

PHILIPPINES CLIMATE RISK PROFILES

VISAYAS

HIGHLIGHTS

- Agriculture is a major contributor to the economy of the Visayas island group, responsible for over five percent of the Regional Gross Domestic Production (GDP) and employing almost three million people.
- The agricultural sector in Visayas is plagued by a variety of challenges including reliance on rain-fed agriculture, a lack of information dissemination regarding new technologies and best practices, agricultural labour shortages, and limited access to financial capital.
- The Philippines is one of the most vulnerable countries to climate change in the world, with climate impacts disproportionately affecting agricultural and rural communities. The country is affected by a range of climate impacts and extreme weather events including droughts, temperature extremes, and typhoons. Super typhoon Haiyan was especially devastating, causing PHP 31 billion (USD 572) in damages in 2013.
- Adaptation options included improved postharvest storage infrastructure; crop insurance; improved crop varieties; water harvesting techniques such as farm dams, water impoundment, and rainwater collection; diversified farming systems including integrated crop-livestock systems and alley cropping of coconut trees with bananas and other annual crops; and improved forecasting and dissemination of climate information.
- Common barriers to these measures include challenges in communicating the benefits and effectiveness of adaptation strategies to traditional or difficult-to-reach farmers, insufficient financial resources and limited access to credit. In the aftermath of major catastrophes such as typhoon Haiyan, farmers often lack the financial capacity to clear their lands of debris before replanting.
- A host of climate change specific policies and programs exist to support rice, corn and coconut value chains in Visayas including the Philippine Climate Change Adaptation Project and Adaptation and Mitigation Initiative in Agriculture. One particularly successful programs conducted is the Sustainable Corn Production in Sloping Areas initiative implemented by the Bureau of Soils and Water Management which was able to establish community based techno-demo farms benefiting corn production dependent families.



RESEARCH PROGRAM ON
Climate Change,
Agriculture and
Food Security



Food and Agriculture Organization
of the United Nations



FOREWORD

The Philippines is one of the most vulnerable countries to climate change [1], with climate impacts disproportionately affecting agricultural and rural communities. Facing challenges such as low productivity, underinvestment, and extreme weather events, farmers are some of the poorest people in the Philippines; the majority manage small farms of less than 1 hectare (ha). The agricultural sector employs some 32% of the Philippines' working population and occupies almost 41% of the country's land area. Comprised of over 7,600 islands—with 11 providing the bulk of the country's landmass—the Philippines faces severe challenges in meeting domestic food demands and relies heavily on imports, especially for wheat and rice.

The Philippines is affected by a range of extreme weather events, particularly tropical cyclones (or "typhoons") [2]. In this humid, tropical environment, climate change is expected to produce even higher temperatures and increasingly unpredictable rainfall by 2050, negatively affecting yields for most crops. In this same period, it is estimated that climate change impacts of all kinds could cost the Philippines' economy over USD 2.7 billion a year [3]. These climate impacts will be exacerbated by rapid population growth, ongoing conflict, and severe land degradation. Still, the government of the Philippines has taken policy and institutional steps to combat the impacts of climate change and adapt the country's agricultural sector to likely impacts.

Given the agricultural sector's importance for poverty reduction and economic growth in the Philippines, it is important to understand the impacts of climate change and extreme weather events across agricultural value chains. To achieve this, three profiles have been created, one for each major island group in the Philippines, namely Mindanao, Luzon, and Visayas, examining the relationship between climate hazards, key commodities, and their value chains. In Visayas, three major value chain commodities (VCC) were selected: coconut (*Cocos nucifera*), rice (*Oryza sativa*), and corn (*Zea mays*). For each of these commodities, we selected a study area through a consultative process supported by relevant literature and expert consultations. The

province of Cebu in Central Visayas was chosen for corn, and Bohol, also in Central Visayas, for rice, both due to their high levels of production and recent losses from droughts and typhoons. For coconut, Leyte province in Eastern Visayas was selected, as it is a major coconut-producing region and has been adversely affected by typhoons in the past.

The profile is organized into six sections, each reflecting an essential analytical step in understanding current and potential adaptation options for key local agricultural value chain commodities. This document first offers an overview of the country's key agricultural commodities for food security and livelihoods, as well as major challenges to agricultural sector development in the island group. This is followed by identification of the main climatic hazards based on the analysis of historical climate data and climate projections including typhoons and droughts. The document continues with an analysis of vulnerabilities and risks posed by these hazards on key commodities through crop suitability mapping. Based on these vulnerabilities, current and potential on-farm adaptation options and off-farm services are discussed. This risk profile also provides snapshots of the enabling policy, institutional, and governance context for the adoption of resilience-building strategies. Finally, pathways for strengthening institutional capacity to address climate risks are presented.

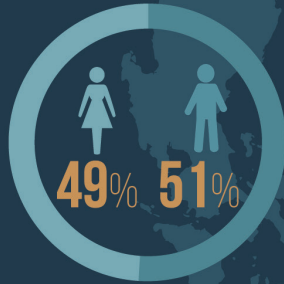
AGRICULTURAL CONTEXT

The Visayas island group is located at the centre of the Philippine archipelago and is the smallest of the three island groups in terms of land area. (Luzon is the largest, followed by Mindanao.) Visayas is composed of three regions: Western (Region VI), Central (Region VII), and Eastern Visayas (Region VIII). The major islands of Negros Occidental, Guimaras, and Panay comprise Western Visayas; Central Visayas includes Cebu, Bohol, Siquijor, and Negros Oriental, while Eastern Visayas is composed of Samar, Leyte, and Biliran.

DEMOGRAPHICS

19% OF THE PHILIPPINES' POPULATION

19,000,000
INHABITANTS



70% LIVE IN RURAL AREAS

FOOD SECURITY

27% OF THE POPULATION SUFFERS FROM **FOOD POVERTY**



44% OF HOUSEHOLD **INCOME SPENT ON FOOD**

26% CHILDREN **UNDERWEIGHT**



40% CHILDREN **STUNTED**

7% CHILDREN **WASTED**

3% CHILDREN **OVERWEIGHT**

VISAYAS

FARMING

TOTAL LAND AREA (HA) **5.9 MILLION**

AGRICULTURE AREA (HA) **1.9 MILLION**

ACCESS TO BASIC NEEDS

28% OF THE POPULATION LIVES IN **ABSOLUTE POVERTY**

WOOD FOR COOKING **66%**

ELECTRICITY FOR COOKING **2%**

ELECTRICITY FOR LIGHTING **79%**

32% OF TOTAL LAND AREA

PEOPLE EMPLOYED IN AGRICULTURAL PRODUCTION **2.7 MILLION**

11% OF  **26%** OF 

ECONOMIC RELEVANCE OF FARMING

The Visayas island group in 2017 accounted for 16% of the country's Gross Value Added (GVA) in the agriculture, hunting, forestry and fishing sector, with Mindanao contributing 33% and Luzon the remaining 51% [4]. The agricultural sector is a major employer in the region, engaging over 2.7 million people, representing 26% of the male population and 11% of the female population.

Agricultural work is predominantly carried out by men, who constitute 65-79% of individuals employed in agriculture across the regions [5]. The daily agricultural wage rate was fairly consistent across the regions, ranging from PHP 231/day (USD 4.26) in Central Visayas to PHP 245/day (USD 4.52) in Western Visayas. On average, female farm workers earned less than their male counterparts. Both male and female agricultural incomes in Visayas fall below those of the other island groups, especially compared to Luzon, where farmers earn, on average, 27% more (33% more when adjusted into real terms) [6]. A consequence of low agricultural incomes is that farming households in Visayas earn only 50% of their income from on-farm activities, turning to more lucrative off-farm activities to generate additional income [6].

PEOPLE AND LIVELIHOODS

Visayas is home to over 19 million people, representing 19% of the country's total population [7]. Of those 19 million people, 70% reside in rural areas. Agricultural households and the rural population of the Philippines are disproportionately impacted by poverty compared to residents of urban areas, with the incidence of poverty amongst agricultural households at 57% compared to 17% for non-agricultural households in 2009 [8]. Almost a third (28%) of the population in Visayas suffers from absolute poverty [9].

Food security is also a challenge, with food poverty impacting 27% of the Visayan population [9]. Consequently, compared with other island groups, Visayas has the largest proportion of underweight (26%) and stunted (40%) children. In Visayas, it is common for children aged ten years old and younger to be underweight, while stunting is prevalent

among youth under 19 years old. Undernourishment remains a challenge in Visayas with a relatively high proportion of household income (44%) spent on food [10].

AGRICULTURAL ACTIVITIES

Although Visayas has the smallest land area among the major island groups in the country, an estimated 1.9 million ha are used for agricultural activities, equivalent to 32% of the total land area of Visayas. The main agricultural activities in Visayas are crop production, livestock rearing (hogs), aquaculture, and fishing. Rice, corn, coconuts, and bananas are the top agricultural crops grown on the island group.

Aggregately, the Visayan islands contributed 18% of the country's rice production in 2017, equivalent to 729,000 metric tons—consistent with historical averages for the region. Another important crop in this island group is white corn, which is consumed as an alternative to rice. Its annual production in 2017 accounted for 14% (297,000 metric tons) of the total national production, and Visayas has been able to maintain its annual production at this level over the past decade [11].

Coconuts are predominantly produced in Eastern Visayas, and aggregately, the Visayan group of islands contributed 1.9 million tons of coconuts in 2017, which represented 14% of the total Philippine production. Unlike rice and corn production, the average production of coconuts has shown a declining trend. Between 2008 and 2017, average coconut production has fallen by three percentage points, from 17% to 14% of the national total. Regardless, Visayas and Eastern Visayas, in particular, remain one of the top coconut-producing regions in the country [11].

STUDY AREAS AND THEIR AGRICULTURAL VALUE CHAIN COMMODITIES



Rendered even more urgent by the importance of agriculture to Visayas, climate variability and hazards may pose a serious threat to the sector. For this analysis, the rice, white corn and coconut value chains were selected for detailed analysis. 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 [12].

To examine these VCCs in detail, three provinces were selected where these crops feature centrally in the local economy and where climate change is likely to adversely affect production: Bohol (Region 7) for rice, Cebu (Region 7) for white corn, and Leyte (Region 8) for coconuts. Bohol is located in the south-eastern part of Central Visayas (Region 7) and has a terrain that is mostly rolling and hilly. Cebu, located west of Bohol, is characterized by rolling hills and rugged mountain ranges. Both are major island provinces in the region, surrounded by beaches, coral reefs, and rich fishing grounds. Meanwhile, Leyte is in the southern part of Eastern Visayas (Region 8) with a terrain that ranges from relatively flat to rolling and mountainous; large forests can be found in the centre of the island.

