooperatives to identify and invite participants for the FFS/FBS.

34. The duration of the FFS/FBS depends on the crop focus as each crop has their own cropping season as well as differ in production activities. The duration of the FFS/FBS training is also dependent on the requirements and needs of the farmers who participate. Generally, an FFS and FBS training lasts 4-5 months (16-18 weeks) and occur once a week, usually in the morning. FBS and FFS are run multiple times a year, and the time and length are dependent on the needs of the farmers and funds available. The number of FFS or FBS models run in a region for each year depends on the mandate from the national DA office to conduct a certain number of trainings for different crops each year. For example, 10 FFS were run within Region 8 in Visayas as mandated by the national DA office in 2017. LGUs are critical to the success of the FFS implementation, as they are responsible for identifying and organizing farmers, providing snacks during the trainings, and facilitating the trainings. LGUs also write training proposals to conduct the FFS in their locality; they identify and send individuals for training at ATI to become AEWs and ATs. And LGUs dispatch vehicles to deliver supplies and materials in the demonstration site.

35. For FFS, participants range from 30-35 farmers for each training and in Luzon CAR region, 60% of attendees are female and 40% are male. For FBS, participants range from 25-30 farmers for each training. In Luzon CAR region, 70% of attendees are female and 30% are male. All meetings are held within the community, usually either at the house of the leader of the farmer group, Barangay hall, or one of the farms of a participant, depending on the needs of the training that day. Farmers generally cover their own transportation costs.

36. Post training supports are provided by the regional ATI and DA offices as well as the facilitating LGU. The local implementors conduct an evaluation to gather feedback from the participants and incorporate this feedback into the curriculum delivery for the next training.

37. **CFBS.** At the regional level, the ATI office employs the CFBS model, which is a recent training model combining elements of FFS, FBS, and CFS to prove more efficient training on relevant topics across all three models. The delivery of the CFBS model depends totally on the recommendation of the ATI Central Office and proposals submitted by LGUs for training. The regional ATI office conducts a training of trainers and funds to support CFBS, while the Career Development Management Services Section of the ATI office is the division responsible for conducting a CFBS. Similar to FFS/FBS, the MLGU

and MAO work together to send individuals for training to become AEWs and ATs, identify target areas for conducting the CFBS, and facilitate the training. Barangay councils work with the farmer organizations and cooperatives to identify participants. Resource persons are expert individuals from various different organizations or agencies that are invited to the CFBS training to give 'special topics' trainings. In Luzon CAR region, the CFBS was first implemented in the region in 2015 and as a rice funded training model, it only focuses on rice throughout the region. Generally, 25 to 30 farmers participate in each training, and a majority (90%) of those are women. It generally takes 4-5 months to complete in lowland areas, and 5-6 months to complete in upland areas, taking place from 8-12pm in the morning once a week at one participants' house or field. Funding for the CFBS training comes from the ATI budget but used for implementation by the LGUs. Across the regional study, the CFBS training is only available to rice farmers (Mindanao Region XI, and Luzon Region CAR).

38. **CrFS.** At the regional level, the facilitator works with the village leader to invite anyone within the community (open invitation) to participate in the first meeting ("calendar meeting") and to participate in the trainings. The village leader coordinates and facilitates the invitation to the community. The CrFS model runs the course of a regular season for whichever agricultural system is the focus. Twice a year at the beginning of the season, R1 holds a Climate Forum to discuss the seasonal forecast. And the model is usually held for 16 weeks or more (most agricultural systems), and sometimes, particularly in coastal areas, it will run for about 2 months. The first meeting is called the "Calendar Meeting," where the facilitator and participants decide on what topics to focus for the training. The facilitator also conducts baselining of vulnerability and capacity at this meeting. The CrFS training incorporates <u>all</u> topics from inputs, farm production, harvesting & storage, and product marketing.

39. A total of 30-35 men and women participate in each CrFS model training. Participants organize into small groups, and they meet once a week during the season (4-5 months long) (Oxfam 2015).

40. Central to the CrFS model is CIS delivery. CIS is disseminated to farmers and community members in several ways. First, short-term and seasonal forecasts are broadcasted over local radio programs as well as community bulletins. Digital and banner weather boards are also implemented within the community to display weather forecasts; these are updated 1x/week. Finally, with funding from Greenpeace, R1 piloted an SMS forecast system using the Chica data system in 2014. This enabled participants to give real-time and localized feedback data to check the validity and reliability of localized forecasts from the LCICs. Unfortunately, the Chica system shut down in 2018, and R1 is still deciding which system (Globe or Smart) to use to continue the program based on cost differentials. There is a slight delay in this SMS program returning, but it was wildly successful and will return soon. In an interview with a DA representative, they indicated that the R1 model was the best approach for CIS and climate-knowledge integration into trainings and practices. They are planning on incorporating the CrFS model across the AMIA3 villages.

41. The costs of running the CrFS model depend on which year the program is in (1st year vs. additional years) and R1's availability of funds. R1 lobbies support from many international donors and the DA, but their overall budget fluctuates based on their total support. R1's National Investment Plan covers 1) CIS, 2) CrFS services and 3) community incubation for enterprise development. For Year 1, the total cost to implement the CrFS model with 1 LGU (to be implemented in 2-3 villages within the municipality) is 1.5 million pesos. This cost includes training for 2 LGU staff, implementation of an AWS at the LGU, SMS and livelihood incubation, and R1's staff for mentoring and training. Costs for food depend on R1's contract with the LGU, sometimes R1 covers food expenses and sometimes the LGU covers those expenses. PAGASA's costs (for implementation, training, and services) are covered in R1's budget; however, more recently PAGASA has been covering their own travel. For Year 2, the costs for R1 to implement the model goes down to about 1.2 million pesos. The implementation and training of the AWS and less training is required in year 2. The idea with this approach is that slowly, the LGU will establish a budget line for implementation of the CrFS model each year and R1 will no

longer be involved. Table 3 highlights logistical differences across the four identified models presented above.

Table 3. Logistics for Prioritized Farmer Training Models

Model	Duration	Staff	Costs	Focus	Responsible Office	Criteria for Selecting Participants	Total Participants	Gender
FFS	4 months	2 Facilitators (LGU) 1 Focal Person (ATI)	PhP45,000 - 70,000	Crop-specific	DA	Crop-specific areas; Farmer Associations Present; 4th or 5th class status	30-35	60% female 40% male
FBS	4 months	2 Facilitators (LGU) 1 Focal Person (ATI) 1 Focal Person (DA)	PhP70,000	Crop-specific	DA	Crop-specific areas; Farmer Associations Present; 4th or 5th class status	25-30	80% female 20% male
CRBS	4-5 months in lowland areas 5-6 months in upland areas	2 Facilitators (LGU) 1 Focal Person (ATI)	Budget PhP 100,000 but expenses cost PhP70,000	Rice (Luzon CAR)	ATI	Crop-specific areas; Farmer Associations Present; 4th or 5th class status	25-30	90% female 10% male
CrFS	4-5 months	2 Facilitators (LGU) 1 CIS Trainer (PAGASA)	*Year 1 PhP500,000 Year 2 PhP400,000	Organic agriculture	R1	Identifying areas vulnerable to climate risks and poor crop production	30-35	N/A

2.7.5 Challenges and best practices emerging in FFS in the Philippines

42. This section presents most challenging issues and best practices from implementing farmer field schools in the Philippines. Particular attention is given to the integration of climate information services and issues of gender sensitivity and social inclusion.

Challenging Issues

43. ***Climate Information Systems: Content and Delivery*** While climate information is increasingly becoming a major priority across all agriculture-related activities in the Philippines, its integration into FFS models is not yet very strong. Climate information topics are covered in the training of trainers, conducted by ATI, so that FFS facilitators are knowledgeable about climate-related topics and solutions. However, this information is not yet diffused to the FFS curriculum. Additionally, several implementors indicated that they themselves are not so educated in climate-related information and would like to be more informed on this topic so that they can relay this onto the farmers. One exception is the CrFS model, which employs strong and innovative integration of CIS and climate-related knowledge into its curriculum and activities at the field level.

44. ***Gender Sensitivity and Social Inclusion***. Overall, there is a lack of comprehensive gender-sensitive and socially-inclusive integrations into the national frameworks of the farmer training models employed across the Philippines. Consistent with the literature, farmer training models such as FFS do not adequately consider gender or social inclusion into their design and implementation. There is little evidence coming from rigorous or large-scale studies about the impacts of any of these models and particularly on their gender differentiated impacts. Across the informant interviews, the extent of a gender-sensitive approach began and concluded with participation quotas, which were not always met.

45. Most organizations at the national level explained their “gender-sensitivity” amounted to a nationally mandated 30% female participation quota, but further indicated that women do not want to participate and therefore they cannot meet these quotas. They do not turn away anyone who wants to participate, who are often males, and thus there is an overrepresentation of male participants of FFS and other farmer training models. Overall, there is little discussion or active steps taken to identify or reduce barriers for female or other marginalized group participation in farmer training models at the national level. However, at the regional level, evidence shows that women are eager to participate in FFS trainings and mostly make up the majority of participants during certain FFS trainings, as men were busy in the field during the day time (when FFS are usually held). In summary, the national level actors perceive men to be the predominant participant, whereas the regional level actors (implementors, representatives, and farmers) perceive the predominant participant to be women. This discrepancy highlights the need for effective M&E systems built into the entire FFS framework (from the national level) that looks into issues of gender sensitivity.

46. ***Overall Challenges.*** Across all farmer training models employed in the Philippines, several overall challenges emerged. However, challenges pertaining to the implementation of all farmer training models, specific to the Philippines, are identified here.

47. <u>Training in production versus business</u>. Models that focus on only production or only on business are challenged because farmers need training and skills in both areas but do not have the time necessary to complete separate trainings. In addition, important training and skill building for climate-related knowledge and climate information services are often not integrated. The devolved approach of holding separate farmer trainings is inefficient. For example, the FFS model only focuses on production level topics and does not include marketing or business-related issues. The regional CAR DA office in Luzon explains it is challenged to update the curriculum to focus on all aspects of the value chain, which is more needed from farmers rather than just the production level information.

48. Farmer time and attention. Overall, time and participants' attention can be an implementation challenge. Most participants who attend trainings are over 50 years old and lose attention after a few hours. As models usually run for at least a half-day, trainings can be rendered ineffective as farmers lose attention. Additionally, those targeted to participate in farmer training models are often time-poor, in that they do not have additional time to spend at a training where they could be seeking additional employment opportunities. Several farmers indicated that attending the trainings cause them to be late to tend to their own daily work needs, which is frustrating. This is a major challenge across all FFS implementation (Braun et al 2005). Another challenge is organizing farmers into cooperatives or farmer organizations to ease facilitation of the trainings. And sometimes, the technologies and curriculum diffused in the trainings are too complicated or unsuitable for the area. As suggested by the regional CAR DA office in Luzon, curriculum and suggested technologies should be reviewed and simplified to ensure they are suitable and applicable to the target areas.

49. Trust between government and farmers. In certain provinces in the Philippines, depending on government involvement, trust between farmers and the governmental units can pose an issue. Anecdotally, Filipino farmers generally have trust in agricultural agents, however this does depend greatly on agricultural involvement and prioritization of the regional government offices and LGUs, which varies from region to region. As a result of potential mistrust, DA agents and facilitators need to convince farmers to attend the trainings or they need to stay in the villages for longer periods to build trust. This is a challenge as it incurs more time and resources needed for implementation. Trust building incurs time, which is not always available in human-capacity and budget-restricted agencies.

50. Logistical Issues. Several logistical issues present challenges for implementing successful farmer training models. Natural disasters and climate induced challenges present an issue for trainers and staff to access barangays to conduct the trainings as well as hinder participation. Additionally, these calamities can severely damage villages and fields so that trainings either must be delayed or cancelled. Representatives of the DA office in Region XI of Mindanao explained that if a typhoon or flood hit the area of the training, the experiments and lessons cannot continue as they are no longer chronologically conducted and thus will need to be redone, taking a lot more time than expected. Coffee farmers from Region XI in Mindanao explained that they sometimes cannot attend trainings because the roads are too poor from their homes to the training and with heavy rainfall, the travel becomes impossible. The farmers suggested having a pair of boots would make it easier to travel to the trainings because if they cannot get there by motorbike, they can get there by foot.

51. Political commitment and funding. Another major challenge across all farmer training models is the political and dynamic nature of funding. With each turnover of administration at the regional or local level, the level of priority accorded to agriculture can change. Agriculture is not always a top political priority across regional policies. Additionally, national offices prioritize examining how much money regional offices spent as opposed to what was actually accomplished, which has caused frustration amongst regional DA offices. LGU support is critical in implementing the different models, but not all LGUs are supportive of training implementation, mostly because they lack human capacity, resources, or funding. Political conflict also hinders resources and support to agricultural activities. It can take a lot of negotiating and leveraging political strategies to ensure the support of the LGU, which is not always successful. The regional DA and its representatives need to discuss with the LGUs and explain the importance of the model implementation for helping their farmers.

52. Human Capacity. Inconsistency in attendance for both the trainers and the participants is an issue spanning across all models discussed in this study. The CAR regional DA office indicated that due to inconsistencies in attendance for their FBS trainings, the training took 8 total months to complete, when it was supposed to take only 4 months. In Mindanao Region XI, the facilitators for FFS and FBS indicated that farmers stop attending trainings closer to graduation as they 'already have the information they need and can consult with facilitators at any time'. To overcome this, facilitators stopped answering farmers' questions all at once and allow the farmers to learn from each training

on their own and by doing. Conflict is also concerning for farmers, where in Mindanao Region XI, farmers indicate that armed conflict hinders their motivation to attend trainings.

53. Institutional Capacity. Finally, another challenge to implementing effective farmer training models is the lack of institutional capacity to ensure the optimal success of each training. At the most local level, the trainings are reliant on efficient and effective LGUs motivated to achieve success for each training. The technical capacity of the AEWs and ATs (facilitators for DA-run trainings) is a challenge, as not all meet requirements to adapt to farmers' needs, communicate technical information, or be responsive and timely for submitting reports. Also, several farmers indicated that facilitators sometimes come late or do not show up at all, frustrating the participants and causing a lack of moral and motivation to want to attend the next training. The lack of M&E capacity is a challenge due to lack of budgets, personnel to conduct the evaluations, and the geographic location for some villages, where long traveling to monitor the trainings is a challenge. Post-training supports for participants is also a challenge due to similar reasons, lack of funding and personnel to continue the supports.

Best Practices

54. Include Agro-Ecosystem Analysis. The agro-ecosystem analysis activity is a very useful part of the traditional FFS model, the FFS models run by the DA already also employ this activity. It is conducted weekly, early morning on the farm. It can include group field observation, analysis, and decision-making where the farmers observe different production factors on the farm that can affect crop production, discuss these factors, then come up with reasonable and effective farm management recommendations.

55. Incorporate localized weather forecasts. In one model PAGASA liaises with the farmer training school to establish AWS and EWS at the municipal level. Localized weather information enables the LGUs to predict more accurate forecasts and advisories for their farmers.

56. Engage farmers in climate data collection and advisory services. The CrFS model actively engages farmers as participants and local researchers to collect data from their farms on climate metrics such as rainfall, using an old milk can, and report data back to the municipal weather system. This directly involves farmers in the process, who can then make their own observations linking traditional knowledge with science and increases the localized knowledge of weather patterns for the municipal LGUs. Through the SMS information program, participants provide direct feedback to evaluate the accuracy of forecasts, and effectively disseminate real-time weather information and advisories.

57. Promote adaptation of livelihoods not just crop production. Women's needs are better met when the training model takes a livelihood approach to climate-resiliency. To make farmer training inclusive and gender-sensitive, broadening the scope of training to encompass the daily roles and responsibilities of both rural women and men. Certain FFS or other farmer training models do conduct gender sensitive activities specifically aimed at including and empowering women. For example, the FFS on cacao in Mindanao explained they include value-added activities for women to learn how to turn raw cacao into *tablea* (dark chocolates) to sell. They also discuss negotiating techniques for women to influence their husbands' decision-making to allow them to make and sell *tablea*, overall improving women's contribution to household income and capacity to contribute in value added activities.

58. Choose location, timing to suit learners. Holding training in the village makes it possible for women to participate. Setting the timing to suit their schedules and providing child care for them during participation is also necessary to be inclusive and achieve equal access. Barriers to female participation include time, childcare and household responsibilities, and not having husbands' permission (specifically in Mindanao). However, some FFS and FBS trainings in Mindanao attempt to reduce this barrier by providing childcare and sometimes extra food for women who attend; these

expenses are included in the food budget for each training. But to note, not all trainings provide childcare since it is 'manageable' and 'women's responsibility to care for children' since they voluntarily join trainings (Luzon CAR Region and Visayas Region VIII).

59. Train Local Farmer Technicians for Technology Diffusion and Uptake. Several models identified best practices in technology diffusion and uptake that improve the efficiency of technology diffusion and the likelihood of uptake. The training and integration of the Local Farmer Technicians is identified as a best practice from the DA's training approach. This practice trains local farmer experts, who then diffuse information and technology to other farmers within the village and serve as a trusted local resource outside of the training models. These LFTs provide and advise on local specific interventions and serve as a source of trust amongst farmers during the trainings as well. This also provides graduates of the farmer training models an additional source of employment.

60. Use Learning-by-doing. As consistent with the traditional FFS model (Gallagher 2003), self-discovery learning is another best practice employed across the models. This style of learning places a heavy emphasis on farmer learning-by-doing and self-discovery, whereas the farmers identify for themselves the observations and results of experiments. Farmers are able to come to their own conclusions, which anecdotally improves ownership over the knowledge, increasing the chance of adoption and behavior change. R1's CrFS model employs this approach for climate-related knowledge, combining evidence-based experiential learning with localized weather data. This technique improves municipal understanding of localized weather patterns as well as engages farmers in research enabling them to self-discover weather patterns (ie., changes in rainfall on their farm).

61. Use of Participatory Rural Appraisal techniques. The Participatory Rural Appraisal techniques that are employed across all models ensures targeting the needs of farmers specific to that village as well as engages the farmers and their inputs into the training development. Anecdotal evidence suggests that this increases farmers' participation and ownership over the training materials.

62. Formative Evaluation. A best practice is after every training session, to ask farmers to assess how the session flowed so that facilitators and trainers can continuously improve the training process.

63. Integrate production, marketing and climate topics. Best practice is to take an integrated approach, such as the CrFS and CBFS, addressing these challenges and facilitates training *across* topics (production, marketing, climate) in a similar time span. Organizations like R1 and ATI (partnered with FAO) began implementing one comprehensive model (ie., CrFS and CBFS). However, both of these models could improve in the quality of their integration of all three components. For example, the CrFS model has very innovative and strong integration of climate information services and production knowledge but is weak in its integration of business and entrepreneurial skills. All key informants strongly supported this type of integrated model. It helps to overcome the identified challenges related to lack of farmer interest and participation, and lack of human capacity, and lack of resources across agencies to coordinate models. Across the Philippines, there is a shift towards operating these kinds of models to replace separate FFS, FBS, CFS, etc.

64. Create opportunity for helping farmers organize in formal group. Consistent with the literature, one best practice of all types of farmer training models employed in the Philippines has been to create a venue to formally organize farmers, particularly for areas where farmers have not yet organized. In the Philippines, farmers must be formally organized and apply as a farmer organization to access funds and a range of necessary supports from the regional DA office. The FFS model employed by the Region 4a DA office has used this opportunity to organize farmers that had not yet been organized, and to train farmers on how to access funds and support, like equipment, via proposal writing to the Regional DA office. R1's CrFS incorporates trainings for participants on how to access local government supports in the post-CrFS program.

65. Secure LGU Staff and Financial Support. LGU support has been essential for implementing all types of farmer training models across the Philippines. It has been a deciding factor in whether a

model is run at the provincial or municipal level. Across all farmer training models, a representative or agent of the LGU must be present and active in the model implementation in the villages. As indicated by the CAR regional DA office in Luzon, when the LGUs work together with MAO and DA offices, the implementation process for the CFBS is easy. LGU funding for farmer training is also critical for continued success. It is essential to have a financial longevity plan to sustain the continued success of the farmer training model. For example, incorporated into the CrFS model is to shift the responsibility and funding mechanisms from R1 (who leverages and raises funds from the DA, international organizations, and other implementing agencies like PAGASA) to the LGU office and implementing agencies, slowly integrating expenses into sustainable budget lines.

66. Coordination Among Regional Offices. The success of implementing any farmer training model depends on strong coordination amongst the regional and local offices responsible for funding and implementing the model. For example, the CAR regional DA office in Luzon explains that for an FFS model to be successful, strong coordination between implementors and stakeholders, including the regional, provincial, municipal, and barangay offices, is essential to quality delivery and effectiveness of the FFS training model. Continuous formative evaluation and adapting curriculum and trainings services depends on this strong coordination, so that content and technology delivery is appropriate, suitable, and adoptable at the local level.

67. Help Implement Mainstreaming in Respect of Climate Change Act of 2009. As part of a financial longevity plan to sustain farmer training, it is essential to make good use of resources for mainstreaming climate change that are available at the LGU level. Mainstreaming adaptation to climate change has not always been included in the agriculture agenda and so has not always been a priority at the regional, provincial, or municipal level. And, due to the devolution of agriculture funding in the Philippines, not all LGUs receive funding for agricultural activities. However, climate change mainstreaming and action is mandated by law by the Climate Change Act of 2009; farmer training models that incorporate climate change components can access more local governmental support and have greater success in negotiating financial support. Incorporating climate change mainstreaming or climate information services components to farmer training models better enables facilitators to leverage funding from LGUs, particularly those that do not prioritize or have budgets for agricultural activities.

68. Based on the literature and primary data collected during this study, several best practices and challenges for implementing farmer training models were presented. In summary, the farmer training models employed across the Philippines possess several challenges and best practices examined here in this study. Comprehensively, the CrFS model employed by R1 holds great promise as an effective model that includes important CIS as well as gender sensitivity and social inclusive measures at the national framework level. However, it is not as widely implemented at the regional level, compared to other DA-run models, such as FFS, FBS, and CFBS. These models also hold promise as effective vehicles for knowledge transfer and farmer behavior change to adapt to climate change and improve livelihoods, but also have several areas for improvement.

Appendix I: Comprehensive Description of Models

This section provides a comprehensive description of each model, drawing from information revealed during the key informant interviews and across the literature. This section is informational, aimed at providing deep description of the mechanisms, frameworks, and logistical components required to employ each model at the national level. While providing descriptions of the national framework and approach to each model, this section in limited in that it does not include regional or local insights to the challenges, successes, and modes of implementation at these respective levels.

This information will be included in following sections, highlighting case studies of the three main island groups (Visayas, Luzon, and Mindanao) and models.

Farmer Field School (FFS)

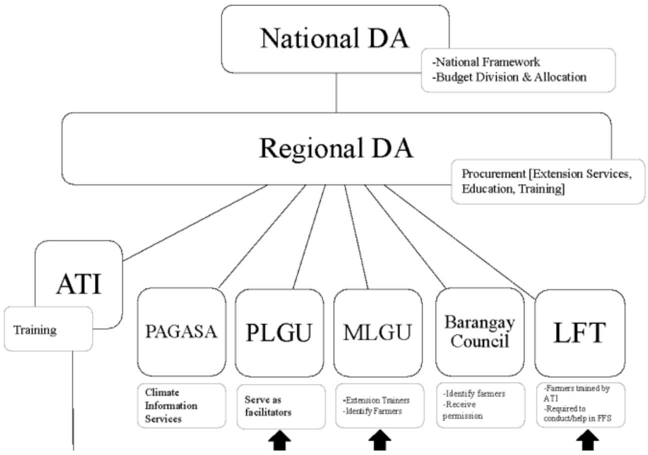
General

To better understand the FFS model, key informant interviews were held with representatives from the National DA office, a former PhilRice agent, and the Region 4a DA office. Additional information comes from further desk research. The FFS objectives are to: 1) increase adoption of technology with the aim of increasing income and resilience for farmers and 2) to increase farm production and competitiveness. The FFS operated by PhilRice is focused on intensive rice production. The FFS model employed by the Regional DA focuses on several different crops, depending on region and priority. In 2017 in region 4a, the FFS models were run for corn and rice.

Infrastructure (National to Regional Level)

The national government level (DA) decides on the frameworks for implementation; the regional level DA offices are only autonomous at the regional level and *must* coordinate with the LGUs to organize the programs (this coordination can involve political motivation). However, it is up to the LGUs to organize and implement the FFS. ATI trains the trainers who will train the farmers and sometimes facilitate the FFS. Figure 2 displays the basic network of actors for implementing an FFS at the local level for the DA. It is important to note that this may be specific to the Region 4a DA Office and will be further explored at the other regional levels to incorporate other potential actors. ATI trains the facilitators and the extension trainers at the PLGU and MLGU levels. ATI also trains farmers within the villages, who graduates with a certificate and title "Local Trained Farmer" (LFT). These are also graduates of the FFS model. The DA provides incentives to these farmers and thus knows where they are located throughout the region; they prioritize areas to implement an FFS in areas where there are LFTs, as they will be required to assist in the trainings. It is mandatory for an extensive agent from the MLGU to be at every FFS. It is also a courtesy and protocol to ask permission to run the training from the Barangay council; it is also for security reasons.

Figure 2: Basic Network of Actors for FFS Implementation



Source: Key Informant Interviews with Region 4a DA & National DA Offices

The regional DA funds the implementation of FFS across the regions. The target number of FFS per year depends on the crop priority level and mostly, the budget allocated for FFS that funding year. For example, in DA Region 4a, the target for 2018 was to hold 31 FFS on rice and 20 FFS on corn (these targets are included for the calendar year, which do not always overlap with the cropping seasons). In 2017, the target was 40 FFS on rice, which was a reduced total number of FFS due to budget prioritization at the regional level.

Curriculum Development

The national DA determines the national curriculum, which is disseminated to the regional offices. ATI is responsible for updating the curriculum; every field worker has the latest version of the curriculum. The curriculum is not tailored towards either gender, nor does it incorporate any gender-sensitive approach in its design. It is designed for "everyone". Climate-related information is not included in the curriculum for the FFS, but it is part of ATI's training of trainers' curriculum.

The training for these FFS come from ATI and PhilRice (for rice specialists). ATI trains facilitators and extension agents at the PLGU and MLGU level. LFT are graduates of the FFS model who also receive training from ATI to be a certified LFT.

Implementation

Targeting Areas: Within the regions, areas for FFS implementation are targeted based off of crop yield indicators. Depending on the crop targeted, the regional DA coordinates with a Regional Seed Coordinator to know the maximum yield potentials for different seeds in the municipalities based on the varieties used. Using this data, low yield municipalities by crop are identified. Sometimes, farmer groups will submit requests for trainings to the regional DA office, to which the regional DA may select and then organize a training in their Barangay. Usually, municipalities with an IPM coordinator or barangays with an LFT will be prioritized for selection.

Identifying Farmers: A local DA agent (for rice: Rice Specialist from PhilRice) will meet with municipal agriculturalist to identify low-yielding villages, and then the agent will set a meeting with the village chiefs to explain the point of the trainings. This is a courtesy and part of the protocol to secure the village chiefs permission, which sometimes can take some political persuading. When permission is granted, together the village chief and the agent will select who will facilitate the trainings (ie., the "president" of the trainings). This person is usually a farm group or village leader. On the second day, the president will be asked to invite farmers to participate (15-20 farmers usually show up the first day and then many more for the next few days). There is no quota for female/male participation.

Course Structure: The FFS is held one time (1x) a week for the first 6 months of the cropping season; then it is held one time (1x) every two weeks during the second 6 months of the season. Each FFS is run for the duration of a cropping season. The trainings are ½ day and are held at a volunteered farm plot, called the "learning field". This is a local farmers' field who has volunteered his land for the demonstrations; he does not receive additional compensation or insurance for doing so (he reaps the benefit if the model was successful or absorbs the risk if it was not).

PRA is used to identify training topics (ie., issues dictated from the farmers needing to be solved). When the FFS focuses on rice, PhilRice agents will conduct two FGDs with the farmers to identify needs, challenges, and areas for improvement. For other FFS models (in region 4a), farmers on the first day of training are organized into 5 groups where they discuss the topics they want to focus on for the training. The most popular topic is selected. The 'learning' field is divided into 5 plots and each group maintains a plot; after each lesson they do "what worked, what didn't work" reflection and discussion sessions. Group dynamic and team building activities are integrated into the trainings as well.

The use of projectors and lecture-style teaching is highly discouraged in the FFS model. The learning is all "learn by doing," "participatory discovery base," and self-discovery learning. Facilitators and technicians are trained in these pedagogical techniques; it is anecdotally known to improve farmer ownership over the knowledge gained at each training.

They hold a Farmer Field Day during the module, where they invite other villages (sans FFS trainings) and as many other farmers as possible to engage in observation, farmer scientist forum (where farmers engage with scientists), and collective work.

Participant Description: Usually, remote and rural farmers will attend the trainings if they hear about them to learn new things; they have less access to readily available information than farmers closer to the markets and towns. Farmers in transitioning urban areas, or those very close to market/information access aren't attending trainings as they already think they know everything and do not believe the trainings will be beneficial to them. For rice-specific trainings, men and women farmers usually attend the trainings together, but it depends on the time of year. During the rice harvest season, men will send their wives to participate for them and gain the information. During non-harvest seasons, men will usually attend as women are busy doing other things and the trainings are geared towards men's activities. For other non-rice FFS models, men and women are all invited to the trainings. If not enough participants show up for one villages' training, people from other villages will join the training.

Course Topics (General): The FFS model incorporated topics relating to inputs (seeds and fertilizers), farm (planting, maintenance, etc.), and harvesting and storage (<u>minus</u> processing). In some areas, the DA has processing facilities, but not for all. No topics of business or marketing are involved in the FFS model.

CIS or Climate Knowledge Integration: Climate change and climate-resilient agriculture is incorporated into the curriculum and trainings for the trainers (from ATI), as it is a major threat to Filipino crop production, particularly rainfed systems. Trainers are trained on these topics and how to facilitate field observation and discussion regarding climate-related issues; however, these topics are not directly integrated into FFS curriculum except for the AESE topic session. Every FFS has a regular topic session on AESE, which covers how to read temperature, how to measure rainfall, what is an agroecosystem, and issues surrounding water. Additional climate-related information is included during the FFS trainings through "special topic sessions," which change depending on the needs of the region and availability of experts. Increasingly, climate-related information regarding agriculture is becoming a priority for the FFS training model (Chandra et al 2017).

Interventions and technology diffusion in the FFS run by PhilRice is predominantly focused on planting different varieties of rice. Strong seed networks are incredibly important to this intervention as lack of access to different varieties of seeds is a challenge; the current administration is focused on hybrid seed production and improving seed networks. The National Seed Quality Control Organization is important to this intervention; they certify seed growers on how to maintain purity, as well as do follow up inspections.

A quarterly forecast is included in the training of trainers' curriculum, but not necessarily in the FFS curriculum. PAGASA, who sometimes provides supports and forecasts to the trainings, offers CIS, but this is not totally integrated to the FFS model. The PAGASA CIS highlighted by the FFS model is provided at the provincial level and offered on PAGASA's website for farmers to access.

*In region 4a DA: In 2016, in collaboration with BSWM (working under the targets of a BSWM project), the regional office installed 5 AWS in 5 different municipalities. They are not sure if the AWS are working in those municipalities. The regional 4a DA office's involvement is to provide trainings for the CFS. They have budgeted plans to establish weather systems in 2019, particularly for the fishing-dependent areas during typhoon seasons.

Financial Analysis: No financial analysis activities are included in the FFS model. These are included in the separate FBS model, run by the regional ATI office.

Gender: Training materials and program implementation is not targeted based on gender, nor do they have a quota for male/female representation. Usually 25-30 farmers attend each FFS. Depending on the location, topic, time of day, time of year, location, etc., sometimes there will be no women attending or sometimes more than 50% of attendees will be women. It was noted that if the trainings were related to organic production or high value crops, more women will attend as these are generally their responsibilities; men are responsible for rice and corn. However, for rice and corn, women (and children) will do the transplanting and harvesting; topics focused on these areas should be sensitive to these gender roles. In addition, women do not usually attend rice-related trainings unless it is during the harvest season, when the husbands will send their wives (in general).

In general, there should be sensitivity to the topics addressed and who would most benefit from the information. Since most of these trainings cover rice and corn, more men will attend. According to the 4a Regional Office, "whatever men can do, women can do too. There is little gender issue here." This highlights a lack of gender-sensitive integration into the curriculum development and implementation.

Evaluation & Post FFS Support

Impact assessment staff from the regional DA offices run post-evaluations after the FFS to assess improvement in farmers' yields and technology adoption. There is a M&E Office at every regional DA level. However, these evaluations depend on funding and capacity at the regional level. For example, in Region 4a, the office did not have enough funding or human capacity to monitor and evaluate their FFS; therefore, they were not being evaluated. There are issues of farmers not adopting technologies in the region from the FFS model, and without evaluation, it's hard to pinpoint why.

The FFS model groups farmers into organizations if they have not already done so. This provides capacity for farmers to request post-FFS supports from the DA in asking for equipment and seeds (if they are available). Farmers must be in officially organized groups to request funding or supports from the regional DA office. Via the FFS model and interaction with DA, the farmers then learn of the available supports and how to request them; then farmers write proposals to receive these supports.

Logistics

The representatives from Region 4a indicated it is very cheap to run an FFS model.

Total Cost: 40,000 PHP plus travel costs

Funding Sources: Regional DA Office

Extension Staff Required: 2 facilitators (from P/MLGU) and LFTs

Description of Costs: The total costs include supplies, t-shirts for participants, training, service fees, and field day snack. Each participant group takes turns bringing/making the field day snack each week. And lunch is provided by the LGU budget.

Farmer Business School

General

To better understand the FBS model, key informant interviews were held with representatives from CIP, DA, DAR and ATI. The aims of the FBS are to enhance the capacity of farmers in the farm business management and market-oriented production by contributing to improved market access and increased farm incomes, overall increasing food security. Increasing farmers' entrepreneurship and entrepreneurial skills are important components of the overall FBS model. Specifically, as described by the FoodSTART+ FBS program implemented by CIP, the objectives of the FBS are to: 1) form and strengthen farmer groups for marketing-oriented learning and action; 2) to identify and describe key actors and their roles in agriculture value chains; 3) analyze and prioritize value chain opportunities towards increasing business profitability of farmer groups and their individuals members; 4) introduce technological, commercial and institutional innovations in collaboration with other chain actors and stakeholders to respond to market opportunities; 5) develop a business plan to make use of new market opportunity by building on innovations; and 6) develop strategies for enhancing farmers' access and use of business development support services. By the end of the FBS training, farmers should have developed a strong business plan for their farm and have initiated these business practices.

