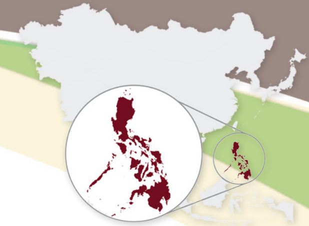


Climate-Resilient Agriculture in the Philippines

Climate-resilient agriculture (CRA) considerations

- **P A $** By 2050 climate change and variability is estimated to cost the Philippine economy approximately PHP 26 billion yearly.
- **A M I** The Government of Philippines has taken major steps in addressing climate change vulnerability and impacts through an ambitious policy and institutional framework that focuses on food security, resilience building, and disaster risk reduction.
- **A P** There is evidence of on-field adoption of CRA practices by small-scale farmers in aquaculture systems (e.g., mangrove restoration and community-based fish stock enhancement), livestock systems (e.g., biogas and composting and alternative feeding systems), vegetable production (e.g., use of adaptive crop calendars and organic farming), integrated farming systems (e.g., agroforestry and soil and water conservation), and maize and rice cultivation (e.g., use of stress-tolerant varieties and integrated crop management), among others.
- **A P I $** However, CRA practices uptake throughout the country is still low and limited by poor availability and access to improved seed, insufficient financial resources to cover investment costs, and the limited resources of extension services.
- **I $** CRA for landscape enhancement involves considerable financial investment and collective action. Land ownership and tenure systems also influence the level of investment in agroforestry and other permanent forms of agriculture on smallholder units. A revision of policies regarding land ownership and land zoning, together with proper implementation, is essential for promoting and scaling-out CRA investments.
- **P A $** Investments in water management and irrigation infrastructure, seed systems, and extension services are key for addressing crop yield gaps, especially in a context where weather is expected to become more variable and unpredictable, with increased and more intense climate shocks.
- **A M I $** To ensure adequate targeting of adaptation and mitigation investments at local levels, more efforts should be made to develop and deploy integrated decision support systems that compile and analyze weather, agronomic, and market information, and deliver timely results to a range of stakeholders and decision makers.

A Adaptation **M** Mitigation **P** Productivity
I Institutions **$** Finance

The climate-resilient agriculture (CRA) concept reflects an ambition to improve the integration of agriculture development and climate responsiveness. It aims to achieve food security and broader development goals under a changing climate and increasing food demand. CRA initiatives sustainably increase productivity, enhance resilience, and reduce/remove greenhouse gases (GHGs), and require planning to address tradeoffs and synergies between these three pillars: productivity, adaptation, and mitigation [24]. The priorities of different countries and stakeholders are reflected to achieve more efficient, effective, and equitable food systems that address challenges in environmental, social, and economic dimensions across productive landscapes. While the concept is new, and still evolving, many of the practices that make up CRA already exist worldwide and are used by farmers to cope with various production risks [23]. Mainstreaming CRA requires critical stocktaking of ongoing and promising practices for the future, and of institutional and financial enablers for CRA adoption. This country profile provides a snapshot of a developing baseline created to initiate discussion, both within the country and globally, about entry points for investing in CRA at scale.

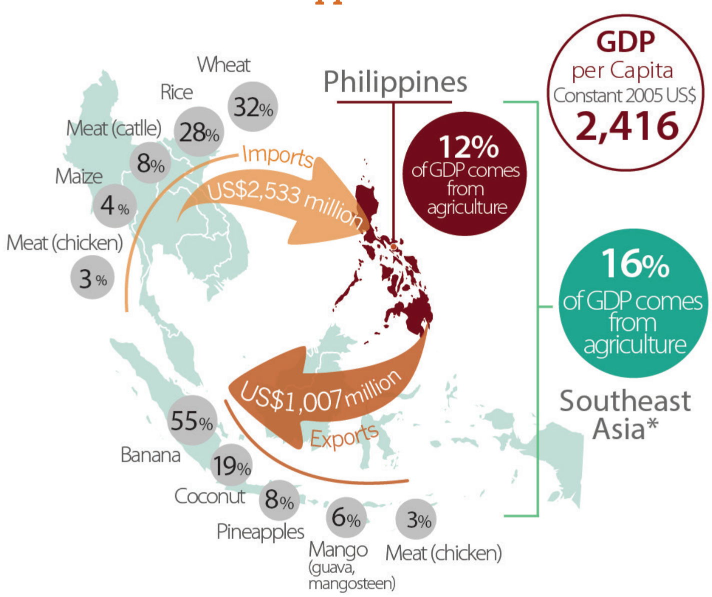
Department of Agriculture 1898 · AMIA Philippines · CGIAR · Research Program on Climate Change, Agriculture and Food Security · CCAFS · CIAT 50 1967-2017

National context

Economic relevance of agriculture

Agriculture[1] is a key economic sector in the Philippines, contributing to approximately 12% of the country's gross domestic product (GDP) [55] and employing around 32% of the economically active population. A combination of farm characteristics (i.e., small-scale and fragmented), a lack of infrastructure[2], and policy and institutional barriers has left the sector underdeveloped and unable to meet the food requirements of the growing population. This has resulted in a heavy reliance on food imports, especially wheat and rice, the population's main staple crops [21]. Top agricultural exports such as banana, coconut, pineapple, and other tropical fruits have the potential to increase growth in the agricultural sector.