CEBU

WHITE CORN

White corn is one of the most important food crops in the Philippines. After rice, it is a staple food for around 20% of the population, primarily in the southern regions of Visayas and Mindanao. In times of economic hardship, white corn is consumed as a substitute for rice partly because of its abundance and low price [13].

Farm inputs for corn include seeds, fertilizer—both organic and inorganic, including chicken dung, complete fertilizer urea, and potash—and pesticides when the need arises. Available seeds include traditional varieties, open-pollinated varieties (OPV), and hybrid corn. Cropping systems adopted by farmers include mono-cropping, crop rotation (e.g., corn-mung beans and corn-peanuts), and corn intercropped with mung bean or peanut during the second cropping. Pest and disease management strategies include the use of biological agents like trichogramma cords to control corn borers and chemicals for particular pests like armyworms. Tractor services—along with a fuel subsidy—are offered by the Department of Agriculture (DA) through Municipal Agriculture Offices (MAO). Some corn farmers practice zero-tillage, especially in hilly areas. Farmers typically double crop corn each year, with the first cropping from May to June and the second beginning after the October harvest.

The key actors involved in the corn value chain are input suppliers, farmers, hired labourers, farm owners, postharvest processors such as corn dryers and millers, the government, traders, and wholesalers. Farmers are charged with all on-farm activities as well as many postharvest tasks like storing, drying, de-husking, shelling, and delivery to buyers or corn millers. Men are involved in labour-intensive activities, such as preparing land, planting corn, and transporting produce. Women, meanwhile, are involved in marketing and selling the corn.

SA1

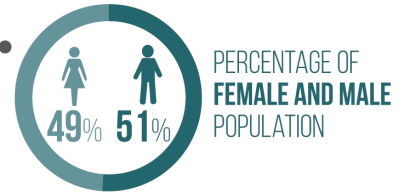


DEMOGRAPHICS

2,938,982
TOTAL POPULATION

15% OF TOTAL POPULATION IN VISAYAS
3% OF TOTAL POPULATION IN THE PHILIPPINES

62% LIVE IN RURAL AREAS



ACCESS TO BASIC NEEDS

34% OF THE POPULATION LIVES IN ABSOLUTE POVERTY

99% ARE LITERATE

FARMING

AGRICULTURE AREA (HA) **146,056**

NUMBER OF FARMS **156,078**

SA2

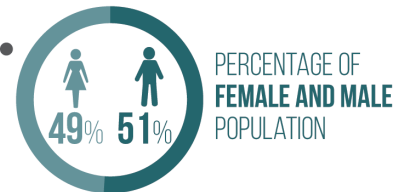


DEMOGRAPHICS

1,313,560
TOTAL POPULATION

7% OF TOTAL POPULATION IN VISAYAS
1% OF TOTAL POPULATION IN THE PHILIPPINES

90% LIVE IN RURAL AREAS



ACCESS TO BASIC NEEDS

23% OF THE POPULATION LIVES IN ABSOLUTE POVERTY

98% ARE LITERATE

FARMING

AGRICULTURE AREA (HA) **136,613**

NUMBER OF FARMS **123,487**

Farmers have access to inputs through government agencies like the DA at the regional, provincial, and municipal levels. Different agencies such as the DA, Agricultural Training Institute (ATI), Philippine Crop Insurance Company (PCIC), and Local Government Units (LGUs) provide crop insurance, demonstration farms, farmer field schools, and training programs for corn farmers. These agencies also provide foundation seeds and other farm inputs together with private companies like Agrivet, seed growers, and some larger-scale farmers.

Corn millers, meanwhile, process the dried corn kernels into corn grits that are then sold in the market for consumption. Corn grits are typically the end product of the corn, although occasionally corn grits are turned into corn coffee. Millers also produce corn bran and feeds, which are sold to traders or directly to consumers. Most corn mill owners employ middlemen to negotiate directly with farmers to buy their product in bulk. Increasingly, with the entrance of larger milling operations, small-scale corn millers are experiencing reduced operations.

BOHOL

Agriculture is the largest sector in the province of Bohol in terms of land use (about 136,000 ha or 66% of all land) and employment. The major crops planted in terms of land area include rice (51%), coconuts (24%), and corn (9%) [14].

RICE

Rice accounts for 35% of the average caloric intake of most Filipinos. Bohol is considered the “Rice Granary of Central Visayas” and is the main rice-producing province. Harvested rice area in Bohol is approximately 72,000 ha, producing 238,728 metric tons and accounting for nearly 75% of all regional production [11]. Rice production in Bohol occupies over half of all arable land in the province. Most rice farmers practice mono-cropping with two crops per year, while only a small minority practice organic farming. Not all farmers have access to irrigation and many depend on rain-fed production. Most farmers use mechanization for land preparation.

The key actors involved in the rice value chain are input suppliers, farmers, hired labourers, postharvest processors, traders, retailers, and wholesalers. Input suppliers provide farmers with inputs like seeds, fertilizers, herbicide, pesticide, tools, and equipment.

Often, the International Rice Research Institute provides genetic material to PhilRice to produce foundation seeds for the DA. These seeds are then distributed to cooperatives and LGUs. Farmers are responsible for on-farm production and produce different varieties of rice, such as black, white, and red rice. Farmers and hired labourers manage most on-farm activities including land preparation, planting, management (weeding, fertilizing and pest control), and harvesting. Farmers also participate in postharvest activities like storage and drying to prepare produce for milling. Women are often involved in rice farm activities that are less rigorous or labour-intensive, especially the pulling of seedlings. In addition, 50% of women are involved in transplanting, weeding, and harvesting. Women are also often engaged in selling, store tending, and other activities.

Small-scale farmers often borrow from traders for farm inputs, paying back these loans immediately after harvest. The Landbank of the Philippines also provides financial assistance to cooperatives and farmers. Different institutions such as universities, the National Irrigation Administration, the ATI, and the PCIC provide trainings, workshops, and insurance to farmers and seed growers. Rice millers, meanwhile, are typically private entities or cooperatives, purchasing from private traders or other cooperatives and selling the milled product to wholesalers, retailers, or directly to consumers.

LEYTE

COCONUT

Coconuts are the second most dominant crop in Eastern Visayas next to rice and is the country’s top export commodity [15]. For many farmers in Leyte, coconuts are described as the “tree of life” given the diversity of income sources they offer. Coconut farming is a very important source of economic activity among farmers across Leyte and Samar islands. Earnings from the coconut industry—USD 1.58 billion from 2009 to 2011—ranked higher than any other agricultural commodity. Many products are made from coconut trees, like wine, vinegar, lumber, charcoal, herbal medicines, and fresh coconut meat. Dried coconuts, copra meal, and coconut oil, however, are among the top export products, worth USD 1.3 billion in 2016 alone [16].

SA3

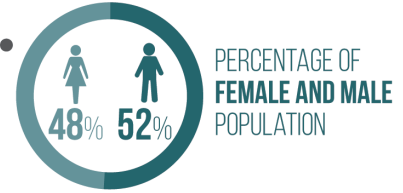


DEMOGRAPHICS

1,724,679
TOTAL POPULATION

9% OF TOTAL POPULATION
IN VISAYAS
2% OF TOTAL POPULATION
IN THE PHILIPPINES

90%
LIVE IN RURAL
AREAS



ACCESS TO BASIC NEEDS

38% OF THE POPULATION LIVES
IN ABSOLUTE POVERTY

97% ARE
LITERATE

FARMING

AGRICULTURE
AREA (HA) 278,115

NUMBER OF FARMS
148,598

SOURCE: PSA.GOV.PH

It is estimated that 33 million coconut trees covering 300,000 ha were damaged by typhoon Haiyan, jeopardising the livelihoods of more than 1 million farming households [17]. Prior to Haiyan, coconut production in Leyte reached 526,559 metric tons a year planted on 167,974 hectares. In the following year production fell by more than 50% to 194,050 metric tons covering a total farm area of just 94,744 hectares (a 43.6% reduction in area) [5]. By some estimates, it will take 6 to 9 years before the coconut value chain returns to full production, threatening the livelihoods and food security of many families.

The key actors involved in the coconut value chain are input suppliers, farmers, hired labour, traders, retailers, and wholesalers. In Leyte, the National Coconut Research Center, Visayas State University, and the Philippine Coconut Authority provide seed nuts or seedlings to farmers along with, historically, salt as fertilizer for the coconut trees. Still, most coconuts used for planting by farmers are from their own harvests. LGUs and the PCIC provide inputs, training, and insurance to farmers.

Farmers participate in on-farm activities like clearing, land preparation, planting, and harvesting. Women in coconut farming are mainly involved in less labour-intensive activities, with the exception of separated and widowed women or single mothers who often undertake all tasks. The main coconut product is copra. Copra (dried meat or kernel), however, undergoes several transformations to produce different products like whole nuts, virgin coconut oil, soap, beauty products, and more. These are produced in processing plants requiring proper facilities and a skilled labour force. These various coconut products are then marketed through traders, wholesalers, and retailers. Farmers sell their copra to private entities or cooperatives and these buyers are responsible for selling the consolidated copra to processors such as SC Global. Women are especially involved in canvassing for potential markets and price negotiations both for the end product, whose price is often determined by the buyer, as well as for hauling and transport services. The National Coconut Research Center promotes the commercialization of various products like cocofresh, macapuno ice cream, coconut biscuits, and wine.

AGRICULTURAL SECTOR CHALLENGES

The agricultural sector in Visayas faces an array of challenges whose impacts are felt across the value chain. If not addressed, these challenges will continue to constrain the sector, resulting in sub-optimal yields and incomes. For a sector characterised by subsistence agricultural production and small-scale value chain actors, such losses are felt acutely.

Labour

Income generated by agricultural workers is less than half that of the average worker in the Philippines. Consequently, 66% of Filipinos who are considered working poor are engaged in the agricultural sector [18]. While the wider economy has experienced economic growth and rising incomes, the basic pay rate in the agricultural sector has remained stagnant. Workers seeing greater opportunities in off-farm labour are either moving to urban areas or demanding higher incomes [18]. The introduction of cash assistance programmes for those living below the poverty line, including the Bridging Program for the Filipino Family and the Modified Conditional Cash Transfer Program, has disincentivized farm labourers from engaging in low-paid labour. While such measures are necessary to support vulnerable families, farmers faced with higher costs of production that were not reflected in the market price of their crops saw their real incomes fall. Farmers in Bohol reported that rice harvests were missed due to labour shortages despite unemployment in agriculture remaining high. Labour shortages are partly due to the highly seasonal nature of agricultural labour in the Philippines, with excess supply during the growing season and excess demand during planting and harvesting, so this income source remains unstable.