There is no particular crop focus; the FBS operates on value chains identified by the needs and priorities of the communities. The CIP-FoodSTART and CHARMP2 collaboration conducts the FBS model with vegetable, roots and tubers, livestock, and coffee value chains. This project focused on coastal communities and linking small-scale farmers to markets via value chain upgrading. And the model has been adapted and currently piloted (in 2018) for aquaculture value chains.

Infrastructure (National to Regional Level)

The DA provides the overall direction for direction and internal coordination of the different actors involved in FBS implementation via the CHARMP2 program. For the initial introduction of FBS to the Philippines, the FAO and ATI worked closely together as co-implementors, with the DA-AMAS, DAR, and selected LGUs as additional implementors of the FBS model activities (other names for these models are "Enterprise Development" or "Enterprise Planning" programs). Through funding from IFAD and CCAFS, and in collaboration with the CHARMP2 DA investment, CIP adapted the FBS model piloted in Indonesia to the Philippine context via the FoodSTART program. The project was piloted from 2012-2013 and then upscaled in 2013-2014. ATI started the national implementation of FBS model in 2014, and DAR started pilot implementation of the model in the 2nd quarter of 2015 (Tumbali 2015).

DAR provides training tools and climate integration into the curriculum but acknowledges that NGOs and the DA (via ATI) runs these FBS models in selected agrarian communities.

The model is currently employed in municipalities across the Philippines. In 2017, 35 new facilitators were trained in the FBS model in the following areas: Bicol, Eastern Visayas, Caraga, and ARMM, with the expectation for the model to be implemented in 2018. In 2017, this model was adapted for aqua-based value chains (mudcrab, seaweeds, cassava), with 14 ABS facilitators trained and the expectation that these will be implemented in 2018.

Curriculum Development

The FBS curriculum is modeled closely after the FFS model (ie., employing a *learning by doing* pedagogy), but is designed to address supply and value chain issues faced by small-scale farmers. Group-based activities enable farmers to conduct experiments on improving crop production and quality, and then farmers are taught on best market practices for selling, negotiating, and linking with diversified buyers. A value-chain curricular framework guides the series of group-based experiential learning activities over a production-marketing cycle while interacting with other chain actors and stakeholders. And the flexible curriculum enables trainers and facilitators to adapt it to the needs, priorities, and opportunities of the selected value chain.

In 2014, the FBS model further adapted in the Philippines to incorporate climate-related and gender-sensitive components to the curricula and overall model structure to respond to national pressure to address climate change and gender. A small grant from CCAFFS/IFAD enabled the climate-change components to be incorporated into the FBS model. The aim with this update was to incorporate a climate-change perspective into farmer-business planning such that the FBS curriculum incorporates "climate smartness" elements aimed at vulnerability factors for business sustainability, and future cropping/value-added scenarios based on climate projections. This model is now being piloted and employed throughout the Philippines.

The trainers and facilitators of the FBS (FoodSTART & CHARMP2) are DA trained facilitators and CIP trained facilitators. All DA trained facilitators are trained by ATI. Each FBS model requires a trained agent from the LGU to facilitate the trainings. Thus, it is essential to have the LGU support in order to successfully implement the trainings.

Implementation

Targeting Areas: Areas for FBS implementation are targeted based off of income indicators; areas with highest density of poorest households are targeted. Additionally, areas with established cooperatives are targeted for "Enterprise Development" trainings.

Identifying Farmers: Facilitators work with the barangay council to promote the training within the community. Signs inviting participants are also placed around the community prior to the initial session.

Course Structure: The most recent/updated FBS model incorporates 7 training modules plus a final event, where graduates showcase and launch their new businesses (Table I.1). The launching event is very important as many local and regional value chain actors (ie., buyers) attend and it serves as a direct opportunity for the participants to engage with other value chain actors and potentially link to diversified markets.

The curriculum was updated after a series of workshops, field visits, and consultations with government agencies (national-local), NGOs, climate change experts, farmer organizations, research agencies, and the project coordinators (CIP-FoodSTART). This model runs for 14-15 weeks, as there are several sessions incorporated into several of the modules. A convenient community space is identified where participants are invited to convene for the trainings.

Table I.1: Current FBS Curriculum

Module	Objectives
1: Planning & Targeting	• Preparatory meetings with prospective participants • Target and select communities and value chains [PRA]
2: Group Formation & Strengthening	• Livelihood and business vision • Individual and group capacity assessment [SWOT] • Group learning dynamics
3: Marketing & Business Concepts	• Market chain perspective • Entrepreneurship for small-scale producers • Types of businesses • Climate change basics • Gender concepts and issues (in business)
4: Identifying & Prioritizing Market Opportunities	• Planning & market chain assessment with data collection instruments • Conduct market chain assessments [interviews] • Discussion and analysis [including reducing livelihood risk] • Sharing and validating results [incorporating climate change and gender lenses]
5: Targeting & Testing Potential Innovations	• Action planning for innovations to address market opportunities • Design and organize innovation testing • Test and monitor innovation • Special topics [including business regulations, ethics, collective marketing, etc] • Analyze and discuss results; present findings
6: Business Planning	• Introduction to business planning • Develop and customize business plans [incorporate climate change and gender-sensitive lens] • Group critique and improve business plans
7: Business Support Services	• Assess available supports for small-scale businesses [financial resources, financial management services, legal services, research and extension for climate change adaptation/mitigation]
FINAL EVENT	• Showcase and launch new business

Source: Interview with CIP-FoodSTART Representative

Participant Description: By 2016, the FoodSTART and CHARMP2 collaboration had conducted 80 FBS trainings, graduating 1387 participants. 83% of these graduates were women. Women are generally the participants of these types of trainings (ie., Business Schools or Enterprise Development models) as they manage household finances and often sell household production, and men are usually too busy in the fields to attend. Participants are not required to be registered with a cooperative or official farmer group to attend.

Course Topics (General): In collaboration with the facilitators, the participants decide which crops to focus on depending on their needs and priorities during the initial planning phase. During the implementation phase, farmers develop a vision and goal for their business, and then work with the trainers to develop their business plan. Lessons on business, marketing, and value-added skills are integrated throughout the implementation phase. The FBS model covers the entire crop production to marketing cycle. The national DAR office indicated the topics for "Enterprise Development" trainings cover agri-technology, packaging, marketing materials, and linking farmers to markets.

CIS or Climate Knowledge Integration: Climate change considerations to the FBS training model were incorporated during the adaptation phase in 2014 by a collaboration between CIP and CCAFS (funded by IFAD). Several indicators and climate-related concepts were incorporated throughout the FBS curriculum, which include identifying mitigation and adaptation practices along the value chain, developing resilient value chains through innovations and systems thinking, BDS services for high-risk value chains, conducting risk, hazard and vulnerability assessments, performing scenario analysis, and doing geographic and commodity targeting based on climate risks. Table I.2 demonstrates where climate change considerations are integrated into the curriculum. The climate knowledge integrated aspects of the FBS were modeled after the CrFS model employed in Tarlac (Central Luzon).

DAR integrates climate-related knowledge into the planning and information development aspects of the FBS. Usually DAR runs trainings on climate knowledge development before the FBS is implemented for the facilitators.

Financial Analysis: As a business focused model, there is heavy financial analysis activity integration into the curriculum and assessment. Table I.1 identifies the different financial activities and analysis incorporated throughout the model, most specifically to enable farmers to develop their own business plans for their production.

Gender: A gender-sensitive perspective was incorporated into the FBS model during the adaptation phase in 2014 (when climate information was integrated as well). Table I.2 demonstrates the integration of gender considerations into the respective phases throughout the FBS model implemented by CIP-FoodSTART.

Table I.2: Integration of Gender Considerations throughout FoodSTART FBS Model

PHASE	CONSIDERATION OF GENDER & CLIMATE CHANGE
Preliminary Preparations	● Targeting areas for FBS to benefit specific target groups (women, youth, IP) ● Considering the gender balance of participants and facilitators
1: Planning & Targeting	● Consider appropriate mechanism to elicit female/male participation ● Consider appropriate venue to hold the meetings for males and females ● Consider availability and feasibility for childcare at the facility for women with young children ● Consider the literacy status of participants ● Consider running gender-disaggregated exercises as appropriate ● Conduct a session including target criteria for women's empowerment and gender equality ● Target communities and value chains based on gender-sensitive and climate change criteria
3: Introducing marketing & business concepts	● Conduct a session on gender concepts that includes gender issues in the agri-value chains ● Integrate gender dimensions in business
4: Identifying & prioritizing market opportunities	● Include climate change and gender considerations
6. Business Planning	● Develop and customize business plans to include climate change and gender considerations

Source: Interview with CIP-FoodSTART Representative

Evaluation

Constant formative evaluation is conducted throughout the training model, and the findings of each evaluation are incorporated into the curricula and determine the main learning content. Specifically, after Module 4 or 5, the facilitators and participants hold a meeting to discuss how things are going, what could be improved, what are the challenges, and what are possible solutions. These are then addressed. A final evaluation is run with the participants to identify challenges with their business plans, and how to better plan for the next season. As a result of the FBS, many farmers indicated that the trainings increased their confidence and instilled a higher self-esteem, as they change their view of themselves from just a ‘farmer’ to a ‘farmer-entrepreneur’ (Tumbali 2015).

Post-FBS supports from CIP-FoodSTART and CHARMP2 include monitoring the different businesses, providing support services and an external business environment, managing business challenges and opportunities, facilitating long-term business plan implementation, and continuing capacity development of project implementors. Additionally, each FBS group receives $2,000 to be managed as the livelihood assistant fund, for developing the new agri-enterprises.

Climate Field School / Climate Resiliency Business School

General

To better understand the CFS and CRBS model, key informant interviews were held with representatives from ATI and the DA. The overall objective of the CFS model is to enhance adaptive capacity and address poverty, vulnerability and their root causes. The first CFS was implemented in 2007 in Dumangas, Iloila, one of the biggest rice producers in Western Visayas. The municipality is prone to extreme flooding during the rainy season, and drought during the dry season, which cause heavy damages on crops and livelihoods. An FFS model had established an agriculture station in the area, but it was found that the advisories were not appropriate for the local area, and thus not effective for the targeted beneficiaries of the FFS. Thus, with support USAID and PAGASA, the LGU in Dumangas developed the CFS model to increase knowledge of localized weather information for more accurate and effective advisories. The goal of implementing the CFS was to reduce disaster risks and enhance the capacity of farmers, extension workers, rural women and other stakeholders to understand the role of climate in plants propagation, growth and development as well as its relationship to plant pests and diseases.

Running three separate training models (FFS, FBS, CFS) at four months each requiring two extension staff present at each training was inefficient, exhausting, and challenging for the farmers/participants to attend. The DA mandated ATI streamline the three models in one model that incorporates all three topics. ATI developed the CRBS training curriculum and implementation model.

The CFS and CRBS models operate based on any crop focus, depending on the priority and needs of the participant group.

Infrastructure (National to Regional Level)

The national DA provides support to regional DA offices, and the national ATI office develops the curriculums and trainings, which are then disseminated down to the regional levels. The national DA office provides funding for these training programs, but ultimately it is up to the regional and local levels to commit support and staff for implementation. The national government offices (DA and ATI) provide incentives to the regional DA offices, LGUs, village leaders and participants for joining the trainings, such as seeds, necessary inputs, and transportation to and from the trainings.

ATI conducts all the trainings of trainers for these models. A representative from the ATI indicated that it is a challenge to find and train trainers who can make such a long time commitment for the trainings and facilitation. Each trainer undergoes a 10-12-day training with ATI and then must facilitate these models in the field.

The national DA also operates the AMIA program. In collaboration with CIAT and other partners, the AMIA program initiated at the research level. The national DA found this to be a fantastic bargaining tool in convincing LGUs to participate in these models as they provide sound evidence-based arguments for climate-based training programs. This year, the AMIA2 program has $5million allotted for each region for climate change programs; next year the budget is set to increase to $10million for each region.

Curriculum Development

BSWM coordinated the training and delivery curriculum for the CFS model, called the Enhanced Climate-Smart Farmers' Field School. The BSWM brought together experts from governmental agencies to academic and NGOs to provide input and contribute to the curriculum development. The program includes three courses as follows: 1) climate elements and application to agriculture, 2) climate change adaptation technologies and options and 3) climate change risk management; each course is sub-divided into two parts: 1) climate change information and 2): Adaptation Options and Strategies. This module is used for the CFS program.

ATI developed the new curriculum for the CRBS school in response to the mandate from the DA to mainstream the three models into one. The training of trainers includes five modules: 1) the framework for the new normal and the integration of climate change risk reduction with the opportunities in the implementation of ASEAN economic community; community managed DRRM; CSA; good agricultural practices certification; and farming as a business. After graduating from this program, participants were able to assess vulnerability threats and agro-environmental risks to small-scale farmer business; identify opportunities for resilience-building in business planning and development; integrate CSA practices into the FBS approach; and develop an action plan for piloting a climate-smart FBS in their respective areas.

ATI conducts all the trainings. The national ATI office trains the regional ATI trainers, who train the LGU staff to facilitate the programs and train the farmers. The national level trainings are fairly general, whereas the regional level trainings are much more specific to their region. While the national level sets the curriculum and handouts, the regional level must adapt the curriculum and handouts to meet their region's needs

In 2017, ATI trained 80 trainers and plans to train 100 more in 2018 (these trainers then implemented these programs). They always run the trainings in different sites and now they see how farmers graduating from these programs are diffusing their knowledge to other farmers. Ag extension agents from the LGUs facilitate the programs within their respective communities.

Implementation

Targeted Areas: In collaboration with CIAT, vulnerability analyses are mapped across the Philippines to identify which areas are most vulnerable to climate change risks and impacts. These maps use exposure, sensitivity, and adaptability analyses to identify these vulnerable areas, including indicators on soil quality, crops (yield), hazards and resources.

Identifying Farmers: The head farmer and village leader select farmers who are interested in learning and participating in the trainings. The DA also notes that they work with identified and organized farmer groups to facilitate these trainings.

Course Structure: This model usually runs for 22 weeks, inclusive of a 2-day intensive meeting, ½ day session once a week for 22 weeks, and a 1-day session during the 18th week. A 1000 sq. m. space in the community is targeted to hold the trainings and is considered the "learning site". This can be under a tree or a volunteer farmer's farm plot. If a farmer volunteers his/her land for the learning site, they assume the risk of whatever happens to the land during that season (for example, sometimes viruses come through and totally destroy the crop).

Participant Description: A group of 20-25 farmers are invited to participate in the training. Usually the breakdown of participants are 60% men, 40% women depending on who is available to attend. The KIs did not have exact data on the participant breakdown but indicated the regional level should have this data.

Course Topics (General): The course topics included in these trainings include inputs, farm production, harvest and storage, and product marketing. CIS is involved across all of these steps.

CIS and Climate-knowledge integration: CRA knowledge is co-produced by the farmers during the trainings. The trainers and facilitators are trained in topics related to CSA and CIS, but they enable the participants to learn by doing and co-produce CSA/CRA practices during the trainings. Across the trainings, there is a heavier emphasis on adaptation strategies but discussion of mitigation activities as co-benefits are also included.

Financial Analysis: In the 18th week of the model, there is a 2-day business school workshop where participants learn business concepts and develop their own business plan for their farm.

Gender: Gender considerations are not included in the national framework. There had been talks of adapting the structure of the programs for male/female needs but there were too many challenges with implementing this. They found that the quota system did not work to increase or include women's participation and empowerment from the trainings. Gender integration is left up to the regional offices as it depends on the regional needs of women; the regional offices must adapt to meet these needs. It is noticeable that many women cannot attend these trainings simply due to their family responsibilities; they cannot leave the house too long, have to be home to prepare meals, and take care of the children and/or elderly. There is an overall lack of knowledge with regard to gender and agriculture and how men/women benefit from these trainings differently. The national DA office indicated they want to include more gender indicators in the M&E and create more databases regarding gender differences in these training programs.

Evaluation & Post-CBFS Supports

ATI conducts an evaluation of the curriculum and programs every two years; they update what needs to be updated or changed based on the evaluation findings then every two years as well. BAR conducts evaluations and assessments of each of the training models for the DA.

One major challenge posed to the success of these trainings is the lack of access to seeds (particularly hybrid rice seeds). There are no suppliers for certain varieties of hybrid seeds, which is the best option to recommend for the farmers. However, due to this lack of access, they must recommend other strategies.

Post-FFS supports and resources are all available at the regional level. But it depends on the regional office and how they disseminate and allocate their supports and resources to the different programs and farmer groups.

Logistics

These are the outlined costs for ATI to train the trainers and facilitate the CRBS model. All these funds come from the national ATI budget. To conduct one training of the trainers (between 25-30 trainers), it costs 600,000 pesos. The budget for conducting the training with participants costs around 100,000-120,000 pesos. This budget includes stipends for two staff members who are present for each CRBS. This also covers items for the graduation ceremony, including t-shirts and certificates. The facilitators receive part of their fees and salaries from the LGU budget, including transportation costs and cell cards.

Climate-resilient Field School

General

To better understand the CrFS model, a key informant interview was held with the director of R1. Modeled after the FFS and CFS training programs, the CrFS model was developed in 2010 and piloted in 2011 towards a climate-informed, sustainable and resilient agriculture training. The first CrFS trainings were held from June to October 2011 in Gerona, Tarlac and Irosin, Sorsogon. The overall purpose of this model is to conduct season-long trainings in the field that are learner-centered, participatory, and reliant on an experiential learning approach (Tanchuling & Dalusag 2011). Additionally, the unique objective of CrFS was to liaise with PAGASA in establishing localized AWS/EWS for agriculture, utilizing local weather data to better inform climate advisories and short-term forecasts. After the devastating Typhoon Haiyan in 2015, R1 received a significant increase in funding and was able to adapt the CrFS model to incorporate a livelihoods approach, focused on more diversified systems and sources of income to increase overall livelihoods as well as production.

The CrFS is focused on crop production systems depending on the needs and priorities of the participants. Organic farming and diversified agricultural systems are promoted as best practices for climate-resiliency via the model.

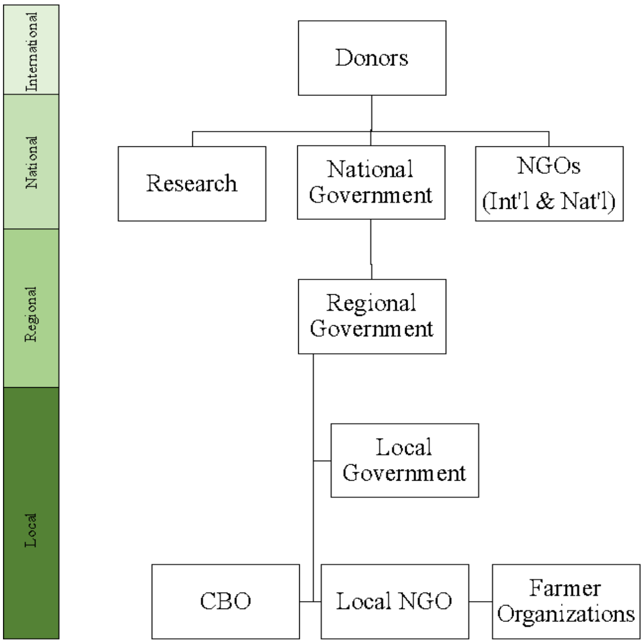
Infrastructure (National to Regional Level)

Adapted from Chandra et al (2017), Figure 3 shows the many actors involved in CrFS development and implementation across the Philippines. Donor and NGO partners, like Oxfam, coordinate with R1 to spread awareness of the CrFS model to the DA and to lobby for additional funding and support to scale-out this model (Oxfam 2015). R1 is a central and critical actor in the CrFS model implementation, fundraising, and advocacy. Since the last change in DA leadership, R1 indicated that the CrFS model may be run in the new AMIA villages in collaboration with the DA. At time of interview (April 2018), the CrFS model was held in 40 municipalities across the Philippines.

R1 plays a heavy role in advocacy and fundraising across many donors (ie., Oxfam and DA) to scale up the CrFS model. These different funders provide the financial support to scale out the model through various programs. LGUs and their support are essential to the success of the CrFS model (as with every other model). The LGU offices provide staff, travel budgets, a center and utilities dedicated to the success of the CrFS model.

It takes 3-5 years to successfully master the program in a municipality. An R1 national representative lobbies the LGU to support the program and to keep CrFS activities in their budget. This activity requires a lot of time, depending on the municipality. With LGU support, an LGU representative undergoes a 12-day training from PAGASA (training on climate risks for the respective community's main activity, ie., livestock, rice production, etc.) and for CrFS delivery (discussion on the modules, delivery modes and pedagogy, and support). For the first year of implementation, an R1 agent will deliver the CrFS. But for the second and subsequent years, a trained LGU representative delivers the CrFS. The intention is that over time, R1 is no longer involved and the LGU takes over the implementation and supports for the CrFS model within their communities. At time of interview (April 2018), there were 15 R1 staff managing CrFS implementation across 25 LGUs (with the model being run in 40 municipalities).

Figure 3: Map of Actors for CrFS Model



Australian Aid, UN (FAO, UNDP, IFAD), World Bank, EU, Asian Development Bank, USAID	Provides funding and institutional capacity for CrFS model
IRRI; DA, DENR, PAGASA, NEDA, DAR, DRRM, ATI; Oxfam, Plan International, R1, CARE	Rice production research; CIS, climate-research; CSA infrastructure and regulations; Monitoring of activities; Implementation & Capacity Building; Climate Change advocacy
DA; Office of Civil Defense; NEDA Regional; Regional DRR and Management Council	Extension services to LGU; Capacity building and awareness; Drip irrigation; Regional plans and tools
Municipal Extension Office, DRRM office, Planning Office; Barangay Councils, Local Traders Associations; Local agricultural/ aquaculture, community and rural-development, and climate NGOs; Farmer, Women's, Organic farmers, religious, & non-organic farmer groups	CIS: use of AWS, data capture, interpretation and reporting; daily and seasonal weather forecasts and advisories; Crop insurance, subsidies, grants for farmer groups; Irrigation and water harvesting; Soil management; BDS; Local conservation activities; Local waste management

Source: Adapted from Chandra et al (2017)

Curriculum Development

The CrFS model is modeled after the FFS, FBS, and CFS training models; thus, a lot of the curriculum is adapted from these models and incorporated into the CrFS training models. However, the CrFS curriculum expands upon these to incorporate stronger aims for including CSA and livelihoods approaches. Chandra et al (2017) found that the CrFS model employed across 5 municipalities in Mindanao integrated 34 CSA techniques, focusing across three major categories: adaptation, mitigation co-benefits, and food production impacts at the village garden, farm, and landscape levels (p. 220). Overall, the CrFS model mainly focuses on adaptation practices in their trainings but assists the LGUs in their capacity building for addressing mitigation and adaptation actions through participatory planning. Through the People's Survival Fund, 1 billion Philippine pesos were allocated across the LGUs to increase local capacity for climate change adaptation.

At the time of interview (April 2018), there were 50 trained CrFS trainers. These trainers are 1/3 from PAGASA, 1/3 from R1, and 1/3 from other governmental agencies. Due to the flexible nature of the CrFS model, there is a 'training resource pool' from academic experts, Bureau of Fisheries and Aquatic Resources, and PhilRice to conduct trainings as well if needed for a specific topic. Trainers receive a 2-week training from PAGASA on data collection techniques and interpretations/analysis for localized weather.

R1 developed a workbook for materials that is sent to trainers at the start of the season. They also send other materials, such as t-shirts, necessary to hold the trainings. The curriculum is flexible to meet the needs and priorities of the community, and facilitators bring in experts from the expert roster to train on different specialized topics. An R1 staff reviews the curriculum for a certain community, sees the topics identified from the calendar meeting, and coordinates with experts to provide training on the specific topics.

Implementation

Targeting Areas: Participatory capacity and vulnerability assessments were carried out by the BINDS program prior to running the CrFS model (Chandra et al 2017), which triangulated biophysical risk indicators with local perceptions of risk and challenges. The BINDS program was a three-year climate change program funded by the Australian Government's Department of Foreign Affairs and Trade and was implemented across 18 municipalities across Mindanao. The BINDS program is an example of the many implementing partners associated by the CrFS model across the Philippines, all of which collaborate with R1 to implement these CrFS training models.

Identifying Farmers: The facilitator works with the village leader to invite anyone within the community (open invitation) to participate in the first meeting ("calendar meeting") and to participate in the trainings. The village leader coordinates and facilitates the invitation to the community.

Course Structure: The CrFS model runs the course of a regular season for whatever agricultural system is the focus. Twice a year at the beginning of the season, R1 holds a Climate Forum to discuss the seasonal forecast. And the model is usually held for 16 weeks (most agricultural systems), but sometimes more and sometimes, particularly in coastal areas, it will run for about 2 months.

The first meeting is called the "Calendar Meeting," where the facilitator and participants decide on what topics to focus for the training. The facilitator also conducts baselining of vulnerability and capacity at this meeting. The CrFS training incorporates <u>all</u> topics from inputs, farm production, harvesting & storage, and product marketing.

Participant Description: A total of 30-35 men and women participate in each CrFS model training. Participants organize into small groups, and they meet once a week during the season (4-5 months long) (Oxfam 2015).

Climate Information Services: PAGASA provides training at the LGUs on instillation, operation, and technical assistance on the AWS. LCICs were established in the local municipalities and collected data on temperature, rainfall, humidity, wind speed, and other climate observations twice a day (Chandra et al 2017). These localized data were analyzed and synthesized by PAGASA and the LGU, and then they were utilized to prepare short-term weather forecasts and advisories for the communities via bulletins and local media (radio, television). Farmers are trained during the CrFS to understand and apply this forecast knowledge to their farm. They are also trained in evidence-based experiential learning techniques to collect their own data at their farm level in measuring these climatic factors. Farmers are able to triangulate their own collected data with the advisories and forecasts from the LGU. Additionally, the LGUs collect the farmers' data to integrate into the LCICs to better target short-term forecasts. These data are also used by the LGU and PAGASA to generate seasonal forecasts and EWS (ie., for El Niño or droughts).

Similar to the FFS model, the CrFS model also includes an AESA activity, conducted weekly early morning on the farm. The activity via the CrFS model includes group field observation, analysis, and decision-making where the farmers observe different production factors on the farm that can affect crop production, discuss these factors, then come up with reasonable and effective farm management recommendations. This activity enables farmers to think systematically, as well as build comradery and teamwork skills with the other CrFS participants. Localized forecasts are also incorporated into the AESA activity.

CIS is disseminated to farmers and community members in several ways. First, short-term and seasonal forecasts are broadcasted over local radio programs as well as community bulletins. Digital and banner weather boards are also implemented within the community to display weather forecasts; these are updated 1x/week. Finally, with funding from Greenpeace, R1 piloted an SMS forecast system using the Chica data system in 2014. This enabled participants to give real-time and localized feedback data to check the validity and reliability of localized forecasts from the LCICs. Unfortunately, the Chica system shut down in 2018, and R1 is still deciding which system (Globe or Smart) to use to continue the program based on cost differentials. There is a slight delay in this SMS program returning, but it was wildly successful and will return soon.

*In an interview with a DA representative, they indicated that the R1 model was the **best** approach for CIS and climate-knowledge integration into trainings and practices. They are planning on incorporating the CrFS model across the AMIA3 villages.

Financial Analysis: As the CrFS takes a livelihood approach, business and marketing skills are fundamental to the curriculum and overall objectives. Specifically, the model promotes value-added activities to increase household incomes and diversified sources of income. The last module of the training is the business planning: participants are required to pick an enterprise and make a plan. R1 provides assistance with the implementation of the enterprise.

Gender: When the model was first implemented (ie., before 2015), there was a quota for 30% women's participation. The CrFS used to be focused on rice production; women would not regularly attend because rice is men's crop, and a quota was necessary. However, since adapting a livelihood diversification approach in 2015, women are now encouraged and eager to regularly attend the trainings and there is no longer need for a quota. For CIS delivery, there is no difference made for men or women as the advice is general and made available to the entire community. These trainings are viewed as an opportunity to access education for women; the R1 approach understands this and ensures that the delivery of materials is gender-sensitive and inclusive. By focusing on livelihoods and home-garden support activities, the CrFS model incorporates women's responsibilities (in addition to men's) into the trainings to make the content and curriculum more inclusive.

Evaluation & Post-CrFS Supports

R1 conducts monitoring and evaluation of the CrFS model. At the "Calendar Meetings," R1 conducts a baseline assessment for the participants in order to conduct a thorough evaluation of how the trainings impacted the participants. A summative evaluation is conducted two years after graduating the CrFS course to assess what practices have been adapted Prior to the trainings, farmers would go to their farms around three times a year, normally either staying at home or working a second job riding a tricycle. They found as a result of the trainings, farmers spent more time on their farm to observe and monitor changes and manage risk.

Post-CrFS training, the LGU and R1 continue to assist participants with their learnings. Graduates of the model develop a community resiliency plan, which outlines how they plan to maintain all their learnings from the trainings for one year and every year after the CrFS model. Similar to the FFS implementation, R1 trains participants of the CrFS model on how to access local government resources, improving their abilities to actually access these funds and other supports.

Chandra et al (2017) conducted a thorough analysis of the CrFS model in Mindanao, presenting best practices and implications for food production, adaptation, and mitigation measures. Presented here are some of these findings. Chandra et al (2017) found that factors influencing CSA adoption rate among CrFS participants include: awareness of environmental and health benefits [of organic farming practices], increasing costs of chemical pesticides and fertilizers, barangay rules on agriculture waste, LGU legislative provisions, and NGO incentives like training, farming tools and finance (p. 221). Factors discouraging organic farming techniques include: high upfront costs, competition with non-organic farmers, weak support from LGU and barangay councils for organic farming, lack of access to formal markets, lack of demand for organic produce, and low quality standards on certification schemes (p. 221). As a result of CrFS training, in addition to organic farming techniques, farmers did also highly adopt diversified cropping and livestock schemes to respond to changing climatic conditions (Chandra et al 2017). Crop diversification stimulated “the establishment of women-led permanent home gardens, thus making season-long crops, income, and nutrition more accessible” (Chandra et al 2017; 221). The CrFS model distributed seeds to the women farmers to encourage planting of these home vegetable gardens (specifically, seeds for okra, talong, ampalaya, sitao, kalabasa, pipino), using other crops (coffee, cacao, abaca) as cover trees for the vegetable gardens and farms. Farmers also widely adopted SRI as a result of the CrFS, specifically a plethora of water conservation techniques (Chandra et al 2017).

Chandra et al (2017) found a myriad of barriers to adoption for farmers of the CrFS model in adopting new technologies and techniques. These include (and are not limited to – see Chandra et al 2017, p. 225 for full list): lack of access to resources (credit, financial capital, raw materials, inputs, education and information, basic needs such as electricity and potable water, etc.), stray animals destroying crops, ineffective local ordinance implementation and monitoring, and lack of venues or means for women to participate in alternative livelihood activities.

Logistics

The costs of running the CrFS model depend on which year the program is in (1st year vs. additional years) and R1’s availability of funds. R1 lobbies support from many international donors and the DA, but their overall budget fluctuates based on their total support. R1’s National Investment Plan covers 1) CIS, 2) CrFS services and 3) community incubation for enterprise development.

For Year 1, the total cost to implement the CrFS model with 1 LGU (to be implemented in 2-3 villages within the municipality) is 1.5 million pesos. This cost includes training for 2 LGU staff, implemented an AWS at the LGU, SMS and livelihood incubation, and R1’s staff for mentoring and training. Costs for food depend on R1’s contract with the LGU, sometimes R1 covers food expenses and sometimes the LGU covers those expenses. PAGASA’s costs (for implementation, training, and services) are covered in R1’s budget; however, more recently PAGASA has been covering their own travel.

For Year 2, the costs for R1 to implement the model goes down to about 1.2 million pesos. The implementation and training of the AWS and less training is required in year 2. The idea with this approach is that slowly, the LGU will establish a budget line for implementation of the CrFS model each year and R1 will no longer be involved.

Best Practices / Successes

The CrFS model liaises with PAGASA to establish AWS at the municipal level. The CrFS modules integrate topics including week- and short-term forecasting, participatory evidence-based learning, climate-related farming knowledge, agroecosystem analyses, and overall capacity and skill building to increase farmer and farm resiliency. The establishment of these localized AWS, and as a result localized EWS for agriculture, which prove critical for farmers to plane their planting times and protect (agricultural and livelihood) assets (Chandra et al 2017).

The CrFS model actively engages farmers as participants and local researchers to collect data from their farms on climate metrics (such as rainfall, using an old milk can) and report these back to the municipal weather system. This directly involves farmers in the process, who can then make their own observations linking traditional knowledge with science, and increases the localized knowledge of weather patterns for the municipal LGUs. Localized weather information enables the LGUs to predict more accurate forecasts and advisories for their farmers.

The CrFS coordinates trilateral partnerships between the smallholder farmers, LGUs, and NGOs, building and strengthening local capacity to work together. This establishes a medium for peer learning and continuous feedback loop between communities and practitioners for advancing rural livelihoods, adaptation and mitigation to climate change, and agricultural outcomes (Chandra et al 2017). These partnerships enable opportunities for local knowledge to integrate with climate science and co-produce localized weather information to better inform climate/weather advisories (for agriculture and DRR purposes) as well as more accurate short-term forecasts. And by working closely with the LGUs, the activities of the CrFS align with municipal activities to reduce vulnerabilities and increase resilience to climate change (via Local Climate Change Adaptation Plans and Local DRR Management Plans). This strong collaboration helps to improve co-knowledge creation and uptake among farmers, LGU, institutions, extension officers, and NGO field facilitations to implement climate-resilient practices for agriculture *and* DRR (Chandra et al 2017). In summary, the CrFS model "was an effective institutional mechanism for advancing trilateral climate-smart interventions through participation of multiple actors, women's leadership, building of technical skills, and promoting awareness on local-specific risks and vulnerabilities" (Chandra et al 2017, p. 228).

A focus on livelihoods *and* income in addition to agriculture increased favorability of CSA practices by smallholder farmers and led to higher adoption rates (Chandra et al 2017). Unlike the FFS model, the CrFS model aims to increase personal/household productivity for overall wellbeing, which is not crop specific. This enables both women and men in their respective roles and capacities to benefit from this training, as well as improve outcomes for their households. In the near future, R1 hopes to partner with the Department of Health to incorporate aspects of household nutrition, home/wild gardens, preventative health measures, and health and climate into the training models.

Challenges

Chandra et al (2017) found that the CrFS model implemented in Mindanao poorly integrated the influence of changing local market demands into the trainings and provided weak incentives for farmers to engage with larger, formal markets.

Funding is a major challenge for continuation and scaling-out of the CrFS model. Due to the livelihoods approach inclusive of CIS, the CrFS model has continued in certain municipalities past the BINDS program due to LGU funding (Chandra et al 2017). In 2014/2015 year, seven municipalities allocated around $700k to sustaining the CrFS model, but this is not inclusive of all municipalities who ran these programs. However, this is not always the case for municipalities, and funding continues to be a challenge.