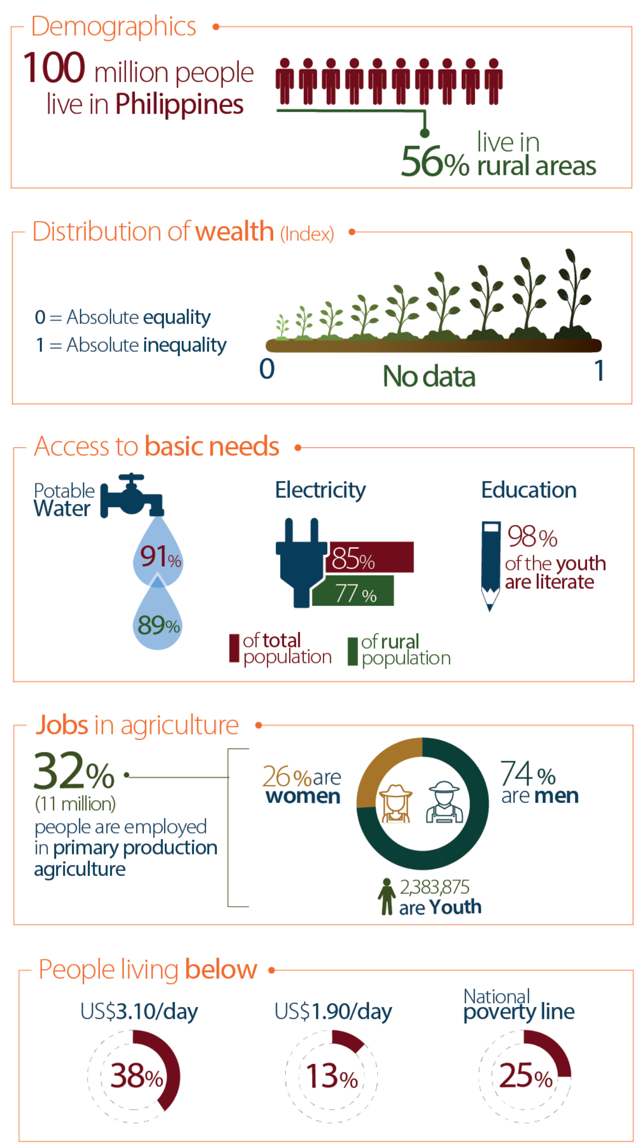
Economic relevance of agriculture in the Philippines[21, 56]



The population of the Philippines has been growing rapidly over the past decades, reaching roughly 100 million people in 2015. More than half of the people live in rural areas and are highly dependent on agriculture and agriculture-related industries [55; 21]. Despite efforts to reach the Millennium Development Goals targets, a quarter of the population still lives below the national poverty line. Farmers and fisherfolks remain the groups most affected by poverty, as a consequence of dwindling investments in the agriculture sector, which have led to low productivity at the expense of growth in the services and manufacturing sectors.

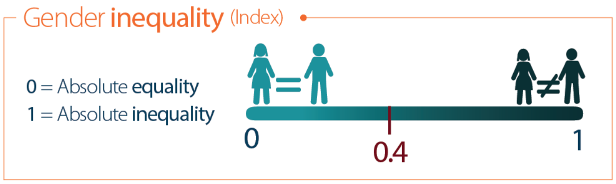
Agriculture is practiced by roughly five million farmers in the Philippines, the large majority of whom operate at the subsistence, small-scale level (i.e., less than 7 hectares [ha]). Women constitute less than a third of the total agricultural workforce, yet their contribution to food production is likely underestimated in official statistics, due to their weak access to productive resources, compared to men. Women are more likely to engage in activities such as rice seedling pulling and bundling, transplanting, weeding, harvesting and threshing, as well as food cooking. Men, meanwhile, assume most of the work related to land and seedbed preparation, leveling, ploughing, and maintenance of irrigation infrastructure. Production, cultivation and harvesting of fodder crops, as well as watering, grazing and milking cattle, are also predominantly activities undertaken by men [25].

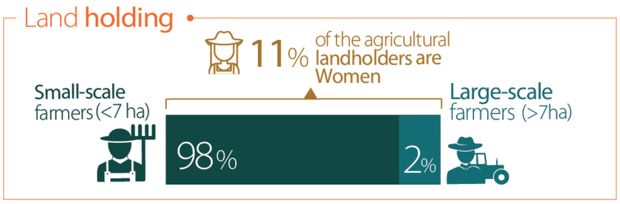
People, agriculture and livelihoods in the Philippines[19, 21, 39, 40, 53, 56]

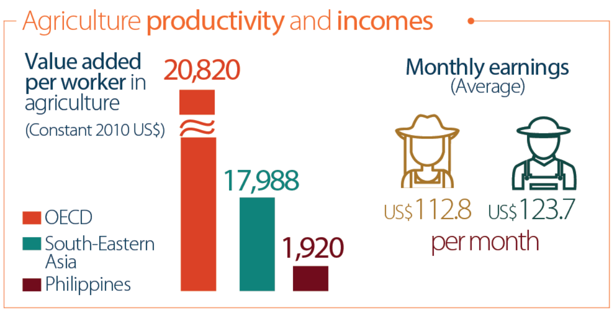


1 Agriculture corresponds to ISIC divisions 1-5 and includes forestry, hunting, and fishing, as well as cultivation of crops and livestock production.

2 These barriers include, among others: weak sustainability planning and institutional harmonization; limited institutional capacity to implement programs and monitoring and evaluation (M&E) mechanisms; and policies that prioritize commodity-based programs.