Mechanisation

Increased mechanisation would help to ease the demand for labour during land preparation, planting, and harvesting. Gains have been made in recent years to increase the level of mechanisation in the Philippines, reaching 2.31 horsepower (hp) per ha in 2013, up from 2.0 hp/ha in 2012 [18]. This rate, however, still lags behind other countries in the region such as Thailand. Much of the investment

in mechanisation has been directed towards rice and corn production, with the DA through the Philippine Center for Postharvest Development and Mechanization investing heavily in the acquisition of farm machinery that is provided to farmer organisations [19]. There are still very limited mechanisation options for coconut production.

Infrastructure

Absent or decaying rural infrastructure represents a major challenge for farmers, especially for those in remote areas. Inadequate irrigation infrastructure and poor-quality farm-to-market roads were identified as major constraints. The impacts of poor infrastructure are felt more acutely in times of extreme climatic events such as droughts and typhoons (see section 3). The lack of good quality farm-to-market roads reduces the options available to farmers when selling their goods, leaving them as price takers. An ADB study measuring the impact of rural infrastructure provided through the Agrarian Reform Communities Project (ARCP) found farm-to-market roads had the greatest impact on rural communities when compared to other infrastructure projects like communal irrigation and potable water supply. This study also, however, observed that the richer members of the community were the largest beneficiaries from improved market access, increasing existing income inequalities [20] especially when local communities lack the means to capitalise on the increased access [21]. Recognising the need for improved irrigation systems under drought, large investments have been made in Visayas, including the National Irrigation Sector Rehabilitation and Improvement Project (NISRIIP) supported by JICA [22].

Credit

The adoption of new technologies or practices in response to climate change and extreme weather events often represents a cost to value chain actors, particularly farmers [23]. In many instances the upfront costs of adopting new methods preclude uptake, as actors do not have adequate financial capital and cannot access credit. Often, farmers are unable to sufficiently finance on-farm expenses so they purchase only limited inputs and supplies, which results in low yields. Alternatively, farmers might operate under a scheme in which they are loaned inputs by a provider, and income generated by selling the produce is used to pay back the loan. Such loans are often at unfavorable rates, or in some cases leave the farmer splitting the profits 50:50 with the input provider.

IMPACTS ON WOMEN AND YOUTH

Gender roles and relations in the Philippines are strongly influenced by cultural, social, and economic factors. Substantial gaps remain between men and women with respect to access to resources, economic opportunities, and influence in decision making [24,25,26]. Many women are marginalized in decision-making power and influence, lacking access to land and other resources, capacity building, training, and income-generating opportunities [27]. In both urban and rural areas, women are solely responsible for home-related tasks like child care, food preparation, and meeting the basic needs of the household, whereas men engage primarily in production-related activities such as agricultural labour or non-farm income-generating activities [28]. Generally speaking, women customarily manage and allocate all household income and finances

provided by their husbands [29]. There are some notable exceptions to these generalized gender norms. In corn systems, in particular, women are actively involved in seed and input provisioning and product marketing. In fact, women in Cebu province are relatively more active across the corn value chain than are women in the rice or coconut value chains in Bohol and Leyte provinces. Separated, widowed, or single mothers often undertake all value chain tasks including more labour-intensive work. In the event of a failed harvest due to drought, women seek off-farm employment such as serving as domestic helpers. Still, women's labour contributions are often overlooked, undervalued, or invisible in both male- and female-headed households [29]. Elderly women, women with children, pregnant women and women with disabilities are the most vulnerable to production and value chain shocks.

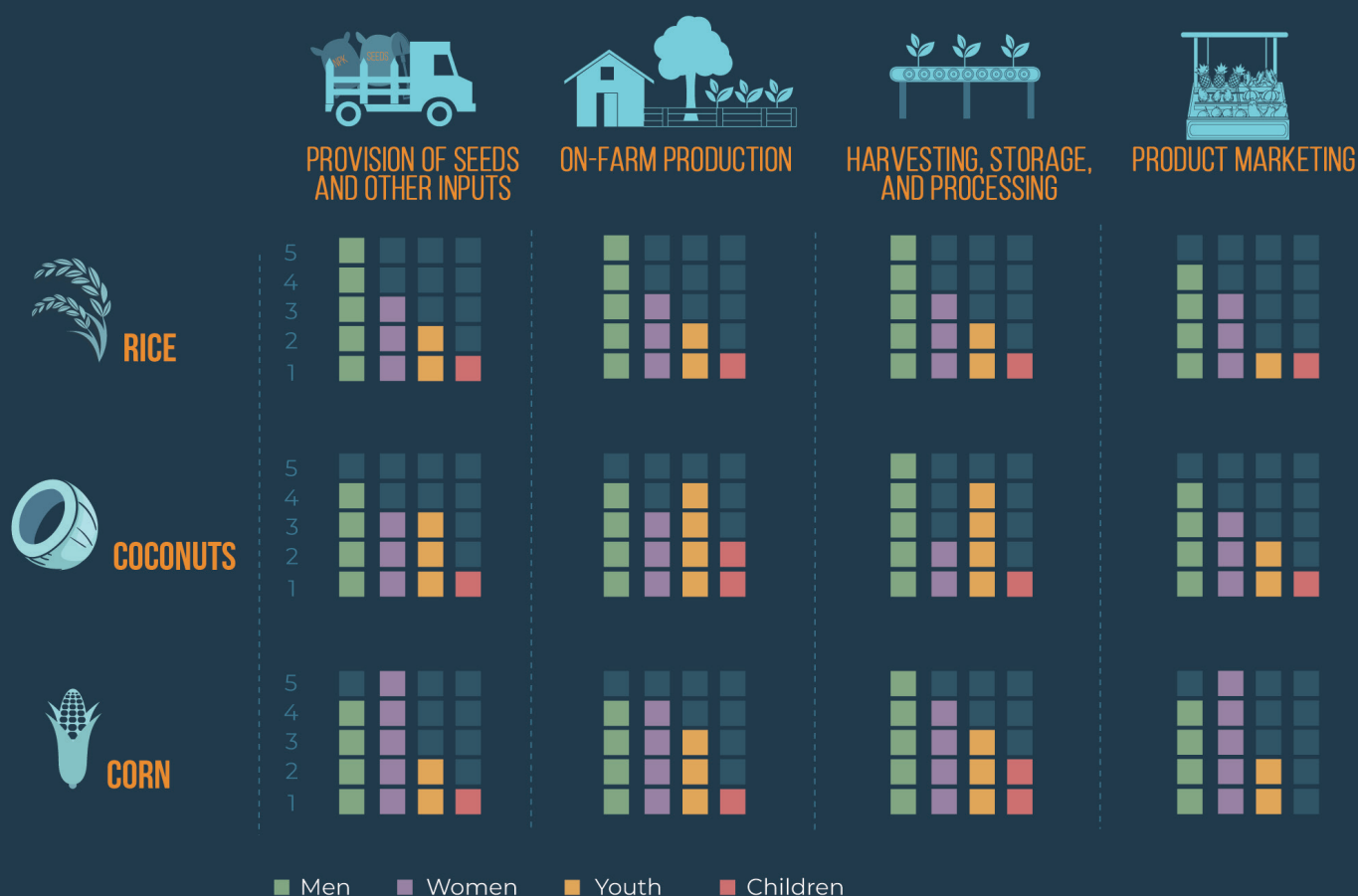


Figure 1: The role of men, women, youths, and children across the different value chain stages. These results were collected through an expert workshop with key value chain actors in Cebu.

It is estimated that up to 2.1 million Filipino children remain trapped in child labour, with agriculture responsible for a large proportion (62%). Boys and those living in rural areas are disproportionately impacted, being twice as likely to be involved than their female and urban counterparts. The most prominent form of labour is unpaid family work. Children's engagement in labor activities often hinders their education, with children absent or too tired to actively participate in their schooling [30].

CLIMATE CHANGE AND VARIABILITY: HISTORIC AND FUTURE TRENDS

The Philippines, by the nature of its geographical location and archipelagic formation of over 7,000 islands, is highly vulnerable to the impacts of climate change. This vulnerability is the result of its high exposure to multiple hazards, its sensitivity to these hazards in human and economic terms, and its limited adaptive capacity [2]. Globally, The Philippines is ranked 5th in terms of climate-related losses for the period of 1997-2016, with 289 events killing 85,955 people and costing 0.6% of GDP [1]. The impacts of climate change in the Philippines are felt most acutely by farmers and those living in rural areas, with typhoons, flooding, and droughts damaging crops and property. From 2000 to 2010, the total economic damage from typhoons, floods, and droughts was estimated to cost the Philippines USD 2.23 billion, including crop losses for rice (USD 1.2 billion), maize (USD 461.50 million), and high-value crops (USD 244.82 million) [31]. By 2050, this figure is projected to rise to USD 2.7 billion a year [3].

CLIMATE TYPE

Based on the Modified Coronas Classification System for climate typology, Visayas is comprised of all four climate types present in the Philippines [32]. The eastern side of the island (Region 8) 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 7 and 8) is classified as type IV, with rain distributed evenly throughout the year, while the western portion of the island (Regions 6 and 7) is classified as type III, with a short dry period from December to February. The western side of Region 6 is classified as type I, with a pronounced dry season from November to April and wet conditions for the rest of the year.

PROJECTED CHANGE IN PRECIPITATION AND TEMPERATURE BY 2050 [32]

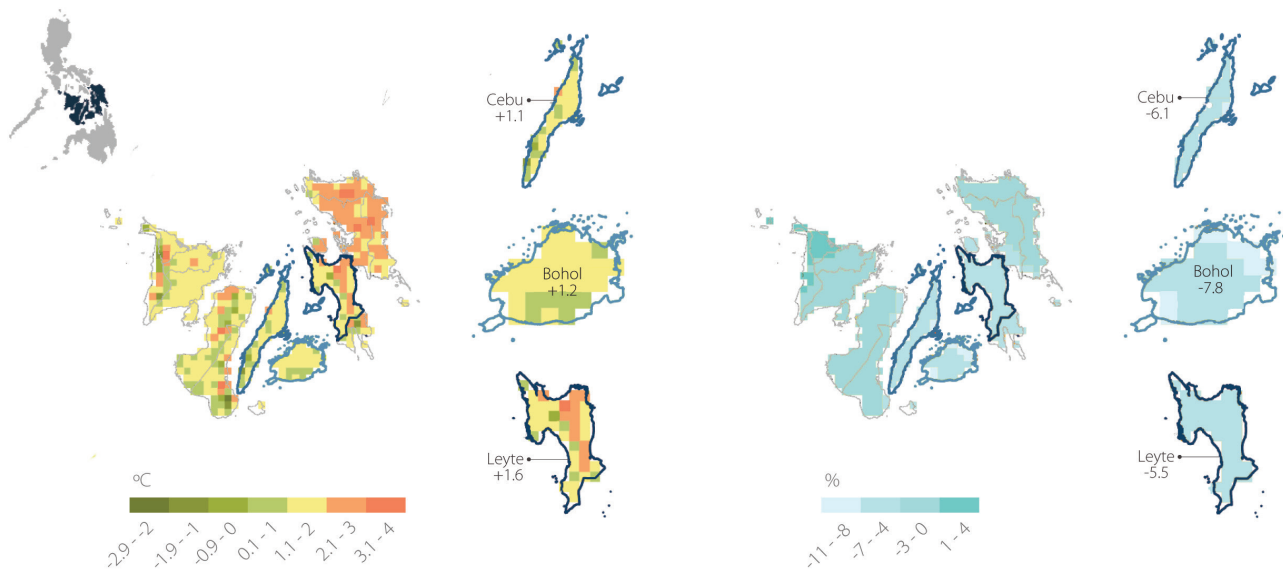


Figure 2: Modelled changes in temperature (left) and precipitation (right) under climate change by 2050, using Representative Concentration Pathway (RCP) 4.5.