Climate Resilient Farm Productivity Support Program (CRFPSP)

General

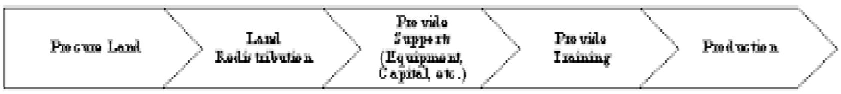
Under the Philippine Climate Change Act of 2009, DAR (along with the other governmental agencies) is mandated to mainstream climate change throughout all of its operations. They adopted, internalized, and adapted GIZ's climate lens approach to the Philippine context.

CRFPSP is a DAR operated framework and program to mainstream climate-resilient support services throughout their network as a government agency, focused on increased mechanization and maximized crop production. This is not a farmer training model per se, but a framework approach and support program employed by DAR in their operational capacity across the Philippines.

Framework: The farm mechanization approach stems from a conceptual framework such that increased mechanization minimizes yield loss. These machines are mainly focused on the post-harvest stage. The maximizing production approach stems from a conceptual framework that to achieve resilience in the face of climate change, poverty must be reduced via increased incomes by increased production. Specific climate preparation information is incorporated throughout all of these approaches and this information dissemination is increased before El Niño and La Niña events.

Figure 4 demonstrates DAR's general approach to providing support and realizing their mandate. For the beneficiaries of the CRFPSP, DAR has identified 3,000 agrarian communities across 17 regions; within those communities 3-5 barangays are selected. The CRFPSP operates under the providing supports, training, and increased production aspects of the DAR overall operational flow.

Figure 4: DAR Operational Flow



Evaluation: Evaluation is mandated by the National DAR for each program. The promoted technologies and trainings are evaluated based on adoption rate, appropriateness, and productivity rates. Productivity is measured by the level of production (total yield per ha) and farmer income. Every year, DAR does an evaluation assessment on each of their support communities to see if the use of technology has been adopted or improved the farmers' productivity. DAR also utilizes localized real-time data collection using data from farmers via cellphone SMS.

Gender: Gender is an important dimension of DAR's support services implementation. It is mandated to take gender into account for any program, intervention, or training. Women's participation is an important gender metric; if it is low, DAR actively encourages women to participate in their support services. Particularly in Mindanao, women's participation can be a challenge due to the cultural restrictions on women's mobility. However, in most other areas, more women are engaged in their support services.

Example: As an example of how they implement this support program, DAR in partnership with BSWM provided training and support for increased green technologies aimed at arid areas. In 2016, municipal officers provided training and equipment for solar irrigation techniques, a new promo technology, as solar is a ‘greener’ approach than motorized irrigation, currently employed by farmers. In 2016, 15 plots were selected as test sites. The procurement of land takes time with the government, as described by the national DAR office. This then increased to 77 sites at the time of interview (April 2018), with a target of 100 sites by the end of 2018. The solar irrigation project includes “community orientation, planning, and training on the operation of project facility and installation of solar pump equipment” (DAR 2018). The solar-powered irrigation system was designed to provide fresh water from a well and reservoir for livestock, household needs, and agricultural production. This technology incorporates climate change mitigation and adaptation measures.

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Section 2.8: Strategic Options for Mainstreaming Adaptation – Technical

Contents

2.8.1 Strengthening of Agro-meteorological information capture and dissemination

Institutional landscape

1. The Philippine Atmospheric, Geophysical and Astronomical Service Administration (PAGASA) and the Department of Agriculture through its Bureau of Soil and Water Management (DA-BSWM) are the two main institutions collecting weather data.

2. PAGASA, as the national weather agency acknowledged by the World Meteorological Organization (WMO), is one of the attached agencies of the Department of Science and Technology (DOST) under its Scientific and Technical Services Institutes. PAGASA has a head office in Manila and its five "Regional Service Divisions" (PRSDs) are located in National Capital Region (Quezon), Northern Luzon (Tuguegarao), Southern Luzon (Legaspi), Visayas (Mactan) and Mindanao (Cagayan de Oro). According to PAGASA's Modernization Program these PRSDs will be restructured and renamed and finally PAGASA will operate eight PAGASA Field Offices (PFOs) in La Union (Region 1), Tuguegarao City (Region2), Quezon City (NCR), Legaspi City (Region 5), Lapu-Lapu City (Region 7), Tacloban City (Region 8), El Salvador City (Region 10), and Davao City (Region 11) respectively. These PFOs will ensure that the Agency's weather-related information will be provided in the countryside in a timely, accurate and reliable manner to mitigate the impacts of hazardous weather events. The PFOs will be responsible for the preparation of local weather and flood forecasts and warnings, with full spectrum of hardware and information system[431].

3. PAGASA's mandate is to (a) provide adequate, up-to-date data, and timely information on atmospheric, astronomical and other weather-related phenomena to help government and the people prepare for calamities caused by typhoons, floods, landslides, storm surges, extreme climatic events, and climate change, among others, to afford greater protection to the people, (b) to provide science and technology-based assessments pertinent to decision-making in relevant areas of concern such as in disaster risk reduction, climate change adaptation and integrated water resources management, as well as capacity building, and (c) to ensure that the country fulfills its commitments to international meteorological and climate change agreements. Their mission is to deliver reliable and relevant weather-related information, products and services to develop communities resilient to typhoons, floods, rain-induced landslides, storm surges, extreme climatic events, climate change and astronomical hazards[432].

4. PAGASA has seven divisions, including the Weather Division, the Climatology and Agrometeorology Division, and the Hydrometeorology Division. The Climatology and Agrometeorology Division (CAD) houses the Climate and Agromet Data Section (CADS), the Climate Monitoring and Prediction Section (CLIMPS), the Impact Assessment and Application Section (IAAS), as well as the Farm Weather Services Section (FWSS). Under the Modernization Program, the current CAD will separate into two divisions: Climatology and Agrometeorology. The former will produce forecasts at longer time scale more than a few days, while the latter will provide daily weather forecasts. The Agrometeorology Division will be a major upgrade (21 staff) from the Current Farm Weather Section (7 staff).

Weather data collection and station networks

5. Among the stakeholders collecting and interpreting weather data and sharing weather and climate related information, PAGASA, based on its extensive network of stations, its Unified

[431] PAGASA Modernization Program (PMP)
[432] http://bagong.pagasa.dost.gov.ph/mandate-and-functions

Meteorological Information System (PUMIS) and its adherence to WMO guidelines, is the most influential actor.

6. PAGASA, as a member of the World Meteorological Organization (WMO), is mandated to establish and maintain a national basic synoptic network and other WMO observational network of stations to provide data for international, regional and national exchanges. Surface weather observations are the fundamental data used to provide accurate and timely weather and climate information. Currently PAGASA operates a total of 112 weather stations which include purely synoptic, purely radar, synoptic-radar, synoptic upper air, agromet, and flood forecasting and warning centers.

7. The DA-BSWM maintains a network of around 100 weather stations, whereby 64 can automatically transmit data, the data of the other stations have to be uploaded manually. Data are sent to the Department of Science and Technology's Advanced Science and Technology Institute (DOST-ASTI) for processing and uploading the information on a DA website. The website is in English, provides daily temperature and rainfall data. Some of the weather stations face difficulties in terms of maintenance, lack of data transmission due to non-payment of transmission-fees, and last not least some are located in places not suitable for collecting weather data. Most of the stations will be transferred to DA RFOs while 16 of them will be maintained by BSWM. There is a plan for BSWM to install even more Automatic Weather Stations. The instruments used by BSWM weather stations do not always meet the WMO standards that PAGASA stations follow.

8. Since the weather stations, operated either directly by DA-BSWM or the Municipal Agricultural Offices, are not always managed according to standard WMO protocol, full integration of the two data-sets are not yet possible. Discussion have recently started on how to accelerate that integration process which would involve a thorough stocktaking, validation, and calibration process of the existing DA-BSWM weather stations in collaboration with PAGASA based on guidelines issued by the WMO Commission for Instruments and Methods of Observation (CIMO).

Weather and climate information production, distribution, and sharing

9. Currently the interpretation of weather data is mainly taking place at PAGASA. PAGASA provides several weather services, including a 24-hour weather forecast (website), a weekly weather outlook (downloadable in PDF from website), and occasional weather advisories (downloadable in PDF from website). More specialized services are available on the website for aviation, marine shipping, tropical cyclones, flood forecasting, and monthly climate assessments and outlooks as well as seasonal climate outlooks.

10. For agriculture, Farm Weather Services Section is compiling and posting farm advisories on PAGASA's website[433] and mobile phone app ("Payong PAGASA"). Information includes a "ten-day regional agri-weather information" section listing weather parameters (rainfall, wind, temperature, relative humidity and leaf wetness), as well as a "climate information for agriculture" section which basically provides the same information but listed according to regions. PAGASA intends to further strengthen its Farm Weather Service by increasing its personnel and to provide the "ten-day regional agri-weather information" on a province basis.

11. PAGASA also is a key member of the National Disaster Risk Reduction and Management Council (NDRRMC) and has various means of delivering information directly to other actors at national, municipal, or barangay level, and. For example, in the event of an impending tropical storm, typhoon, tsunami, or other calamities, mobile phone service providers are mandated to send out alerts at

[433] https://www1.pagasa.dost.gov.ph/index.php/agriculture/climate-information-for-agriculture#climate-information-for-agriculture

regular intervals as required by the NDRRMC, PAGASA, the Philippine Institute of Volcanology and Seismology (PHIVOLCS) and other relevant agencies[434].

12. Also, as member of the NDRRMC, PAGASA collaborates on various projects and activities with other agencies and institutions related to disaster management, especially as far as severe weather forecasting is concerned. In such cases Standard Operating Procedure apply and warnings issued by PAGASA are disseminated to the decision-makers and the public through various forms of media. On the National level, PAGASA sends the warnings to the Office of the President, the NDRRMC/Office of Civil Defense, PAGASA Regional Centers and the National Media. After which, it is forwarded to the local DRRMCs, Local Government Units, PAGASA Local Stations and Local Media. The primary and ultimate recipient of the warnings are the general public[435].

13. The distribution of weather information products to the farmers is mainly done through websites, mobile phone apps, text messages (in the case of typhoon warnings), radio and TV. Other, more sporadic channels of communication, are meetings and workshops on various level. Some of these events also occur in the context of training programs. During interviews with farmers it became apparent that they mainly access weather information through TV or radio, as well as through short message services (SMS) on their mobile phones as far as typhoon warnings are concerned. A majority would also appreciate localized weather information per SMS.

14. Information sharing between PAGASA and DA-BSWM as well as other stakeholders seems to be of limited and sporadic nature with the exception of PAGASA's strong link to the NDRRMC and the regular seasonal climate outlook forum that is organized by PAGASA with open invitation to all relevant actors in the country. The National Climate Outlook Forum is being conducted by the Climatology and Agrometeorology Division (CAD) under the Climate Impact and Prediction Section (CLIMPS) to give an update on the Weather and Climate Outlook for the next coming months of the year. The regular presentations included are: (1) Latest Weather Update and Weather Outlook for the next 3 to 5 days; (2) Status of Monitored Major Dams; (3) Review of the Climate Conditions; (4) Climate Outlook for the next 6 months; and an (5) Open Forum, where the participants can give suggestions, comments, and recommendations for the continuous improvement of the PAGASA climate products and services[436].

15. An initial system – an application program interface (see figure below) has been developed under the GCF preparation project for bringing together relevant PAGASA data for accessing by DA (from mid term accomplishment report PAGASA 2018).

[434] Republic Act No. 10639; https://www.lawphil.net/statutes/repacts/ra2014/ra_10639_2014.html

[435] World Meteorological Organization, 2017. SWFDP-SeA Cascading Forecasting Process: Status of SWFDP Implementation and Evaluation of SWFDP Progress Reports and Key outcomes of Case Studies at National Level

[436] PAGASA, 2014. Annual Report

B. Development of an application program interface (API) for data displayed on PAGASA's webpage "Climate Information for Agriculture"

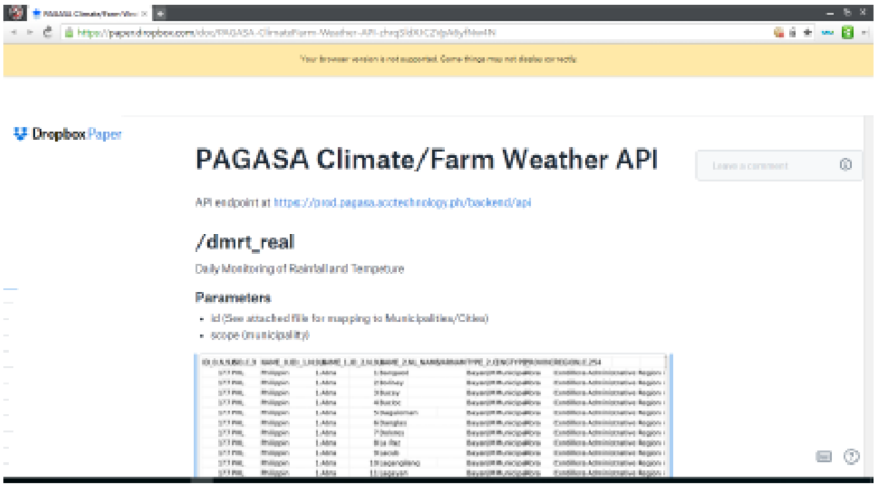

Figure 2. API created for data sharing of Climate Information for agriculture

- An application program interface (API) was already created for faster data sharing of Climate information for agriculture. Farm Weather advisories, Daily Monitoring and Monthly Forecast are some of the data available in the API. API documentation is available in this link https://paper.dropbox.com/doc/PAGASA-ClimateFarm-Weather-API-zhrqSldXJC2VpA6yfNw4N

User feedback mechanisms

16. Interactions between end-users of weather information and information generators occur only in a few cases through formal mechanisms, for example by participating in Barangay assemblies or through extension services. However, in most cases interactions are informal and with limited scope in terms of number of people reached. Otherwise the mechanisms for systematic feedback on information products are passive, for example through online feedback forms or info-lines, but not as an active feedback collection process. In fact, knowledge on the current uses of weather information by farmers is not systematically assessed but rather anecdotal.[437]

Farmers' information needs

17. Interviews with a variety of farmers confirmed the importance of the weather information received and its use in decision making as far as farm operations are concerned[438]. Localized weather information can be used for scheduling and rescheduling of planting time, irrigation cycles, fertilizer and pesticide application time and harvest time amongst other field operations. Currently farmers mainly receive weather information through TV, radio, and warning texts from DRRM Offices in the case of severe weather events (floods, typhoons). Farmers indicated that TV weather forecasts are not very reliable and they would appreciate more localized weather forecasts and weather related agricultural advisory services being transmitted in local languages.[439]

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[437] CIAT, 2018. Analysis of Communication Channels in the Network of Climate Information Services in Philippines

[438] CIAT, 2018. Analysis of Communication Channels in the Network of Climate Information Services in Philippines

[439] Based on interviews with farmers during a field mission in November 2018.

Constraints in establishing enhanced agrometeorological services

18. The current system of agro-advisory generation based on weather information is characterized by a few constraints. These can be grouped into (a) lack of clear roles and responsibilities, (b) lack of established processes and communication channels, (c) insufficient translation of weather information into agriculture relevant information at local level, (d) infrastructural constraints, (e) lack of skillful personnel, and (f) resource constraints.

19. Lack of clear roles and responsibilities exist in the area of data collection (more or less two separate entities, DA-BSWM/DOST-ASTI and PAGASA, collecting data) as well as in the area of developing agriculture advisories (currently only done by PAGASA, bypassing DA).

20. The lack of established processes and communication channels refers especially to the data collection, production of information products (forecasts, advisories) and delivery of climate/weather based agricultural advisory services (Note: for extreme weather events there is an established process) to end users such as farmers. This needs to be supported by effective coordination mechanisms between DA and PAGASA at the national to local levels.

21. In terms of the content of information products (forecasts, advisories), translation of weather information into agriculture-relevant information which farmers can actually use to make decisions on the farm, can be improved. This includes provision of information at smaller spatial scale relevant to on-farm interventions.

22. The insufficient information product is partly due to lack of skillful technical staff that are trained to operate weather stations, and produce enhanced agro-advisories at the local scale, based on the collected data, models and other technical tools.

23. Infrastructural constraints mainly refer to a lack of sufficient number of weather stations across the country, especially in those areas expecting significant climate change impacts. The country's geography is characterized by complex terrains and a number of islands with four main climate types. Luzon island exhibit all four climate types, while Mindanao has three of them. Many Visayas islands have two climate types within an island. Localization of climate and agricultural advisories require a good coverage of weather station networks to account for the high spatial heterogeneity of climate pattern. As more meteorological observations become available, numerical weather model simulations, which use observed data as inputs, will become better, which in turn improves the quality of weather and climate forecasts from the models. And then the forecasters will be able to provide better localized information. There also need to be more agrometeorological weather stations that are equipped with such sensors as soil moisture, soil temperature, and evaporation. Agrometeorologists will be able to translate weather information into agricultural advisories taking into account the history of these additional agrometeorological variables along with standard meteorological variables over the past days, weeks and months.

24. Many of the constraints described above are closely linked to the resource constraint which refers to budgetary constraints hindering or delaying the establishment of sufficient weather stations and required communication systems, as well as to the lack of qualified staff within PAGASA and DA.

Successful pilot projects

25. Pilot projects for localizing climate information services (CIS) for agriculture have already been successfully piloted in various municipalities such as Irosin and Santa Magdalena in Sorsogon Province, and Dumangas Municipality in the Iloilo Province. Such pilots usually have two components, namely (1) localization of climate services, and (2) capacity building of farmers on how to use climate services. Organizationally they built on strong partnerships between the farming communities at barangay level, LGUs, Municipal Agriculture Offices (MAO) and PAGASA. Farmers are organized into Farmer Field Schools (FFS), under the Climate Resiliency Field School approach. The objective of those FFS is that (1) farmers can understand and interpret weather information and forecasts, and (2) are able to

identify available management options in order to mitigate weather and climate related risks or take advantage of a favorable climate.

Lessons learnt

26. Based on the successful pilots in localizing CIS in the Philippines as well as on good practice evidence from climate service pilot projects implemented in recent years by the World Meteorological Organization and its partners in implementing the Global Framework for Climate Services (GFCS) at regional and national levels, five steps have been identified to successfully deliver services for end-users[440].

Step 1: Understand the demand side

27. What appears as an intuitive step, asking end-users what they need, is often overlooked in the design phase of initiatives aiming to deliver salient information services in support of local/national climate risk management efforts. However, end-user participation in the assessment of their climate service needs is a pre-requisite to the success of any national program aiming to build resilience to climate variability and change.

Step 2: Bridging the gap between climate forecasters and sector expertise

28. This is the most challenging component of climate service delivery to overcome. The lack of interaction between National Meteorological and Hydrological Services (NMHSs) and their essential partners from national technical departments – agriculture, disaster management, public health planning, etc. – hinders efforts to tailor climate information. There is a necessity of face-to-face dialogue to bridge the gap between forecasters and other sector specific staff. However, the process has to be mediated and pro-actively inserted into efforts to develop climate services for end-users. For the interaction to be sustainable, all major players in the chain of climate services will have to discuss and agree on clearly delineated roles and responsibilities for the production, communication and delivery of climate services for end-users.

Step 3: Co-producing climate services to address end-user climate service needs

29. Localized climate information services in agriculture aim to provide a full range of advice regarding climate, its impacts on crops, livestock, fisheries and management practices to be followed to prevent, reduce and/or manage risks. Thus, it needs to contain details and inputs from agricultural support services/institutions, suppliers, local cooperatives or community-based organizations in order to address farmers' needs and help them to make practical, feasible and relevant decisions.

Step 4: Communicate to reach 'the last mile'

30. It is vital to ensure that the final advisory product is efficiently and effectively communicated. Assessments of delivery channels are necessary to ensure that vulnerable communities and national planners receive the climate support services destined to them. There are many options: rural radio, SMS, voice recorded messages, "agro-met bulletin boards" posted across strategic locations, etc. The format should be suited to local needs. For example, radio alert for farmers should be sent when they are available to hear them, in the local language and timed to inform ongoing farm operations.

Step 5: Assess and re-assess

31. Finally and most important, one needs to keep assessing adherence of provided services to local needs throughout the life span of the climate services program. One cross-cutting issue in the five steps is to keep focus on the needs of the most vulnerable. It is relatively easy to scale up climate services for millions of farmers in a country, but it is quite another to reach the most vulnerable who tend to be resource poor, female and marginalized groups, constrained by the invisible boundaries of

[440] WMO, 2013. Special Bulletin Vol.62-2013

their community's socio-cultural norms. Therefore, it is important to target specifically these sub-groups in the various steps of the design and deliver of the national climate services programs.

Way forward

32. ***Operationalising the PAGASA Modernization Program on agriculture related climate change.*** PAGASA has established an overarching Modernization Program which in turn is based on the PAGASA Modernization Act of 2015[441]. The Modernization Program's objectives specifically aim at upgrading physical infrastructure and equipment, inclusion of climate adaptation in socioeconomic development planning, strengthening of linkages and cooperation among various providers of weather, climate, and water-related information, and providing appropriate mechanisms for this purpose.

33. Although the modernization plan is quite comprehensive and acknowledges the increasing weather and climate information demands of a variety of clients, it does not specifically address how these client needs will be assessed. However, as elaborated earlier (Step 1 and 5 above), understanding the demand side is crucial, especially also in the context of agro-meteorological services. The project aims to fill that gap and will support PAGASA and DA on conducting needs assessments and establishing feed-back mechanisms among the farming community.

34. ***Address key agromet infrastructure needs for weather stations.*** In order to urgently address the gap in needed infrastructure and equipment, the project aims to support the establishment, upgrading or repair of weather stations, especially in those areas which are prone to increased impacts of climate change in form of increased precipitation and floods as well as droughts – See Table H.1 below. Table H.2 shows the distribution of stations across climate change impact regions, with initial roll out in the project regions.

35. An increased number of weather stations will be the backbone for providing more accurate and more localized agro-meteorological services to the farming community and will enhance their adaptive behavior in terms of farming practices.

36. ***Strengthen institutional information flow mechanisms between PGASA and DA.*** In order to address the lack of clear institutional roles and responsibilities and to bridge the gap between climate forecasters and sector expertise, the GCF project will facilitate a dialogue and collaboration between the DA and PAGASA. This will result in a collaborative modus operandi between PAGASA owned and DA-BSWM owned weather stations in terms of operation, maintenance, calibration, and data collection and processing. The agencies, in close partnership through an inter-agency technical working group, will also review and agree on roles, responsibilities and processes in the area of generating and disseminating of weather and climate information plus related agricultural advisory services. They will establish an operational mechanism for co-production of climate information and agrometeorological services. This will avoid duplications and will result in defined channels of communication and information flows, including the "last mile services" to farmers.

37. ***Strengthen technical capacity for operations:*** Last not least the GCF project will address some budgetary resource constraints, especially as far as capacity building measures are required. This will involve training of PAGASA, DA and LGU staff in utilizing weather information for compiling agricultural advisory services, as well as training farmers on how to access and utilize weather information and related agricultural advisories. (Farmer Training will be elaborated under the Extension Chapter)

Weather stations upgrading to agromet functionality cost estimates

38. The tables below summarise the required costs through both government co-financing via the PMP, and from the GCF grant, for equipment, O&M and other costs.

[441] The PAGASA Modernization Act of 2015 (republic Act 10692)

Table H.1 Cost for renewing or upgrading weather stations with co-financing and GCF grant

			Government share through co-financing via PAGASA Modernization Plan					GCF Grant share				
Type of upgrading	**Example locations**	**Estimated number**	**Equipment/ Hardware**	**Operation and Maintenance**	**Other**	**Total**	***average co-financing***	**Equipment/ Hardware**	**Operation and Maintenance**	**Other**	**Total**	***average GCF***
Synop to synop/ agromet	**Iloilo, Leyte, Orental Mindoro, Quezon**	**4**	-	78,382,832.00	-	**78,382,832.00**	*19,595,708.00*	920,000.00	920,000.00	3,200,000.00	**5,040,000.00**	*1,260,000.00*
agromet to agromet synop (by PMP)	**Cagayan-isabela**	**1**	-	15,595,708.00	20,606,292.00	**36,202,000.00**	*36,202,000.00*	-	-	600,000.00	**600,000.00**	*600,000.00*
new synop-agromet (by PMP)	**Banaue-ifugao**	**1**	6,771,500.00	19,595,708.00	-	**26,367,208.00**	*26,367,208.00*	-	-	600,000.00	**600,000.00**	*600,000.00*
new synop (by PMP) to synop/agromet	**Apayao, Camarines Norte**	**2**	13,543,000.00	34,727,116.00	-	**48,270,116.00**	*24,135,058.00*	460,000.00	460,000.00	1,600,000.00	**2,520,000.00**	*1,260,000.00*
Upgrading BSWM AWS to agromet AWS	**Agusan del sur, Kalinga**	**2**	-	-	-	**-**	-	2,117,526.00	529,381.50	1,700,000.00	**4,346,907.50**	*2,173,453.75*
re-opening agromet stations	**Bukidnon, North cotabato-Kabacan**	**2**	-	-	-	**-**	-	5,143,000.00	14,769,744.00	1,600,000.00	**21,512,744.00**	*10,756,372.00*
existing agromet stations	**Camarines sur, Capiz**	**2**	-	11,961,144.00	-	**11,961,144.00**	*5,980,572.00*	-	928,600.00	1,200,000.00	**2,128,600.00**	*1,064,300.00*

existing synop/agromet	**Nueva Ecija**	**1**	-	-	-	**-**	-	-	-	600,000.00	**600,000.00**	*600,000.00*
Calibration equipment and maintenance	General	**1**	25,646,850.00	-	-	**25,646,850.00**	*25,646,850.00*	10,874,160.00	1,812,360.00	-	**10,874,160.00**	*10,874,160.00*
		Total govt PHP	*45,961,350.00*	*160,262,508.00*	*20,606,292.00*	***226,830,150.00***	***total GCF PHP***	*19,514,686.00*	*19,420,085.50*	*11,100,000.00*	***48,222,411.50***	
		total gov USD	*882,457.92*	*3,077,040.15*	*395,640.81*	***4,355,138.88***	***total GCF USD***	*374,681.97*	*372,865.64*	*213,120.00*	***960,667.61***	

Table H.2 Co-financing and GCF grant for upgrading of agromet stations by climate change regions

		Government share through co-financing via PAGASA Modernization Plan (PMP)				**PMP USD**	**GCF Grant share**				**GCF USD**
CC Eco-region	No.	**Equipment/ Hardware (PhP)**	**Operation and Maintenance (PhP)**	**Other (PhP)**	**Total (PhP)**		**Equipment/ Hardware (PhP)**	**Operation and Maintenance (PhP)**	**Other (PhP)**	**Total (PhP)**	
North East Central Luzon	2	-	15,595,708.00	20,606,292.00	36,202,000.00	695,078.40	-	-	1,200,000.00	1,200,000.00	23,040.00
South Luzon Eastern Seaboard	7	6,771,500.00	105,939,684.00	-	112,711,184.00	2,164,054.73	1,150,000.00	2,078,600.00	5,200,000.00	8,428,600.00	161,829.12

Cordillera (upland)	4	13,543,000.00	38,727,116.00	-	52,270,116.00	1,003,586.23	3,860,263.00	7,879,562.75	3,050,000.00	14,789,825.75	283,964.65
Mindanao	3	-	-	-	-	-	6,201,763.00	15,034,434.75	2,450,000.00	23,686,197.75	454,775.00
Average per unit		1,269,656.25	10,016,406.75	1,287,893.25	12,573,956.25	246,548.16	700,751.63	1,562,037.34	743,750.00	3,006,538.97	**58,951.74**

2.8.2 Extension and farmer field schools

Institutional and regulatory landscape

39. Provision of extension services in the Philippines involves several actors and extension service providers. The Agriculture and Fisheries Modernization Act (AFMA)[442] refers to these as the National Extension System for Agriculture and Fisheries (NESAF). NESAF is composed of three major subsystems, namely: National Government Agencies (NGA), including the State Universities and Colleges, Local Government Units (LGUs) and the private sector. The law summarizes four major services that these agencies provide, namely: (a) training, (b) technology demonstration, (c) farm and business advisory, and (d) information, education and communication. Their delineation is also stipulated: LGUs (composed of the provinces, cities and municipalities) provide direct extension services to farmers; NGAs and SUCs capacitate the LGUs to perform such a critical task; and the private sector provides complementary extension services. Overall, ATI is mandated to coordinate all extension services nationwide as the apex agency for extension. As far as the private sector is concerned, the institutional landscape includes a variety of NGOs, Associations, and development agencies such as the "International Institution of Rural Reconstruction" (IIRR), the "Rice Watch and Action Network" (also referred to as "R1"), various church organizations such as the "Mindanao Baptist Rural Life Center", known for its engagement in sloping agricultural land technology, the World Vision Development Foundation, and many more.

40. However, in the absence of a pragmatic policy framework and direction that would unify the NESAF, it was observed that the advisory services provided through multiple actors lacked coherence and did not complement each other. The purpose of establishing a National Extension Agenda and Program (NEAP), spearheaded by the Agricultural Training Institute (ATI), was to address this issue in a consultative way and to provide a clear direction agreeable by all stakeholders. NEAP itself has a strong legal basis (AFMA-IRR Rule 81.11.2 and Rule 81.11.3; EO 366 and EO 388).

41. NEAP provides a strategic framework for extension interventions drawn from identified extension concerns and issues. The framework delineates six thematic programs (strategic goals) which will become the focus of public investments, which, according to AFMA, corresponds to a budget of one percent (1%) of total gross value added (GVA) for agriculture annually. The operationalization of the framework was done through the elaboration of a detailed Agriculture and Fisheries Extension Strategic Plan. The relationship of NEAP with the AFE Strategic Plan is that the former serves as an important input for the latter. The strategic plan is now the entry point by which extension service providers will be able to avail of catalytic finance for collaborative undertakings. It will serve as basis for evaluating priority projects to be proposed by these entities. [443]

42. The strategic goals listed below enumerate the priorities of the AFE in the Philippines for the period 2017-2022[444].

Strategic Goal 1: Enhanced access to AFE knowledge products and services

- 1.1 Maximized/intensified use of high-impact alternative extension modalities to serve a greater number of stakeholders
- 1.2 Developed and widely distributed quality knowledge products
- 1.3 Documented and shared various good agriculture and fishery practices
- 1.4 Developed and managed information systems that provide information/ knowledge on-demand to facilitate decision-making, knowledge sharing and linking producers and consumers to market

[442] Agriculture and Fisheries Modernization Act of 1997 (AFMA)

[443] ATI, 2016. The National Extension Agenda and Programs 2017-2022

[444] ATI, 2016. Philippine Agriculture and Fisheries Extension Strategic Plan 2017-2022

Strategic Goal 2: Strengthened competitiveness and capacities of the AF sector
- 2.1 Professionalized Philippine extension service
- 2.2 Built up competencies of the AFE client system through appropriate and relevant training and education support
- 2.3 Intensified provision of farm and business advisory services
- 2.4 Provided after training support to start-up projects

Strategic Goal 3: Expanded partnerships in advancing excellence in AFE delivery
- 3.1 Strengthened research, development and extension and market linkages
- 3.2 Intensified joint ventures and convergence initiatives between public-public and public-private sectors
- 3.3 Intensified provision of catalytic finance for collaborative undertakings
- 3.4 Enhanced inter-country collaboration

Strategic Goal 4: Scaled-up AFE innovations
- 4.1 Developed new extension modalities, methodologies, and approaches that are fit to the changing extension contexts
- 4.2 Enhanced existing extension models
- 4.3 Developed a cadre of extension innovators
- 4.4 Undertaken extension research

Strategic Goal 5: Strengthened AFE stakeholders' capacity in climate change resilience and disaster risk management
- 5.1 Intensified Provision of Extension Services on Climate Change Mitigation & Adaptation and Disaster Risk Reduction & Management
- 5.2 Strengthened Extension Support on Organic Food Production, Consumption and Food Safety
- 5.3 Increased Awareness on Biodiversity Conservation and Sustainable Development

Strategic Goal 6: Improved enabling environment and quality of governance
- 6.1 Developed and implemented policy, planning, monitoring and evaluation mechanisms for agriculture and fisheries extension to ensure efficiency, effectiveness and transparency
- 6.2 Optimized resource management

43. Each of the above listed objectives is underpinned with actionable initiatives and indicators, which will allow monitoring the implementation progress.

Extension Approaches

44. The Philippine Agriculture and Fisheries Extension Strategic Plan 2017-2022[445] outlines ATI's existing extension approaches, methodologies and tools, as well as its potential for further improvement. Coming a long way from a modified training & visit extension system using a top-down approach, followed by a decentralization of extension services to the Local Government Units (provinces and municipalities), the Philippines have now adopted a more participatory extension approach. Pilots are underway to strengthen further the Provincial level focus on coordination of extension in the country (see box below).

45. Extension methodologies and tools became more diversified and range from face to face visits between farmers and the Municipal Agricultural Officer (MAO), radio programs, e-learning courses[446], Farmers' Contact Centers and Farmers Information and Technology Services Centers (FITS), to mobile phone based information services (e.g. "Rice Crop Manager").

46. The Philippine Agriculture and Fisheries Extension Strategic Plan 2017-2022 under its Strategic Goal 1 (Enhanced Access to Agriculture and Fisheries Extension Knowledge Products and

[445] ATI, 2016. Philippine Agriculture and Fisheries Extension Strategic Plan 2017-2022
[446] http://e-extension.gov.ph/elearning/

Services) especially envisages increased utilization of ICT tools in agricultural advisory services. One of the objectives is to maximize and intensify the use of high-impact alternative extension modalities to serve a greater number of stakeholders.

Box - Pilots on Province-led Agriculture and Fisheries Extension Systems (PAFES)

Starting in 2018, there have been some initiatives on Province-led Agriculture and Fisheries Extension Systems (PAFES) through which the Province aims to become the leading actor in extension, a hub that orchestrates all the different stakeholders (DA, Municipal and City Government Units, State Universities, agencies, private sector, private organizations and community-based organizations) thus synchronizing all the agricultural plans and programs. The province level has economies of scale, can reflect more strategic priorities, but at the same time is closer to the local context. Since 2020 two piloting projects have started in Ilocos Norte and in Apayao, and three more are expected to join (Quezon, Bohol and Davao del Norte).

In Ilocos Norte, PAFES aims to showcase an innovative model of strengthening research-extension-farmer linkages by sharing science-based knowledge and technology from various institutions, building upon the Priority Commodity Investment Plan (PCIP) created under PRDP. This pilot is implemented through a co-financing arrangement between the Provincial Government Unit (80%) and the DA (20% counterpart). It has also a clear agri-enterprise focus, aiming to catalyze the establishment of small and medium scale and the links with markets, through the development of managerial, marketing, financial and entrepreneurial skills.