Land use

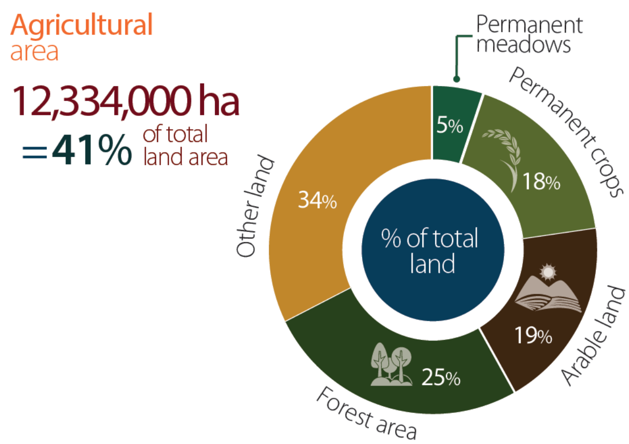
The Philippines is an archipelago consisting of approximately 30 million ha of land, and containing over 7,640 islands (11 of them take up roughly 95% of the total land area). Luzon, Visayas, and Mindanao, constitute the main island groups. Agricultural land in the Philippines covers 12.3 million ha, the equivalent of approximately 41% of the country's total land area [21]. The number of individual farms increased by 63% from 1980 to 2012, while the average farm size decreased from 2.84 ha per farm in 1980 to 1.29 ha per farm in 2012 [39]. Land holdings and parcels have been dispersed to new generations, contributing to a significant, continuously increasing fragmentation of farm land. The average rice farm size is 1.14 ha [52], while maize farms tend to be, on average, slightly larger at 2.55 ha [28].

Crops occupy roughly 76% of the harvested land, with rice, coconut, and maize occupying the largest share of this area. The rapidly growing population in the Philippines is expected to increase the demand for food and lead to the expansion of the agricultural land frontier by 5.2 million ha by 2025 [10].

Intensive cultivation has caused land degradation (e.g., erosion, shifting cultivation and nutrient depletion), affecting both agricultural productivity and ecosystem services [10]. Changes in agricultural land use are intimately linked to changes in forest cover in the country. Widespread logging has contributed to a dramatic decrease in forest cover over the years, from 10.9 million ha in 1970 to only 5.4 million ha in 2000, with an annual loss rate of 3% [21].

Most of the lowland forests in Southeast Asia are also being converted to cash crop plantations [50]. This has caused significant soil erosion in the uplands and a loss of biodiversity. As a result of stricter policies regulating logging, deforestation rates have been slowly decreasing in recent years [30].

Land use in the Philippines [21]



Agricultural production systems

Based on parameters such as rainfall, temperature, elevation, and land form, the country's area has been divided into three main agro-ecological zones (AEZs): wet, moist, and dry [11].

The wet zone covers the mountainous regions in the country, with annual precipitation levels of 2,500 mm and above. Given the semi-temperate climate, these regions are predominately used for the production of strawberries, tea, grapes, and pears.

The moist zone stretches over most of the agricultural area in the lowland and upland regions, with annual precipitation between 1,500 mm and 2,500 mm. Overall, this AEZ extends over 15 million ha, with 5.7 million ha in Luzon, 2.8 million ha in Visayas, and 6.5 million ha in Mindanao [26]. Finally, the dry zones are low rainfall regions with precipitation of less than 1,500 mm annually and with considerable moisture deficits during the dry season (December-May). Production of rice and maize mainly occurs in moist and dry zones.

Most of the harvested areas in the country are devoted to rice, coconut, and maize crops. Rice is the main staple crop in the Philippines. Following the green revolution in the 1960s, rice yields have been increasing steadily, reaching, on average, 3.8 t ha^{-1} in the country, compared to an average of 4.0 t ha^{-1} in the Southeast Asian (SEA) region. However, the mean rice yield gap (i.e., the difference between mean farm yield and potential yield) is still high, especially in Central Luzon, where it is estimated at 3.8 and 4.8 t ha^{-1} in the wet and dry season, respectively [47]. Adoption of stress-tolerant varieties and optimal application of inputs can potentially close this yield gap.

The average maize yield in the country (2.8 t ha^{-1}) is also lower than average regional yields (4.4 t ha^{-1}) [21]. Erratic, unpredictable weather conditions and tropical storms represent major constraints to higher yields. Moreover, farmers use less fertilizer than the recommended rate due to a lack of capital availability. Soil acidity and declining soil fertility also affect plant nutrition and yields in the Philippines [28].
Mango is the fourth top export fruit after banana, coconut, and pineapple. The area planted for Mango has consistently expanded in the country from below 80,000 ha in 1990 to 200,000 ha in 2009. However, yields decreased from 8 t ha^{-1} in 1997 to the current yield of 4 t ha^{-1}. The decrease in production is due to climate extremes (e.g., typhoons and strong winds) as well as the occurrence of pests and diseases [8].

The Philippines has the largest coconut area harvested globally, approximately 3.6 million ha [21]. Production is generally concentrated in medium-sized farms in Mindanao and Luzon. Most of the coconut production is exported in the form of copra, coconut oil, and desiccated coconut. Coconut trees in the country, however, have been classified as "senile" (old) and with poor genetics, signaling challenges ahead for this important fruit export.