Mean temperatures in Visayas are projected to increase by the middle of the century, with the largest increase projected in Leyte (+1.6°C), followed by Bohol (+1.2°C) and Cebu (+1.1°C). It is, however, the projected increases in extremely hot days (>35°C) that will have the greatest impact on crop production [32]. Bohol is projected to see the largest decrease in mean rainfall (-7.8%), but will also see the number of days annually with extreme rainfall (>100mm) increase from 15 to 23. Cebu will see a decline in mean rainfall (-6.1%) and an increase in extreme rainfall events from 12 to 17. Leyte follows the same trend, with decreasing annual rainfall and a small increase in extreme rainfall events [32].

HAZARDS

Globally, typhoons are projected to increase in intensity due to progressive climate change in coming decades [33, 34]. The Philippines is situated in the Pacific Basin, the source of 57% of global typhoons [35]. This makes the country the second most exposed in the world to typhoons after China [36], receiving at least 15 tropical storms and typhoons a year [37]. Of the three island groups, Visayas was the only one to have experienced an increase in the frequency of intense tropical cyclones over the period between 1951 and 2000 [32]. In 2013 Super Typhoon Haiyan

(also called Yolanda) made landfall in Visayas with sustained wind speeds of 315 kilometers per hour, making it one of the most powerful tropical cyclones ever recorded. The island of Eastern Samar and much of eastern Visayas sustained considerable damage to infrastructure and the agricultural sector.

A further consequence of typhoons is an increase in storm surges and associated flooding in low-lying coastal areas. The storm surge that followed Typhoon Haiyan in 2013 was among the deadliest in the last 50 years with an estimated 7,000 fatalities recorded by the Philippine government organization National Operational Assessment of Hazards. The impact of Typhoon Haiyan on agriculture was estimated to be USD 241 million, of which USD 195 million represented production losses with a further USD 45 million in damage to agricultural infrastructure [38]. Typhoons are identified as the most damaging geophysical hazard to the agricultural sector in the Philippines, with production damage and losses caused by typhoons and storms amounting to USD 3.5 billion, or 95% of all agricultural losses for the 2006 to 2013 period [39].

TYPHOON HAZARD MAP OF VISAYAS [40]

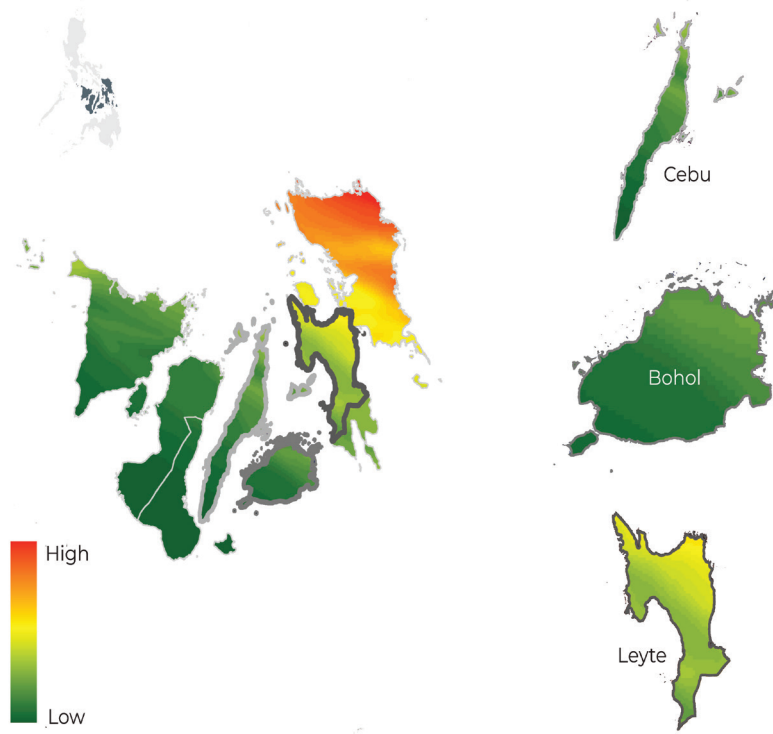


Figure 3: The typhoon map was acquired from the UNEP/UNISDR dataset using a 1 kilometer pixel resolution. The estimate of tropical cyclone frequency is based on Saffir-Simpson scale category 5 (wind speeds > 252 km/hr) from 1970 to 2013.

DROUGHT HAZARD MAP OF VISAYAS [41]

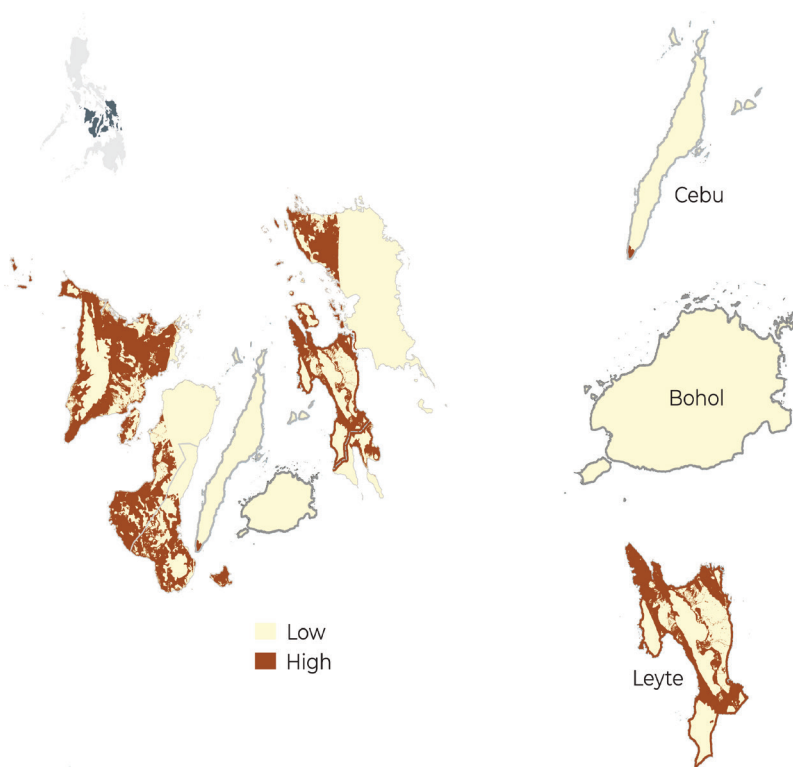


Figure 4: This drought map was acquired from the AMIA 1 dataset. It was produced using the integration of groundwater potential from the National Water Resources Board (NWRB) with topography and climate data from the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA).

The increase in mean temperatures and hot days experienced in Visayas, coupled with the reduction in rains brought on by the southwest monsoon, have increased the frequency and intensity of droughts [42]. The El Niño Southern Oscillation (ENSO) is a naturally occurring climate phenomenon that impacts much of the tropics. It can be broken down into two phases: El Niño, the warm phase, and La Niña, the cold phase. The ENSO has a strong modulating effect on rainfall patterns in the Philippines. El Niño is associated with droughts and water stress, while La Niña results in excessive rainfall [43]. Climate type I experiences the largest positive rainfall anomaly during La Niña years, while climate type III experiences the largest negative rainfall anomaly during El Niño years. The 1997 to 1998 El Niño resulted in production losses of 100% during the dry season and of more than 33% during the wet season. This pattern was repeated during the 2004 El Niño but to a lesser extent, causing 18% losses during the dry season and 32% in the wet season [40]. Bohol experienced reduced rainfall as a result of the 2016 El Niño, causing an estimated USD 81 million in losses in Mindanao and Visayas [44].

CROP SUITABILITY MAPPING

The climate change impacts and hazards outlined in the previous section—increased frequency and intensity of typhoons, higher temperatures, and increased likelihood of prolonged droughts—each acutely impact agricultural systems in Visayas. By combining climate projections, for instance, about temperature and rainfall, with specific parameters regarding a plant’s basic physiology, modelling for suitability can provide useful projections as to where favorable growing conditions may exist for certain crops into the future. Suitability mapping for 2050 is provided here for coconuts, corn, and rice in Visayas, as compared with baselines from 1997 to 2000. Suitability ranges from 0 to 100%, with intervals being classified as very high (81–100), high (61–80), moderate (41–60), marginal (21–40), and very marginal (<20). These measures of future suitability will support agricultural planning and investment in the selected regions, supporting long-term planning and transformation in response to climate change.

COCONUT

Today, coconut trees are generally suitable in almost all the major islands of Visayas with a climate suitability ranging from high to very high. The region does not show significant negative suitability effects of climate change on coconuts by 2050. Indeed, some areas in the east side of the island may even become more favorable. These suitability projections, however, do not take into account the impact of extreme events such as droughts and typhoons. When Typhoon Haiyan made landfall in Visayas, it damaged 41,662 ha of coconut production at an estimated cost of USD 28 million [38]. With the frequency and severity of tropical cyclones in Visayas expected to increase, this poses a serious threat to coconut production in Eastern Visayas and Leyte [43].

MAIZE

Historically, corn has high to very high climate suitability throughout Visayas. By 2050, however, there is a marked decline in corn suitability across the island group from high to marginal suitability across much of the low-lying areas. This projection also does not account for the impacts of droughts and typhoons, which can severely damage production. Corn is highly vulnerable to the impacts of typhoons, with Typhoon Haiyan damaging 21,699 ha of corn at an estimated cost of USD 5 million [38].