Many stakeholders support a decentralized extension system and the desire of not go back to a national extension system. Yet they also highlighted a great need of better coordination among extension actors with a technical leadership and a clear setup of roles and responsibilities. The choice of the Province as the focal point is of particular interest and seems to be gaining potential support across different regions. Hoverer, it is recognised that still 2-3 years are needed to prove that PAFES model is successful and ready to upscale. Potential challenges of the upscaling could also arise from the wide economic inequalities among provinces, the setup of the co-financing mechanism or from the lack of long-term support and commitment from the provincial governors. In addition, it is important to keep in mind that agricultural research or market assistance will still be better handled at the national level. The DA will still need to lead the research on new crop varieties or pest management, national and international markets and exports information, and food safety amongst other themes.

Source: Extract based on study DA, World Bank and FAO study on extension in Philippines 2020.

Farmer Field Schools

47. The Philippines has a long history of farmer field schools (FFS). The first steps towards the creation of the IPM farmer field school approach were actually taken in the Philippines with a farmer training programme lasting for five consecutive planting seasons from 1978 through 1980. Philippine rural sociology and community organizing experts, extension officers, and an anthropologist and entomologists from IRRI made up the team that conducted this training programme. This initial farmer training programme was followed by a cadre of officers from the Crop Protection Division of the Bureau of Plant Industry. After 1982, the FAO Inter-Country Programme for Integrated Pest Control in Rice in South and Southeast Asia provided technical and financial support for the training effort. By 1984 about 200 master trainers, 4 500 extension agents and 55 000 farmers had been trained in IPM.[447]

48. Over time various projects in the Philippines have now used FFS and, depending on the farmers' needs as well as the various project's objectives, have adapted the curricula and added or dropped certain training modules. This resulted in a plethora of various names for FFS such as Farmer Business School (FBS), Climate-Resiliency Business School (CRBS), Climate Field School (CFS), and Climate-Resiliency Field Schools (CrFS).

49. The overall objective of the traditional FFS approach in the Philippines has been and still is to increase adoption of improved technologies with the aim to increase farm production, resiliency, and farmers' income. Section 2.7 of Feasibility Study examines the various FFS models as to their relevance and lessons for climate change, summarised here.

50. The FBS model aims to enhance the farmers' capacity in farm business management and market-oriented production to facilitate better market access and increased farm incomes. Farmers become aware of the whole value chain, its actors, its demand in terms of quality and quantity, and how this influences their farm enterprises. They learn how to interact with other value chain actors and stakeholders and how to respond to market opportunities.

51. The CFS and CrFS models aim to enhance the adaptive capacity of small-scale producers to address the negative impacts of climate change and to reduce their vulnerability to climate induced risks and disasters. The CFS models increase farmers' knowledge and understanding of localized weather information and resulting farm advisories.[448] This enables farmers to adjust their cropping calendars, choice of varieties, timing of field operations such as fertilization or application of pesticides, as well as timing their harvests.

FFS Implementation structure

52. The national DA through the national ATI office develops the FFS curriculum. In collaboration with other agencies or bureaus, such as the BSWM, ATI will also compile the training modules. While the national level trainings are rather general, the regional level trainings are much more specific to their region. While the national level sets the curriculum and produces general handouts, the regional level may adapt the curriculum as well as the handouts to meet their region's needs.

[447] http://www.fao.org/docrep/005/ac834e/ac834e04.htm

[448] CIAT, 2018. Feasibility Study on Farmer Field School Approaches and their Use in Scaling Up Climate Change Adaptation in Philippine Agriculture

53. The national ATI office trains the regional ATI trainers in a kind of Training of Trainers (ToT) workshop. Each trainee undergoes a 10-12-day training with ATI and must then facilitate a FFS in the field for one growing season. These “Master Trainers” or “Focal Points” will then train LGU staff (province and municipality) to become FFS facilitators in their areas. This will also last for one season. Finally, the newly trained FFS Facilitators will establish a number of FFS in their municipalities. This means, unless there are already trained and experienced FFS Facilitators at hand, it requires two growing seasons of training (which may equal two years) until the FFS approach can be fully rolled out.

54. ATI experience shows that out of 1 FFS they might get 1-5 potential Local Farmer Technicians (LFT) to continue to work as facilitators for other FFS, under the supervision of FFS Facilitators from the Municipal Agricultural Office. This system will then enable a faster and larger outreach. LFTs are being compensated for their efforts by some incentives. Usually they may receive a kind of honorarium, some small farming equipment, even some chairs and tables for holding the weekly meetings, etc. The national DA office contributes to the funding for these training programs, especially if the FFS implementation supports the strategic objectives of the national commodity programs (e.g. the “rice-program”, the “corn program”, etc.). The national government offices (DA and ATI) may provide incentives to the regional DA offices, LGUs, village leaders and participants for joining the trainings, such as seeds, necessary inputs, and transportation to and from the trainings. However, ultimately it is up to the regional and local levels to commit support and staff for implementation.

Successful pilot projects

55. There are a couple of successful pilot CFS projects in the Philippines (Section 2.7 for detail). The first CFS was established in the Municipality of Dumangas, Iloilo, and was hailed as a big success by the Climate Change Commission. The promotion of Climate Field Schools in the country was in line with the President’s call in his 2017 State of the Nation Address to help farmers cope with the adverse effects of climate change on food production[449]. Other CFS (also called CrFS) implemented by Rice Watch and Action Network (R1) in partnership with the Local Governments of Gerona, Tarlac and Irosin, Sorsogon, non-government organizations and PAGASA in 2011, are also among the most successful pilot projects worth up-scaling.

56. The CrFS model developed by R1 is modeled after the FFS, FBS, and CFS training models. Thus, a lot of the curriculum is adapted from these models and incorporated into the CrFS training models. However, the CrFS curriculum expands upon these by increasingly incorporating “climate-smart agricultural technologies” and livelihoods approaches. In April 2018 there were 50 trained CrFS trainers. These trainers are 1/3 from PAGASA, 1/3 from R1, and 1/3 from other governmental agencies. Due to the flexible nature of the CrFS model, there is also a ‘training resource pool’ from academic experts, Bureau of Fisheries and Aquatic Resources, and PhilRice to conduct needs based training for specific topics. Trainers also receive a two-week training from PAGASA on data collection techniques and interpretations/analysis for localized weather.

57. R1’s CrFS modules promote awareness on climatic factors affecting crops, the use of a variety of climate-friendly and climate resilient farming approaches including diversification, crop rotations and mixed cropping. It also highlights the importance establishing farmers’ organization, and the necessity of crop insurance to shield the farmers from the ravage of changing climate.

58. The main goal of R1’s CrFS is to build and institutionalize Early Warning System (EWS) for Agriculture. A critical component of this EWS in agriculture would be the setting up of the Municipal Climate Information and Monitoring Center. This center will record local weather data, localize and disseminate weather, climate forecast and advisories, liaise with PAGASA and determine their own

[449] http://climate.gov.ph/knowledge-bank/newsroom/press-release/365-ccc-lauds-efforts-of-ph-s-first-climate-field-school-in-dumangas-iloilo

climate change impact thresholds as the center moves towards a more precise, climate-informed, strictly localized municipal climate change adaptation plan.[450]

Challenges and best practices of the FFS

Challenges

- Climate Information Systems: While climate information is increasingly becoming a major priority across all agriculture-related activities in the Philippines, its integration of content and delivery into FFS models is not yet very strong.
- Overall, there is a lack of comprehensive gender-sensitive and socially-inclusive integrations into the national frameworks of the farmer training models.
- Training in production versus business - farmers need training and skills in both areas but do not have the time necessary to complete separate trainings.
- Farmer time and attention can be difficult: timing and specific appropriateness of content and process is important, and also allowing for weather calamities disrupting programs.
- Commitment and continuity in FFS budget and good human resources from DA and LGUs as well as to focus on results of use of budget.

Best practices

- Include Agro-Ecosystem Analysis activity is a very useful part of the traditional FFS model, this can be expanded for different systems and further incorporate climate analysis. Also new modules are important such as use of localised weather forecasts.
- Engage farmers in climate data collection and advisory services as participants and as local researchers to collect data from their farms on climate metrics, using very local tools.
- Promote adaptation of livelihoods not just crop production. Women's needs are better met when the training model takes a livelihood approach to climate-resiliency.
- Integrate production, marketing and climate topics.
- A range of key modules appropriate to FFS and resilience building are listed in box below.
- Choose location, timing to suit learners. Holding training in the village makes it possible for women to participate, and for men times when they are taking rest days and times.
- The training and integration of the Local Farmer Technicians who then diffuse information and technology to other farmers within the village and serve as a trusted local resource, end encourage learning by doing by farmers.
- Use participatory rural appraisal techniques, and feedback mechanisms to improve training and process.
- A best practice of all types of farmer training models has been to serve to create a venue to formally organize farmers, particularly for areas where farmers have not yet organized.
- Strong coordination between implementers and stakeholders, including the regional, provincial, municipal, and barangay offices, is essential to quality delivery and effectiveness of the FFS training model.
- LGU support has been essential for implementing all types of farmer training models across the Philippines, in terms of presence, institutional support, technical staff, and short and longer term budget resources to sustain activities.

Box H.1 Range of FFS Modules for CRA

[450] http://www.r1phils.net/CRFS.html

- Agroecological systems and local farm systems scanning
- Basic agrometeorology

- Where to get data climate information and CRA advisory
- Interpreting weather data
- Adjustment of cropping calendars
- Application of weather info in cropping calendar – immediate
- Indigenous knowledge on climate and CRA

- Selection of suitable varieties
- Mixed cropping and integrated – also minimise losses,
- Sloping areas – SALT and integrated
- Specific practices technologies for certain weather and climate conditions – wind breaks
- Working on soil fertility and organic matters – to improve water holding capacities, and better drainage
- Fertiliser management – in uncertain conditions, increasing efficiency
- Water harvesting systems, water saving methods
- Water management systems – SRI, AWD
- Mechanisation for larger farmers – minimum tillage
- Other equipment, infrastructure – protective greenhouses and other
- Weather proof seed and grain storage

- Using finance and insurance options
- Farm budget for helping to make decision on diversification and integration
- Basic financial literacy for farms and households
- Basic business planning and FBS, basic market scanning

- Sensitize farmers on gender and social inclusion with the use of household methodologies.
- Raise culture awareness and build confidence among the indigenous peoples on IK systems and practices.
- Household livelihoods diversification options
- Integrated farming with livestock – for diversification – often priority for women
- Processing and value addition – to safeguard harvest to address adverse weather

2.8.3 Philippine seed systems in relation to climate resilience

Introduction

59. A key aspect of climate resilient agriculture and of climate change adaptation in agriculture is the choice of varieties. It is important that the seed system provides farmers access to varieties that are:

a) adapted to the forecasted change in climatic characteristics (e.g. higher average temperatures);
b) performing relatively well in adverse weather conditions that may be projected to occur more frequently (e.g. dry spells or flooding as a result of heavy rains); and/or
c) are adapted to climate resilient agricultural practices (e.g. intercropping or changed sowing dates).

60. This section provides an overview of the functioning of the seed system in the Philippines for various crops and to what extent it is ready to provide farmers access to the varieties they need to be able to adapt to climate change. The note is based on a combination of literature research and interviews with farmers and actors in the seed system.

Institutional and regulatory landscape

Formal seed system

Rice

61. The formal seed system is most developed for irrigated rice. Table H.3 summarizes the regulatory functions at each stage of the seed supply chain. All the regulatory functions fall under the various units of the Bureau of Plant Industry (BPI). When new varieties are approved, they are registered with a National Seed Industry Council (NSIC) code, e.g. NSIC Rc222, after which they may be multiplied by accredited seed growers. Seed quality control is assured by a certification system where seed fields are inspected for true to type and final seed quality is tested in laboratories.

62. At the regional level, seed inspectors who control seed movements and inspect seed growers for National Seed Quality and Control Services (NSQCS) may also have other functions. For example, the rice coordinator at DA RFO5 (Bicol) is also a seed inspector.

Table H.3. Formal rice seed system (based on Sombilla and Quilloy, 2014 and mission observations)

Supply chain			Regulatory environment	
Function	**Public supply actors**	**Private supply actors**	**Function**	**Main actors**
Breeding	PhilRice, IRRI, PhilSCat, UPLB	Syngenta, Bayer, Pioneer, Dhaanya Seeds, DevGen, Long Ping, a.o.		
Two-year multi-location yield testing (obligatory	PhilRice	Seed companies (&PhilRice)	**Variety approval for commercial release and registration**	National Seed Industry Council (NSIC) under BPI

for any new variety)			**Certification for breeder right protection**	Plant Variety Protection office (PVPO) under BPI
Foundation seed production	Public: PhilRice branch stations, universities, IRRI	seed companies	**Quality control through Field inspections and lab tests** **(less rigorous for private seed)**	National Seed Quality Control and Services (NSQCS), under Bureau of Plant Industry (BPI)
Registered seed production	SeedNet (78 members): PhilRice branch stations, state universities, cooperatives and NGOs	Seed companies	**Quality control and certification as "registered seed"**	NSQCS
Distribution and sale of registered seeds	PhilRice branch stations (with DA RFOs)	Seed companies	**Inspection and control of movement of seed.**	Plant Quarantine Services (PQS) under BPI
Certified seed production	accredited seed growers (=farmers)	Seed companies & their contracted seed growers (accredited)	**Production targets for public certified seed**	Regional Seed Coordinator at DA RFO
			Seed grower accreditation	BPI
			Seed grower inspections and **Seed certification**	Seed inspectors, NSQCS
Seed transport, distribution and retail	DA-RFOs and LGUs. Seed distribution points of PhilRice branch stations.	Seed wholesalers Seed dealers, input suppliers & direct sales	**Inspection and control of movement of seed.**	Plant Quarantine Services (PQS) under BPI
			Pricing of public hybrid seeds (as of 2014 fixed price)	

63. The irrigated rice seed sector is dominated by the public supply chain. Of all the varieties registered in the period 2009 – 2018, 70% came from public institutions, and only 30% from the private sector, see table H.4. Most varieties in use by small farmers are high-yielding non-hybrid varieties (locally referred to as inbreds) from PhilRice or IRRI.

64. Seed growers produce mainly under contract for DA for the rice banner programme, or for Local Government Unit (LGU) seed distribution programmes. However, the public system suffers from a lack of accredited seed growers. According to seed growers and DA staff in Bicol, seed production is more profitable than production of consumption rice. However, it requires more working capital to cover higher labour and input costs, accreditation and certification costs and a longer cycle before

payment. Furthermore, the production may be eventually rejected, in which case it has to be sold as consumption rice for a lower price. Therefore, they were of the opinion that only relatively richer farmers can afford to become seed growers.

65. In the private supply chain, after due testing and registration of the variety, the seed may also be imported, in which case most of the activities from breeding to seed production occurs outside the Philippines, and BPI checks certification status at import. Sombilla and Quilloy (2014)[451] claim that the private supply chain receives less scrutiny for the regulatory institutions than the public seed supply chain.

Table H.4 Source of rice and corn varieties registered by NSIC in the period 2009 – 2018

	Public	**Private**
Rice	104 inbred 26 hybrid	55 hybrid
Yellow corn	10 OPV	66 hybrid 16 GMO
White corn	10 OPV	9 hybrid
Glutinous corn	6	1

Corn

66. In 2018, The Plant Genetic Resources (PGR) Center opened at Cagayan Valley Integrated Agricultural Research Center (CVIARC) at Isabela. The PGR houses a variety of collections of major and high-value crops for future source of genetic materials for crop improvement. Among its collections are 2,000 native corn varieties out of the Corn Germplasm Utilization through Advance Research and Development (CGUARD) initiative. Initiated in 2015, the CGUARD program aims to collect, conserve, and develop corn germplasm for agronomic response to different environment and physiological stresses including pests and diseases, soil acidity and salinity, soil fertility, drought, and water logging.[452]

67. For *yellow* corn for the feed industry, the CVIARC and the Institute of Plant Breeding at the University of the Philippines Los Baños (UPLB), breed open pollinated varieties. However, yellow corn variety breeding was dominated by the private sector (Bioseed Research Philippines, Monsanto, Pioneer, Syngenta and others) with 66 yellow hybrids and 16 GMO varieties registered over the last ten years.

68. Recently registered white corn varieties included 10 OPVs and from public institutes (CVIARC and University of Southern Mindanao Agriculture Research Centre USMARC) and 9 hybrid from the private sector (B.M. Domingo & Co, Syngenta and others). In addition, there were 7 glutinous corn varieties registered over the same period, of which 6 from the public sector.[453]

[451] Sombilla, M.A. & Quilloy, K. 2014. Strengthening the Philippine Rice Seed System. ReSAKKS Asia Policy Note 10. IFPRI.
[452] https://www.philstar.com/business/agriculture/2018/05/27/1818875/plant-genetic-resources-center-opens-isabela
[453] www.nseedcouncil.bpinsicpvpo.com.ph/downloadables/nsic-cornsorghum.xlsx

69. The DA corn banner programme covers both white and yellow corn and mainly distributes OPV varieties from the public sector, but sometimes also hybrids purchased from seed companies[454] [455]. However, as the corn programme is smaller than the rice programme[456], it reaches far fewer farmers with subsidized seed[457]. Consequently, most farmers buy commercial seeds in the market or save their own seed. MASIPAG (2013) estimated that in 2011 43% of area was sown with hybrids, 26% with modern OPVs and 23% with native OPVs.[458] As saving own seeds from hybrids gives bad results, it can be assumed a high percentage of the hybrid acreage is sown with purchased seeds.

Vegetables

70. The vegetable seed sector is completely dominated by the private supply chain. The regulatory system is however the same, with the various services of BPI inspecting the private actors. Registered vegetable varieties will still get an NSIC code, but are sold by the private seed companies such as East-West Seeds and Condor under their own brand names. Subsidized seeds are also distributed under the DA High Value Crops Development Program (aka HVC banner program) or LGU support programs, which are procured from the private sector, e.g. input shops or seed dealers in the region.

Coconut and other perennial crops

71. The Philippines Coconut Authority (PCA) has a varietal improvement programme at its research centres in Albay, Davao and Zamboanga. However, as a perennial crop, the breeding cycle is naturally very long, and so far 28 varieties have been registered, both tall and dwarf.

72. PCA collects an Accreditation Fee on Coconut Seednuts/Seedlings Producers[459]. However, the main demand for certified seedlings comes from the PCA itself, although PCA contractors do sub-contract to smaller suppliers. The formal (certified) private sector seedling supply chain thus consists mainly of the sales of surplus production from PCA contracts.

73. For cocoa, varieties registered since 2009 originated from UPLB, the Philippines Industrial Crops Institute (PICRI) at the University of Southern Mindanao (USM) or large farmer cooperatives. BPI has accredited cocoa nurseries for the production of certified seedlings. As with coconut, most certified seedlings are produced for government funded seedling distribution programmes.

74. For coffee, all varieties registered since 2009 originated from Nestlé, whereas older registrations were mostly from BPI. As with cocoa, BPI has accredited coffee nurseries for the production of certified seedlings.

Informal seed system

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[454] Corn program of RFO 6 Western Visayas in 2014 includes an OPV Seed Subsidy Program for marginal farmers: http://rfu6.da.gov.ph/corn-program/; ARMM corn program does support OPV seed production. http://dafarmm.da.gov.ph/corn-program/;

[455] https://drive.google.com/drive/folders/1mJIOf3A4SinI0FHyE1ToP9YKxIETeIFs

[456] Note the difference in RFO 12 budget in 2016 for production support for rice at 143,000 peso against only 1,700 peso for white corn.

[457] E.g. the corn road map for DA-RFO 12 planned to provide production support for 15-25 ha per year, whereas the total area planted in the region is around 130,000ha.
http://rfu12.da.gov.ph/index.php/programs-projects/corn
DA-RFO 3 corn program deals as much with cassava as it deals with corn, and includes no seed distribution for corn at all. http://rfo3.da.gov.ph/corn-program/

[458] Magsasaka at Siyentipiko para sa Pag-unlad ng Agrikultura (MASIPAG). 2013. Socio-economic Impacts of genetically Modified Corn in the Philippines.

[459] http://pca.da.gov.ph/pdf/disclosure/manualofoperations2016.pdf

75. When farmers cannot afford to buy certified seed and do not benefit from free or subsidized distribution by DA or LGUs, they resort to the informal seed system. This is mainly seed they have saved themselves or which they exchange with other farmers. This is common for white corn and coconut.

76. The term "good seed" is often used for own saved seed, especially if they are of improved varieties (i.e. registered high yielding inbred/OPV varieties). However, according to RFO5 DA staff, farmers who use their own saved seed did not receive any training on seed selection, handling and storage for their own saved seed.

77. For heirloom rice and for "small crops" like Pili nuts, indigenous vegetables etc. no varieties have been officially registered with NSIC and therefore, no certified seeds exist (not in the public nor in the private sector). Thus, farmers have no choice than to rely on the informal seed system, which, apart from own saved seed, may also include non-certified seed sold by non-accredited sellers.

Improved informal and semi-formal seed systems

78. For potato there exists an improved informal system, or semi-formal system. The Northern Philippines Root Crops Research and Training Center (NPRCRTC) at the Benguet State University has bred the Igorota variety which is popular for processing and by 2016 covered around 70 % of the total highland potato production area of 11,000 ha in the Philippines.[460] With the International Potato Centre (CIP) they have trained potato farmers in seed multiplication, with positive and negative selection. Thus, now farmers buy only a small amount of seed from the university, which they multiply themselves. They need to replace their seed stock only every 3 to 7 years, depending on disease pressures in their fields (C. Kiswa, NPRCRTC, personal communication).

79. Also for rice there have been similar initiatives towards semi-formal community based seed systems for native varieties. In 1992, the Southeast Asia Regional Initiatives for Community Empowerment (SEARICE) set up the Community-based Native Seeds Research Centre (CONSERVE) as a non-profit organization. Its flagship programme involved the conservation and development of crop genetic resources at the community level – including collection, conservation, research, development and utilization of these resources in partnership with farmers. CONSERVE initiated the first community seed bank in the Philippines.[461]

80. The IFAD funded IRRI-CURE project[462], with support from PhilRice, University of Southern Mindanao, Municipal Agricultural Office (MAO) and LGU, established a Community-Based Seed System in Cotabato (Mindanao). The Arakan Community Seed Bank Organization (ACSBO) multiplies both traditional as well as modern upland varieties.

81. In 2014, DA-RFO-1 (Iloco) started a Community Seed Bank project for farmers living in a marginalized community, who have no access and cannot afford to buy quality seeds and were not

[460] Chien at al. 2016. American Journal of Potato Research 93(3) https://www.researchgate.net/publication/296623252_The_Adoption_of_Cv_Igorota_in_the_Philippines_and_Vietnam

[461] Diversifood. 2018. Community Seed Banks: Sharing Experiences From North And South. Report from a side event held 1 November 2017, during the seventh session of the governing body of the international treaty on plant genetic resources for food and agriculture in Kigali, Rwanda.
See also Regine Andersen, Terresita Borromeo and Nestor Altoveros (2013) 'A community registry in the Philippines' in: Regine Andersen and Tone Winge (eds). Realising Farmers' Rights to Crop Genetic Resources – Success Stories and Best Practices, Abingdon: Routledge, p. 83.
18 - Republished as paperback in 2017

[462] IFAD 2014 Moving Up Innovations to Scale, page 53-62: Community-Based Seed Systems: Improving Access to Quality seeds.

able to get intervention from the current formal seed system.[463] The project was to be managed by the Irrigators Associations, Farmers Organizations or Non-Government Organizations. Registered seed would be provided as starter seeds while training assistance would be provided to them along with the provision of seed storage facilities, harvest and post-harvest equipment.

82. In 2018, the DA launched the Farmers' Production and Exchange of High Quality Inbred Rice Seeds or Seed Exchange programme (SEEDEX). Through an informal farmer production and exchange system, the project is designed to facilitate rice farmers to shift to high-quality seeds and highlight advantages of using high-quality seeds. It will be implemented in various rice-producing provinces of all the 16 regions in the country, except in provinces prioritized for hybrid rice production.[464]

Farmers access to quality seed

Rice

83. For irrigated and rainfed rice, most smallholder farmers tend to rely completely on government hand-outs for certified seeds, and do not buy seed in the market. In years that they are not beneficiary of one of the seed distribution programmes, they will rely on own saved seed.

84. From interviews in Bicol, it appears that not all farmers have equal access to subsidized seed distribution. Formal selection criteria stipulate that farmers have to be registered in RSBSA, or in DA farmer registration, and sometimes they favour organized farmers. When selection involves LGUs, in LGUs where PAOs and MAOs are political appointees, farmer selection may also be politically motivated. In addition, more remote farmers are usually less served, for practical logistical and budgetary reasons.

85. The choice of varieties in the rice seed support programmes depends on farmer preference and availability. LGUs and DA claim to consult farmers on their preferences, but when contracting seed growers, they also depend on the availability of foundation seeds from the local PhilRice branch. But the PhilRice production of foundation seed is also influenced by the DA requests and farmer preferences. According to a seed grower in Bicol, a few years ago PhilRice conducted some farmer consultations there.

86. However, in DA-RFOs requests for bids they do not specify the variety but only indicate the agronomic specifics or characteristics. If the RFOs do not know how to properly describe their preferred varieties, they may have to accept a lowest bidder who is producing another variety than preferred. Unfortunately this still happens in many regions, but some regions like Central Luzon and Bicol have done exceptionally well in limiting qualified bids according to specifications.[465]

87. In 2018, PhilRice studied what were the most popular and best performing modern varieties, taking into account data from farmers' participatory trials under the "*Accelerating the development and adoption of next-generation rice varieties for major ecosystems in the Philippines*", known as the Next-Gen project, the National Cooperative Test results, production data based on the seed system workshop, farmers' preferences based on the report of the regional seed coordinators, and value chain analysis survey.[466]

88. The resulting top 5 (top 3 national + 2 local) has been used by DA Central to issue general guidelines for the preferred varieties that has helped regions with the technical specifications for their bidding process. In Bicol, many RFO staff though talked about the top 5 as being the only varieties allowed to be procured for the seed subsidy program.

[463] See web-article: http://ilocos.da.gov.ph/index.php/programs/rice
[464] http://www.pna.gov.ph/articles/1035635
[465] Information provided by the focal person for the rice program in DA Central, 5 March 2019.
[466] http://www.philrice.gov.ph/top-5-popular-rice-varieties/

89. Despite the dominance of the subsidized seed distribution by government programmes, in Bicol there is still a market for the sale of certified rice seed, as demonstrated by AB Seeds. Since 9 years, AB Seeds has a small chain of shops in Camarines Sur that only sell rice seeds. There are thus commercial or peri-urban farmers who are not selected as beneficiaries for the government programmes but who can afford to buy quality seeds.

90. Part of this market demand may also come from farmer cooperatives, such as the Camsur multipurpose cooperative, that purchase inputs in bulk and provide them on credit to their members, after which they subtract the loan amount from the payment when purchasing the harvest from their members (A. Panerio, CamSur MPC, and M. A. Carbonell, Ambos MPC, personal communication). So called "trade financiers" have the same function[467]. Some of the thus privately traded seed may be non-certified.

Other crops

91. For potato there are only two popular varieties, *Igorota* for processing, which is produced locally and *Granola* for table potatoes, for which farmers buy imported seed potatoes. Other varieties bred by the Benguet university have not been accepted by the market.

92. Regarding coconut, the PCA Accelerated Coconut Planting & Replanting Program (ACPRP) promotes coconut planting in suitable areas and replanting of unproductive trees and those damaged by natural calamities, using farmer's preferred variety sourced within the locality.[468] Despite this support, some farmers are cutting down coconut farms to replace them with other crops, due to the current low copra prices. In 2017 PCA announced scaling up commercial production of coconut hybrid seedlings, with PCA technicians supervising hand pollination with pollen supplied by PCA at the participating farms. All certified hybrid seedlings will be purchased by PCA for redistribution to other farmers.[469]

93. Most commercial cacao farmers purchase planting materials from nurseries while smallholder farmers commonly produce their own seedling.[470]

94. According to the Bureau of Soil and Water Management, the DA and Nestlé collaborate under the National Convergence Initiative for Sustainable Rural Development (NCI-SRD) and by 2017 Nestlé had delivered over ten million seedlings and over 30,000 farmers and 5,000 partners have received trainings and technical assistance in support to PCA's Coconut-Coffee-Based Enterprise Development (COCOBED) project.[471] That means they would have reached about 11% of the total 275,681 coffee farms and added significantly to the total number of coffee tree, which was estimated at 79.4 million trees in 2015.[472]

95. As already mentioned above, for some crops or varieties there are no certified seeds available. For example, corn farmers in Bicol who want to plant upland rice in rotation cannot find seed of upland varieties.

[467] CIAT Stakeholders Workshop, CAR, 2018 (CIAT Luzon paper)

[468] http://www.pca.da.gov.ph/index.php/2015-10-23-06-25-48/programs

[469] https://business.mb.com.ph/2018/10/27/a-wee-bit-of-good-news-about-coconut-for-a-change/

[470] CIAT report Mindanao

[471] http://www.bswm.da.gov.ph/news/0065/da-nci-set-to-stabilize-coffee-farming-in-the-philippines

[472] 2017-2022 Philippine Coffee Industry Roadmap http://bpi.da.gov.ph/bpi/images/PDF_file/Coffee%20Industry%20Roadmap%20-%20Signed%20%20%20March%2010,%202017.pdf

The seed system in relation to agromet information and climate change adaptation

96. One aspect of climate resilient agricultural practices is the use varieties that are adapted to the changing climate. A climate resilient seed system will therefore:

- breed varieties that are adapted to forecasted climatic conditions
- inform the seed sector when and where these varieties may be needed, so that they can adapt multiplication and distribution programmes accordingly
- inform extension agents and farmers about variety characteristics and under which climatic conditions they perform better than other varieties

Rice

97. For rice, PhilRice already has bred a range of varieties that are adaptable to abiotic stress conditions. In 2012 NSIC published the second edition of a catalogue of these varieties, and is now planning a new update[473]. The catalogue contains varieties suitable for: a) drought prone rainfed lowland; b) rainfed lowland dry seeded; c) saline prone areas; d) flood prone areas (only 1); e) tungro hot spot areas; and f) cool elevated areas.

98. The DA recommended top 7 per region do not include any of these varieties. However, for specific situations, the regional office may distribute specific varieties for specific conditions. For example, in Bicol the RFO may supply a saline tolerant variety for fields suffering from seawater intrusion.

99. Nevertheless, the current focus on top varieties narrows the range of varieties available to farmers, thereby also narrowing their options to adapt to climate change. For example, farmers at the tail end of the irrigation system are the first to suffer from water scarcity during prolonged droughts. Other variations within a region, such as rainfed conditions, salinity, different soil types etc., will also all be impacted differently by climate change. Therefore, 7 varieties per region provide a too limited a choice for climate change adaptation, if not already for current conditions.

100. The current centrally organized contracting and distribution of subsidized seed makes it difficult to include many different varieties and to tailor varieties to individual farmers' agro-ecological conditions. A voucher system, whereby beneficiary farmers receive a voucher with which they may "purchase" seed directly at accredited seed suppliers, would make a free choice possible. DA would no longer need to plan which varieties to procure and distribute. Instead, seed shops and seed grower associations would need to estimate for which varieties there is demand. Farmers will try to purchase their preferred varieties and if not available opt for their second best choice. It would save DA transport expenses for seed purchases and distribution.

Other crops

101. Breeders' description of varietal characteristics and farmers judgement do not always correspond. For example, early fruiting and high yielding dwarf coconut variety Tacunan is being promoted by PCA to endure strong winds in typhoon prone areas.[474] However, farmers in Bicol consistently rated them more typhoon prone due to a shallower root system than native late fruiting tall varieties.

102. According to a representative of East-West Seed Int. Ltd., in the two-year multi-location trials for vegetables, performance results are not linked to actual weather conditions during these trials. Results are only analysed per season (dry and wet season). For potato, as the farmers' fields in which trials are conducted are too far from weather stations, the university uses their own mobile sensors, but these have limited measurements compared to weather stations.

[473] http://www.nseedcouncil.bpinsicpvpo.com.ph/downloadables/ccvar2012-2nd.pdf
[474] http://www.pca.da.gov.ph/pdf/techno/tacunan.pdf

103. This means it is difficult to judge how well these varieties are adapted to forecast climate change impacts. For more information about how varieties respond to conditions such as higher average temperatures, more extremely hot days, dry spells, heavy rains or high wind speeds, it would be useful to collect and analyse more weather data during these trials.

104. In addition, assessment of variety resistance to drought, flood, high or low temperature will have interactions with soil type. To evaluate that properly, more trials are needed than the minimum required for varietal registration.

Limits to seed system responsiveness

105. Of course there is a limit in how precisely and how quickly the seed system can adapt to changing climate conditions. For example, if an El Niño related drought forecast is now provided and PhilRice immediately shifts some of its foundation seed production to more drought tolerant varieties, these would reach the seed growers 6 months later and the farmers one year later. Whereas El Niño forecasts are typically made less than 6 months before onset, as according to WMO, forecasts going through the March-June period have lower confidence than those made in the second half of the year [475].

106. Whereas research institutes and seed companies will maintain low levels of foundation seed stock for every variety, it would be too expensive to produce high volumes of drought tolerant varieties that may be in high demand only once in every 2 to 7 years, and without knowing when this demand will occur. Thus, it will be impossible for the seed system to react in time on an El Niño warning.

107. For forecasted climate change impacts, such as a higher frequency of longer dry spells, heavy rains causing flooding, or more severe typhoons, it will be even more difficult to assess when it will make sense for farmers to plant another than usual variety which may produce slightly less in “normal conditions”, but would perform better during such stress conditions. And thus near impossible to decide when it will be time for the seed system to start producing more foundation and registered seeds for those adapted varieties. The search will be for varieties that are both high yielding under normal conditions ànd still performing reasonably well under these stress conditions.

108. For farmers planting perennial crops now, it would be important to know the forecasts about the expected climatic conditions in 5 to 20 years, to be able to plant varieties that are well adapted to these conditions. As most of the seedlings are provided though government subsidized, these programmes should be informed of the same, and plan for the best varietal characteristics – location combinations. However, most varietal characteristics information currently focus on pest and disease resistance and marketable qualities, rather than suitability for certain climatic conditions.

109. Strategic areas for improvement to increase the seed system’s responsive capacity to climate change:

- evaluate new varieties more extensively in terms of their response to specific weather conditions during trials, and include weather-related performance characteristics in variety catalogue descriptions
- improved coordination between research, DA-RFOs, PAGASA, seed multipliers and farmer representatives to discuss how the seed system can better respond to farmers’ needs in relation to climate change.
- ensure flexibility in seed subsidy programmes for greater varietal diversity and to allow farmers to adopt varieties adapted to climate change.