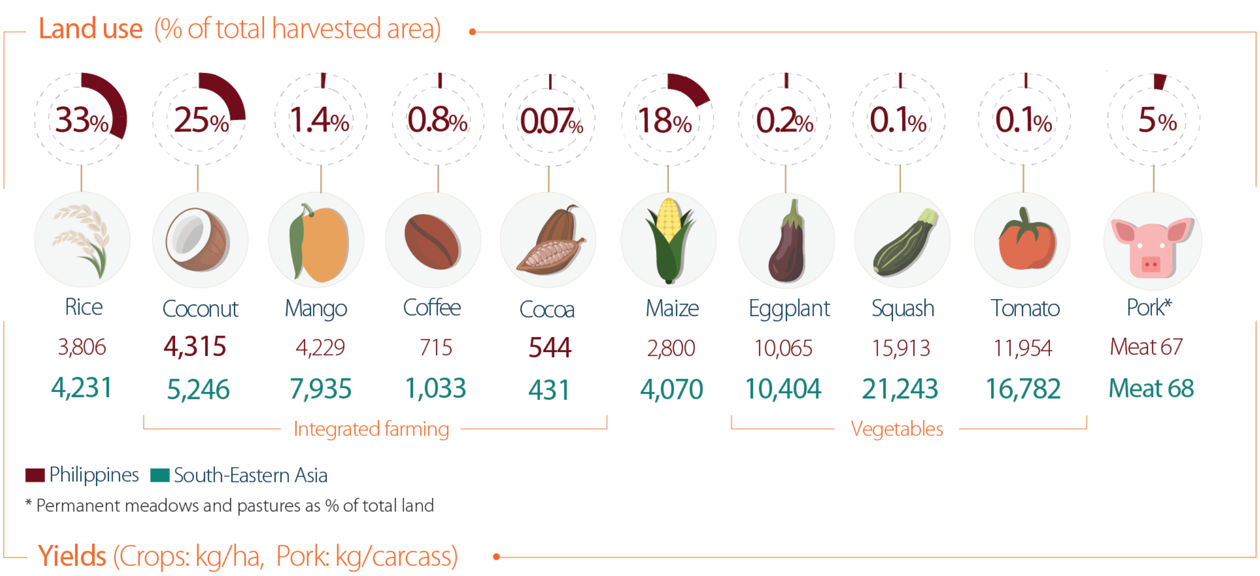
The country has a significant comparative advantage in cacao production due to favorable climatic conditions and its geographic location. Despite the high potential for intercropping cacao with coconut (approximately two million ha of the coconut plantations are suitable for intercropping), this practice is not widely adopted due to risks brought on by pests and diseases [41].

Coffee is grown mainly in Mindanao, where more than half of the coffee production takes place in the SOCCSKARGEN, Davao, and ARMM regions [40]. Due to declining yields and conversions of land for other export crops (e.g., banana and pineapple), the country is a net importer of coffee. The aging of existing trees, a lack of sound agricultural practices, and a limited supply of high quality planting material are among the major factors that result in the declining yield of coconut, cacao, and coffee in the Philippines.

Tomato is cultivated throughout the country, with the largest production area in the Ilocos Region, Central Luzon, and Northern Mindanao [40]. The planted area of tomato is decreasing, however, as farmers are switching to other crops that are less vulnerable to weather changes and price fluctuations.

Next to rice, the swine industry is the second largest contributor to the country's agricultural sector. Only 35% of swine production is commercial-oriented (although commercial operations are expanding across the country), with 65% of the total population kept informally in backyards. The top swine producing regions in 2015 included Central Luzon, CALABARZON, and Western Visayas [40].

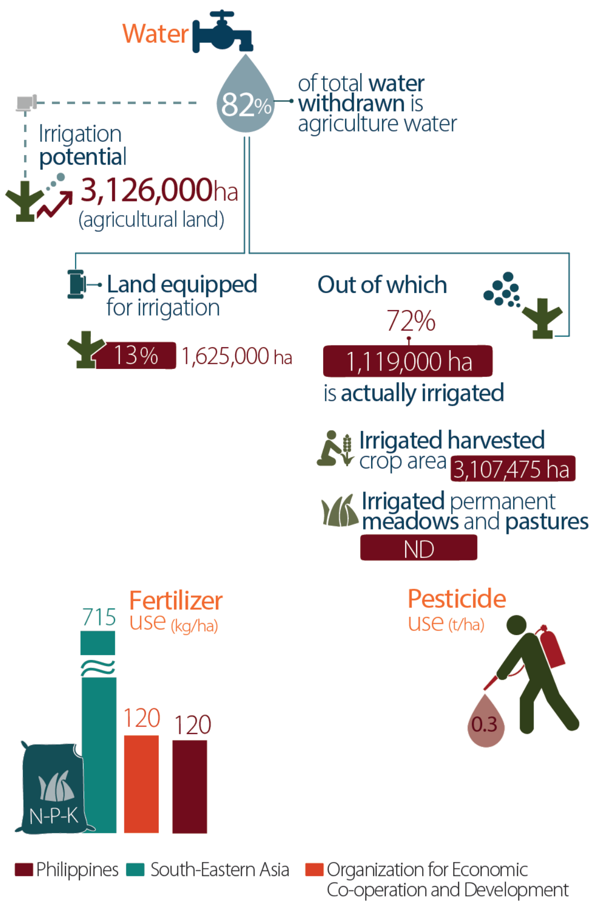
Production systems key for food security in the Philippines [21]



Educational campaigns on integrated pest management led to a reduction in pesticide use [52]. The Government has abandoned price policies and subsidies, focusing instead on standard-setting, quality regulation, and training. Increasing fertilizer prices has reduced total utilization [7]. Today, the average fertilizer use in the Philippines is 120 kg ha-1, which is 83% lower than the average fertilizer use in the SEA region [55].

About 13% of the total agricultural area in the Philippines is equipped for irrigation, varying considerably across regions [21]. The Ilocos region, Central Luzon, and the Cordillera administrative region, for example, reported that more than half of their farmlands utilized irrigation facilities while the other 15 regions reported a use rate below 50% [39]. Some regions in Mindanao lack irrigation facilitaties altogether. In Western Visayas and Central Visayas, irrigation development that requires water storage has been constrained by prolonged dry season [1].