CLIMATE SUITABILITY OF COCONUTS IN VISAYAS, CURRENT AND IN 2050 [32, 43]

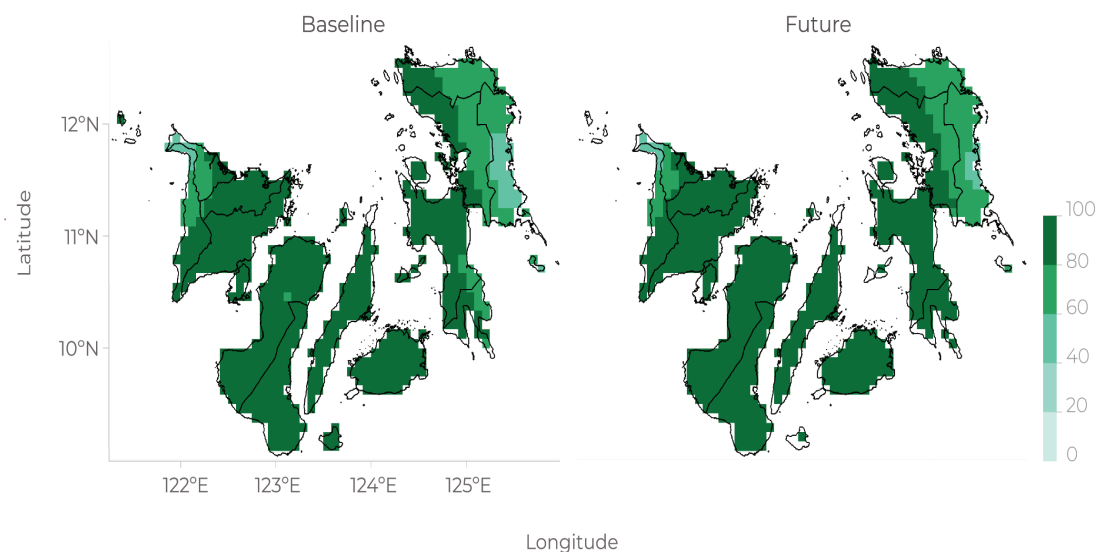


Figure 5: Climate suitability maps represent how well the crop will thrive in an area based on climatic factors such as temperature and rainfall. Suitability ranges from 0–100% with an interval of 20: 81–100 (very high), 61–80 (high), 41–60 (moderate), 21–40 (marginal), and <20 (very marginal).

CLIMATE SUITABILITY OF CORN IN VISAYAS, CURRENT AND IN 2050 [32, 43]

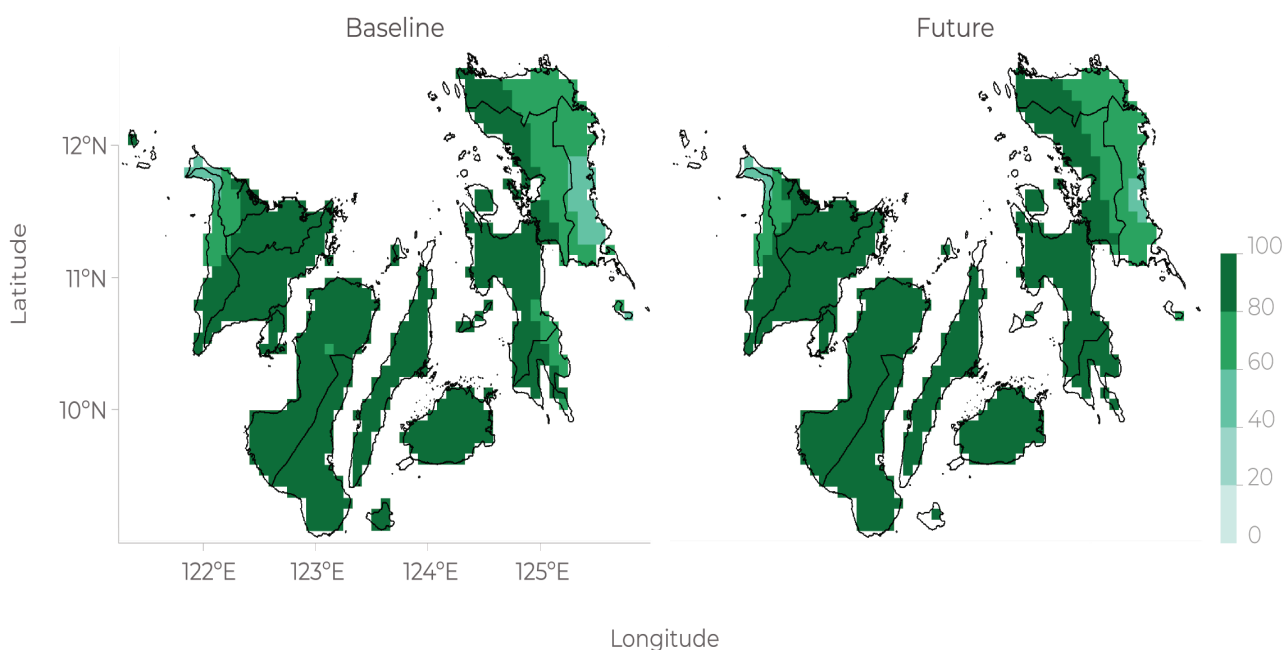


Figure 6: Climate suitability maps represent how well the crop will thrive in an area based on climatic factors such as temperature and rainfall. Suitability ranges from 0–100% with an interval of 20: 81–100 (very high), 61–80 (high), 41–60 (moderate), 21–40 (marginal), and <20 (very marginal).

RICE

Rice is typically suitable in almost all the lowlands of the Visayas islands, particularly in the provinces of Aklan, Capiz, Iloilo, Negros Occidental, Cebu, Bohol, Samar, and the northern part of Leyte. By 2050, however, the climate suitability of the crop is expected to decrease in almost all of these areas from very highly to highly suitable. Studies conducted

in Bohol found that farmers have already observed changes in both temperature and precipitation as a result of climate change [46]. For each 1°C increase in the minimum temperature during the dry season, rice grain yields fell by 10% [47], and for every 1% increase in the share of wet days, yields fell by 36 kg/ha [48]. In the wake of typhoon Haiyan, 77,719 ha of rice were impacted, with damages estimated at USD 44 million [38].

CLIMATE SUITABILITY OF RICE IN VISAYAS, CURRENT AND IN 2050 [32, 43]

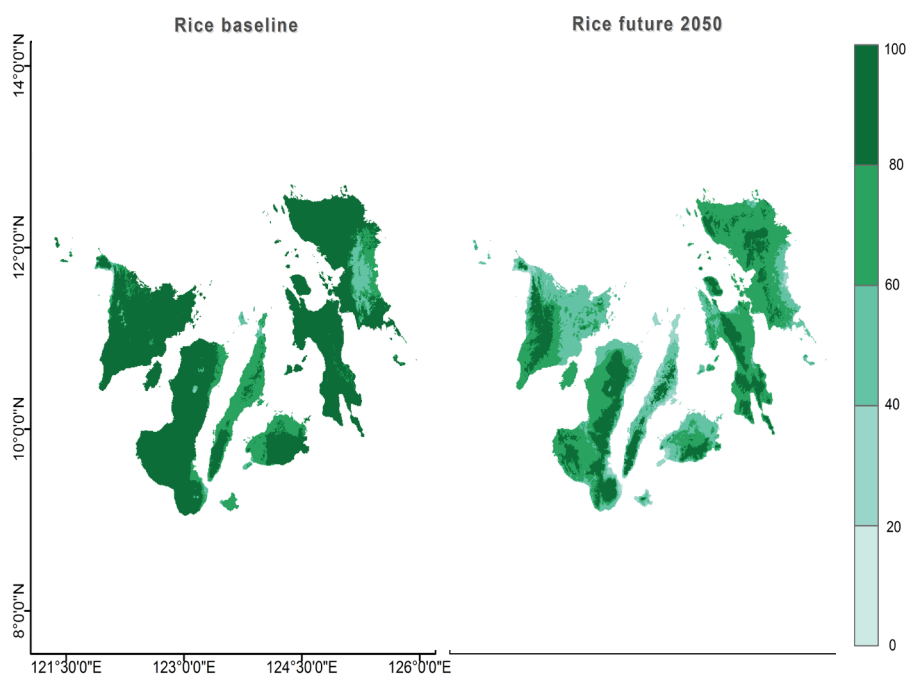


Figure 7: Climate suitability maps represent how well the crop will thrive in an area based on climatic factors such as temperature and rainfall. Suitability ranges from 0–100% with an interval of 20: 81–100 (very high), 61–80 (high), 41–60 (moderate), 21–40 (marginal), and <20 (very marginal).

THE CLIMATE FROM FARMERS' PERSPECTIVES

Farmers in Cebu, Bohol, and Leyte have observed that weather patterns are growing less predictable when compared to historical trends. Months that are typically dry, for example, are experiencing increased rainy days. In times of extreme heat and drought, some farmers observe that even irrigation cannot prevent losses in rice fields because plants still wilt from unsustainably high temperatures. Long dry seasons have adverse effects on coconut farmers because trees produce fewer and/or smaller fruits.

Moreover, the extreme heat is often accompanied by pest infestations.

Farmers have affirmed that the intensity of typhoons and rainfall have increased over time, damaging plants and reducing yields, sometimes resulting in failed harvests. As the weather grows increasingly unpredictable and forecasts unreliable or unavailable, planning for on-farm activities has become more challenging, especially for fertilizer application that can be washed away by flooding or heavy rains. Farmers added that extreme weather also affects animal production, adversely impacting this alternative source of income as well.

VALUE CHAINS, VULNERABILITIES, AND PROPOSED ADAPTATION OPTIONS

CORN

The corn value chain in Cebu is vulnerable to the impacts of both droughts and typhoons. Farmers in the region identified a range of consequences brought on by drought conditions. In times of drought, the quality and quantity of available seeds drops as farmers seek to replace crops lost or damaged through the increased incidence of pest and disease outbreaks and through diminished germination. The consequences of typhoons are felt across the whole value chain, disrupting the transportation of inputs and produce between actors. Low yields and reduced quality of corn due to rotting and pest and disease outbreaks reduced the income earned by farmers, with knock-on effects across the value chain as processors and traders do not receive sufficient high-quality products.

Corn farmers identified the need for early warning systems as an effective adaptation option for both droughts and typhoons, allowing them to take preventative measures, reduce their losses, and facilitate recovery. The delivery of early warnings should be made through feature phones in SMS format because many farmers still lack access to smartphones or live in areas with limited connectivity. For farmers who are unaware of how to respond effectively, early warnings should come with targeted advisory on the best resilience-building activities.