[475] https://public.wmo.int/en/media/news/el-ni%C3%B1o-la-ni%C3%B1a-update-june-2018

2.8.4 Agriculture lending and insurance

Introduction

110. Clearly for adaptation options to be made accessible even if the calculated or demonstrated returns are positive, farmers and fishers may face initial investment hurdles in terms of credit. Or they may be risk averse if insurance instruments are not accessible or appropriate to replace damages and losses from climatic events. Often credit and insurance are linked. Apart from its role in facilitating climate change adaptation investments, insurance is, by its nature, also a direct tool to increase climate change resilience. This note is based on FAO GCF team consultations with credit and insurance actors and farmers in the Philippines.

Access to credit for adoption of climate resilient agriculture

Overview of credit sources and products

Formal financing institutions

111. Access to agriculture credit financing in the Philippines is limited, particularly for vulnerable farmers. In a 2014 report, the Agricultural Credit Policy Council (ACPC) estimated credit demand for priority commodities of the Department of Agriculture (DA) to be almost PHP 522 billion (USD 11.31 billion) but the amount supplied by banks for production of these commodities in the same year was only PHP 158 billion (USD 3.42 billion), leaving a credit gap of PHP 364 billion (USD 7.88 billion).[476] This lack of access to credit prevents vulnerable farmers and fisherfolks to invest and increase the resilience of their farming activities, for instance, by building climate-proof infrastructure, by opting for climate-resilient farming practices and inputs, or by diversifying their production.

112. The DA, in collaboration with DAR, offers various financial and risk-transfer products to vulnerable farmers and fisherfolks including credit, insurance, and guarantee funds. These products are offered through the Agricultural Credit Policy Council (ACPC) the Philippine Crop Insurance Corporation (PCIC) and the Agriculture Guarantee Fund Pool (AGFP), which are institutions of the DA.

113. To incentivize financial institutions to lend more to farmers, the AGFP provides a 85% guarantee cover on agricultural production loans granted by accredited private financing institutions and other lending entities against all types of risks of non-repayment by farmer-borrowers. AGFP extended P5.21 billion coverage for 105,007 beneficiaries in 2015.

114. The ACPC and PCIC use other institutions as conduit for their products and services, notably the Land Bank of the Philippines (hereinafter referred to as Land Bank), rural and thrift banks, and micro-finance institutions (MFIs) to enhance access to finance of the vulnerable communities. Of these MFIs, the Centre for Agriculture and Rural Development (CARD) is the largest with 1.8 million clients.[477] Land Bank has also a range of regular credit products not subsidized through ACPC. Appendix 1 provides an overview of ACPC and Land Bank credit products.

115. Some of ACPC lending products have low annual interest rate (ex: 6% - 15%) and flexible repayments modalities. Through its new Production Loan Easy Access (PLEA) range of products, it is actively seeking to increase the use of rural-based MFI and cooperatives as conduits. Smaller conduits

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[476] Agricultural Credit Policy Council (ACPC). 2016. Celebrating 30 years of bringing credit closer to poor farmers and fisherfolk. Paper presented at the ACPC-APRACA Policy Forum on Microinsurance and Microbanking, and ACPC's 30th Anniversary Celebration, 28-29 April 2016. Quezon City, Philippines.

[477] https://www.ifc.org/wps/wcm/connect/news_ext_content/ifc_external_corporate_site/news+and+events/news/philippines+crop+insurance+helps+farmers+when+typhoon+strikes

such as multi-purpose cooperatives may provide their farmers in-kind input loans, buying the inputs in bulk, and recovering the loans through deductions from the price paid for the harvest, as they also act as buyer.

116. Land Bank offers both wholesale loans to farmer cooperatives and associations as well as loans to individual farmers. According to a lending officer in Bicol, for direct loans to individual farmers, Land Bank is increasingly strict on collateral requirements, after many farmers were not able to pay back their loans due to typhoons or other reasons, despite pre-screening by and coordination with Irrigators Associations. It is thus mainly through wholesale loans that it is trying to reach small farmers.

117. As of 2020, there are currently 36 state-funded credit programs dedicated to the agriculture and fisheries sector. Fifteen (15) of these programmes are being administered by DA and its attached agencies, namely, the ACPC, the Bureau of Fisheries and Aquatic Resources (BFAR), the National Tobacco Administration (NTA), and the Sugar Regulatory Administration (SRA) while two (2) programs are overseen by the Department of Agrarian Reform (DAR). Land Bank has 17 credit facilities available to crop farmers, livestock and poultry raisers, fishers, and agricultural entrepreneurs while the Development Bank of the Philippines (DBP) implements two (2) credit windows for agribusinesses and agriculture entrepreneurs (DA and ACPC 'The state of agricultural finance, 2020' see Appendix 2.8.1.

118. The SURE product is relatively new and its implementation is confined to areas officially declared under a state of calamity. In its first year of operation (2017) SURE has provided approximately 65M PHP (1,3M USD) in recovery loans to farmers. By 2018 it had reached 7,429 small farmers.

119. The Climate Change Adaptation Financing Program - CCAFP is specifically geared towards investing in climate resilience, however, the funds allocated to CCAFP (150 PHP or 3M USD) have been put on hold due to low disbursement[478]. For funding climate change adaptation initiatives, ACPC is waiting for the AMIA project to identify projects for funding[479].

120. In 2020, five (5) new credit facilities were launched by ACPC and LANDBANK. ACPC started three (3) financing programs: a) Kapital Access for Young Agripreneurs (KAYA); b) Agri-Negosyo (ANYO); and c) Expanded SURE-Aid and Recovery (SURE COVID-19). SURE COVID-19 is intended to provide loans to small farmers and fisherfolk (SFF) whose incomes were affected by the enhanced community quarantine (ECQ) due to COVID-19 pandemic. KAYA is ACPC's initiative to encourage the youth, above 18 to 30 years of age, to go into farming and agribusiness while ANYO is intended for SFF, SFF organizations and micro and small enterprises (MSEs) engaged in agriculture and fisheries food production, delivery of products, and other supply chain activities to ensure the availability of food supply in the country. Land Bank opened two (2) credit windows: a) Rural Agro-Industrial Partnership for Inclusive Development (RAPID Growth) Credit Facility, a tie-up project with the Department of Trade and Industry (DTI); and b) Commercial Fishing Vessel Financing Program intended for commercial fishing operators. RAPID Growth aims to upgrade agri-based micro, small and medium enterprises (MSMEs) to create a sustainable market demand for the output of specific agricultural farmers (see Appendix 2.8.1).

121. According to DA and ACPC, loan demand from small farmers is projected to grow by more than 30% over 5 years: from PHP 148 billion in 2019 to 194 billion PHP in 2024 on the low estimate, and from PHP 318 billion to 416 billion on the high estimate (see Appendix 2.8.1)

Informal lenders and value chain actors

122. Apart from formal credit, farmers make regularly use of other sources to obtain loans. They can get production loans from local traders, so-called "trade financiers", which they have to pay back in-kind with their harvest. Although there is no official interest rate set, interest is charged nonetheless

[478] Data provided during a consultation with Ramon Yedra, Deputy Executive Director of ACPC, December 4 2017.

[479] Information provided during a consultation with Jocelyn Badiola, Executive Director of ACPC, January 29 2019.

as these traders offer lower prices for the produce they buy than so-called “guerrilla traders”, who have no outstanding loans with them. Local traders avoid such side-selling by not extending loans to farmers who have not repaid their loan from the previous season and the farmers feel even obliged to sell additional volume to them.[480]

123. When farmers face liquidity problems during the season, they may ask family, or request an advance from buyers. The latter risks they receive a price that is lower than the actual market price at the time they are effectively providing the product to the buyer. However, this is preferred over the “*5-6*” moneylenders, so called because when you borrow 5 pesos you have to pay back 6. Their effective interest rates may vary from the 20% implicit in their name; Capacio et al. report moneylenders charging 25% every 4 months. As these rates are considerably higher than other sources of credit, farmers use these moneylenders only as a last resort.

Barriers to uptake of credit

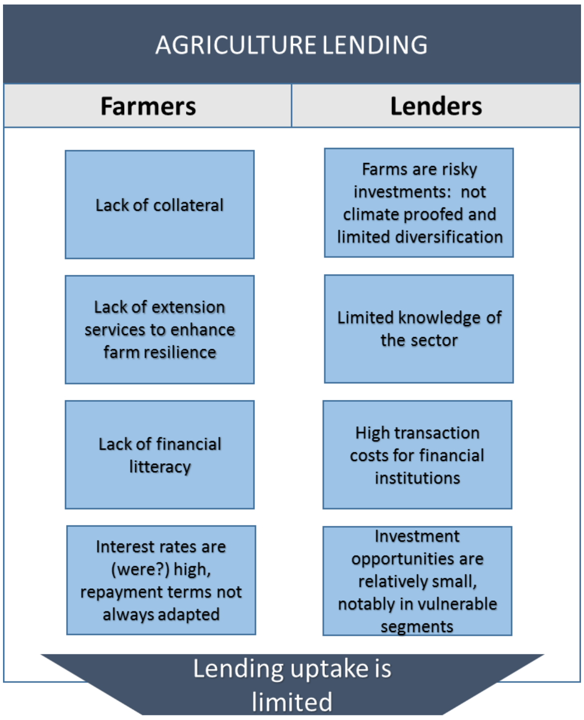
124. In the consultations leading to the preparation of this note, stakeholders mentioned several issues to explain the low credit intake by farmers and fisher folks, including:

1) the high risks that farming represents for financing institutions, which are accentuated by the intensity, frequency and uncertainty (of patterns and trends) of extreme weather events in the Philippines;
2) the lack of financial literacy of farmers who do not understand well the type of lending products available;
3) the limited knowledge about the farming sector and its business opportunities by financial institutions;
4) farmers’ perception that they may not have the required collateral or steady cash flow to receive and repay a loan;
5) the limited presence of coop banks/rural banks and micro-finance institutions (MFIs) in remote rural areas. There are 552 municipalities (34%) without any banking office, of which 108 (92%) in ARMM, 95 (66%) in Eastern Visayas, 44 (61%) in Zamboanga Peninsula and 46 (60%) in CAR[481];
6) the high transaction costs for financial institutions and farmers, particularly for small/micro-loans, also due to the small scale and often high dispersion of individual farms ;
7) the relatively small-size of the business opportunity per farm (since loans are sought mainly to cover production inputs);
8) the lack of technical assistance to increase the productivity and resilience of farming, which could reduce risks for financial institutions; and
9) the lack of appropriate insurance products to insure agriculture loans.

125. The following figure summarizes some of the key issues related to agriculture credit lending:

[480] Capacio et al. 2018 Breaking barriers …

[481] Bangko Sentral ng Pilipinas. 2018. Unbanked Cities and Municipalities in the Philippines. http://www.bsp.gov.ph/banking/unbanked.pdf and DILG. 2018. Regional summary; number of provinces, cities, municipalities and barangays, by region as of September 30,2018 https://dilg.gov.ph/PDF_File/factsfigures/dilg-facts-figures-20181016_3707d7278c.pdf



Strategic areas for improvements in agriculture credit in support of climate change adaptation

126. These issues suggest that low loan intake in the agriculture sector may be broadly explained by an incomplete or inappropriate marketing of lending products to farmers, a lack of sector understanding by financial institutions, and a high risk factor (real or perceived) for financial institutions to enter the business. As such, creating new lending products or increasing the amount of lending capital available would unlikely solve the problem of low loan intake in the agriculture sector.

127. A few modifications to existing products could help nonetheless, including ensuring that repayment loan terms align with harvesting cycles. Also, increasing AGFP's coverage to provide additional guarantee funds to financial institutions could unlock untapped capital.

128. Still, stakeholders broadly believe that **reducing on-farm risks** through technical assistance and investments that improve productivity, generate steady yields, increase farm resilience to climate risks, climate shielding investments, early warning information and seasonal forecasts, etc. would trigger a greater credit intake by reducing the lending risks faced by financial institutions.

129. Also, **increasing the financial literacy** of farmers by making them aware of available lending products and of the investment opportunities available for their farms, by supporting them in packaging bankable investments to secure loans, by assisting them to maintain a good borrowing record, is essential.

130. Finally, increasing **the role and enhancing the knowledge and capacity of financial institutions in geographic proximity to farmers** (rural/coop banks, as well as MFIs) is deemed essential to increase lending to the agricultural sector in the Philippines, particularly to increase the lending agriculture portfolio of private financial institutions. Strengthening their understanding of the

sector and its risks, showing them how farm risk can be reduced through technical assistance and targeted investments, and supporting partnerships between financial institutions and industry actors along the value-chain can all contribute to enhancing their interest and ultimately, loan portfolio to the sector.

131. Indeed, ACPC is trying to do just that with its PLEA products, also providing technical assistance to new conduits. By **2018** it had reached 33,000 farmers, of which 54% were first time borrowers. It reached 10% of the unbanked municipalities. As of December 2018, the programme registered a repayment rate of 91%, down from 97% in September 2018, due to the impact of Typhoons Ompong and Usman.

132. Interviewed multi-purpose farmers' cooperatives that recently became a conduit for ACPC PLEA loans are learning by doing, but have the advantage that they know their members very well, and as they also purchase the produce, have a high recovery rate. However, with their limited geographic reach, such cooperatives are vulnerable to climatic extreme events, which may easily affect their entire loan portfolio. Even if these loans are insured, delays in claim processing (see next section) would cause an acute liquidity crisis for such cooperatives.

Access to insurance

Overview of insurance in agriculture

PCIC products

133. Agriculture insurance in the Philippines faces a similar low intake challenge. It is provided almost exclusively by PCIC, a government owned and controlled corporation under the Department of Agriculture. Appendix 2 provides an overview of PCIC crop and non-crop insurance products.

134. Crop insurance products insure –among others - against losses due to natural disasters. As climate change projections forecast more extreme weather events, they are thus a tool for increasing climate change resilience. The Weather Adverse Rice Areas (WARA) special program also refers explicitly to climate change (see box 1).

135. Insurance premiums are highly subsidized and intake is low. Although it is possible to buy crop insurance also if a farmer does not avail of a loan, in practice, most insurance uptake is linked to loan products. That is because many loan products (see appendix 1) require PCIC insurance. These products mainly protect credit providers against defaults on loans as a result of natural disasters, although farmers can optionally increase the insured amount with 20%, in which case they would also receive a pay-out after such a calamity.

Box 1. DA- Weather Adverse Rice Areas program (WARA) (Source: Reyes et al. 2015)

The WARA special program aims to provide crop insurance subsidy to rice farmers in flood-prone areas to mitigate losses that may be incurred due to the effect of climate change. DA-RFOs are required to provide a masterlist of farmers in flood-

136. When not obligatory to obtain a loan, there are many barriers for uptake. In 2015, about 1.12 million farmers were insured by PCIC, representing only about 11% of the total farmers registered in the RSBSA. The percentage of farmers who have availed of PCIC insurance has increased to 15% in 2018.[482]

137. However, most of the growth in uptake is for special program insurance products with 100% subsidy for the insurance premium. In 2017 a total of 1,699,871 farmers and fisherfolk were insured

[482] Data provided during a consultation with Atty. Jovy Bernabe, PCIC president, February 6, 2019.

of which 1,107,631 (65%) under the special programs. Total claims paid amounted to P1.5 billion, of which P1.2 billion under the special programs.[483]

138. To increase insurance uptake, the provincial governments of Isabela (since 2010) and Cebu (since 2011) co-subsidized the regular program rice and corn insurance premium using the local disaster risk reduction and management fund, resulting in a 100% subsidized premium for the farmers. Since 2011, Negros Occidental provincial government assisted farmers with an interest-free loan to pay the premium. Such arrangements received interest and by 2016, 14 local government units had a partnership with PCIC, with various modalities.[484]

139. Under the AMIA villages project in Pamplona municipality in Bicol, a promotion campaign persuaded massive enrolment in crop insurance (for the entire municipality, not only the AMIA barangay).

Agriculture micro-insurance from other insurance providers

140. With a view to increase the resilience of the country's agriculture sector in the face of climate change and extreme weather events, the Department of Finance in 2015 issued a letter on the adoption and implementation of agriculture micro-insurance framework. Its vision is to promote the provision of agriculture micro-insurance products, with the PCIC to assist in product development and to provide training to micro-insurance providers and act as aggregator of risks and/or as reinsurer.[485]

141. Cooperative insurance societies (CIS) and the Micro-insurance Mutual Benefit Associations (MBAs) are thus encouraged to add agricultural products to their micro-insurance portfolio. The first to do so was the CARD Pioneer Micro Insurance Inc. (CPMI), a joint venture between CARD Mutually Reinforcing Institutions (CARD-MRI) and Pioneer Insurance. In October 2016 CPMI launched the Binhi Micro-Crop Insurance Program. The first phase of the project was an indemnity-based crop insurance, which was launched in October 2016. The second phase of the project will be an index-based insurance product (see below). For the moment it is available only to cover typhoon-related damages to rice and corn plantations in selected provinces.[486]

Meso-level insurance

142. The GCF team did not receive much information on insurance at meso-level, i.e. of risk aggregators. LGUs, farmers' cooperatives and associations can insure their property (buildings, machinery and equipment), and the loans that cooperatives provide to their members are usually insured through the obligatory insurance that farmers have to take who want to avail of the loan. Interviewed cooperatives did not avail of any other insurance, e.g. to cover lack of income from processing activities during calamities.

Index-based insurance

143. There have been several pilot products testing index-based insurance**.** PCIC and UNDP are currently implementing the GEF funded project "Scaling up Risk transfer Mechanisms for Climate

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[483] PRDP 2018. Agricultural Financing in the Philippines (unpublished)

[484] Reyes C. M., Agbon, A. D., Mina, C. D. & Gloria R.A.B. Opportunities for strengthening agriculture insurance programs: Philippine Crop Inusrance Corporation and LGU partnerships. Philippine Institute for Development Studies, Discussion paper series no 2017-01

[485] Department of Finance Insurance Commission. 2015. Adoption and implementation of agriculture microinsurance framework. Circular letter to all insurance companies doing business and operating in the Philippines. https://www.insurance.gov.ph/wp-content/uploads/2017/02/CL2015_53.pdf

[486] https://businessmirror.com.ph/2017/09/12/binhi-micro-crop-insurance-program/

Vulnerable Agriculture-based in Mindanao", aka as the WIBI-Mindanao project, implemented in Region 10 and 11. So far the insurance products is only for rice covering rainfall hazard. The experience learned that products take about 3 years to develop, in which time the indices can be tested. However, there are several limitations to WIBI (see barriers).

144. Supported by IFC, the government of Canada and the Global Index Insurance Facility (GIIF), CPMI has created an index-based typhoon insurance for rice and corn as the second phase of its Binhi Micro-Crop Insurance Program. It will initially target CARD's farmer clients and be bundled with loans. IFC will continue to work with CPMI on designing an index-based portfolio insurance product to protect institutions lending to farmers against typhoon risk.[487] It was set to launch in 2017, however this was apparently postponed as the CPMI 2017 annual report stated that the Binhi Micro-Crop Insurance Program will be piloted.[488]

145. In addition to the CPMI product, the Insurance commission has approved three other index-based products. Pga Sompo Insurance Corporation, named Typhoon Guard Insurance, launched in 2014. After trials with banana producers, it was targeting banana, sugar cane and other crops.[489]. The other two approved products, from Bankers Assurance and Western Guarantee were packaged with fertilizer providers and lasted for only 3 and 6 month respectively due to the lack of efficient channels for distribution.[490]

146. GIZ conducted a simulation of Area Based Yield Index Insurance in Leyte for 2014, with pay-outs triggered in 2 out of 6 municipalities at the 90% average yield coverage level. As DA is gathering rice yield data for all municipalities using radar satellites, it would in theory be possible to cover the entire country and not be limited by the coverage of calibrated automated weather stations.[491]

Overall situation of insurance offer and uptake in the Philippines

147. In summary, the insurance market is dominated by PCIC and insurance uptake is low. Because of the high premium subsidy provided by PCIC, few private sector players have attempted to enter the market. Most agriculture insurance is packaged with loans, which establishes a direct relationship between their respective intake rate. As such, low credit intake implies a low insurance intake. Index based insurance products have not yet been developed at scale. In addition, insurance is not always available for the types of risks farmers are facing. Facing limited access to agriculture insurance (and credit), vulnerable farmers and fisherfolks mostly reduce their climate-related risks by diversifying their production and by adapting their practices using their own means.

Barriers for uptake of insurance

Limitations in the agriculture insurance sector – supply side

148. Our literature review and stakeholders consultations indicate that there are many factors preventing the development of the agriculture insurance market in the Philippines. First, the high level

[487] https://www.indexinsuranceforum.org/project/typhoon-index-insurance-philippines
[488] CPMI. 2018. CARD Pioneer Microinsurance Inc. Annual report 2017
[489] Artemis. 2014. PGA sompo lunches parametric typhoon insurance for Philippines. http://www.artemis.bm/news/pga-sompo-launches-parametric-typhoon-insurance-for-philippines/
[490] Funa, D.B. 2018. Agricultural insurance in the Philippines. Business Mirror-Insurance Forum. https://businessmirror.com.ph/2018/01/09/agricultural-insurance-in-the-philippines/
[491] GIZ. 2017. Issues and challenges in Implementing Parametric Insurance in the Philippines: Lessons Learnt and Recommendations. Regulatory Framework Promotion of Pro-poor Insurance Markets in Asia (RFPI Asia) www.inclusiveinsuranceasia.comhttps://microinsurancenetwork.org/sites/default/files/2017_Feb_9_II_Lessons%20Learnt_Final_w_references.pdf

of premium subsidization by PCIC is a barrier to more private sector competition. At the same time, PCIC's annual funding (and capacity to insure more farmers) is limited, as it is directly linked to its annual Government allocation. As of February 2019, the standing fund for the 100% subsidized RSBSA special program was PHP3.5 billion[3], up from PHP2.5 billion in 2017 (fully utilized). [492]

149. Second, farming in the Philippines is considered a risky business by insurers, limiting their appetite to enter the market. Farmers often run small operations, with a limited and unsteady production. Because farms tend to be scattered and difficult to access, processing claims for indemnity-based insurance products generates high transaction costs for insurers, who have to assess damages on site. Also, given that many farms are prone to extreme weather events (such as typhoons), the risk of multiple, simultaneous claims (base-risk) is high for insurers. Processing multiple indemnity-based claims at a time can create an important operational and cash flow challenge, particular for small private insurers.

150. Many actors pointed that PCIC face similar issues, creating important delays in claim processing (some stakeholders mention that claim processing can take up to one year). The long delays faced by PCIC's to process claims effectively transfers the financial burden on the lending institutions that sold the insurance in the first place, which then have to absorb temporarily the defaulting loans. Transaction costs of processing multiple similar claims at once could potentially be lowered if insurance claims were processed in a more streamlined, uniform matter, using an index-based insurance (IBI) products.

151. Still, many of the stakeholders raised also the point that insurers are generally unfamiliar with the Filipino agriculture market and lack the data to properly assess its inherent risks. Most stakeholders mentioned that there was an urgent need to avail existing data and generate new information to incentivize the emergence of a private insurance market for agriculture in the Philippines.

152. Notably, stakeholders mentioned the need to obtain access to production/yield data to develop better products (ideally at municipality/barangay level), and time series of meteorological data (ex.: temperature, soil moisture) that goes back several years (sometimes up to 30 years), particularly for the development of weather index-based products. Most importantly, stakeholders mentioned the need to improve data sharing and data access, since most of the available/relevant data is produced and owned by Government agencies such as DA and PAGASA.

153. PCIC would benefit from linking the PAGASA weather measurement system with their own PCIC automated system (PAS) so that they can do faster insurance underwriting and claims pay out. They now have to wait ten days to receive PAGASA data, and they also depend on data from the National irrigation Authority [CD: on water availability in the irrigation system?].

154. Weather index based insurance would potentially lower transaction costs for insurers, however, they also have their limitations. The PCIC/UNDP WIBI pilot learned that indices can be established only for areas within 50km of PAGASA weather stations where 30 years of measurements are available.[493] The coverage could have expanded if the Nationwide Operational Assessment of Hazard (NOAH) stations were to be integrated, but these are not WMO standard, although they could be recalibrated by PAGASA. The best reliable index is for drought, but the drought index insurance cannot cover rainfed rice, only irrigated. A challenge is that the insurance coverage is yearly, but

[492] PCIP. 2018. Excellence in governance for the Filipino farmer. Annual report 2017. http://pcic.gov.ph/wp-content/uploads/2018/10/AR-2017-Web-Version-October-2.pdf

[493] Mr S. Ahmed, FAO senior officer, told the GCF team that this is ideally even reduced to 20km, or even 10 km in mountainous terrain, otherwise within the area the weather and linked damage variation is too high, resulting at times in pay-outs to farmers without damage, whereas at other times farmers with damage would not receive anything.

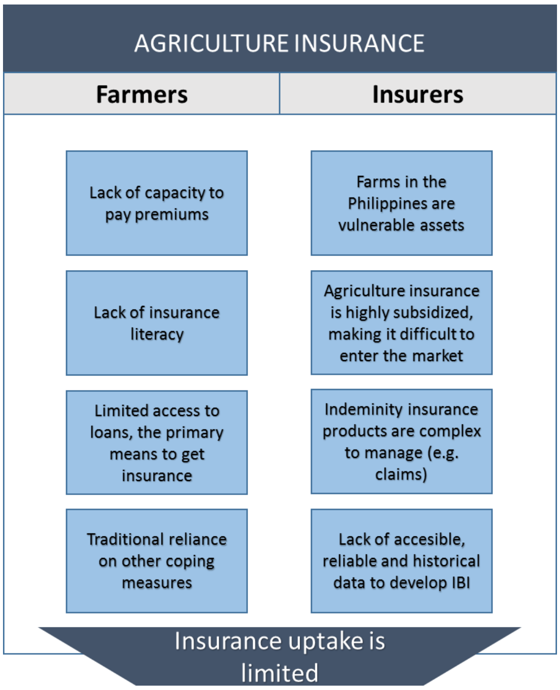
drought effects often go beyond the year in which the index is triggered, especially in the case of perennial crops.

Limitations in the agriculture insurance sector – demand side

155. It is also worth examining some of the limiting factors on the insurance demand side. Farmers' insurance literacy in the Philippines is considered low. Also, one can reasonable assume that the demand for agriculture insurance may be limited for purely financial reasons, particularly when it comes to the most vulnerable farmers. Given the relatively small size of farms (stakeholders mentioned that they vary between ~0.8-2.00 hectares) and their corresponding low productivity, the poorest farmers may simply not have the extra income to consider purchasing an insurance. In this context, subsidizing insurance premiums (at least partly) may be a reasonable to support market development.

156. The PCIC premium costs are also very high, especially for corn (up to 20% of insured amount), which ads considerable to production costs, even if 55% of the premium is subsidized under the PCIC regular program. Farmers also cited that for important risks they cannot get insurance, e.g. yield loss of rainfed rice due to drought or rain damage to onions at bulbing stage[494] cannot be insured. In addition, application procedures are demanding, which entail transaction costs for farmers. Interviewed farmers cited the need to indicate the owners of adjacent land as a particular difficult requirement, as they often do not know this. Therefore, from the farmers' perspective the offered insurance package is not always good value for money.

157. The following figure summarizes some of the key issues identified by the mission related to agriculture insurance :



[494] Capacio et al 2018 Breaking barriers …

Strategic areas for improvements in agriculture insurance

158. Based on the observations of the missions and the consultations conducted, the mission team concluded that the low agriculture insurance intake was the limited offer of agriculture insurance that does not always provide good value for money from the farmers' perspective.

159. The limited offer is due to the **entry barriers faced by private insurers.** This could potentially be turned around if some of the entry barriers were reduced or if PCIC were to forgo its role as an insurer to become a reinsurer. For instance, the acquisition, generation and dissemination of robust data (weather, remote-sensing, etc) to support the development of new products could reduce some of the entry costs faced by private insurers that wish to enter the agriculture sector. Likewise, providing support to develop new insurance products, notably through technical assistance (actuarial, technical, etc) was pointed as necessary by key stakeholders (such as PCIC). Increasing the knowledge of private insurers about the agriculture sector, including its opportunities and its risks (and how to manage those), could further alleviate some of the perceived entry barriers.

160. The development of **index based insurance** would significantly reduce transaction costs by avoiding the need to handle many small individual claims. However, the density of weather stations would need to be increased significantly before meaningful weather index based products could be developed, and global experience shows that such products may not be attractive to farmers due to high basis risks. An alternative approach would be the development of area yield index based products, such as the one proposed by GIZ. Nevertheless such products need (public) investments in crop cutting samples to interpret and calibrate satellite images to assess yields.

161. Instead of individual farmers as policy holders of index insurance products, during the last decade, **index based** insurance **for meso-level organizations** as policy holders has increasingly been studied. Such products could be designed for rural MFIs and farmer cooperatives to protect from damage from extreme weather events at the organization level, for example due to a halt of their income earning activities (e.g. processing). It could also help them avoid an acute liquidity crisis as a result of slow indemnity based insurance payments on outstanding loans of individual members. Such products could also be designed to provide relief assistance to the citizens/members of the organizational policy holder. In such a scenario, index triggered pay-outs can be used by an LGU or cooperative according to their own local data gathering on damages and relief needs and according to their own procedures.[495]

162. Finally, **increasing farmers' financial and insurance literacy** to enhance agriculture insurance demand, and building their technical capacities to reduce on-farm risks could be important steps to incentivize growth in the market.

Possible project activities related to credit and insurance

163. Based on the various consultations held during the drafting of the concept note, the project proposes to enhance vulnerable farmers and fisherfolks' access to agriculture credit and insurance to enable investments in climate resilient agriculture and offer protection for damages from extreme weather events.

164. This would broadly include:

[495] See for example WFP & IFAD. 2011. Weather Index-based Insurance in Agricultural Development A Technical Guide, page 18. and Weber, R., Fecke, W., Moeller, I., & Musshoff, O. 2015. "Meso-level weather index insurance: Overcoming low risk reduction potential of micro-level approaches", Agricultural Finance Review, Vol. 75 Issue: 1, pp.31-46

- Development of knowledge products, outreach and exchange platforms at national level on agriculture credit and insurance;
- Strengthen regional/local collaboration between key actors (DA/DAR officers, LGUs, organizations, COOPs, financial institutions, insurers, etc) and train those actors to enhance the offer of agriculture credit and insurance products, and increase intake;
- Enhance financial literacy (savings and credit, and insurance) among local farmers and provide them technical assistance to identify, finance and implement investments to enhance the resilience of their farms and of relevant value-chains;

Appendix 1. Overview of credit products

Sources: PRDP 2018 - unpublished

Geron, Llanto and Badiola, 2016 (PIDS paper), and CN Annex 4, CIAT workshop information, BMSMED compendium[496]

Note: Commodity/area specific programmes for commodities/areas not within the scope of the GCF proposal are not listed.