Agriculture input use in the Philippines [21, 22, 55]



Food security and nutrition

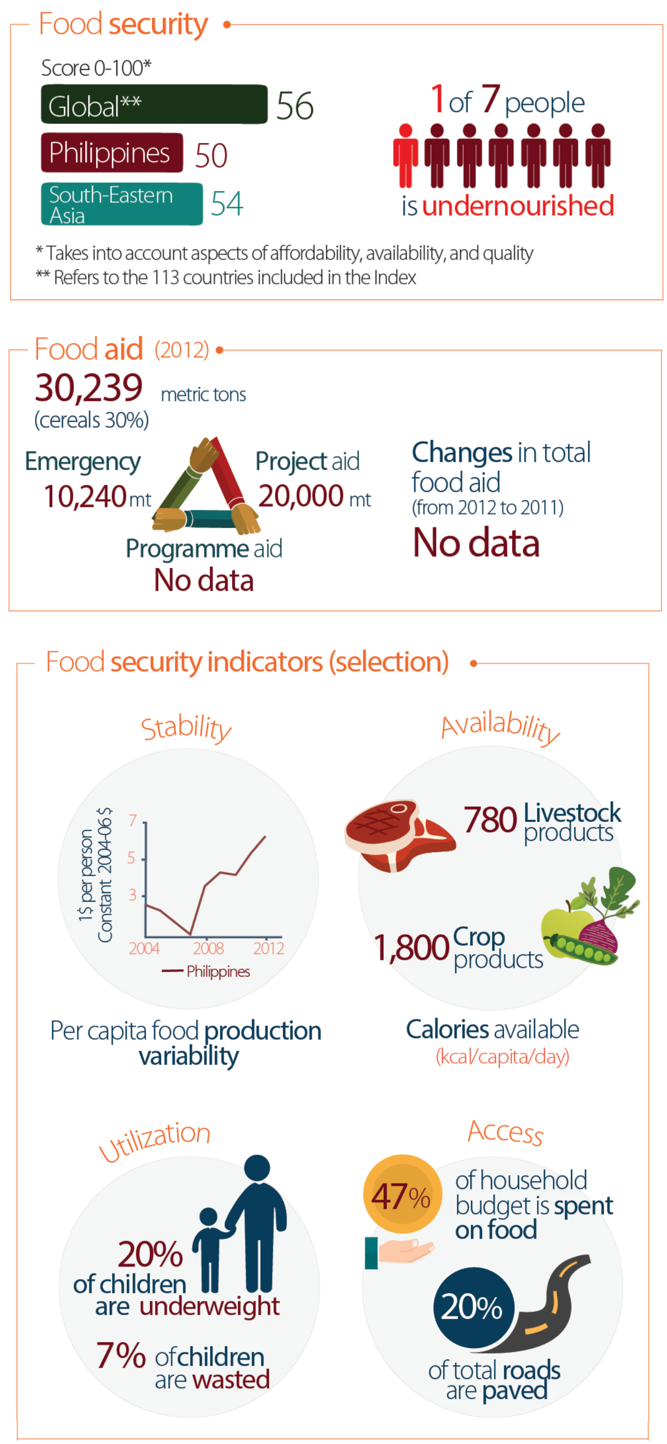
The Philippines ranks 72nd out of 109 countries in the Global Food Security Index (GFSI), which analyzes aspects of food availability, affordability, and quality and safety around the world. Public spending on the agricultural sector has been largely directed to the rice self-sufficiency program [56], which, despite its contribution to the increased availability of this staple crop, has had important consequences on the population's ability to access food.

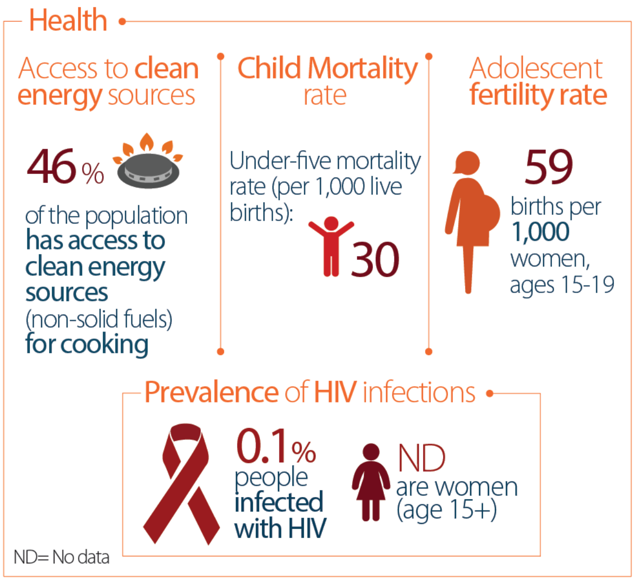
It has been observed that rice self-sufficiency came at the inevitable cost of increased rice prices, making the crop unaffordable for the poorest segments of the population and that increased poverty rates in 2014 were actually a consequence of these higher rice prices, rather than of decreased incomes [46]. The population is sensitive to price fluctuations, as each household spends almost a half (47 %) of its total budget on food [55].

Poverty affects roughly a third of the rural population [6] and is closely linked to low agricultural productivity. Despite its vast natural resources and agricultural potential, Mindanao remains the poorest region of the country. In terms of commodity systems, maize farmers have a high poverty incidence (57%), associated with very low yields of white maize (1.65 t ha^{-1}) and hence limited income. Poverty rates among coconut farmers reach 40%.

The country's nutrition situation also remains a public health problem. The prevalence of underweight pre-school aged children (20%) has remained unchanged between 2003 and 2015. Despite the implementation of several health and nutrition interventions to address malnutrition across the country, the majority of target populations in rural areas and marginalized groups still lack access to appropriate services [27].

Food security, nutrition, and health in the Philippines [20, 21, 55, 57]





Agricultural greenhouse gas emissions

The total GHG emissions in the Philippines amount to 101 megatons (Mt) of CO^2 equivalent. One-fourth of these emissions are attributable to the agricultural sector, where rice cultivation contributes 63% to the total agricultural GHG emissions [21]. In 2011, the annual CO_2 footprint of the Philippines was reduced by 5%, while the country also improved the CO_2 intensity of its economy by 14% [16].