Diversified farming was also identified as an adaptation option with the potential to reduce losses from both droughts and typhoons, safeguarding food and income security for corn farmers in Cebu. Transitioning from a corn monocrop to diversified farming and integrating livestock and other crops will lessen the vulnerability of farmers by providing multiple income sources. Such a system would also have numerous environmental co-benefits, improving soil quality, reducing the

need for synthetic fertilizers, and safeguarding agrobiodiversity. Another proposed adaptation option is a corn-peanut crop rotation, which was found to offer higher yields than conventional production [49].

Typhoons were found to have a moderate to major impact on the harvesting, storage, and processing of corn, disrupting transport and resulting in increased postharvest losses. Two proposed adaptation options are the use of moisture meters and improved storage facilities to ensure harvested corn remains in the optimal conditions.

RICE

Although drought-tolerant varieties of rice are being introduced, farmers in Bohol still face serious challenges from droughts. During long dry spells or droughts, infestations of armyworms, blast, and brown spot become more prevalent. Agricultural labour is also affected by extremely hot days, limiting the number of man-hours they can work in the field each day. In these instances, proper management practices or technologies are often not applied. This has downstream effects on consumers whose demand for rice is not met, leading to price increases. While on most occasions Bohol is not directly hit by typhoons, these events can damage irrigation infrastructure. Typhoons and heavy rainfall also affect harvesting, storage, and processing, potentially resulting in higher labour costs and drying expenses from collapsed or water-logged crops.

The adoption of agro-forestry and diversified farming systems were considered effective adaptation options at the farm level to both droughts and typhoons. The incorporation of trees into rice monocrop landscapes acts as an effective shield from the elements, reducing the damage caused by heavy rains, high winds, and extreme temperatures. The integration of livestock and high-value multipurpose trees into farming systems brings additional income sources to farmers, improving their financial stability. Planting nitrogen-fixing leguminous crops on the boundaries of their paddies (sometime referred to as “alley cropping”) was identified as an effective adaptation option with positive impacts on yield.

Another promising adaptation strategy is to transition to organic production, reducing input costs and opening up higher-value markets. A good example would be the production of red rice using organic



CORN



PROVISION OF SEEDS AND OTHER INPUTS



ON-FARM PRODUCTION



HARVESTING, STORAGE, AND PROCESSING



PRODUCT MARKETING

Hazard

DROUGHT

Consequences

- Insufficient stock of buffer seeds
- Reduced quality or viability of inputs (e.g., seeds)
- Damage during reproductive stage
- Increased incidence of pest outbreaks
- Reduced production
- Delays in the implementation of farm activities and operations
- Fewer employment opportunities for hired labourers
- Reduced yields and lower-quality produce

Underlying vulnerability factors and sensitive groups

Biophysical: soil erosion in hilly areas, **Socioeconomic:** low levels of partnerships or association, low levels of education, a lack of savings or investment capital after extreme climate events, **Cultural:** little interest and enthusiasm to be part of groups and attend meetings, **Institutional:** difficulties in accessing information, a lack of insurance services

Adaptation options proposed

- Crop insurance
- SMS-generated early warning system with advisory
- Organic fertilizer (\$) (chicken manure)
- Diversified farming (\$) (crops-livestock)
- Use of improved varieties
- No weeding
- Application of foliar fertilizer
- Water pumps for irrigation
- Organic farming

Hazard

TYPHOON

Consequences

- Insufficient stock of buffer seeds
- Reduced quality or availability of inputs like seeds
- Damage to crops from being submerged or knocked over
- Damage during reproductive stages
- Increased incidence of pest outbreaks
- Reduced production
- Delayed implementation of farm activities and operations
- Stoppage of postharvest operation
- Low yield, making it difficult to produce the quantity necessary for buying in bulk
- Fewer employment opportunities for hired labourers
- Difficulties to generate employment (hired labourers)
- Low yield and low-quality produce

Underlying vulnerability factors and sensitive groups

Biophysical: soil erosion in hilly areas, **Socioeconomic:** low levels of partnerships or association, low levels of education, a lack of savings or investment capital after extreme climate events, **Infrastructure:** blockage of roads and bridges, difficulty in reaching markets

Adaptation options proposed

- Crop insurance
- Buffer stock of corn feeds
- SMS-generated early warning system with advisory
- Diversified farming facilities (crops-livestock)
- Organic farming
- Moisture meters
- Use of good storage facilities
- Early harvesting
- Buying fresh corn instead of dry corn

Magnitude of impact

Score priority

Cost-benefit analysis available in supplementary material

- Minor
- Moderate
- Major
- Severe
- High
- Medium
- Low

- Available

inputs [50]. Organic red rice production in Visayas supports DA-Negros Island Region's Promotion and Development of Organic Agriculture Program. It also has garnered strong support from the Negros Island Organic Producers' Association (NIOPA) and is recommended by the Municipal and City Agriculture Office and the Regional Field Office of the DA.

Rice farmers' financial capacity to adopt new practices is often constrained due to limited access to credit needed to cover the upfront costs. Programmes that remove barriers for farmers to access credit would help them to take preventative measures to build their resilience to droughts and typhoons. As all risk cannot be mitigated through the proposed adaptation options, investments must be protected through crop insurance schemes, allowing farmers to transfer their risk.

COCONUTS

Typhoons are the most damaging climate hazard for coconut production in Leyte, as evidenced by the devastating impacts on the sector from Super Typhoon Haiyan in 2013. It will take almost a decade for uprooted or truncated coconut trees to re-grow and for farmers to fully recover their livelihoods. Some farmers continue to be impacted by heavy rains and flooding, especially those in open and low-lying areas exposed to strong winds and rains. Droughts can also adversely affect coconut trees, resulting in wilting and drying of leaves and button shedding.

For coconut farmers in Leyte, periods of drought are also accompanied by an increased incidence of pest and disease outbreaks. In these circumstances, farmers may choose to adopt integrated pest management strategies, including the use of bio-controls to prevent pest infestations and disease outbreaks. Manual spraying of trees may also serve as an adaptation strategy for some farmers, and in some extreme cases, controlled burning of heavily infested or diseased trees may be required. In extreme drought conditions, seedlings, which are not typically watered, may be irrigated to ensure their survival.

Diversified farming systems may also be adopted by farmers facing drought conditions, including integrated crop-livestock systems and alley cropping between coconut trees involving, for instance,

bananas and other annual crops. In a recent study, coconut-banana intercropping was found to be an effective crop diversification adaptation option. Intercropping of banana in areas planted with coconut trees was found to significantly increase farm productivity as compared to coconut monocropping. The practice also requires minimal fertilizer and pesticide input [51].

In adapting to typhoon conditions, some farmers may choose to adopt improved coconut varieties, especially shorter trees that are less prone to damage from high winds. Early harvesting of coconuts may also be needed in advance of typhoons, a practice dependent on the availability of and access to weather forecasts. Like corn and rice farmers, coconut producers may choose to insure their production through the PCIC.



RICE



PROVISION OF SEEDS AND OTHER INPUTS



ON-FARM PRODUCTION



HARVESTING, STORAGE, AND PROCESSING



PRODUCT MARKETING

Hazard

DROUGHT

Consequences

- Reduced quality of seeds
- Increases public and government expenditures
- Water stress and crop failure
- Pest and disease outbreaks
- Reduces total volume harvested, hence lower incomes
- Low supply of milled rice
- Reduced supply of raw materials to rice processing complexes
- Higher prices for milled rice
- Low supply for final consumers

Underlying vulnerability factors and sensitive groups

Socioeconomic: short-term thinking, low levels of partnerships or association, **Institutional:** precarious access to basic services like potable water, medicines, and food, and to information, LGU with low budget relative to the population, **Infrastructure:** blockage of roads and bridges

Adaptation options proposed

- Local biodiversity conservation (mixing crops and wild species)
- Access to financing
- Rainwater harvesting (\$)
- Farm mechanization
- Procurement of short-term buffer stock
- Buffer stock of rice seeds
- Diversified farming (crops-livestock)
- Agroforestry
- Incentive system involving support or subsidies for organic products and inputs
- Crop insurance
- Alley cropping
- Mobilizing multi-stakeholders through partnerships and networking
- Organic farming
- Soil fertility conservation technologies
- Sourcing of raw materials from other provinces to sustain the market

Hazard

TYPHOON

Consequences

- Reduced quality of seeds
- Defoliation or crop failure
- Higher production costs
- Reduced product quality
- Damage to postharvest, storage, and processing equipment
- Wet palay

Underlying vulnerability factors and sensitive groups

Biophysical: landlocked areas, soil erosion in hilly areas, **Socioeconomic:** short-term thinking, high costs of transportation for farmers living in remote areas, **Institutional:** precarious access to basic services like potable water, medicines, and food, and to information, **Infrastructure:** blockage of roads and bridges

Adaptation options proposed

- Local biodiversity conservation (mixing crops and wild species)
- Access to financing
- Diversified farming (crops-livestock)
- Farm mechanization
- Procurement of low-term buffer stock
- Buffer stock of rice seeds
- Agroforestry
- Incentive system involving support or subsidies for organic products and inputs
- Crop insurance
- Alley cropping
- Mobilizing multi-stakeholders through partnerships and networking
- Organic farming
- Soil fertility conservation technologies
- Sourcing of raw materials from other provinces to sustain the market

Magnitude of impact

Score priority

Cost-benefit analysis available in supplementary material

- Minor
- Moderate
- Major
- Severe
- High
- Medium
- Low

- \$ Available



COCONUTS



PROVISION OF SEEDS AND OTHER INPUTS



ON-FARM PRODUCTION



HARVESTING, STORAGE, AND PROCESSING



PRODUCT MARKETING

Hazard

DROUGHT

Consequences

- High cost of nursery management
- Longer span for crop recovery from climatic impacts
- Damages to processing site and facilities
- Less copra to buy from farmers
- Reduced quality of seedlings
- Physiological problems (e.g., coconuts not fully developed)
- Reduced total harvest
- Compromised supply of raw materials
- Scarcity of seedlings
- Decreases in production
- Shorter storage life for coconuts
- Higher time and labour costs for crop management and rehabilitation

Underlying vulnerability factors and sensitive groups

Biophysical: for farms far from water sources like rivers, insufficient water supply, **Socioeconomic:** young coconut plants prone to drought and pest infestation, low access or registration to crop insurance services, **Institutional:** lack of participation or membership in any agricultural organization, **Infrastructure:** reduced raw material supply

Adaptation options proposed

- Seed selection
- Crop insurance
- Livelihood diversification and value addition technologies
- Integrated pest management (biocontrol)
- Sanitation
- Diversified farming (coconut-banana or coconut-cacao) (\$)

Hazard

TYPHOON

Consequences

- High cost of nursery management
- Decreased production
- Plant site damage
- Less copra to buy from farmers
- Reduced quality of seeds
- Less harvest
- Decline in supply
- Scarcity of seedlings

Underlying vulnerability factors and sensitive groups

Biophysical: farms located in remote or hilly areas prone to landslides, **Socioeconomic:** low crop diversification and few alternative livelihoods, low, unstable incomes, high cost of gasoline, a lack of alternative energy sources, high transportation and operation costs, low access or registration to crop insurance services, **Institutional:** a lack of participation or membership in any agricultural organization, **Infrastructure:** blockage of farm-to-market roads due to landslides or damaged roads

Adaptation options proposed

- Use of improved varieties
- Use of dwarf variety of coconut (\$)
- Insurance systems
- Selling of whole nuts instead of copra
- Capacity building in integrated pest and disease management
- Livelihood diversification and value addition technologies
- Early harvesting

Magnitude of impact

Score priority

Cost-benefit analysis available in supplementary material

■ Minor ■ Moderate ■ Major ■ Severe

● High ● Medium ● Low

● Available

OFF-FARM SERVICES

Various off-farm adaptation support mechanisms in Visayas are provided to farmers by LGUs and government agencies like the DA, the Agricultural Training Institute, the Philippine Crop Insurance Company, and the Philippine Coconut Authority. These organizations help farmers respond to the adverse impacts of climate change through trainings, workshops, livelihood support programs, financial assistance, crop insurance, farm demonstrations, infrastructure provision, equipment and machinery supply, and subsidies or cash incentives.