Funding source/ lead overseer	Credit programme Name, year started	Implemented by	Lending through	End borrowers	Purpose/ Commodity/ area coverage	Loan terms & amounts	Annual interest rate	borrowers reached [1]
DA Agro-Industry Modernization Credit and Financing program (AMCFP), (AMCFP administration overseen by ACPC)	Agriculture and Fisheries Financing Program (AFFP), 2013	Land Bank	X	Non-ARB marginalized farmers* and fishers listed in the Registry System of Basic sectors of Agriculture (RSBSA)	All commodities except rice and corn, & machinery. Areas with completed RSBSA	Crops & livest. 6 months, machinery 3yrs. P20,000 – 300,000 USD 370-5,540. No hard collateral.	15%	51,023 (2018)
		People's Credit and Finance Corporation (PCFC)	Retail MFIs				21%	8,977 (2015)
	AFFP Sikat-Saka, 2012	Land Bank	Pre-screening by Irrigators Associations (IA) certified by NIA	Small rice and corn farmers, members of the IAs	Production loan, Rice and corn, 45 provinces	4-6 months, up to P50,000/ha, collateral: assignment of produce or PCIC proceeds	15%, declines to 9% at 9th crop cycle	63,922 (2018)

[496] Bureau of Micro, Small and Medium Enterprise development (BMSMED). No date (but not later than January 2016). No title. Department of Trade and Industry. https://www.google.com/search?ei=OJhuXMPNI4PZxgO8-K-4AQ&q=PTMA+%22production+technical+and+marketing+agreement%22+csf&oq=PTMA+%22production+technical+and+marketing+agreement%22+csf&gs_l=psy-ab.3...36349.36954..37201...0.0..0.132.462.0j4......0....1..gws-wiz.fRxFskU1NOI

Funding source/ lead overseer	Credit programme Name, year started	Implemented by	Lending through	End borrowers	Purpose/ Commodity/ area coverage	Loan terms & amounts	Annual interest rate	borrowers reached [1]
	AFFP Agricultural Microfinance Program (AMP)	PCFC		Women from agric hh engaged in on-farm and off-farm income generating activities		Short & long term	24%	72,865 (2015)
	Calamity assistance program	Various FIs				Short & long term	Interest free, 5% service charge	5,022 (2015)
	Coop Bank Agri-Lending program (CBAP)		13 provincial Cooperative Banks**	Farmers listed in Registry System for Basic Sectors in Agriculture (RSBSA)		As per coops own loan products	15%	56,973 (2015)
New products overseen by ACPC	Program for Unified Lending in Agriculture (PUNLA)				15 poorest provinces			
	Climate Change Adaptation Financing Program (CCAFP)							2018: Funds on hold

Funding source/ lead overseer	**Credit programme Name, year started**	**Implemented by**	**Lending through**	**End borrowers**	**Purpose/ Commodity/ area coverage**	**Loan terms & amounts**	**Annual interest rate**	**borrowers reached [1]**
	Production Loan Easy Access (PLEA), 2017		Rural banks, coops, NGOs (159)	Marginal farmers registered under JMRS**** or RSBSA	All commodities, nationwide	max P50,000 (USD 920), 2-10 yrs depends on crop/ project, need PCIC	6%	33,150 (2018)[497]
	PLEA Working Capital loan Facility aka Capital Loan easy Access (CLEA), 2018		Rural banks, coops, NGOs	Cooperatives and associations	For trading, marketing and processing	Max coops equity or P5million, Collateral: post-dated checks in favour ACPC, inventory, purchase order.		
	PLEA Farm/Fishery Machinery, Equipment and Facilities Loan Program, 2018		Rural banks, coops, NGOs	Individual or groups of small farmers	For equipment etc. to increase productivity, efficiency and reduce post-harvest losses.	Max 10yrs, max P250,000/member, collateral: chattel mortgage & insurance	6% based on diminishing balance	
	Survival and Recovery Assistance program (SURE), 2017	Land Bank (?) transfers funds interest free to…	Rural banks, coops, NGOs	Small farmers affected by calamities	Areas declared under state of calamity	Max 3yrs. Max 25,000, need PCIC	0%	7,429 (2018)

497 https://www.philstar.com/business/2019/02/14/1893416/acpc-disburses-p164-billion-loans-farmers-2-years

Funding source/ lead overseer	**Credit programme Name, year started**	**Implemented by**	**Lending through**	**End borrowers**	**Purpose/ Commodity/ area coverage**	**Loan terms & amounts**	**Annual interest rate**	**borrowers reached [1]**
DA	Agricultural Competitive Enhancement fund (ACEF), 2018	Land Bank Direct lending or wholesaling to..	X or conduit PFIs (= Private finance initiative?)	Individual farmers, MSEs, coops & association	Individuals: inputs& equipment, Coops: production & processing facilities	Ind. Max P1 million, Coops Max P5m. Collateral: assignment of produce, chattel mortgage, PCIC	2%	
DA, DAR, DENR, ACPC	Agrarian Production Credit Program (APCP), 2012	Land Bank (wholesales to..)	ARB coops and farmers associations	Agrarian reform Beneficiaries (ARBs) of organizations (ARBOs) not yet eligible for regular Land Bank programmes	Production, agri-enterprise and livelihood projects (also non-agric!). All commodities, nationwide	Working capital based on cash flow, production up to 7yrs, asset purchase up to 5yrs. Free PCIC loan insurance	For ARBOs: STL 8.5%, TL 9.5%, for end: STL 15%, TL: 16%	526 (ARBOs? 2015), 57,735 individuals (2018)
DAR	Credit Assistance Program for Program Beneficiaries Development (CAP-PBD), since 1996	Land Bank (wholesales to..)	ARB coops and farmers associations, with capacity building	Coop and association members	Working capital & asset acquisition. All commodities / nationwide	Up to 80% total project, up to 2yrs, collateral: marketing contract /asset mortgage. Free PCIC loan insurance	STL: 8.5%., TL: 9.5%	86 (individual farmers, 2015)

Funding source/ lead overseer	**Credit programme Name, year started**	**Implemented by**	**Lending through**	**End borrowers**	**Purpose/ Commodity/ area coverage**	**Loan terms & amounts**	**Annual interest rate**	**borrowers reached [1]**
	Microfinance Capacity Development program in Agrarian Reform Areas	Land Bank	MFIs and then through ARB cooperatives	ARB cooperative members				
	Micro-Agri Loan Product (MALP) Development Program		Bank-assisted coops and countryside financial institutions	Coop members				
	DAR-CARD Inc.	Center for Agriculture and Rural Development (CARD) Inc.	ARB cooperatives	Coop members		None? Capacity building program		
	DAR-NATCCO Microfinance innovations in Cooperatives in Agrarian reform Areas (MICOOP)	National Confederatio n of Cooperatives (NATCCO)	cooperatives	Poor hh engaging in MSMEs in AR areas that have no access to formal lending institutions				

Funding source/ lead overseer	**Credit programme Name, year started**	**Implemented by**	**Lending through**	**End borrowers**	**Purpose/ Commodity/ area coverage**	**Loan terms & amounts**	**Annual interest rate**	**borrowers reached [1]**
National Livelihood Support Fund (NLSF)	Livelihood Credit Assistance Program (LCAP)	National Livelihood Development Corporation (NLDC)	Accredited MFIs (RFIs, coops, NGOs)	Small farmer ARBs & members of marginalized sectors		Micro credit		
Land Bank commodity specific programmes	Credit Assistance for Cacao Agri-Business and other Organization Program (Cacao-100), 2013	Land Bank		FOs, Coops, NGOs, LFUs, rural financial institutions (RFIs)	For cocoa nurseries & plantations (new & rehabilitation), & post-harvest & processing	Short (up to 1 yr) & long term based on cash flow and life of fixed assets, 80% of total project cost. Any acceptable asset as collateral and insurance/ marketing contract	Prevailing Land Bank rate	
	Coffee 100 financing programme, 2015	Land Bank		Small farmers, coops, Associations, NGOs, RFIs, SMEs, agri-business enterprises, corporations, LGUs	Clone gardens & nurseries & plantations (new & rehabilitation), & post-harvest & processing. Coffee	Short (up to 1 yr) & long term based on cash flow and life of fixed assets, 80% of total project cost. Collateral: asset mortgage, surety or insurance, assignment of leasehold rights	Prevailing Land Bank rate	

Funding source/ lead overseer	**Credit programme Name, year started**	**Implemented by**	**Lending through**	**End borrowers**	**Purpose/ Commodity/ area coverage**	**Loan terms & amounts**	**Annual interest rate**	**borrowers reached [1]**
	Coconut financing program, 2015	Land Bank		Farmers, Coops, FOs, SMEs, agri-business enterprises	Coconut production and processing	Same as cacao 100	Prevailing Land Bank rate	
	Integrated support for the development of Aquaculture Program (ISDA)	Land Bank		Coops, associations, NGOs, SMEs, agribusiness enterprises, RFIs.	Working capital & asset acquisition for aquaculture	Short (up to 1 yr) & long term based on cash flow and life of fixed assets, 80% of total project cost. Collateral: asset mortgage, sub-promissory notes	Prevailing Land Bank rate	
	Land Bank-SMC Corn and Cassava Assemblers/ Consolidators Financing Program	Land Bank		wholesalers	Corn and cassava	Short & long term		
	Food Supply Chain program	Land Bank						

Funding source/ lead overseer	**Credit programme Name, year started**	**Implemented by**	**Lending through**	**End borrowers**	**Purpose/ Commodity/ area coverage**	**Loan terms & amounts**	**Annual interest rate**	**borrowers reached [1]**
Other Land Bank programmes	Climate Resilient Agriculture Financing Program, 2016	Land Bank		Farm owners, corporations, coops, Associations, NGOs, LGUs	To promote initiatives towards CRA. Working capital & asset acquisition. All commodities / nationwide.	Short (up to 1 yr) & long term based on cash flow and life of fixed assets, 80% of total project cost. Collateral: asset mortgage, surety or insurance, assignment of LGUs net income and IRA	Prevailing Land Bank rate	
	Upland Southern Mindanao – Credit and Institution Building Program (USM – CIBP), 2007	Land Bank		Non-bank assisted cooperatives in USM	Upland areas of Southern Mindanao.	Max. P 3 million but not exceed 60% of trust deposit. Sub-borrowers Collateral: promissory notes and marketing agreements	STL: 8.5% TL 9.5%	

Funding source/ lead overseer	**Credit programme Name, year started**	**Implemented by**	**Lending through**	**End borrowers**	**Purpose/ Commodity/ area coverage**	**Loan terms & amounts**	**Annual interest rate**	**borrowers reached** [1]
	Empowering Barangays in remote Areas through Credit and Enterprises (EMBRACE), 2016	Land Bank		Small farmers and fishers, MSMEs in unserved areas.	All commodities, 169 municipalities nationwide	80% of total project costs, Max. P500,000. Up to 1yr or via 180-day PN, Any acceptable collateral.	15% for first 2 loans, if prompt payments less 1% for every next loan	
	Agri-mechanization Financing program, 2016	Land Bank		Farm owners, coops, corporations, LGUs	Promote mechanization from planting to processing. Nationwide	80% of total project costs, collateral: asset mortgage, assignment of receivables, applicable insurance/ guarantee	Prevailing Land Bank rate	

Funding source/ lead overseer	Credit programme Name, year started	Implemented by	Lending through	End borrowers	Purpose/ Commodity/ area coverage	Loan terms & amounts	Annual interest rate	borrowers reached [1]
	Accessible and Sustainable |Lending (ASL) Program for Small Farmers	Land Bank		Farmers, ARBs, agri-based coops and associations (for on-lending)	For crop production	Up to 90% of total project costs or of loan requirement of members. Collateral: assignment of produce, AGFP coverage (see next), insurance, land title or tax declaration	6% (individual and coops), subject to review	
DA-Agriculture Guarantee Fund Pool (AGFP)	Individual banks', (&MFIs?) agricultural production loan products have 85% guarantee cover***		Commercial banks (&MFIs?)	Eligible farmers & enterprises; usually need collateral				105,007 (2015)

Appendix 2 Overview of PCIC insurance products

(source: PRDP Agric financing paper)

Insurance program	Object of insurance	Amount of cover	Covered risks	Premium rate and subsidy	Premium subsidy	# farmers insured 2017
REGULAR PROGRAMS						
Rice	Standing rice crop on specified land	Cost of inputs per Farm Plan and Budget + optional additional max. 20%. But max: Inbred: P41 000/ha Hybrid: P50 000/ha	Natural disasters (drought only for irrigated), pests & diseases	Variable per region, season & risk classification. Low/medium/high risk: Multi-risk cover: 9.36%/ 10.81%/ 12.27% Natural disaster only: 6.84%/ 7.97%/ 9.07%	55% PCIC subsidy	70 057
Corn	Standing corn crop on specified land	Cost of inputs per Farm Plan and Budget + optional additional max. 20%. But max: OPV: P28 000/ha Hybrid: P40 000/ha	Natural disasters, pests & diseases	Variable per region, season & risk classification. Multi-risk cover: low risk 16.45%/ medium: 19.27%/ high risk: 22.10% Natural disaster only: 11.40/13.30/15.20%	55% PCIC subsidy	30 935
HVC	Standing crop on specified land	Cost of inputs as agreed by PCIC and insured + optional additional max. 20%.	Any, all or a combination of specific natural disasters, pests & diseases as specified in contract	On per project basis, range from 2-7% of total sum insured.	None	5 641
Livestock					None	25 126

Insurance program	Object of insurance	Amount of cover	Covered risks	Premium rate and subsidy	Premium subsidy	# farmers insured 2017
- non commercial mortality insurance	Cattle, carabao, horse, swine, goat and sheep	Cattle & carabao: P7 000 – 15 000 Horse: P9 000 – 15 000 Swine: P3 000 – 10 000 Goat & sheep: P1 000 – 6 000	Diseases, accidental drowning, snake & dog bites, fire, lightning, accidents during transport for treatment (goat & sheep only)	Cattle & carabao: 5 – 7.5% Horse: 5 – 7.25% Swine: breeder: 3-8% fattener: 0.5%/month, Goat & sheep: 10%		
- commercial mortality insurance	Cattle, carabao, horse, swine, goat & sheep, and poultry	Cattle & carabao: P10 000 – 50 000 Swine: breeder P5 000 – 10 000 Fattener: P3 000 – 7 000 Goat & sheep: breeder P20 000 fattener P10 000 (?) Poultry: no data	Diseases, accidental drowning, snake & dog bites, accidents during transport for treatment (goat & sheep only) Poultry: catastrophic losses from death of birds due to accidents or diseases.	Cattle & carabao: 5 – 10%, for over P30 000 cover >10% or as agreed Swine: breeder: 3-8%, fattener: 0.5%/month, Goat & sheep: breeder 12%, fattener 10% Poultry w/o typhoon/flood cover: 3.25 – 3.5% With typhoon/flood: 4%		
- special cover	Livestock dispersal, game fowls, fighting cocks, race horses etc.					
Fisheries/ Aquaculture	Unharvested crop/stock	Costs of inputs including labour	Limited cover: natural disasters Extended cover: loss due to fortuitous events	Depends on pre-coverage evaluation by PCIC	None	51

Insurance program	Object of insurance	Amount of cover	Covered risks	Premium rate and subsidy	Premium subsidy	# farmers insured 2017
Non-crop					None	5 311
- Fire and lightning	Warehouse, machinery, equipment, processing facilities, stables etc.	Not specified	Damage due to fire and lightning	Prevailing industry practice		
- property floater	Farm machineries and shallow tube wells	Not specified	Physical loss or damage to the property from any external cause	Prevailing rate in area, max. 1% of sum insured or P400 000 per policy		
- commercial car	Agricultural transport vehicles	Not specified	Loss or damage of vehicle due to accident, mechanical breakdown, fire, theft, or malicious act while in transit	Prevailing industry practice		
Credit & life term					None	455 119
- Agricultural producers protection plan	Death of the insured	P15 000 – 50 000	Death due to accident, natural causes, murder and assault	P180 – 2 100/yr, depending on age and amount covered		
- loan repayment protection plan	Guarantees payment of face value or amount of approved agricultural loan	Amount of loan (+legitimate interest)	Death or disability of insured borrower due to accident, natural causes, murder or assault.	0.375%- 1.5% of approved loan		
- accident and dismemberment scheme	Death or disablement of insured	P15 000 – 100 000	Death or disablement of insured due to accident	0.1% - 0.5%/yr of amount insured		
SPECIAL PROGRAMS						

Insurance program	Object of insurance	Amount of cover	Covered risks	Premium rate and subsidy	Premium subsidy	# farmers insured 2017
RSBSA	For rice, corn, HVC, livestock, fisheries and credit and life term insurance for those subsistance farmers in RSBSA not receiving any other PCIC subsidy	Amount of loan for borrowing farmers, or Max P20 000 for rice and corn, of max for other crops, livestock etc. as per above			100% govt subsidy	1 029 761
Sikat-Saka	Standing rice crop of subsistence farmers participating in Sikat-Saka credit	Up to the amount of loan granted by Land Bank under Sikat-Saka			100% govt subsidy	14 659
Weather-Adverse Rice Areas (WARA) 2015	For rice farmers in flood-prone areas who are member of IA.	Max. P 10 000/ha	Floods		100% govt subsidy	2 543
High Yield technology Adoption (HYTA) rice insurance 2015	Rice crop using high quality hybrid and inbred seeds and yield enhancing inputs				100% govt subsidy	1 056
Yolanda Rehabilitation and Recovery Program (YRRP)	Farm investments and accident and dismemberment security scheme in areas hit by Typhoon Yolanda (Visayas)				100% govt subsidy	36 499

Insurance program	**Object of insurance**	**Amount of cover**	**Covered risks**	**Premium rate and subsidy**	**Premium subsidy**	**# farmers insured 2017**
ARB insurance	Crop loans to ARBs and their members	Amount of loan from Land Bank under the APCP or CAP-PBD credit programme (see appendix 1)			100% govt subsidy	20 583
PLEA	Crops, livestock, fisheries and non-crop agricultural assets of recipients of PLEA loan				100% PCIC	2 530

Section 2.9: Project area and beneficiaries selection and activity targeting, and phasing

Contents

2.9.1. Project area selection

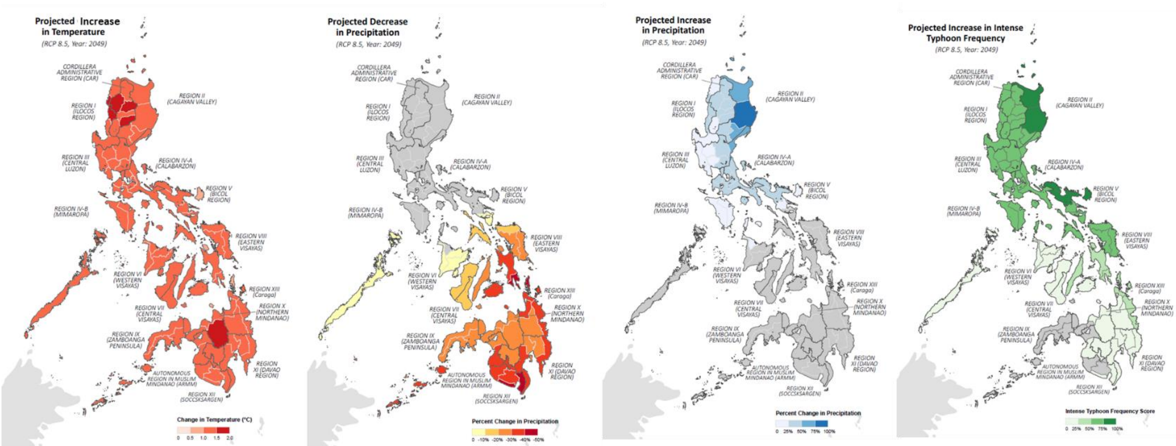
1. Following careful review of existing data, information, past projects and analysis as well as assessments and comprehensive consultations with key stakeholders at national, regional, provincial and municipality levels, key project area and beneficiary selection criteria has been deliberated. Joint assessments and close consultations were held with the DA, the Philippines Council for Agriculture and Fisheries (PCAF), a body of stakeholders advising the DA on programmatic and policy matters, the NDA, regional DA and other regional stakeholders. Based on the comprehensive assessments and stakeholder consultations the FAO formulation team and the government stakeholders jointly selected the project areas, and criteria for beneficiary selection. This Section provides summary of the area selection criteria and the process of selecting project areas and beneficiaries.

Agroecological zones of greatest climate change impact

2. Mapping of areas of highest predicted climate change in the country was done based on climate rationale (see FS part 1 A), identifying priority agroecological regions with major impact types. The country was classified into agroecological areas (or regions, covering one or more administrative regions) which encompass major farming systems and various climate typologies across the country. The agroecological zoning was necessary not only to take stock of the varying farming systems, but crucially to take account of the actual and projected trajectory and scale of climate change impact in each zone. The project's ambition is to upscale CRA practices and technologies throughout the country, it is, therefore, necessary to target a representative set of farming systems in the country.

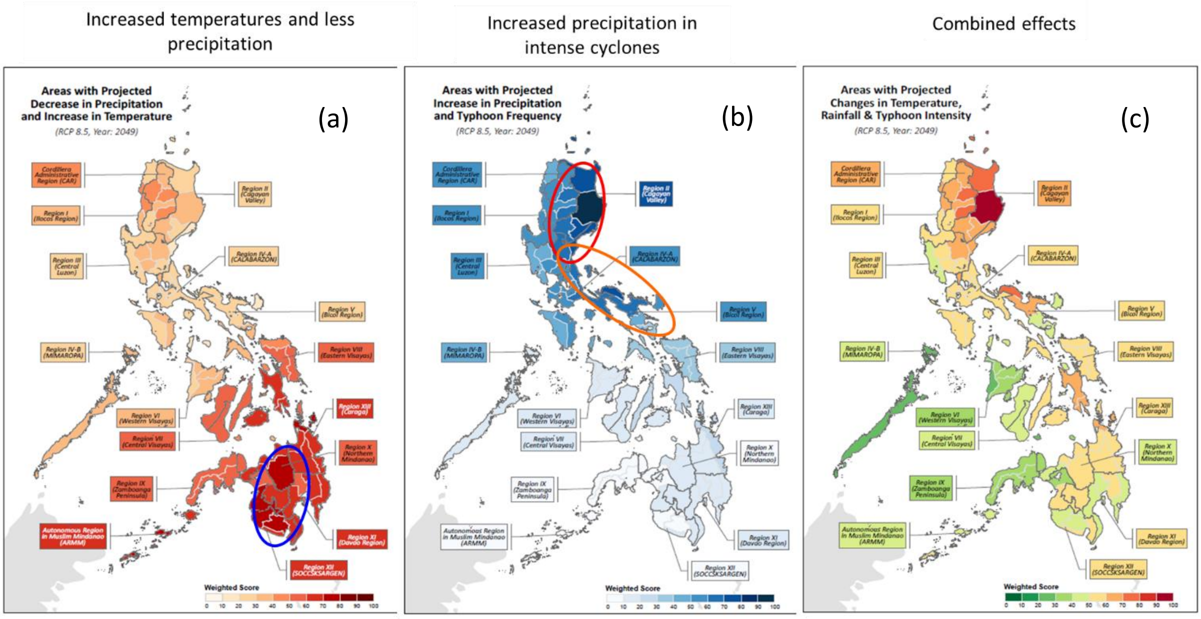
3. The primary criterion for selecting priority target regions and provinces was the severity of projected climate change. These include the likely impact of droughts, increase/decrease in precipitation, high temperatures and cyclones on the agri-food systems. Figure 1 present schematic maps of the projected effects by regions and provinces.

Figure 1. Projected climate change risks



4. Figure 2 presents the combined effects of key climate change variables. High temperatures and low precipitation (Fig. 2.a), and increased precipitation and more intense cyclones (Fig. 2.b) in the same areas. Figure 2.c. presents the combined effects of all four climate indicators. The projected changes in key climate indicators as highlighted in Figure 2 have significant implications for the agri-food system of the country. These are likely to variously affect the agri-food system depending on the climate change scenario and farming systems. The focus is on the agri-food system because the projected climate change scenarios affects not only production but also other parts of the value chain such as access to inputs (seeds, fertilisers, tools, finance and others), processing, marketing, food safety and nutrition.

Figure 2. Combined climate change risks



5. As extensive parts of the country are affected by both above phenomena, and additional check was made in case significant other agriculture areas would stand out due to a combination of effects (Figure 2.c).

6.

Based on the combined projected effects of the four key climate change variables, four agro-ecological zones were selected for support under the project. These are:

i. Cordillera mountains and uplands, indigenous people (with complex CC combined effects)
ii. Luzon foodbasket – especially corn and rice – rainfed and irrigated (CC of increased precipitation, intensified cyclones)
iii. Eastern Seaboard mixed and coconut farming systems (CC intensified cyclones, increased precipitation)
iv. Western and Northern (central) Mindanao (decreased precipitation, increased temperatures)

Table 1 presents, in each column, relative severity of climate change risks across the regions, with higher risk regions highlighted in color. Figure 3 presents farming systems of each region together with key climate change risks. Climate change affects the whole country but some are more affected than others. Priority has been given to areas that are more severely affected by climate change.

7. The regions that are comparatively less affected have not been prioritised and they include:

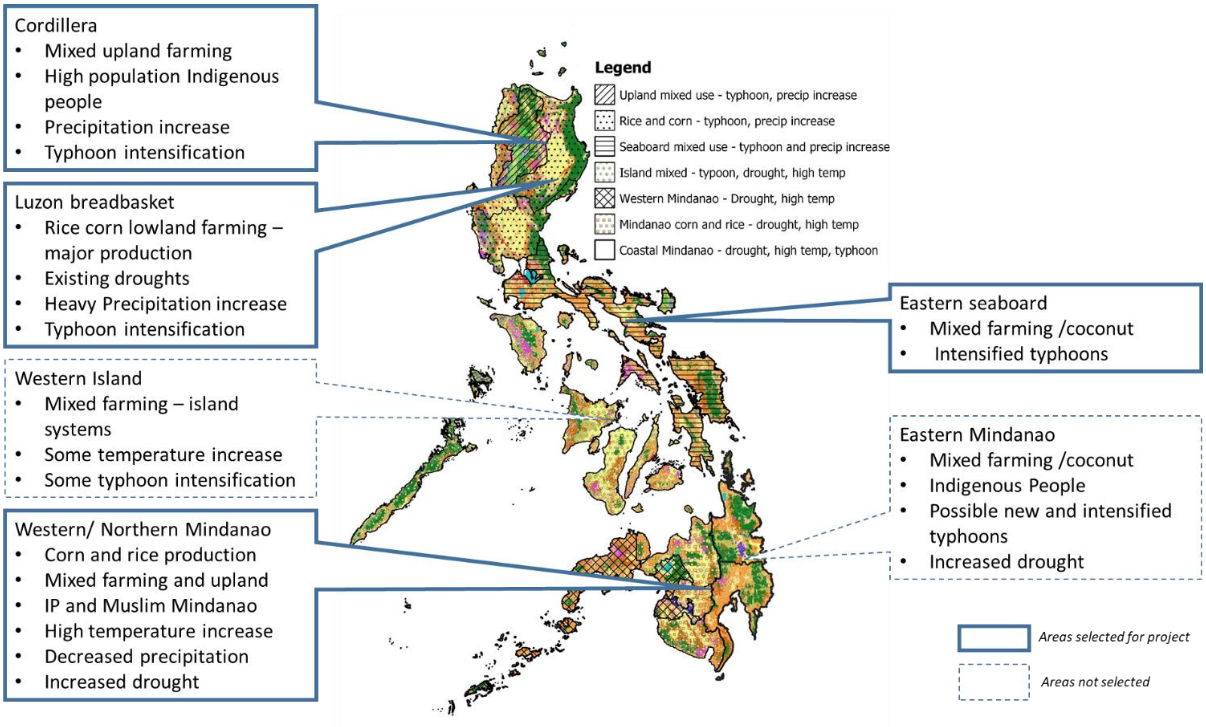
a. The extensive central islands system of Visayas and Southern Luzon was not included. While they have suffered effects of climate shocks, and are expected to face some increasing future combined climate change effects, the effects are predicted less severe than in other areas.
b. While parts of Eastern Mindanao are expected to face decreased precipitation and increased temperatures, these are slightly less than other parts of Mindanao. At the

time of original project design, the GIZ was in the process of developing a dedicated climate change program in Eastern Mindanao.

Table 1. Relative severity of different types of climate change risks

Geographic climate change impact regions	Average of Decrease Rainfall + Increased Temp	Average of Increase Cyclone + Precipitation	Average of Combined CC physical impact	Notes on application of significant selection criteria	Selection as project area
1. Cordillera mountains (complex combined effects)	0.41	0.57	0.49	Combined effects high	Yes
2. Luzon foodbasket (increased precipitation, intensified cyclones)	0.29	0.60	0.45	High cyclone and precipitation	Yes
3. Eastern Seaboard (intensified cyclones, increased precipitation)	0.37	0.47	0.42	High cyclone and combined effects	Yes
4. Central islands (combined effects)	0.39	0.23	0.31	While CC expected, less exposure than other regions	
5. Eastern Mindanao (decreased precipitation, increased temperatures)	0.63	0.17	0.40	Ongoing plans for other climate project at the time of GCF design	
6. Western Mindanao (decreased precipitation, increased temperatures)	0.64	0.04	0.34	Greatest expected decrease in precipitation and increased temperatures	Yes
Grand Total	**0.44**	**0.33**	**0.39**		

Figure 3. Farming systems and key climate change risks



Selection of administrative regions within agroecological zones

8. The Department of Agriculture operates through administrative regions of the country, and interacts with local government and other agencies to support farmers, providing advisory, capacity building and crop and farming systems support programs. Agro-ecological zones, however, span across administrative regions, which necessitate a second layer of selection process. Therefore, following the initial agro-ecological zone selection based on the criteria mentioned earlier,

administrative regions within each of the selected agro-ecological zones were selected also based on the severity of climate change impact.

9. Where there were minor differences between regions, the project design team in close consultation with the Department of Agriculture (DA) applied the analytic hierarchy process (AHP) for multi-criteria decision making (see Box 1). This uses statistical data and stakeholder inputs into weighting of key criteria on environmental stress, importance in terms of poverty and food insecurity, importance in terms of agriculture, and capacity to implement, to provide an overall non-climate change score which could be used as a secondary criterion for prioritisation. The selection process and criteria were further strengthened by considering additional indicators, as highlighted in Box 1, using the AHP methodology. As a result the following five administrative regions from the four identified agro-ecological zones were prioritised through this process (Table 2):

1. Cordillera - CORDILLERA ADMINISTRATIVE REGION (CAR)
2. Luzon foodbasket - REGION II (CAGAYAN VALLEY)
3. Eastern Seaboard - REGION V (BICOL REGION)
6. Western Mindanao - REGION X (NORTHERN MINDANAO) & REGION XII (SOCCSKSARGEN) – two regions are included as Mindanao is spatially very large with large population.

Table 2. Relative severity of climate change risks by administrative regions

Administrative regions (within geographic regions)	Average of Decrease Rainfall + Increased Temp	Average of Increase Cyclone + Precipitation	Average of Combined CC physical impact	Average of Score weighted (with no climate criteria)	Average of Combined (CC impact plus Other)	Notes	Selection for project
1. Cordillera							
CORDILLERA ADMINISTRATIVE REGION (CAR)	0.41	0.57	0.49	0.35	0.42	Only administrative region	Yes
2. Luzon foodbasket							
REGION I (ILOCOS REGION)	0.34	0.53	0.43	0.28	0.36		No
REGION II (CAGAYAN VALLEY)	0.27	0.75	0.51	0.37	0.44	Significantly most exposed region	Yes
REGION III (CENTRAL LUZON)	0.28	0.55	0.41	0.36	0.39		No
3. Eastern Seaboard							
REGION IV-A (CALABARZON)	0.26	0.58	0.42	0.36	0.39	More similar in effects to Region II	No
REGION V (BICOL REGION)	0.28	0.54	0.41	0.50	0.45	Region most likely exposed to increased cyclone intensity Also high vulnerability	Yes
REGION VIII (EASTERN VISAYAS)	0.54	0.31	0.43	0.47	0.45		No
6. Western Mindanao							
AUTONOMOUS REGION IN MUSLIM MINDANAO (ARMM)	0.69	0.03	0.36			Regions undergoing Political and administrative changes at time of design	
REGION IX (ZAMBOANGA PENINSULA)	0.55	0.00	0.28				No
REGION X (NORTHERN MINDANAO)	0.59	0.08	0.33	0.36	0.35	Increased droughts with climate change	Yes
REGION XII (SOCCSKSARGEN)	0.70	0.06	0.38	0.45	0.42		Yes
Grand Total	0.44	0.33	0.39	0.39	0.39		

Box 1. Additional second level refinement in prioritisation using analytic hierarchy process (AHP) for multi-criteria decision making

The analytic hierarchy process (AHP) is a widely-used method for multi-criteria decision making. Both quantitative and qualitative criteria may be employed in the evaluation process. It also allows group decisions, in which members of the group can vote based on their expert judgements without a single member dominating the decision-making process.

The objective of this exercise is to assign a score for every region and rank them based on the selected criteria, using AHP to determine the weights in the scoring system.

The first step is to identify the criteria. FAO and Field Programs Operational Planning Division of the Department of Agriculture (DA-FPOPD) selected the following criteria.

- Rates of agricultural loss and damage over the past years (DA data damage and loss), reflecting vulnerability to existing climate risks
- Deforestation rates (% change 2010-2016, DENR data) – as environment stress
- Malnutrition rates (PSA)
- Poverty incidence (2012 PSA) and SAAD areas
- Number of farmers and fishers (2014 PSA) – to reflect agri-food importance
- Regional DA capacity for coordination in project implementation (Based on DA central ranking)

Instead of ranking these criteria from most important to least important, the criteria are judged in a pairwise comparison, and overall score was created.

Selection of provinces within administrative regions

10. According to the main principle, the greatest climate change impact rationale was also applied to the selection of priority provinces (see ranking table below), followed by a secondary use of the AHP scores where differences were more subtle between provinces. Relative severity levels across provinces are assessed in terms of climate change risks, and higher risk provinces are highlighted in color in Table 3.

1. Cordillera uplands - CORDILLERA ADMINISTRATIVE REGION (CAR)
    - APAYAO; IFUGAO; KALINGA
2. Luzon foodbasket - REGION II (CAGAYAN VALLEY)
    - CAGAYAN; ISABELA
3. Eastern Seaboard- REGION V (BICOL REGION)
    - CAMARINES NORTE; CAMARINES SUR

6. Western Mindanao
    - REGION X (NORTHERN MINDANAO) - BUKIDNON
    - REGION XII (SOCCSKSARGEN) - NORTH COTABATO

Table 3. Relative severity of climate change risks by province

Regions and provinces	Average of Decrease Rainfall + Increased Temp	Average of Increase Cyclone + Precipitation	Average of Combined CC physical impact within region	Average of Score weighted (with no climate criteria)	Average of Combined (CC impact plus Other)	Notes	Selection as priority provinces
1. Cordillera uplands							
CORDILLERA ADMINISTRATIVE REGION (CAR)	**0.41**	**0.57**	**0.49**	**0.35**	**0.42**		
ABRA	0.44	0.54	0.49	0.27	0.38		
APAYAO	0.40	0.56	0.48	0.50	0.49	Provinces with high increased precipitation and combined effects and other factors important	Yes
BENGUET	0.26	0.51	0.39	0.21	0.30		
IFUGAO	0.50	0.61	0.56	0.41	0.48	Provinces with highest increased precipitation and combined effects	Yes
KALINGA	0.50	0.63	0.56	0.36	0.46		Yes
MOUNTAIN PROVINCE	0.34	0.58	0.46	0.33	0.40		
2. Luzon foodbasket							
REGION II (CAGAYAN VALLEY)	**0.27**	**0.75**	**0.51**	**0.37**	**0.44**		
BATANES	0.11	0.50	0.31	0.20	0.25		
CAGAYAN	0.28	0.80	0.54	0.48	0.51	Provinces with highest expected increased precipitation, and also cyclone intensity and combined effects	Yes
ISABELA	0.38	1.00	0.69	0.48	0.59		Yes
NUEVA VIZCAYA	0.32	0.64	0.48	0.33	0.41		
QUIRINO	0.24	0.80	0.52	0.37	0.45		
3. Eastern Seaboard							
REGION V (BICOL REGION)	**0.28**	**0.54**	**0.41**	**0.50**	**0.45**		
ALBAY	0.27	0.45	0.36	0.47	0.42		
CAMARINES NORTE	0.30	0.76	0.53	0.44	0.48	Provinces of high possible expected cyclone intensity impact but also heavy precipitation and combined effects	Yes
CAMARINES SUR	0.24	0.66	0.45	0.56	0.51		Yes
CATANDUANES	0.15	0.59	0.37	0.47	0.42		
MASBATE	0.38	0.38	0.38	0.56	0.47		
SORSOGON	0.31	0.38	0.34	0.50	0.42		
6. Western Mindanao							
REGION X (NORTHERN MINDANAO)	**0.59**	**0.08**	**0.33**	**0.36**	**0.35**		
BUKIDNON	0.72	0.13	0.42	0.54	0.48	High expected drought increase and combined effects, and other factors	Yes
CAMIGUIN	0.39	0.13	0.26	0.20	0.23		
LANAO DEL NORTE	0.63	0.00	0.32	0.43	0.37		
MISAMIS OCCIDENTAL	0.53	0.00	0.27	0.33	0.30		
MISAMIS ORIENTAL	0.68	0.13	0.40	0.31	0.36		
REGION XII (SOCCSKSARGEN)	**0.70**	**0.06**	**0.38**	**0.45**	**0.42**		
NORTH COTABATO	0.66	0.13	0.39	0.51	0.45	Similar scores to other in region on combined, other factors important	Yes
SARANGANI	0.66	0.13	0.39	0.45	0.42		
SOUTH COTABATO	0.71	0.00	0.36	0.37	0.36		
SULTAN KUDARAT	0.75	0.00	0.37	0.49	0.43		
Grand Total	**0.44**	**0.33**	**0.39**	**0.39**	**0.39**		

Selection of Municipalities

11. **Municipalities** – will be selected during the project inception in close consultation and cooperation with key stakeholder institutions in the the 9 target provinces. During the inception, the project shall conduct the Provincial Climate Risk and Vulnerability Assessment (CRVA) and prepare the provincial CRA strategic plans, which would facilitate informed-decisions on municipality selection. The project intends to target 100 municipalities in the 9 selected provinces. Similar to agro-ecology and provinces, the selection of project municipalities will be underpinned by the following criteria in relative terms:
    - High climate change exposure and vulnerability of farming systems, agriculture livelihoods and ecosystem
    - High rates of agricultural loss and damage over the past years (DA data damage and loss), reflecting vulnerability to existing climate risks
    - High deforestation rates (% change from the 2010-2016 baseline, DENR data) indicating environmental stress
    - High malnutrition rates (PSA – Philippine Statistics Authority)
    - High poverty incidence (2012 PSA) and SAAD areas
    - High proportion of households dependent on agriculture-based livleihoods (crop production and fisheries (2014 PSA) – to reflect agri-food importance
12. Additional selection criteria shall include municipalities that:
    - Have committed to climate actions
    - Have incorporated CC and DRR in local policies, preferably also with some counterpart budget

- Have willingness to contribute to the project implementation including counterpart support – in terms of agriculture and extension personnel, support to farmer groups and CRA enterprise development, preferably also with some counterpart budget and M&E of project activities, and especially for supporting farmers implement CRA
- Expressed commitment to CIS dissemination, CRA knowledge sharing, farmer to farmer learning, O&M and CRA scaling up
- Existing past and ongoing relevant initiatives to build on, but not where it would duplicate activities of other programmes/projects.