In the country's Nationally Determined Contributions (NDCs) submitted to the United Nations Framework Convention on Climate Change (UNFCCC), the Philippines conditionally committed to a 70% reduction in GHG emissions by 2030, compared with business-as-usual levels. However, the target covers emissions from energy, transport, waste, forestry and the industry sectors while excluding agriculture on the grounds that this would have adverse effects on livelihoods. Mitigation efforts are conditional upon financial resources availability, technology development and transfer, and capacity building [29].

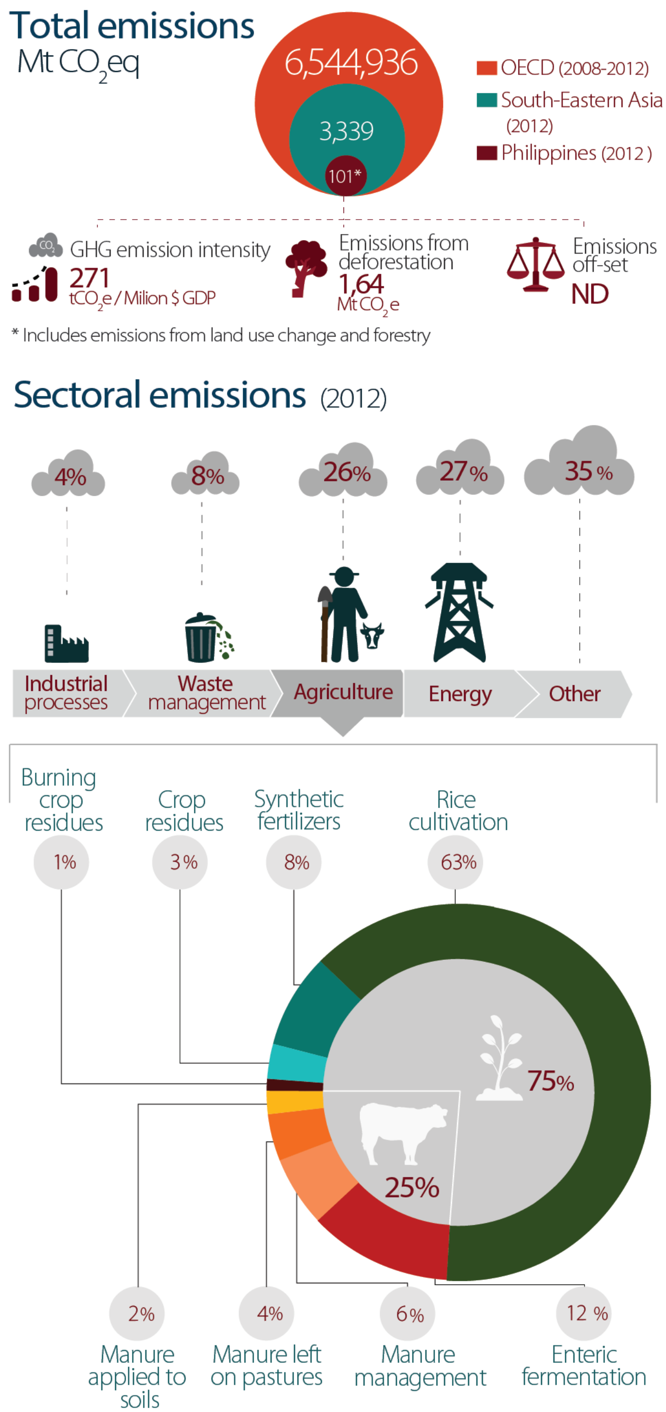
Challenges for the agricultural sector

Challenges facing the agricultural sector in the Philippines include a growing population with changing dietary preferences, and aging farm labor force, poor market access and information services, and limited investment in agricultural research, among others.

The country's population is expected to grow to 150 million by 2050, an increase of 50 million people over this period [54]. Most farmers in the Philippines are old and risk-averse. The average age of a Filipino farmer is 57, with an average life expectancy of 70 years [5]. Older farmers tend to shy away from training opportunities and are less likely to innovate, posing a long term risk the sector's performance.

Dietary preferences area also changing alongside the growing population. Cereals represent the largest share of food consumed in the Philippines, making up 41% of per capita annual calorie intake [3]. Globally, and in the Philippines, total calories delivered per capita are projected to continue to grow with increased consumption and diet diversification in developing countries. In Asia, much of this growth is due to increased meat and vegetable oil consumption [35].

Greenhouse gas emissions in the Philippines [21, 36, 58]



Land for food production in the Philippines is limited, while demand is increasing due to the combined effects of dietary change and population growth [34]. Further intensification of agriculture could stabilize land demand for food. However, the continued intensification of farmland with synthetic or chemical inputs will eventually build up toxic and hazardous chemicals in the soil, air, and ground water.

Apart from the deterioration of agricultural lands, the socio-economic vulnerability of farmers is further exacerbated by the poor quality of farm-to-market roads and a lack of processing facilities. In addition, agricultural data is often outdated, unreliable, or inadequate [18]. Many farmers lack access to quality technical information regarding production options, weather patterns, and markets. The lack of collection, aggregation, and analysis of up-to-date primary farm data puts further strain on research, innovation, and policies that can potentially benefit farmers.

Finally, expenditure on agricultural research and development (R&D) accounts for only 0.14% of the country's GDP [56]. In 2008, the value of agricultural R&D spending in the Philippines, at US$ 133 million, was one of the lowest among countries in the same income group in the Asia-Pacific region, —compared to US$ 188 million in Pakistan, US$ 379 million in Indonesia and US$ 4,038 million in China [4].