In Cebu, the DA together with Visayas State University and the Municipal Agriculture Office in Daanbantayan conducted a workshop on research into community-based participatory action for climate-resilient agriculture under corn-based farming systems in Region VIII. LGUs also host programs to help farmers secure microfinancing and to provide equipment like tractors for land preparation as well as corn mills for postharvest activities. During trainings, farmers are encouraged to adopt no-tillage practices to minimize soil disruption and erosion. In Bohol province, meanwhile, various off-farm support mechanisms have been established through the DA Agricultural Promotion Center and the Agricultural Training Institute, including rice technical demonstrations on featured rice farms, subsidies for the purchase of hybrid seeds, farmer field schools for rice intensification systems, and the conservation of plant genetic resources. In Leyte, as a response to losses from Typhoon Haiyan, a replanting incentive program has been established where farmers are given cash incentives to replant coconut trees. A coconut fertilization project is also being promoted by the Provincial Coconut Authority (PCA), using agricultural-grade salts and coir-based organic fertilizer, an approach that is acceptable to farmers given its cost effectiveness and environmentally-friendly nature. The DA also has seed stocks for corn, rice, and coconuts ready for distribution to affected farmers in the case of extreme events or production losses. Weather forecasting services are also provided by LGUs through Agromet Stations, with text updates available to some farmers.

BARRIERS

Farmers are often prevented from responding effectively to climate change and its associated hazards by a range of barriers, which either directly or indirectly limit their adaptive capacity. These barriers can be categorised as financial, technical, behavioural, informational, and institutional. Figure 8 examines the impact of each barrier category across the value chains analyzed in this report.

Rice farmers were found to lack sufficient information on climate change and its impacts, which, coupled with a lack of technical capacity to respond, leaves them especially vulnerable. Those farmers looking to adopt new techniques or resilient crop varieties often find themselves limited by financial constraints such as a lack of access to credit and by inadequate buffer stocks. In times of drought or following a typhoon, the prices of key inputs rise and the quantity of supplies available decreases. There is also a reluctance amongst farmers to adopt new practices. Institutional barriers include the failure of the government to provide sufficient compensation to farmers who attend their “agri-schools”; due to budget constraints, some farmers are unable to afford the time away from the farm.

Corn farms located in remote, hilly areas have limited access to information, often relying on traditional methods in the absence of training on improved practices. Suppliers struggle to reach such remote regions and have little incentive to do so, as farmers lack the financial capacity to purchase improved varieties and other inputs. Technical constraints exist for both on-farm production and processing due to a lack of experts to provide training to farmers and processors.

In the aftermath of major catastrophes such as Typhoon Haiyan, coconut farmers lacked the financial capacity to clear their lands of debris before replanting. Many farmers participated in cooperative loans to help them re-establish their farms. Limited institutional capacity result in many farmers not receiving information about the spread of pests and diseases or training in improved practices. Farmers are, in some instances, reluctant to adopt new and improved practices, preferring to continue with traditional methods.

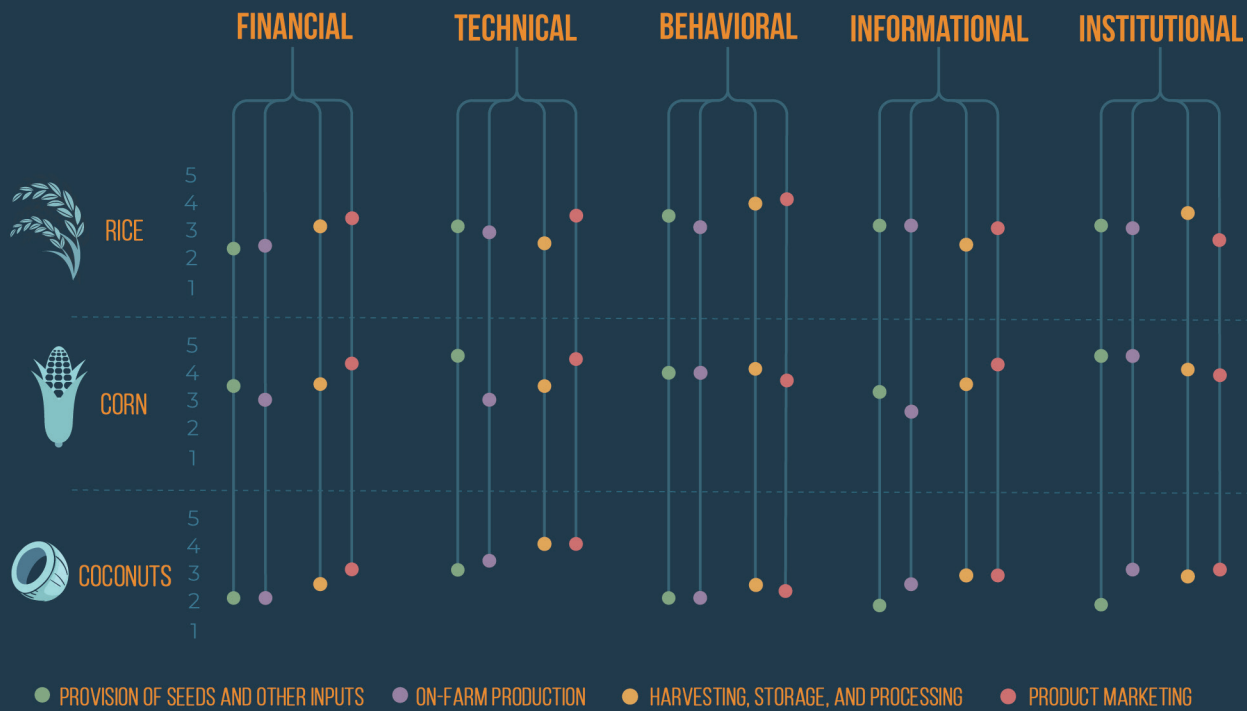


Figure 9: A map of the severity of different barriers across the value chain for the key commodities. The height of the barrier corresponds to the severity on the left-hand scale with 1 = no barrier and 5 = severe barrier.

POLICIES AND PROGRAMS

The Philippines has long-established laws aimed at promoting adaptation to climate change. The Climate Change Act of 2009 (Republic Act No. 9729) mainstreams climate change into government policy formulations. Through this act, the Climate Change Commission (CCC) was created to serve as the sole policy-making body responsible for coordinating, monitoring, and evaluating climate change programs and action plans in the country. In order to ground this national level policy, LGUs subsequently crafted Local Climate Change Action Plans (LCCAP) for their respective communities, directly engaging barangays (the country’s smallest administration units).

Amending the Climate Change Act, R.A. No. 10174 established the People’s Survival Fund in 2012 to provide long-term financing for projects that address climate change. Its PHP 1 billion (USD 18.5 million) appropriation from the General Appropriations Act (GAA) is supplementary to any annual appropriations

allocated by LGUs for Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA). Recognizing the close interrelation of DRR and CCA activities, R.A. No. 10174 mandated the integration of DRR activities into climate change programs and initiatives. The National Framework Strategy on Climate Change for 2010-2022 was introduced by the CCC, with an emphasis on adaptation.

The Philippines Nationally Determined Contribution (NDC), submitted to the United Nations Framework Convention on Climate Change in accordance with the Paris Agreement, stipulates the target of a 70% reduction in greenhouse gas (GHG) emissions by 2030 compared to the business-as-usual scenario. While adaptation is the focus of many policies due to the Philippines’ high exposure to the impacts of climate change, there are also a number of mitigation policies and initiatives. In 2014, President Benigno Aquino III signed Executive Order No. 174 to institutionalize the Philippine GHG inventory management and reporting system. This was created to enable the country’s transition to a climate-resilient approach to sustainable development.

The Adaptation and Mitigation Initiative in Agriculture (AMIA), meanwhile, is the flagship program for

climate change and mitigation within the DA. The Department of Agriculture System-wide Climate Change Office (DA-SWCCO) oversees AMIA. Central to the AMIA initiative is the establishment of “AMIA Villages,” where climate-smart best practices are showcased [52]. As part of this project, in Cebu, the provincial government with its provincial agriculture office introduced organic farming methods to their local farmers. Through series of trainings, farmers were taught how to make fertilizer out of organic materials such as compost and fermented fish. In Bohol, a rice program called Production, Marketing and Technology Enhancement of Organic Rice (PROMOTE-Rice) was implemented. The central components of this program were the creation of the Centre for Agribusiness and Sustainable Agriculture and training programs in organic agriculture; the development of vermicast production; the establishment of marketing facilities in six municipalities for producing and distributing affordable, high-quality organic fertilizer; and the creation of the Balay sa Humay Rice Museum to promote organic rice production and attract tourists. In 2013, DA Secretary Proceso Alcala issued the memorandum, “Mainstreaming Climate Change in DA Programs, Plans and Budget”, to further strengthen the implementation of R.A. No. 9729, particularly under the agriculture and fisheries sectors. The Secretary likewise approved the Department’s Seven-Wide Programs on Climate Change (DA-SWPCC), which entails the following seven pillars: “(1) Mainstream Climate Change Adaptation and Mitigation Initiatives in Agriculture; (2) Climate Information System; (3) Philippine Adaptation and Mitigation in Agriculture Knowledge Toolbox; (4) Climate-Smart Agriculture Infrastructure; (5) Financing and Risk Transfer Instruments on Climate Change; (6) Climate-Smart Agriculture and Fisheries Regulation; and (7) Climate-Smart Agriculture Extension System.” In 2016, the program fund was linked to the Climate Change Program of the Bureau of Agricultural Research (BAR) to be used for research and development activities that are aligned with the AMIA framework, with an emphasis on increasing the adaptive capacity and productivity potentials of agriculture and fisheries livelihoods.