Selection of sites for FFS/CFFS for CRA demonstration

13. Specific sites for FFS will be determined in part through the CRA enterprise development learning plans developed under Activity 2.1.1, which are also guided by CRVAs. These plans will identify inter alia CRA practices to be promoted through FFS/CRFS in each of the 100 targeted municipalities. The planning process will also help assess the current state of FFS in each municipality and specify the number of new FFS that the Project will establish in each municipality.

14. Once the scope, focus and number of FFS to be established in each municipality are defined, the DA will identify specific sites on which to establish any new FFS. After consultation with FAO, the DA Regional Offices (RFOs) will endorse to the regional steering body (such RAFCs – Regional Agriculture and Fishery Councils) to approve the final selection of sites for FFS at the regional level.

15. Sites will be selected based on the following criteria:

- Priority vulnerable crop/farming systems identified in CRVA, and regional strategic review (see above for municipality)
- Priority vulnerable target groups identified in CRVA
- No Climate change FFS or CRFS in place
- Proximity of each site to the anticipated Farmer Beneficiary households to be trained at the FFS sites (note: this qualitative assessment will be made by FAO experts).
- The use of land as an FFS site during the project implementation.

16. The sites for community adaptive structures such as small scale water harvesting, group land management (such as terracing) will be identified through the CRA enterprise investment planning and based on core FFS sites (see above), as well as in consultation with the communities as to the nature of adaptation and priority vulnerable beneficiary group needs.
    - *Within the selected communities and linked with FFS/CRFS sites.*
    - *Vulnerable to climate hazards*
    - *Important to increase access for communities, particularly women, IP and other marginalized groups*

- *Hotspots of natural resources and ecosystem degradation*
- *Having cultural and social importance for the community*

2.9.2 Selection of Beneficiaries

17. The project targets the following direct and in-direct beneficiaries

Table 4. Direct and in-direct beneficiaries

Direct beneficiaries	Project interventions	Target number
Farmers *(female/male, indigenous people)*	CRA Enterprise development learning, investment plan development and implementation (Output 2.1)	45,000
	CRA awareness raising, trainings, peer learning, farmer exchanges (Output 3.1)	205,000
Farming HH members *(female/male, indigenous people)*	Benefiting from increased HH resilient livelihoods, well-being, food and water security	1.25 Million (250,000 x 5 members/HH)
CRA Master Trainers, CRA Enterprise Development Facilitators	CRA training and service delivery capacity development (Output 1.2) Heighten CRA awareness (Output 3.1)	200
Farmer organizations	CRA Enterprise development learning, investment plan development and implementation (Output 2.1)	500
Professional beneficiaries – staff of DA, PAGASA, LGUs and other agencies	Capacity building for CIS, CRA service development and delivery and CRA mainstreaming	TBD during project inception
Indirect Beneficiaries		
Farmers/rural population in 5 target regions	CIS and CRA awareness raising, knowledge sharing	5 million

Selection of direct farmer beneficiaries

18. **Farmer Beneficiaries** will be selected to ensure that the more vulnerable farmers in major crop and farming systems under the project are targeted, and that they are also capable of engaging in CRA uptake. These core beneficiaries will be involved in farmer learning groups and CRA enterprise development, and they will further be screened for readiness for additional farm and CRA value chain investments. The selection criteria include:

- Priority vulnerable crop/farming systems identified in CRVA, and regional strategic review (see above for municipality)
- Priority vulnerable target groups identified in CRVA
- Small scale farmers: < 1 ha land if rice or corn; < 2 ha if upland coconut
- Agrarian reform beneficiaries (ARBOs); informal farmer groups, associations, recently established small coops
- Women farmers (50 %)
- Young famers < 25 years
- IP groups in key provinces
- SAAD beneficiaries, or fitting same criteria on poverty, food security
- Specific vulnerable groups (similar to SAAD beneficiaries) – who may not be organized but are significantly exposed to climate risks, will be identified for support on linking with social protection programs and specific schemes.
- Willingness to commit to FFS season, willingness to commit labour, and minor in-kind material for testing and rolling our new practices
- No previous Climate change FFS, CRFS and AMIA VIllage.

Selection of farmer organizations

19. Existing Farmer Organizations/cooperatives in the project target area, that meet the Farmer Beneficiaries criteria explained in the preceding section, will be considered for support under the project. The following criteria will underpin the selection of farmer organisations. These will be further elaborated and additional criteria may be considered during the project inception. The potential beneficiary farmer organisation would:

- Have registered as FO
- Experience in farmer group learning, production and marketing
- Have management structure
- Have at least 50% members in line with the project criteria for selecting Beneficiary Farmers
- Be willing to experiment CRA and develop CRA enterprise
- Commit to participate in project training and capacity building activities
- Able to mobilize farmers contribution of 25% resources for the CRA investment plan implementation
- Willing to contribute to the project learnings i.e. pre and post training/workshop assessments, baseline, mid and end line surveys, project review and evaluation, etc

20. While not primary targets, well established coops and organizations of large land-holding farmers can benefit from information material, climate forecasts and advisory, as well as advice on financial services. They can also support and engage in CRA enterprise development and CRA awareness raising, training and peer learning. But they will not be beneficiaries of project investment support.

Selection of Master Trainers and CRA Enterprise Development Facilitators

21. The Master Trainers will be selected from DA, DA-RO, LGUs, established research institutions, farmer networks and NGOs. The CRA enterprise development facilitators will be selected from the project provinces and municipalities to ensure service delivery efficacy and continuity. In addition to the established public, private and civil society organisation service providers, young professionals with keen interest for career in agriculture may also be considered. Ideally, they should be from the farmer beneficiary group (see above), they may be a lead farmer with more land and resources, but with farming systems identified as highly vulnerable in the CRVA. They will need to be able to commit time to being trained, and also delivering training and follow up. Some of the criteria will be:

- Have experience in CIS, agriculture, natural resources management;
- Commit the time, to being trained, and also delivering training and follow up;
- to the extent feasible should be based in the target province or region to ensure continuation of support;
- have experience and familiarity with FFS and/or CRFS; and
- possess at least 3 years of relevant work experience and at least a Bachelor degree in their field of expertise.

Selection of Professional Beneficiaries

22. Selection of public sector profession beneficiaries. Professionals, largely in government agencies, will be benefiting from mainly Component 1 and 2 of the project and national and regional/local level respectively, but also frontline extension agents in Component 3. The project with its emphasis on institutional capacity will benefit a wide range of professional beneficiaries – staffers of DA, PAGASA and other relevant agencies (DAR, DENR and others) at national and regional levels. Activities will also build capacity of LGU staff at provincial and municipal levels. The selection of these professional beneficiaries will be done in close consultations with the concerned agencies and for project specific activities, particularly for deep technical trainings and activities such as the production of CIS.

23. The following criteria will be finalized during the project inception and used:

- Job description and roles/responsibilities are relevant to the project and topics of training and workshops
- Relevant background, by training and experience, particularly for technical training and capacity building activities i.e. production of CIS and agromet advisories
- Interest in the sectors especially for career development
- Women (50 %)
- Young professional < 35 years
- Willingness to commit time for training, knowledge sharing and project activities
- Willingness to conduct training, facilitation for farmers/FO if trained as Master Trainers and/or CRA enterprise development facilitators
- Willingness to contribute to the project learnings i.e. pre and post training/workshop assessments, baseline, mid and end line surveys, project review and evaluation, etc.

24. While staff of Land Bank, other financial institutions and insurance companies are NOT the project direct beneficiaries, they will be engaged the project’s exchange of information. They will benefit from a better understanding CRA practices and technologies, interpretation and use of CIS information packages, farmer group needs and requirements. In this regard, the project will facilitate a two-way flow of information and coordination between these financial institutions and private

sector service providers and the farmers/CRA enterprises as well as LGUs and other value chain actors to promote inclusive CRA value chains and improve credit and financial products. As such, the project will also agree with the institutions on criteria to select their staff to join the project activities. Selection criteria to be finalized in consultation with and used include:

- Job description and roles/responsibilities are relevant to the project and topics of training and workshops
- Relevant background, by training and experience
- Women (50 %)
- Young professional < 35 years
- Willingness to commit time for training, capacity building and knowledge sharing
- Willingness to participate in follow up activities after training/workshop e.g. design and implement CRA value chains with the project Farmer Organizations or improve financial products.
- Willingness to contribute to the project learnings i.e. pre and post training/workshop assessments, baseline, mid and end line surveys, project review and evaluation, etc.

25. **Assumption on the Professional Beneficiaries.** Professional benecificiaries will be predominantly from the core mandated agencies of DA and PAGASA, from national to regional level, but also Department of Agrarian Reform (DAR) and Landbank. At local level provincial and municipal local governments will be at the forefront as they are mandated to deliver direct support to farmers and rural communities on agriculture. Table 5 presents estimated number of professional beneficiaries by office and by output

Table 5. Estimated number of professional beneficiaries

	Professional beneficiary group					
	Department of Agriculture	**PAGASA**	**Provincial LGU**	**Municipal LGU**	**DAR, IP reps, other**	**Assumptions, comments**
Output 1.1: **Strengthened capacity and coordination for Climate Information Services (CIS)**	National agromet – 3 Regional – 5 M&E and planning - 8 Other – 20		M&E – 9			
	O&M – 2 Long term CIS - 10	Forecasting – 10 Long term CIS - 10	O&M - 18			
	DA operations/ agromet - 20 DA-ATI - 5	Agromet - 5			DAR - 5 NCIP - 5	
Output 1.2: Develop capacity for localized CRA services	DA – planning - 5 DA-regional-operations – 30	PAGASA regions - 10	PAO - 45	MAO - 100	DAR (PARO) – 18 NCIP - 5	

	DA – planning - 5 DA-regional-operations and planning - 30		PLGU (including PAO) - 45	MLGU (including MAO) -200	DAR (PARO) – 18 NCIP - 5	
Output 2.1: CRA enterprise investment plans prepared and implemented	Regional ATI - 15		PAO - 45	MAO - 300	PARO/ MARO - 150 IP reps - 9 NGO - 9	
Output 3.1: CRA mainstreamed into national and LGU programmes	M&E Planning – 10 Field Operations - 10		PAO – 9 Planning Office – 18 Other offices – 36	MAO – 300 Planning Office – 18 Other offices - 9	DAR – 5 NCIP – 5 NGOs – 9	
Output 3.2: Enabling financial mechanisms and value-chains for sustainable CRA adoption	Central – 10 ACPC – 5 Other bureaus – 10		PAO – 9 Planning Office – 18 Other offices - 36 Business unit – 45	MAO – 300 Planning Office – 200 Other offices - 100	DAR – 5 NCIP – 5 NGOs - 45	

In-direct beneficiaries

26. As in-direct beneficiaries, the project targets 5 million rural people in the 5 administrative regions. The estimation is based on an analysis of demography, land use, climate vulnerability and assumptions in the following section 2.9.3.
27. This represents about 16% of the rural population exposed to climate change in the 5 target regions.

2.9.3 Additional statistics by region for in-direct beneficiaries estimate

28. Using PSA census data (2015), farmer registry data, and LADA land use maps developed by DA BSWM and FAO, estimates for coverage and representativeness of the project in terms of indirect impacts is assessed. Formal data assessing the number farmers by type of farming are less easy to come by, as local disaggregated statistics is gathered on production basis. The **indirect beneficiaries** are assumed to be around 5 million farm household members in Project supported provinces.

Table 6. Farmer, rural households numbers in project areas and country

	Rural people in *project regions* (based on PSA 2015)	**Rural people in 9 *project provinces* (based on PSA 2015)**	**Number of poor in project provinces (& poverty rate)**	**Farmers in project provinces – indicative only by region (DA Farmer registry is ongoing)**
High combined climate change impacts	4.3 m (whole area)			
CAR - Cordillera	1,251,185	489,000	(30%) 160,708	80,000
R2 – Cagayan Valley	3,060,949	2,462,000	(18%) 510,066	420,000
High climate change - cyclone intensity	14.6 m (whole area)			
R5 - Bicol	4,890,170	2,029,000	(31%) 782,057	170,000
High climate change – Drier and warmer	12.3 m (whole area)			
R10 – Northern Mindanao	4,689,302	824,000	(45%) 638,967	100,000
R12 - SOCCSKSARGEN	4,545,276	1,058,000	(44%) 613,539	170,000
Total	**20,204,983**	**6,862,000**	**(30%) 2,705,338**	**940,000**
		Number of farmer household members assumed around 5 million (slightly less than rural households)		Under-estimate of farm household members (average 5/hh) is 4.7million
Total – all areas exposed to high climate change impacts	31.3 m rural people		13.3 m poor people in high impact climate change areas (66% of total)	
Total Philippine population	101 m (55 m rural population)		(20%) 20,241,367 poor in country	

Table 7. Land use in climate impact areas, project regions and provinces

	Sum of Land area km2	*% total*	*Forest area km2*	*% total*	*Grasslands shrubs unmanaged - area km2*	*% total*	*Grasslands with livestock area km2*	*% total*	*Coconut systems - area km2*	*% total*	*Rice irrigated - area km2*	*% total*	*Rice and corn rainfed - area km2*	*% total*
High Impact regions	229,030	66%	56,744	72%	45,961	59%	26,145	61%	55,944	74%	8,551	59%	39,236	64%
Prioritised administrative regions	111,014	32%	29,809	38%	23,706	31%	15,113	36%	17,368	23%	5,183	36%	23,595	38%
Prioritised provinces	60,508	17%	16,600	21%	11,601	15%	6,759	16%	6,358	8%	4,233	29%	15,305	25%
National	347,681		78,299		77,367		42,530		75,896		14,544		61,374	

Percent of land within project province														
CAR - Cordillera			41%		32%		13%		0%		3%		13%	
R2 – Cagayan Valley			39%		11%		8%		1%		11%		29%	
R5 - Bicol			11%		19%		6%		41%		6%		15%	
R10 – Northern Mindanao			21%		20%		13%		7%		3%		35%	
R12 - SOCCSKSARGEN			5%		24%		19%		23%		7%		27%	
National			23%		22%		12%		22%		4%		18%	

2.9.4 Assumptions on number of beneficiaries and costs per farmer

29. Based on consultation with the Department of Agriculture (DA) the project will allocate equal amounts of resources for farm level activities (FFS and investments) to each province on the assumption that each province will cover about 11 municipalities each. While provinces vary considerably in size and density of farm population, smaller provinces with fewer municipalities and lower population density (like upland and mountain areas, in contrast to rolling or lowland areas) tend to be also poorer with more difficult-to-access areas, hence justifying a proportionately greater ratio of person-per-province. To note is that the number of poor in the target provinces are of a similar number, aside from the much less densely populated Cordillera with upland indigenous people. Also the project is not aiming for spreading its resources evenly as this would be inefficient, and the aim (also in the priority area selection process) to represent different typologies of climate impact regions and agroecologies.

30. The tables below provide estimates for assessing coverage of 1) more intensive farmer support – primarily through farmer field schools (FFS) and on farm investment, either individual (stress tolerant seed varieties) or communal activities (nurseries, water harvesting); and 2) more extensive support through information and knowledge dissemination, hence direct beneficiaries.

Table 8. Project area assumptions on number of farmers and CRA enterprise development costs

Provinces covered by project	9			
Average municipalities targeted per province	11			
Municipalities – total in project (GCF and co-financing)	100			
Total farmers per municipality (average) – one farmer per household is assumed	5000			
Total target farmers (farmer household) in project targeted municipalities	250,000			
No. CRA enterprises per municipality – average	5			
Farmers per CRA enterprise – average	90			
Famers in each municipality directly experiencing CRA enterprirses (FFS/CFFS)	450			
Percent of farmers in municipality experience project CRA enterprirses (FFS/CFFS)	9%			
Other farmers reached on average in each municipality through awareness raising, capacity building, peer learning	2050			
Cost per farmer to implement CRA enterprise investment plans (Based on ATI CRBS model)	23,625	PHP	375	USD
Total Cost of project CRA enterprise per municipality	10,631,250	PHP	168,750	USD
Total cost on project FFS/CFFS	225,000,000	PHP	4,326,923	USD

Total number of farmer learning groups (FFS/CFFS) under project (A)	1,500
Total number of farmers intensely involved in CRA enterprise development (B)	45,000
Total number of farming HH members (5 members/HH) (C)	225,000
Total number of other vulnerable farmers reached through CRA awareness raising, training, farmer leaders support, peer learning) with project support (D)	205,000
Total farmer household membership reached (x5 household members on average) in target municipalities (E)	1,025,000

Direct number of beneficiaries: 50% poorer farm household members in project municipalities (C+E)	1,250,000
Indirect beneficiaries: rural farm household members covered in provinces, receiving enhanced extension and information outreach	About 5,000,000
In regions - rural household members covered	About 20 million

Table 9. Assumptions on co-financing and project investments to intensive CRA support

Average investment per farmer for implementing CRA enterprise investment plans, adopting CRA technology or practice (based on average CIAT CBA investment costs etc.)	23,625	PHP	375	USD
Support for CRA Enterprise investment plan implementation per municipality - TOTAL	10,631,250	PHP	168,750	USD
Support for CRA Enterprise investment plan implementation - GCF	*3,543,750*	*PHP*	*56,250*	*USD*
Support for CRA Enterprise investment plan implementation - DA Co-finance	*3,543,750*	*PHP*	*56,250*	*USD*
Support for CRA Enterprise investment plan implementation - Farmer in-kind contribution	*3,543,750*	*PHP*	*56,250*	*USD*
Capacity building for farmers to adopt CRA by municipality (average 2050 farmers/municipality) - DA PARALLEL FINANCE	6,586,650	PHP	104,550	USD
Total intervention costs by municipality	17,217,900	PHP	273,300	USD
Total intervention costs project areas - GCF	354,375,000	PHP	5,625,000	USD
Total intervention costs project areas - DA co-financing	354,375,000	PHP	5,625,000	USD
Total capacity building for CRA adoption - DA parallel finance	658,665,000	PHP	10,455,000	
Total intervention costs directed at farmers – intense support CRA Enterprises and capacity building for CRA adoption	**1,367,415,000**	**PHP**	**21,705,000**	**USD**

2.9.5 Phasing

31. The project will phase the roll out the CRA enterprise development trainings and support to CRA investment plan implementation over a 5-year period. This is to build up and refine the systems, experience and skills, focusing on 1 or 2 municipalities per province in the first two years. Full implementation of the CRA enterprises are expected to be implemented at least a year after the CRA enterprise development and demonstration year.

32. The table below shows the planned reach in terms of no. of municipalities, no. of farmer groups, and no. of farmers as direct beneficiaries. The attribution of support to the GCF and co-finance is shown below.

Table 10. Number of beneficiaries reached by year

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	Total
Total No. of Municipalities (CRA enterprise development training)	0	18	36	36	10	0	0	100
Total No. of Farmer Groups (CRA enterprise development training)	0	280	540	540	140	0	0	1500
Total Direct Beneficiaries - No. of Farmers (CRA enterprise development training)	0	8400	16200	16200	4200	0	0	45000
Total Direct Beneficiaries - No. of Farmers (Learning Year - CRA demonstration support)	0	8400	16200	16200	4200	0	0	45000
Total No. of Municipalities (CRA investment plan implementation)	0	0	18	36	36	10	0	100
Total No. of Farmer Groups (CRA investment plan implementation)	0	0	280	540	540	140	0	1500
No. of Farmer groups (GCF funded) (CRA investment plan implementation)	0	0	190	360	360	90	0	1000
No. Farmer groups (DA Co-finance) (CRA investment plan implementation)	0	0	90	180	180	50	0	500
Total Direct Beneficiaries - No. of Farmers	0	0	8400	16200	16200	4200	0	250000
No. Farmers (GCF Funded) (CRA investment plan implementation)	0	0	5700	10800	10800	2700	0	30000
No. of Farmers (DA-Cofinance) (CRA investment plan implementation)	0	0	2700	5400	5400	1500	0	15000
No. of farmers (Receiving CRA materials and adoption)	0	0	36900	73800	73800	20500	0	205000

Appendix 2.9.1 – Summary of criteria and process for project geographic location and beneficiary selection (Appendix 4 of the Funding Proposal)

<table>
<tr><th>Level/ Type/ Related project activities</th><th>Criteria/ Process</th><th>Stage / Timing</th></tr>
<tr><td rowspan="3">Geographic location: Agroecological Zones, Administrative regions, Provinces and Municipalities</td><td><u>Agroecological Zones:</u> Preliminary analysis of past/present and projected climate change impacts was conducted by FAO and discussed and reviewed with national and regional stakeholders to identify overall priority geographic regions (see Table 1 above). The following selection criteria were considered (see Section 2.1 of Annex 2):
• Pattern of climate variables (i.e. rainfall, temperature, tropical cyclones, sea level rise);
• Historical trend of climate variables;
• Future projections by 2050 of climate variables;
• Level of climate impacts (e.g. trend of extreme events);
• Representativeness of agroclimatic zones in for country's agriculture, and thus relevance for scaling-up in the country</td><td>Completed during project design. The following four (4) Agroecological Zones were prioritized and constitute the "Project Area":
• North East Luzon
• Cordillera
• Eastern Seaboard
• Western and Central Mindanao</td></tr>
<tr><td><u>Administrative Regions</u>: Multi-criteria analysis was used to assess regions which are expected to have the greatest impact in terms of predicted climate change. The following selection criteria were considered (see Section 2.9 of Annex 2)::

• Severity of projected climate change (level of increase/ decrease of temperature, precipitation, cyclone intensity, etc.)
• Rates of agricultural loss and damage over the past years (DA data damage and loss), reflecting vulnerability to existing climate risks
• Deforestation rates (% change 2010-2016, DENR data) – as environment stress
• Malnutrition rates (PSA)
• Poverty incidence (2012 PSA) and SAAD areas
• Number of farmers and fishers (2014 PSA) – to reflect production importance
• Regional DA capacity for coordination in project implementation (Based on DA central ranking)

<u>Provinces:</u> Within each Administrative Regions, the provinces predicted to have the greatest climate change impact were identified and prioritized by following the selection of Regions (see Section 2.9 of Annex 2).

The process and results of prioritizing regions and provinces was discussed and reviewed with stakeholders at national and regional levels.</td><td>Completed during project design. The following five (5) Administrative Regions and nine (9) Provinces were prioritized and constitute the "Project Area":

<u>Region II – Cagayan Valley:</u> Cagayan and Isabela Provinces

<u>Cordillera Autonomous Region:</u> Ayao, Ifugao, and Kalinga Provinces

<u>Region V – Bicol:</u> Camarines Norte and Camarines Sur Provinces

<u>Region X - Northern Mindanao:</u> Bukidnon Province

<u>Region XII – SOCCSKSARGEN</u>: North Cotabato Province</td></tr>
<tr><td><u>Municipalities:</u> Municipalities in provinces will be selected based on the results of an ongoing DA Climate Risk and Vulnerability Assessment (CRVA) applied to each province with the aim of addressing the needs of municipalities and areas with greatest exposure and vulnerability to climate change (see Section 2.9 of Annex 2). The selection criteria will be as follows:</td><td>During the project implementation, 100 municipalities will be selected in the target provinces.
The selection will be verified through a participatory CRA strategic planning</td></tr>
</table>

	● Importance in terms of climate change exposure, crop and farming systems, vulnerabilities and farmer groups per municipality; ● Willingness of LGU to support CRA enterprise development, planning activities, FFS, M&E, and implementing CRA at farm level; ● Availability of integrated climate change and DRR plans in local policies preferably with some counterpart budget; ● Expression of commitment to O&M and CRA scaling up; ● Past and ongoing relevant initiatives in place to build on, but not where it would duplicate activities of overlapping project. ● DA's confirmation immediately after the meeting discussion	process (Activity 1. 2.1). The final lists of municipalities will be reviewed by the Project Steering Committee (PSC) and finally approved by the respective Executing Entities under the overall and final confirmation of the AE.
Selection of sites for FFS/CRFS under CRA enterprise development learning and investment plan implementation (Activity 2.1.1, and 2.1.3)	Specific sites for FFS/CRFS will be determined in part through the CRA enterprise development learning plans developed under Activity 2.1.1, which are also guided by CRVAs. These plans will identify, inter alia, CRA practices to be promoted through FFS/CRFS in each of the 100 targeted municipalities. The planning process will also help assess the current state of FFS in each municipality and specify the number of new FFS/CRFS that the Project will establish in each municipality. Once the scope, focus and number of FFS/CRFS to be established in each municipality are defined, the DA will identify specific sites on which to establish any new FFS/CRFS. After consultation with FAO, the DA Regional Offices (RFOs) will endorse to the regional steering body (such RAFCs – Regional Agriculture and Fishery Councils) to approve the final selection of sites for FFS at the regional level. Sites will be selected based on the following criteria (see Section 2.9 of Annex 2): ● Priority vulnerable crop/farming systems identified in CRVA, and regional strategic review (see above for municipality) ● Priority vulnerable target groups identified in CRVA ● No Climate change FFS or CRFS in place ● Proximity of each site to the anticipated Farmer Beneficiary households to be trained at the FFS sites (note: this qualitative assessment will be made by FAO experts). ● The use of land as an FFS site during the project implementation.	Upon selection of Farmer Beneficiaries. Finally selected sites will be reviewed by the Programme Steering Committee (PSC), to also ensure synergies with PILAR and other initiatives under the programme approach for Philippines CRA Transformation The selection will be approved by the respective Executing Entities under the overall and final confirmation of the AE.
Sites for community nature-based solutions DRR infrastructure for Activity 2.1.3	The sites for community adaptive structures such as small scale water harvesting, group land management (such as terracing) will be identified through the CRA enterprise investment planning ad based on core FFS sites (see above), as well as in consultation with the communities as to the nature of adaptation and priority vulnerable beneficiary group needs. *Within the selected communities and linked with FFS/CRFS sites.*	These sites will be established after FFS/CRFS, and Local plans have been completed, as well as project due diligence applied. Finally selected sites will be reviewed by the Project Steering Committee (PSC) and finally approved by the respective Executing Entities under the overall and final confirmation of the AE.
Farmer Beneficiaries	Farmer beneficiaries are selected based on being vulnerable target group identified in climate resilience and vulnerability assessments led by DA, small scale farmers (generally less	Finally selected farmer beneficiaries will be reviewed by

For Activities 1.2.1, 2.1.1, 2.1.2, 2.1.3, 3.1.1	than 2ha), specific community vulnerable groups (see Section 2.9 of Annex 2). The following eligibility criteria were considered, also linked to FFS groups (Conduct CRVA and participatory planning under Component 2.2, see also above): ● Size of land/ small scale farmers: < 1 ha land if rice or corn; < 2 ha if upland coconut ● Vulnerability level (crop farm system, farmer group type, local area vulnerability) ● Agrarian reform beneficiaries (ARBOs); informal farmer groups, associations, recently established small coops ● Women farmers (50 %) ● Young famers < 25 years ● IP groups in key provinces ● SAAD beneficiaries, or fitting same criteria on poverty, food security ● Specific vulnerable groups (similar to SAAD beneficiaries) – who may not be organized, but are significantly exposed, will be identified for support through linkages with social protection programmes and specific schemes. ● Willingness to commit to CRA enterprise development learning, FFS seasons, labour, and in-kind material for testing and rolling out new practices and implementation of CRA	the Project Steering Committee (PSC) and finally approved by the respective Executing Entities under the overall and final confirmation of the AE. 45,000 farmers will be selected for CRA enterprise development 205,000 for CRA awareness raising, capacity building for adoption of CRA practices
Farmer Organizations/ Cooperatives for Activities 1.2.2, 2.1.1, 2.1.2 and 2.1.3	● Have registered as FO/Cooperative ● Experience in farmer group learning, production and marketing ● Have management structure ● Have at least 50% members in line with the project criteria for selecting Beneficiary Farmers ● Willingness to experiment CRA and develop CRA enterprise ● Commitment to participate in project training and capacity building activities ● Ability to mobilize farmers contribution of 25% resources of the on-farm financial model for the CRA investment plan implementation ● Willingness to contribute to the project learnings i.e. pre and post training/workshop assessments, baseline, mid and end line surveys, project review and evaluation, etc.	The finalization of criteria and selection will be done during the project inception phase, drawing on the baseline assessment.
Beneficiary institutions at national level for Activities: 1.1.1, 1.1.2, 1.2.2, 2.1.1, 3.1.1, 3.1.2, 3.1.3, 3.2.1, 3.2.2	Beneficiaries will be Departments, institutions, academia, CSOs, including, among the others, DA, PAGASA, Department of Agrarian Reform (DAR), NCIP, Climate Change Commission (CCC), ACPC, PCIC, Land Bank at national level	Identification of primary beneficiaries was completed during project design. Additionally institutions, academia and CSOs will be inclusively considered based on the discussion at the PSC and final approval by the Executing Entities under the overall and final confirmation of the AE during the project implementation. Contractual agreements required for services of any of these institutions for project implementation will

		be signed by FAO, DA and PAGASA as EEs, in line with the EE rules and procedures.
Beneficiary institutions at regional and provincial levels for Activities: 1.1.1, 1.1.2, 1.2.1, 1.2.2, 2.1.1, 2.1.2, 2.1.3, 3.1.1, 3.1.2, 3.1.3, 3.2.1, 3.2.2	Beneficiaries will be regional agencies and provincial-based administration, academia, CSOs, and smallholder value chain actors in the Project Area including, among the others, provincial LGUs, branches of DA, PAGASA, Land Bank and DAR, and NCIP. Eligibility criteria for regional and provincial level stakeholders include institutions involved in coordination and partnership with one another to deliver climate-informed programmes and services in the Project Area both during and after the project. The following criteria will be used and tailored by the Executing Entities for specific Activities: ● Job description and roles/responsibilities are relevant to the project and topics of training and workshops ● Relevant background, by training and experience, particularly for technical training and capacity building activities i.e. production of CIS and agromet advisories ● Interest in the sectors especially for career development ● Women (50 %) ● Young professional < 35 years ● Willingness to commit time for training, knowledge sharing and project activities ● Willingness to conduct training, facilitation for farmers/FO if trained as Master Trainers and/or CRA enterprise development facilitators ● Willingness to contribute to the project learnings i.e. pre and post training/workshop assessments, baseline, mid and end line surveys, project review and evaluation, etc.	Identification of primary beneficiaries was completed during project design. Additionally NGOs and private sectors will be inclusively considered based on the discussion at the PSC and final approval by the Executing Entities under the overall and final confirmation of the AE during the project implementation.
Beneficiary Institutions at municipality level for Activities: 2.1.1, 2.1.2, 2.1.3 and 3.1.1, 3.1.2	The beneficiaries will be municipal LGUs, municipality administrations, the local operating units of DAR and NCIP, MFIs, CSOs in the Project Area. Eligibility criteria for local level stakeholders in the Project Area include public institutions involved in local planning and budgeting processes, mainstreaming of CRA approaches and ongoing programmes, and delivery of climate-informed support and services to farmers and farmer groups during and after the project implementation. Eligibility criteria for non-public stakeholder participation in the Project activities include involvement in providing services to farmers and shaping patterns of agricultural development in the Philippines.	Identification of primary beneficiaries was completed during project design. Additionally research and educational institutions, private sectors and NGOs will be inclusively considered based on the discussion at the PSC and final approval by the respective Executing Entity under the overall and final confirmation of the AE during the project implementation.
Professional Beneficiaries in institutions above	Professional staff who will benefit from training and capacity building support under this Project ("Professional Beneficiaries") will be selected by: (i) PAGASA and the DA for relevant Activities under Component 1, with guidance from FAO; and (ii) DA for relevant Activities under Components 2 and 3. PAGASA and DA will apply the following criteria and process when doing so: ● Organizations have been and/or will be identified based on alignment between the proposed activities and the organizations' mandates, expertise and/or services delivered (note that these determinations have been/will be made by PAGASA and the DA). They could include local	Project Steering Committee (PSC)

	operating units of DAR and NCIP municipal LGUs and administrations, CSOs, financial service providers and private sector; ● Identified organizations will be invited to nominate staff to participate in the activities based on the alignment between the contents of the proposed activity (e.g. technical focus of the training) and the respective individuals' responsibilities and expertise within their organization; ● PAGASA and the DA will review the lists of nominated participants, and either confirm or reject their nomination based on an assessment of the alignment between the activity and the participants' responsibilities and expertise. The following criteria will be used and tailored by the Executing Entities in reviewing the nominated participants of different Activities: ● Job description and roles/responsibilities are relevant to the project and topics of training and workshops ● Relevant background, by training and experience, particularly for technical training and capacity building activities i.e. production of CIS and agromet advisories ● Interest in the sectors especially for career development ● Women (50 %) ● Young professional < 35 years ● Willingness to commit time for training, knowledge sharing and project activities ● Willingness to conduct training, facilitation for farmers/FO if trained as Master Trainers and/or CRA enterprise development facilitators ● Willingness to contribute to the project learnings i.e. pre and post training/workshop assessments, baseline, mid and end line surveys, project review and evaluation, etc.	

Section 2.10: Farmer Organization and Entrepreneurship Development

2.10.1 Introduction

1. The Philippines has recently transformed into a dynamic emerging economy that sustained a growth trajectory of 6.4% between 2016 and 2019. However, agriculture growth was just 1.3% during this period. Over the last two decades, the total factor productivity (TFP) in Philippine agriculture rose by about 32% - a much slower pace compared to the TFP growth in regional neighbors such as Vietnam (73%), Thailand (67%) and Indonesia (50%) (World Bank, 2020). Rice productivity rose at about 3% per year between 1997 and 2007 and this was 1.2% during 2008-2016 (Mataia et al, 2019). The share of high-value crops (HVC) in Philippine agriculture only rose from 19.6% in 2000 to 20.6% in 2018 and 22.9% in 2019 (World Bank, 2020).