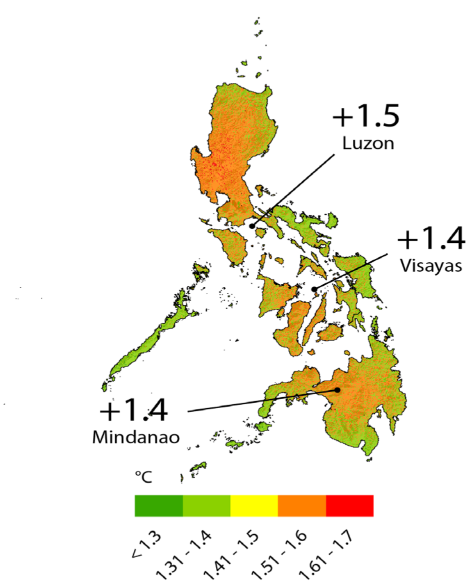
Agriculture and climate change

The climate in the Philippines is characterized by relatively high temperature, high humidity, and abundant rainfall. The coolest month of the year is January, with a mean temperature of 25.5°C, while the warmest month is May, with a mean temperature of 28.3°C. The mean annual temperature is 26.6°C, however, changes in altitude lead to significant differences in temperature across the country. For instance, temperature in Baguio, a semi-mountainous city in northern Luzon, is comparable with the semi-temperate areas. Relative humidity in the country is high, varying between 71% in March and 85% in September. Mean annual rainfall ranges from 965 to 4,064 mm. Baguio City, Eastern Samar, and Eastern Surigao receive the greatest amount of rainfall, while the South Cotabato receives the least.

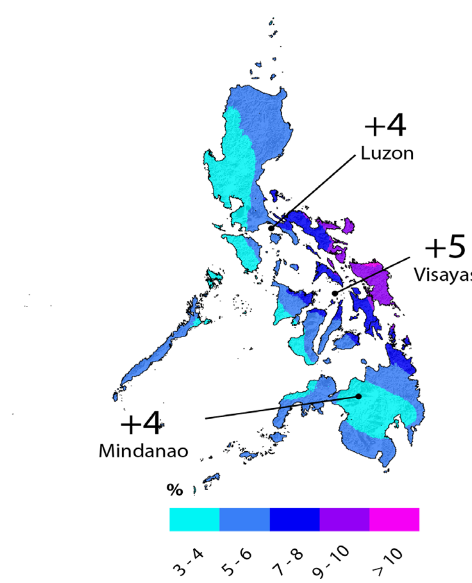
There are two major seasons in the Philippines: the dry season (from December to May) and the wet/rainy season (from June to November). The country has experienced an increase in mean temperature of 0.64°C between 1951 and 2010. According to climatic projections of the Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA), all areas of the country are expected to get warmer inn the short- (2020) and medium-term (2050). A reduction in rainfall is also projected during the months of March, April, and May [14].

Projected changes in temperature and precipitation in the Philippines by 2050 [15, 43, 44]

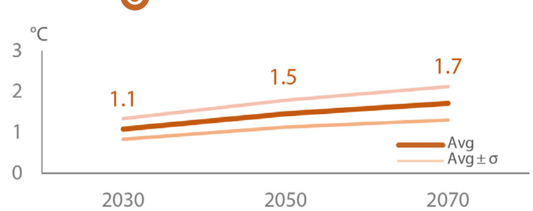
Changes in annual mean temperature (°C)



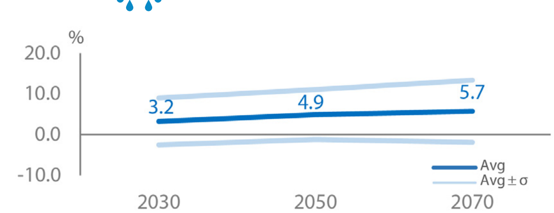
Changes in total precipitation (%)



Average temperature (°C)



Average precipitation (%)



Potential economic impacts of climate change

The impact of climate change on net trade in the Philippines (2020-2050) [31, 59]

Due to its geographical location and archipelagic formation, the Philippines is one of the countries most vulnerable to the impacts of climate change. The country ranks highest in the world in terms of its vulnerability to tropical cyclones, third in terms of people exposed to such seasonal events, and fourth among countries most affected by extreme weather events [48]. A large proportion of damages from disasters, which are generally climate-related, are experienced by the agricultural sector each year. From 1990 to 2006, damages to agricultural production were caused by typhoons (70%), droughts (18%), and floods (5%). On average, annual typhoon-related damages to the sector are estimated at US$ 136 million [14]. The provinces of Cagayan Valley, Pangasinan, Isabela, Nueva Ecija, Iloilo, and Camarines Sur—the country's top rice producers—are highly exposed to floods and typhoons. Meanwhile, North Cotabato and Maguindanao—the food baskets in Mindanao—are more prone to droughts and El Niño events. The 2016 El Niño season brought pest infestation (e.g., armyworm and rodents) in Central Luzon, SOCCSKSARGEN, and ARMM regions. Moreover, 181,687 farmers (representing 224,843 ha of farmland) were affected by the 2016 drought. Of this group, 54% were rice farmers, 38% maize farmers, and 8% high-value crop farmers [32].

Previous studies estimated that, overall, climate change could cost the Philippines' economy approximately US$ 520 million a year by 2050 [45]. Due to increased water and heat stress, climate change and variability is expected to decrease crop yields[2], increase the incidence of pests and diseases, and cause shifts in crop production suitability. Upland areas, for example, will potentially benefit from increases in temperature by creating adequate conditions for the growth of new crops.

In order to quantify the economic impacts of climate change, understood as the difference in the percentage change in 2050 over the baseline year 2020—under climate change (CC) and no climate change (NoCC) scenarios—the study used the International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT)[3].