The Agriculture and Fisheries Modernization Act (AFMA) aims to modernize the agriculture and fisheries sectors of the Philippines and to enhance these sectors’ profitability and preparedness for the challenges of globalization. The AFMA has also led to the establishment of Strategic Agricultural and Fisheries Development Zones and the Agricultural

and Fisheries Modernization Plan. Across these policies, the government prioritized access to credit for farmers and support for irrigation. However, given underinvestment in the agricultural sector, progress in these areas has been slower than expected [53, 54].

Climate change is also captured in the country’s overarching framework for the DA, the Agri-Pinoy strategy (2011-2016). This strategy was based on four central themes: (1) food security and self-sufficiency, (2) sustainable agriculture and fisheries, (3) natural resource management, and (4) local development. It calls for coordinating regionally-based spatial planning, providing infrastructure necessary to priority value chains, and building a more resilient production base to accommodate the variations in global markets and the effects of climate change [55]. The framework itself has various sub-programs, most notably the rice and corn programs.

The Philippine Coconut Authority region VIII implemented a project that could help address climate change and rehabilitate and recover the coconut sectors devastated by Typhoon Haiyan. The Accelerated Coconut Planting and Replanting Program of the PCA has three main components: the Participatory Coconut Planting Project (PCPP); the Coconut Seedlings Dispersal Project (CSDP); and the Indigenous People’s Outreach Program (IPOP). The PCPP involves providing cash incentives to farmers who plant coconut trees. The CSDP distributes high-quality coconut seedlings to farmers and other organizations. The IPOP is designed to encourage indigenous people to participate in coconut planting. Coconut intercropping is also included in this program, which entails planting annual crops in unutilized spaces between coconut trees to improve food security, especially after typhoons, and provide an additional source of income.

The Philippine Rural Development Project (PRDP) is a six-year national project under the DA that aims to establish a modern, value chain oriented, and climate-resilient agriculture and fisheries sectors. The PRDP is a scaled-up version of the Mindanao Rural Development Program (MRDP) and is aligned with the Agri-Pinoy strategy. Through this project, value chains—including high-value crops such as coffee and cacao—are prioritized for investment and development. The “I-PLAN” component of the PRDP assists LGUs in the development of Provincial Commodity Investment Plans that serve as blueprints for investment in priority commodities. The “I-BUILD”

component of the PRDP then establishes strategic and climate-resilient rural infrastructure along these value chains, including farm-to-market roads, communal irrigation systems, potable water supplies, and postharvest and other rural infrastructure.

GOVERNANCE AND INSTITUTIONAL RESOURCES AND CAPACITY

Government institutions active on climate change issues include the Climate Change Commission (CCC), DA and related agencies, such as the Philippine Atmospheric, Geophysical and Astronomical Services Administration and LGUs. The CCC is responsible for coordinating, monitoring, and evaluating programs and actions on climate change by the government. The DA is mandated to promote agricultural development by providing public investments, policy frameworks, and services needed for domestic and export-oriented agricultural business enterprises. Through its offices serving the regional, provincial, and city levels, the DA is pivotal in implementing new technologies, practices, and other services that may impact farmers or agricultural value chain actors in the Philippines. The DA has attached bureaus and agencies—like the Agricultural Training Institute or the Bureau of Agricultural Research—tasked with implementing climate change-related programs, conducting research, providing trainings, and offering extension services. The Systems-Wide Climate Change Office, meanwhile, coordinates and manages AMIA, the flagship program for climate adaptation and mitigation of the DA.

LGUs also play a central role in mainstreaming climate change adaptation in the Philippines, as evidenced by their development and implementation of Local Climate Change Action Plans. LGUs consist of various sub-national administrative units including the region, province, city, municipality, and the barangay. According to the Local Government Code of the Philippines, the barangay acts as the primary implementing unit of government policies, plans, programs, projects, and activities. Municipalities also coordinate and deliver primary services within their territorial jurisdictions. The province serves as a dynamic mechanism for developmental processes and effective governance of other LGUs within its

territorial jurisdiction. The Provincial Agriculturist's Office is mandated to promote sustainable agriculture and enhance the growth of fisheries through increased productivity and profitability, coordinating DA projects and programs. This office employs coordinators for every crop grown in the province, reaching specific farmers with specially tailored services.

EXTENSION

The DA, through the Agricultural Training Institute, is charged with delivery of extension services for the agriculture and fisheries sectors, providing training to agricultural extension workers. Apart from the ATI, DA offices in LGUs also conduct ad-hoc trainings for farmers. The Municipal Agriculture Office, for example, offers trainings in nursery establishment, crop production, and postharvest practices. NGOs and private entities or companies like the Cacao Industry Development Association of Mindanao, Inc. often have more resources to provide extension services to farmers and often do so through seminars.

RESEARCH AND DEVELOPMENT

The Department of Science and Technology (DOST), the Department of Environment and Natural Resources, and the DA through the Bureau of Agricultural Research are among the institutions that provide research and development support to the agricultural sector in the Philippines. In addition, individual academics also play a key role in research and development related to climate change and climate-smart agriculture. Under DOST, the Philippine Council for Agricultural Resources, Research, and Development has a number of researchers working on these topics. Through the BAR, spending on agricultural research for national programs pertaining to rice, corn, and high-value crops has grown substantially in recent years. Still, the research system of the Philippines remains fragmented and lacks synergy among institutions in terms of identifying shared research priorities [56].

FINANCE

There are also various financial institutions in the Philippines that support climate change adaptation. The Philippine Crop Insurance Corporation, for example, is a DA-affiliated agency that provides insurance protection for corn, rice, and other crops against losses resulting from natural disasters, pest infestations, or plant diseases. Coverage typically protects farmers for up to 120% of the cost of production inputs. Not all farmers are able to access insurance, however. Some are not properly enrolled in the Registry System for Basic Sectors in Agriculture, while others are unaware of its existence entirely.

The Land Bank of the Philippines is also a formal provider of financial services to the agricultural sector. Through its Agricultural Credit Support Project and the Agrarian Production Credit Program (APCP), the bank is able to provide loans and financing to farmers. APCP is a joint credit program with the Department of Agrarian Reform to provide financing to newly-organized Agrarian Reform Beneficiary Organizations and to farmer organizations that would traditionally be ineligible to access loans from commercial banks. Another government-owned bank that provides financial support to farmers is the Development Bank of the Philippines. The bank has SEED High-value crops Financing Programs with an interest rate of 10-12%, but requires a Securities and Exchange Commission and Cooperative Development Authority registration with a land title and other business documents. Commercial and private banks can be a source of financial services to farmers, although private banks often have a number of conditions with which it are difficult for farmers to comply, including higher collateral requirements.

The Agricultural Credit Policy Council (ACPC) assists the DA in synchronizing all credit policies and programs in support of the DA's priorities. Under ACPC and closely related to the Agriculture and Fisheries Financing Program, the Climate Change Adaptation Financing Program (CCAFFP) seeks to encourage small farmers and fisherfolk to adopt climate change adaptation practices and technologies.

Another program under ACPC is the Production Loan Easy Access program, a special credit facility of the Unified Lending to Agriculture program. Eligible borrowers are marginal farmers or fishers engaged in agri-fishery production. The program provides two-to-ten-year loans up to PHP 50,000 (USD 922), subject to the project requirements and repayment capacity of the borrower as evaluated by the lending agent.

Finally, as determined by the DC and ACPC, the Survival and Recovery (SURE) assistance program can be mobilized to serve as a fast-response, post-disaster support facility, providing grants and loans to calamity-affected small farmers and fisherfolk and their households. SURE has initial funding of PHP 100 million with a further PHP 1 billion committed by the President.

SYNTHESIS AND OUTLOOK

Agriculture plays a major role in the economy and society of Visayas, yet the sector faces considerable threats from the threats from climate change. Climate hazards in the form of droughts and typhoons pose a significant threat to rice, corn, and coconut production in Visayas. The disruption caused by such events is felt across the entire value chain from the provision of seeds and inputs to product marketing.

Unpredictable weather in Visayas has produced uncertainty and delays in critical farm activities, including the distribution of seeds and inputs. On-farm, intense heat forces farmers and labourers to work fewer hours in the fields, affecting production. The powerful Typhoon Haiyan in 2013 demonstrated the devastating impact of tropical storms on farmers in Visayas; it destroyed livelihoods and production and postharvest infrastructure.

These and other impacts will continue to shape the future of agriculture in Visayas. The high costs of rehabilitation after extreme events are incurred by both private actors and the government, since these institutions are responsible for safeguarding the agricultural sector against such hazards. During harvest periods, droughts, and typhoon can affect the quality of produce, by interrupting processing and drying and by increasing the costs of labour and processing.

Various adaptation options were identified by value chain stakeholders in Visayas. In addition to a host of on-farm strategies like integrated crop-livestock systems and diversification, to protect against both typhoons and droughts, farmers across the three value chains under study indicated the need to protect their harvests with crop insurance provided through the PCIC. Improved access to credit for farmers with limited financial capital is another high-level strategy that many stakeholders suggested, which would allow producers to access improved inputs like crop varieties tolerant to droughts, heat, and floods.

The difficulty of communicating the benefits and effectiveness of adaptation strategies to traditional or difficult-to-reach farmers is a significant barrier to adaptation. Limited manpower availability,

sometimes due to disincentives created by government safety net programs, also limits the adoption of labour-intensive adaptation measures and negatively impacts harvest periods. A lack of financial resources also plagues farmers and limits adaptation.

To overcome these challenges, government and private sector actors can work to ensure that farmers, even in distant places, are able to join organizations that improve access to inputs and credit and facilitate better market rates. These efforts may be combined with ordinances to ensure price premiums for organic production. Given the country's vulnerability to extreme events, the Philippine Atmospheric Geophysical and Astronomical Services Administration, weather stations, LGUs, and the National Disaster Risk Reduction and Management Council are responsible for providing weather advisories. These text advisory services should be expanded to offer early warnings for long periods of drought or rain.

Ultimately, a host of actors, from the government to civil society to the private sector, must work together to support value chain actors in Visayas to adapt to the impacts of climate change. These measures will provide generous returns by alleviating poverty and by safeguarding the future of the agricultural sector, which is critical to livelihoods and the regional economy.

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