2. In 2020, the agriculture, forestry, and fishing industry generated gross value added (GVA) amounted to around 1.78 trillion Philippine pesos and the sector contributed only 10.2% to the country's GDP (Philippine Statistics Authority). Nevertheless, the country remains an agricultural economy with about 40% of land devoted to agriculture and crop production contributing 54% to the total agriculture and fisheries production. Around a quarter of the country's labor force, who are mostly in the rural areas, rely on agriculture as a source of livelihood. Poverty among farmers and fisherfolk has fallen over time, but it remains far higher than the national average, and nearly three times greater than poverty among urban households.

3. Transforming Philippine agriculture into a dynamic, high-growth and resilient sector is essential. The Government of the Philippines (GovPH) "New Thinking" for agriculture includes eight paradigms: agricultural modernization, industrialization, export promotion, farm consolidation, roadmap development, infrastructure development, securing budget and investments, and legislative support. Underpinning these are the four pillars of the Department of Agriculture's (DA's) agro-industrial strategy: inclusive sector, utilization of science-based tools, market-oriented interventions, and resilience to climate risks.

4. The World Bank report "Transforming Philippine agriculture during COVID-19 and beyond" recommends policies such as shifting explicitly from supply-oriented to a demand-driven agriculture; investing in public goods such as research and development (R&D), infrastructure, innovation systems, market information systems, and biosecurity systems that generates higher returns for increasing productivity, poverty reduction and overall modernization of agriculture; and support farmers connect to value chains through, for example, 'decoupled payments' that are independent of production or inputs to give farmers more choices and encourage private sector development in both upstream (inputs, services) and downstream (processing, market) markets.

5. The project proposes CRA enterprise development, particularly among vulnerable smallholder farmers, as a new business model for them and other value chain actors to adopt economically viable and profitable CRA technologies and practices, contributing to Philippine agriculture transformation. It aims to build on existing farmer organizations, usually in the form of cooperatives in the Philippines, to establish learning groups and cluster them to form CRA enterprises as part of the AMIA Village network to develop and implement CRA enterprise investment plans.

6. The purpose of this paper is to provide an overview of farmer organization/cooperative development in the Philippines to understand the barriers and opportunities for developing CRA enterprises. The analysis is mainly based on desk review of available reports and statistics and findings are crossed checked with key informant interviews, focus group discussions, and stakeholder

workshops with farmers, agriculture experts, banks, financial institutions and other private sectors, undertaken for other studies such as for the Technical and Financial Analysis of Available Adaptation Options in Agriculture (Section 2.5) and Strategic Options for Mainstreaming Adaptation (Section 2.8).

7. The paper provides a snapshot of legal and policy framework for cooperatives in the Philippines and their performance. It maps existing cooperatives, by types of services in the project provinces. Analysis of challenges and opportunities for the cooperatives, particularly those active in the above-mentioned prioritized crop value chains is also informed by the analysis of these value chains in Appendix 2.2

2.10.2 Why farmer group entrepreneurship

8. Smallholder farmers usually farm for one of the following reasons in the ladder of interventions: Exclusively for home consumption with rarely any surpluses produced - Mostly for home consumption, but with the intention of selling surpluses on the market - Partly for the market and partly for home consumption; or - Exclusively for the market (Kahan D. 2013).

9. Smallholder farmers need access to finance, land, labour, information and knowledge to be successful entrepreneurs because they operate in a complex and dynamic environment and often lack the security to take risks (Figure 1).

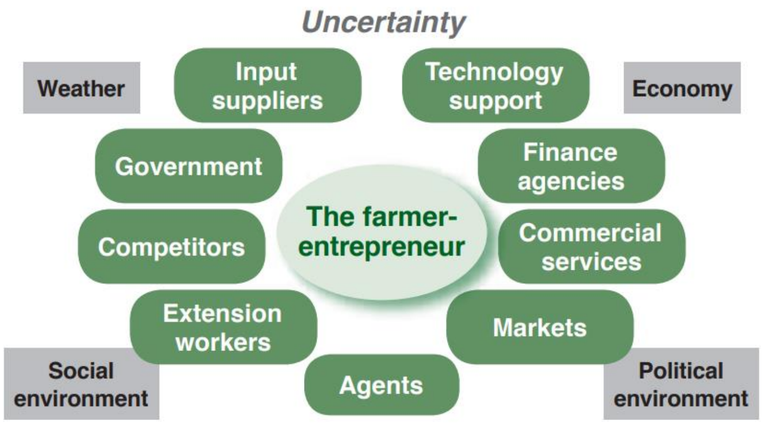


Figure 2.10.1: The world of farmer-entrepreneur (Kahan D. 2013)

10. Some smallholder farmers are more secure if they work together with others in a group. Group entrepreneurship is particularly attractive among those farmers who would not be able to start an entrepreneurial business on their own and often these are the poorest farmers in the community or the farmers with the weakest links to the economy (ibid).

11. Group entrepreneurship brings farmers with similar goals and objectives together and pool their resources, and jointly own and control the enterprise to share the benefits and risks and develop a social 'safety net'. It has many advantages such as building group solidarity and greater power from pooled resources, drawing on shared life/business experience of group members, protecting them from common 'enemies' such as exploitive traders and markets and stimulating the common desire to progress and advance economically. Kahan D 2013 also highlights the need to address the following barriers to entrepreneurship: Poor or absent infrastructure, Unsupportive legal and regulatory framework, Social barriers, Lack of training facilities, Lack of financial support, Lack of support services and trained extension staff and Marketing constraints.

2.10.3 Policy environment for cooperatives in the Philippines

12. The cooperative has been the policy instrument of the Government of the Philippines in promoting social justice and economic development. The policy is well spelled out in the Philippine Constitution of 1987 and in the enabling laws passed by Philippine legislature, notably the Cooperative Code (Republic Act 6938 in 1990), amended by RA 9520 in 2008.

13. The **Cooperative Development Authority (CDA)** is a key governmental organization tasked to promote, develop, register, and support Filipino cooperatives. It was created in 1990 by Republic Act 6939 and congressionally mandated by the Creating the Cooperative Development Authority Act (March 10, 1990).

14. CDA's mandate is to '*promote the viability and growth of cooperatives as instruments in equity, social justice, and economic development in fulfillment of the mandate in section 15, Article XII of the Constitution*.' Its vision is to be '*an effective and efficient regulatory agency working towards the development of viable, sustainable, socially responsive, and globally competitive cooperatives*.' The CDA is governed by a Board of Administrators consisting of a Chairman and six members appointed by the President. Board members are selected from among cooperative sector nominees, with two representatives each from Luzon, Visayas, and Mindanao. Board members serve for a term of six years without reappointment.

15. CDA's key functions include:

- Formulating and adopting cooperative development policy initiatives;
- Registering all cooperatives and their federations and unions, including any divisions, mergers, consolidations, dissolutions, or liquidations;
- Formulating and implementing the Cooperative Development Program;
- Designing and providing comprehensive training programs and support activities;
- Coordinating the efforts of local government units and the private sector in the promotion, organization, and development of cooperatives.

16. The Philippine Cooperative Development Plan (PCDP) for 2018-2022 has the strategic goals of:

- Enhanced policy, regulatory environment and partnerships;
- Improved institutional development, governance and management;
- Sustained human capital development among cooperatives;
- Globally competitive cooperative products and services;
- Increased access to finance; and
- Increased access to markets and infrastructure.

17. The plan lists concrete steps and actions for the CDA to reach their target outcomes of enhancing an enabling environment for 1) The growth, development, and regulation of cooperatives; 2) The success of the members, officers, and management; 3) Cooperative access to alternative and non-traditional financing, and 4) Cooperative market retention and growth.

18. The Department of Agriculture (DA) also highlights the importance of collective action that involves organizing farmers/fishers into cooperatives or business entities to become viable blocks or units of production enjoying higher efficiencies in operations and improved profits. It emphasizes the need to establish linkages between organized farmers/fishers and major players in the agri-food industry to gain a steady market for their produce and to facilitate transfer of technologies.

19. CDA has extension offices in all the regions. It provides technical services (trainings, mentoring, cliniquing, consultancy and the provision of legal opinions), regulatory services

(registration, monitoring, enhancement) with on-line access by the cooperative and Developmental services.

20. The National Confederation of Cooperatives or **NATCCO Network** was formed in 1977 with the task of coordinating training and educational services for cooperatives. Following the 1986 EDSA Revolution, NATCCO transformed into a multi-service national cooperative federation and the regional training centers became multi-service cooperative development centers. In 2004, NATCCO became a two-tiered federation, with primary cooperatives as its direct members. Its core services include financial intermediation, education, and allied services. Today, NATCCO is the Philippines' largest federation in terms of geographical reach, membership, financial capacity, and array of services with 787 member cooperatives in 77 provinces, having 3.4 million individual members, serviced through 1,403 offices and over 60 ATMs and combined assets of around P96 billion (USD 2 billion).

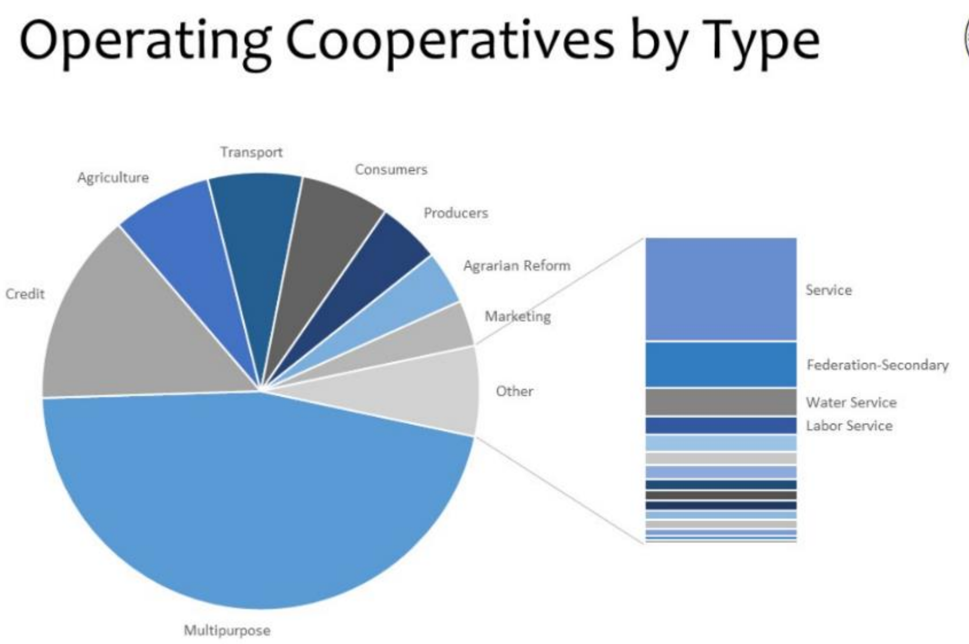
21. Other cooperative partners include • the Philippine Cooperative Center (PCC) organized in 1995 to coordinate national cooperative networks; • The Philippine Federation of Credit Cooperatives, with 89 members, with a mission to strengthen cooperatives by enabling them to provide quality financial and related services; • Quezon City Union of Cooperatives (QCUC) is a non-profit organization; • Cooperative Union of Taguig and Pateros (COUNTPA) that offers CDA-accredited training on cooperative fundamentals, training of trainers, and multiple focused sessions; • Victo National Federation of Co-operatives and Development Center (VICTO NATIONAL).

22. In February 2021, an Agricultural Cooperative Development Agenda (ACDA) was launched led by some of the country's largest and most influential agricultural cooperatives. The ACDA aims to support the creation of an enabling policy and business environment to strengthen the position of agri-coops in the value chain, the market, and with government and the private sector.

2.10.4 Cooperative Performance

23. Philippine cooperative law distinguishes the following types of cooperatives: • Advocacy; • Agrarian reform (ARC); • Consumer; • Cooperative banks; • Credit, Dairy; • Education; • Electric; • Federation; • Financial services; • Fishermen; • Health services; • Housing; • Insurance; • Labor services; • Marketing; • Multi-purpose; • Producers; • Service; • Transport; • Union; • Water service and • Workers.

24. Cooperatives in the Philippines were traditionally predominately agricultural. Today, more than half are multi-purpose cooperatives (MPCs). Credit, service, agriculture, transport and consumer cooperatives form the largest part of the remaining cooperatives.

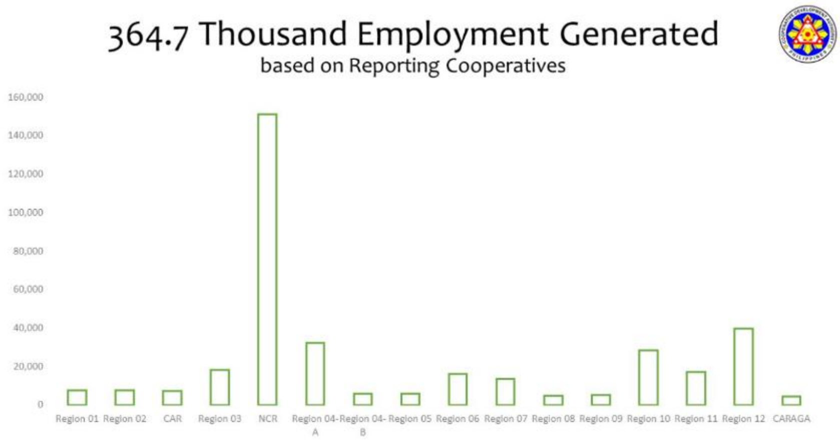


25. In 2020 there are 18,848 operating cooperatives in the Philippines (Table 2.6.1) - an increase from 370 in 1939, to 3,350 in 1985, to 24,435 in 2014, to 26,626 in 2017 and down to 18,068 in 2018.

Table 2.10.1: Operating Cooperatives by region, number, assets, and net surplus – Project target regions highlighted

Region	# of Operating Cooperatives	Reporting Cooperatives	Assets (PesosBillions)	Net Surplus (Pesos-Billions)
Region 01	974	714	29.8	0.8
Region 02	2088	583	27.0	0.7
CAR	962	468	28.2	1.2
Region 03	2025	1189	38.4	1.4
NCR	1790	1098	197.6	7.7
Region 04	1715	1171	38.4	1.8
Region 04B	700	461	11.2	0.3
Region 05	975	478	10.6	0.4
Region 6	1292	772	29.0	1.1
Region 7	1645	703	49.6	2.2
Region 8	687	401	13.1	0.4
Region 9	677	385	9.9	0.3
Region 10	1390	908	46.6	2.2
Region 11	1148	720	38.4	1.7
Region 12	927	507	17.7	0.7
CARAGA	852	435	9.1	0.5
Total	**18848**	**10900**	**572.5**	**23.3**

26. The 10,900 reporting cooperatives in 2020 had 11.5 million members (increased from 7.6 million in 2016 to 10.8 million in 2018) and employed 364.7 thousands people (Figure 2.10.2). Employment generation was declined from 580.8 thousands in 2018 (CDA statistics).



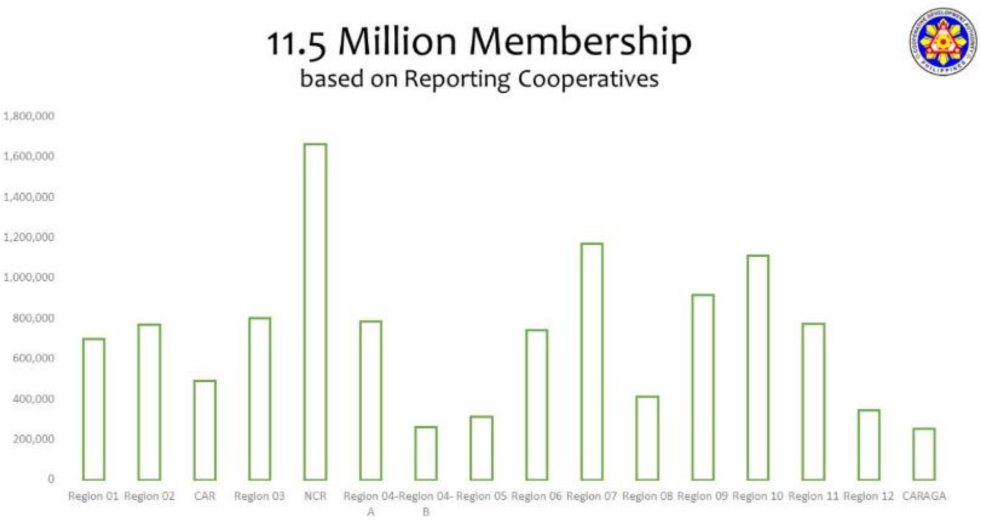


Figure 2.10.2: Cooperatives Membership and Employment Generated by Region https://cda.gov.ph/updates/fy-2020-

27. About 50% of operating cooperatives are micro and another 26% are small with a total of 1.3 million members in 2018. These micro and small cooperatives account for less than 30% of total asset but generate 50% of total employment. Their net surplus was however, low at only 0.3 and 1.3 billion pesos respectively in 2018, compared to 4.5 and 12.5 billion pesos in asset by Medium and Large cooperatives respectively (CDA 2018 annual report).

28. Table 2.10.3 shows the number of major cooperatives present in the project target provinces as of December 2018. Isabela had the largest number of related cooperatives as well as credit and producer cooperatives. Camarines Sur has relatively higher number of agriculture cooperatives while Cagayan has the largest number of marketing cooperatives.

Table 2.10.2 Major cooperatives in project provinces

Project Region	Province	Multi-purpose Cooperative	Credit	Agriculture	Producer	Marketing	Total
	Cagayan	189	59	21	45	46	360

Cagayan Valley (Region 2)	Isabela	183	197	26	49	34	489
Cordillera Administrative Region (CAR)	Apayao	37	6	12	1	3	59
	Kalinga	46	50	13	4	10	123
	Ifugao	46	14	3	5	1	69
Bicol (Region 5)	Camarines Norte	105	20	10	4	3	142
	Camarines Sur	200	31	38	38	7	314
Northern Mindanao (Region 10)	Bukidnon	226	35	17	26	19	323
SOCCSKSARGEN (Region 12)	North Cotabato	169	81	8	31	23	312
Total		**1201**	**493**	**148**	**203**	**146**	**2191**

29. Studies provide examples of small-scale farmers cooperatives from the Philippines and other countries that successfully engaged in sustainable agriculture production (Box 1), processing, marketing, and distribution. The cooperatives also provided members with technological training and organized groups to facilitate saving for both emergency needs and for building up personal capital for future investment opportunities. There are case studies of agricultural cooperatives contribute to improving market efficiency for ag commodities through vertical integration and integration with global value chains, benefitting small farmers.

Box 1 – Cooperatives stimulate unified action to help individual farmers improve

In 2014, PhilRice partnered with farmer cooperatives in Nueva Ecija and Pangasinan for the promotion, evaluation, and adoption of technologies to help their farming communities.

Among the partner-agricultural cooperatives was Parista Barangay Defense System Multipurpose Cooperative (PBDS-MPC) in Lupao, Nueva Ecija.

The cooperative practiced conventional farming such that its members do not use quality rice seeds and other technologies and apply fertilizers without assessing their soil needs. To address these gaps, the project established technology demonstration farms and conducted season-long training programs, field days, farmers' forum, and training for the cooperative's farm advisors on various technologies such as the use of certified seeds, Minus One Element Technique (MOET), leaf color chart (LCC), integrated pest management (IPM), and rice-based farming systems.

Of the 59 farmer-members of PBDS-MPC who participated in the project, 78% adopted the technologies promoted by the project in 2015 wet season and 2016 dry season. In 2016 dry season 73% of the participating coop-members achieved an average yield increase of 0.5 t/ha while 22% of farmers attained more than 1 t/ha increase in yield.

2.10.5 Success factors and challenges for cooperatives

30. Czachorska-Jones, 2019 review of available literature and studies on cooperatives highlights that while Philippine cooperatives have enjoyed overall growth, many have faced challenges. Lack of education and training was the main reason for cooperative failure which is strongly correlated with factors such as Lack of capital; Inadequate business volume; Lack of membership support and loyalty; Vested interests among cooperative leaders, leading to graft and corruption; Weak leadership and mismanagement; and Lack of government support.

31. Other factors included: members' failure to internalize cooperative principles and practices; inadequate marketing facilities; political interference, particularly in the collection of overdue accounts.

32. Specific studies on agriculture cooperatives identify the following commonly observed attribute of successful cooperatives: *conception, initiation and management by local talents and resources*. Self-reliance and responsiveness to the needs of members benefitted not only members and their families but also the communities in which cooperatives were located. The following five core indicators were found to have the greatest significance in determining an agriculture cooperative's effectiveness and success:

- Savings mobilization (72% divergence);
- Sufficient budget level (67% divergence);
- Innovation and entrepreneurial skill development (62% divergence);
- Members' active participation in activities and decision-making processes (47% divergence); and
- Continuous education (42% divergence).

33. Government support (such as that provided through CDA) was recognized as playing a vital role in the socioeconomic development of cooperatives. For small and weak agriculture cooperative organizations the following support was highlighted as critical: Strengthening cooperative enabling policy; Increasing government support; Strengthening capability building systems; and Developing a strong, centralized, agricultural, financial, production, and marketing system. However, research also highlighted that government support can create dependency, which impedes the self-reliance and sustainability of cooperative societies.

2.10.6 Financial services.

34. The Agriculture Credit Policy Council (ACPC) and the Department of Agriculture study in 2015 found that a large majority of farmers who needed financial assistance in their farm operations were not members of a cooperative and were therefore unserved by a formal credit source – those farmers typically resorted to informal sources. The study found that 'supply of credit is not a problem', the problem is how to deliver the funding to small farmers and fisher folks and highlighted the importance of capacity building assistance, using the coaching and mentoring approach specifically in bookkeeping, financial management, loan evaluation and loan monitoring

35. Among the non-banking financial service providers (FSPs), credit cooperatives are one of the most dominant financial sources in the Philippines (Quilloy, K. 2015). The above mentioned ACPC and DA study compared the practices of multi-purpose cooperatives (MPCs) and credit cooperatives and found that while both cooperatives used the same criteria in considering successful lending programs, which were: (1) repayment performance, (2) positive impact on members, and (3) good income of members, the credit coops have higher lending percent for agriculture/fishery (65%) compared to 48% by the MPC. Strict monitoring/collection and stringent loan evaluations were found to be the major factors for success. Problems in marketing, bad weather, and character were found to be the major cause of unsuccessful lending.

36. Studies also found that the nature of the cooperative as a member-owned community-based organization establishes itself as an effective access point to financial services, especially in unbanked areas, typically rural or remote areas. Strengths in credit cooperatives include interest payments on deposits and interest charges on loans, member relations and their fee structure. Programs to reward member loyalty as well as incorporation of savings mobilization to promote financial independence and sustainability were found to be strategies leading to credit cooperative's success.

2.10.7 Youth engagement

37. While the Philippines has a population with a median age of 24.09 years, the Government estimates that the average age of Philippines 11 million farmers is 57 years which raises concerns on who will carry out the important task of farming in the coming years. Maruja M. B, 2020 identified three key trends that attributed to the decline in interest of farming amongst Filipinos:

- The Filipino population is quite young and the level of education of these young Filipinos is much higher compared to the previous generations. They are also incredibly tech savvy and this combination gives the Filipino youth a variety of options to consider when making career decisions.
- Decrease in agriculture contribution to the overall gross domestic product (GDP). Agriculture accounts for the smallest share of GDP at only 9.4 percent while over half of the population still live in rural areas. Along with a decline in productivity, farmers are faced with a decline in their quality of life. The jobs available in the agriculture trade are requiring less skill and are resulting in lower productivity thus making them unappealing.
- Mass migration of young people, which is also a global trend. Those who are young and have a higher level of education are more likely to want to migrate. However, youth Filipinos migrants have been found to be concentrated in low-skilled and vulnerable occupations regardless of their high educational backgrounds.

38. Maruja M.B found through surveys that families play a large role in influencing children toward or away from agriculture. There are three types of parenting strategies: parents influencing their children away from agriculture, parents who involve their children in agriculture, and parents who develop their children's agricultural skills as a contingency. The report noted that parents with negative attitudes about farming have children who are less likely to want to be involved in agriculture.

39. A study conducted by the Asian Farmers' Association for Sustainable Rural Development (AFA) cited several factors as to why Filipino youth are turning away from agriculture. Some of these reasons included: a general disregard for farming, lack of access to land, lack of access to capital, lack of participation in governance, and risks to agriculture wrought by climate change.

40. A Youth Enterprise Act aims at actively promoting entrepreneurship and financial education among youth and requires financial institutions to allocate 25% of their micro, small and medium enterprise (MSMEs) programs to young entrepreneurs. But unless agriculture and agro-enterprises generate higher financial returns, youth out-migration is unlikely to abate.

41. There are also a number of programs established by the Department of Agriculture and ATI to encourage and increase participation in agriculture amongst Filipino youths:

- *Schools for Practical Agriculture (SPA)* - A program in which farmers are trained to use their farmland as a demonstration area or learning site for other farmers or out-of-school youth (OSY).
- *Ladderized Course for OSY* — A program that provides scholarships to 4-H Club of the Philippines members for a two-year diploma course program. Graduates may apply for a Bachelor of Science in Entrepreneurial Management or Bachelor of Science in Agricultural Entrepreneurship.
- *e-Extension Program* — Programs developed for online learning by ATI to broaden the scope of agricultural learning.
- *Young Filipino Farm Leaders Training Program in Japan* — A program in which young Filipino farmers spend 11 months on a Japanese host farm to exchange farming techniques and knowledge.

- *Glamorizing Farming through Agriculture*: *Metropolitan Youth in Sustainable and Healthy Living* — A new program establishing and expanding 4-H programs to urban areas to promote food security and sustainability.
- *Produktibong 4-H Scholarship of the Youth Empowerment through a Sustainable (YES) Program* — A program which provides educational support to children in low-income farming families.
- *Expanded Human Resource Development Program (EHRDP)* - A local program focused on improving the human resources sector of the agriculture and fishing sector of the country.
- *Educational Assistance for the Youth:* Degree Courses in Agriculture and Agricultural Biosystems Engineering" (EAsY Agri)

- *Digital Farmers Program (DFP)* – that aims to encourage and provide opportunities for young people, particularly children of smallholder farmers and fishers, to pursue degree courses related to agriculture.

42. Seeing young people as the key driver in boosting the agriculture sector, the DA the ATI, continue to support and undertake programs and services for the youth, such as

- The "Mentoring and Attracting Youth in Agribusiness" program which has reached more than 3,000 applications as of February 2020.

- The "Kapital Access for Young Agripreneurs" that offers non-collateral loan and the Go Negosyo partnership for "Kapatid Agri Mentor Me Program", a face-to-face mentorship via teleconference of prospective agripreneurs, including the youth.

43. In 2020, the Department of Agriculture (DA) allocated P2 billion to fund youth agripreneurship ventures to encourage the young generation to go into agriculture. The programme is implemented by the Agricultural Credit Policy Council (ACPC) through the state-owned Landbank of the Philippines, Development Bank of the Philippines, ACPC-accredited cooperative banks, rural banks, cooperatives and viable non-government organizations. Filipino millennials can tap this money to jumpstart agricultural projects through two lending programs, namely the Young Agripreneurs Loan Program (YALP) and Micro and Small Agribusiness Loan Program (MSALP), will receive an initial budget of P1 billion each. Agri-fishery graduates and hobbyists aged between 18 and 30 years old are eligible to avail themselves of the YALP loans. They can borrow startup funds of up to P500,000 with zero interest, payable in five years. Under the MSALP, they can also borrow a working capital from P300,000 up to P15 million to finance micro and small enterprises.

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2.11: Additional information on project activity description

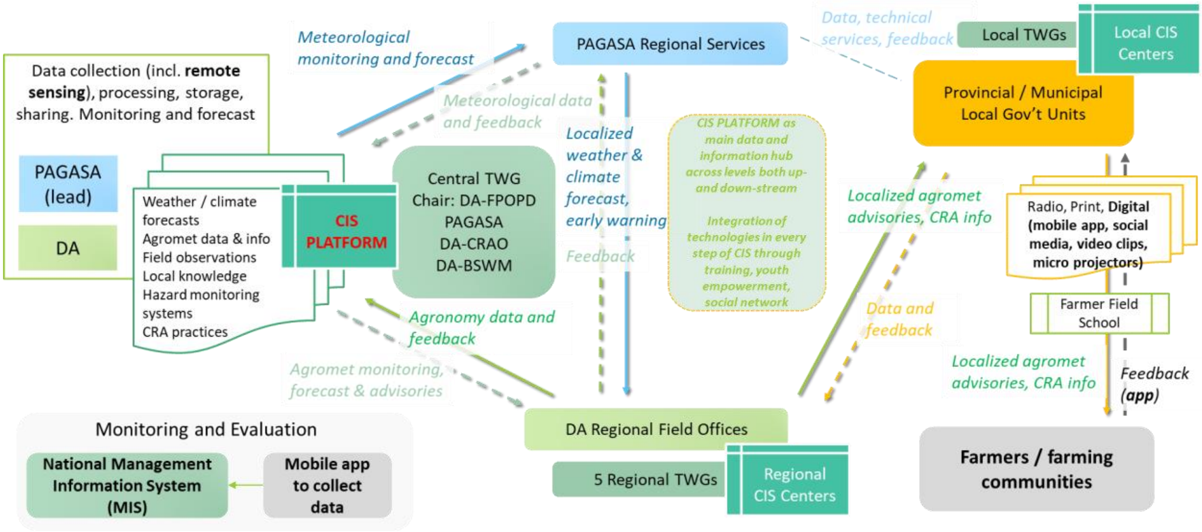

Figure. Linkages of CIS and CRA to develop CRA Enterprises among Farmer Organizations

Table: Selected existing finance programmes and project proposed interventions for CRA support

<table>
<tr><th>Finance programme</th><th>Proposed APA project interventions</th></tr>
<tr><td colspan="2">LANDBANK Climate Resilient Agriculture Financing Program</td></tr>
<tr><td>Objective: Provides financing to promote CCA initiatives towards climate resilient agriculture.

Eligibility: Crop, livestock, and fishery production projects that utilize climate resilient technologies (i.e seedling techniques, other new and emerging technologies approved or endorsed by the Department of Agriculture and the locality's Municipal Agriculture Office) and equipment i.e. for rainwater harvesting, terracing and system of rice intensification; establishment of windbreaks).

Construction of facilities (reservoirs, controlled irrigation system; for greenhouses, hydroponics, aquaponics), farm-to-market roads

Resiliency projects such as crop-based farming systems that diversify sources of income (e.g. palayamanan plus, rice-duck system, growing vegetables in floating gardens), and equipment/facilities that help prevent harvest and post-harvest losses during typhoons or periods of rain (e.g. mini-rice combine harvester, outdoor grain storage facilities).

Financing: mix of 80% (Land Bank) and 20% Borrower, with a repayment term from 1 to 3 years depending on the cash cycle.</td><td>● Joint review of the CRA Finance Programme in the project target areas and identify localized barriers.
● Involve staff from Landbank network of banks in the project sites in seminars and workshops to improve their understanding of climate risks and the use of localized CIS, CRA services.
● Engage LandBank local offices and LGUs in the CRA enterprise investment plan preparation, particularly in developing viable financing mix, and securing the technical requirements, including the endorsement from the DA or MAOs
● Collaborate with the network of banks for their outreach activities to increase understanding of available financing windows, transaction requirements
● Assist farmer organizations to assess their appetite for possible borrowing from Landbank.and meeting requirements for group borrowing from the Land Bank CRA Financing Program
● Promote sharing of experiences and learning across provinces and regions.</td></tr>
<tr><td colspan="2">LANDBANK Food Supply Chain Program</td></tr>
<tr><td>Objective: Priority programs of Land bank in partnership with DA to promote rural and value chain development toward increasing agricultural and rural enterprise productivity and tourism

Eligibility: provides financial and technical assistance to agricultural producers, market processors, consolidators and other market players to promote sustainable market linkages to all key players in the agricultural value chain.

Anchors firms are, in turn, expected to buy the produce of the participating cooperatives and organizations, and provide technical assistance to improve productivity and product quality.

Among the projects now being implemented are hog fattening; oil palm production and processing; fruits and vegetable production and processing; rice and corn production, processing and trading; cardava banana production and processing; fish production and processing; onion production, cold storage and marketing; and sugarcane production and milling.</td><td>● Engage local Landbank branches to increase their awareness of the emerging agri value chains, especially those that may be introduced by the project
● Assist farmer organizations to locate themselves in the local food supply chain and connect them to markets through the possible availment of this program</td></tr>
<tr><td colspan="2">LANDBANK Sikat-saka Program</td></tr>
</table>

Objective: Support to the national government's Food Staples Sufficiency Program. **Scope**: Provides credit assistance for the palay production of small farmers who are not members of Landbank's accredited cooperatives and having difficulty securing loans from other financial institutions. The cumulative loan releases have reached P11.82 billion with outstanding balance of P1.23 billion involving a total of 17,949 small farmers and fishers	• Based on the CRA Strategic Plan and CRA enterprise investment plans, this program could be considered for special groups i.e. as a finance source to complement social protection benefit and project technical support to implement a graduation approach (see Preparing investment plan for special groups under Activity 2.2.1)
LANDBANK Access of Small Enterprises to Sound Lending Opportunities (ASENSO)	
ASENSO is a program jointly implemented by different Government Financial Institutions (GFIs) in support of the National Micro, Small and Medium Enterprise (MSME) Development Plan. It is designed to simplify and standardize the lending procedures for SMEs among participating GFIs comprising the SME segment of the revitalized MSME Financing Program. Cumulative loans released under the Program amounted to P61.50 billion benefiting a total of 19,019 MSMEs	• The project will explore ASENSO to support agri-MSME that are interested in working with FO/AMIA Villages to implement the CRA enterprise investment plans. • Through the CIS Platform, the project will facilitate dialogue as well as joint trainings/workshops of the agri-MSME, LandBank and other financial institutions to improve the understanding of available finance and how to accee it.
ACPC Agri-Negosyo Loan Program (ANYO)	
Objective: ANYO offers 0% interest loans to finance capital-requirements of agri-fishery based micro and small enterprises. **Eligibility**: Micro enterprises can avail to loans of up to P 300,000 to finance income-generating activities such as production, processing, or marketing of agri-fishery products or a combination of agri-fishery income generating activity and non-farm activities.	• Linked with activity 3.2.1, the APA project will identify micro and small enterprises with interest in working with the CRA enterprises and facilitate their access • Explore the availment of the farmer organizations especially for finance of non-farm activities relevant to running the CRA enterprises.
ACPC Survival and Recovery Loan Assistance (SURE) Program	
SURE provides immediate financing relief to SFF affected by natural and other calamities, animal disease outbreak, and other disastrous events, to help them regain their capacity to earn a living	• Support ACPC to explore the use of SURE for anticipatory/ex-ante risk mitigation activities by the FO/CRA enterprises and LGUs in project areas, utilizing improved CIS and early warning. • Support FO/CRA enterprises and LGUs to understand requirements and incorporate SURE in the CRA enterprise investment plan as a source of financing for implementation.