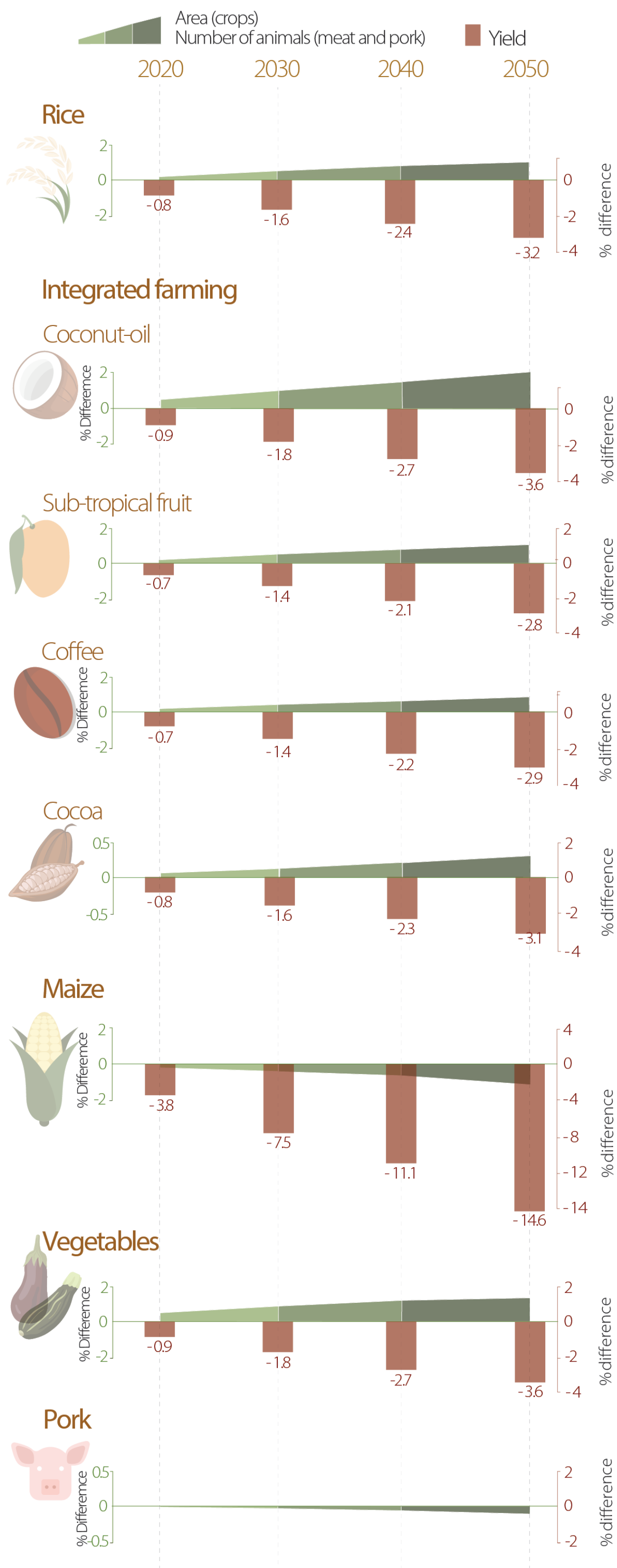
Model results[4] suggest that by 2050 the Philippines may become dependent on imports of cocoa, coffee, maize, pork, rice, and vegetables, irrespective of the scenario (i.e., CC or NoCC). However, under climate change, import dependence is likely to be more pronounced for most of these commodities, but notably less for cocoa and maize (a reduction of 1.41 percentage points (pp) and 1.68 pp, respectively, relative to a NoCC scenario).

2 Rice yields have declined by 10% for every 1°C increase in mean nighttime temperature over the past years [42].

3 IMPACT, developed by the International Food Policy Research Institute [31], is a partial equilibrium model using a system of linear and non-linear equations designed to approximate supply and demand relationships at a global scale. This study used the standard IMPACT model version 3.2, less the IMPACT-Water module. The tool uses the GAMS program (General Algebraic Modeling System) to solve a system of supply and demand equations for equilibrium world prices for commodities. The tool generates results for agricultural yields, area, production, consumption, prices and trade, as well as indicators of food security.

4 The IMPACT model scenarios are defined by two major components: (i) the Shared Socioeconomic Pathways (SSPs), which are global pathways that represent alternative futures of societal evolution [37, 38] and (ii) the Representative Concentration Pathways (RCPs), which represent potential greenhouse gas emission levels in the atmosphere and the subsequent increase in solar energy that would be absorbed (radiative forcing) [51]. This study used SSP 2 and RCP 4.5 pathways.

Climate change impacts on yield, crop area and livestock numbers in the Philippines [31, 59]



*A negative value denotes potential decreases in area and yield expressed as percentage difference in a climate change scenario vs. non climate change

Results also suggest that the Philippines will increase exports of tropical fruits and coconut oil under both CC and NoCC scenarios, although exports would be reduced under CC compared to a NoCC scenario by about 0.09 pp and 0.33 pp, respectively. Yield and animal populations are projected to increase for all production systems, but less so under CC. Most notably, the increase in maize yield over 2020-2050 is projected to be 12.97 pp less under CC than under a NoCC scenario.

Finally, the results also suggest that area cultivated for cocoa, coconut oil, coffee, fruits, and rice would expand significantly under the CC scenario (by a range of 0.29 pp to 1.69 pp), but also under NoCC. Area under maize and vegetable cultivation is expected to increase mostly under NoCC. Porcine numbers are projected to be almost the same under CC and NoCC scenarios. In general, under climate change, all production systems in the Philippines are expected to undergo changes in productivity

CRA technologies and practices

CRA technologies and practices present opportunities for addressing climate change challenges, as well as for economic growth and development of the agriculture sector. For this profile, practices are considered CRA if they enhance food security as well as at least one of the other objectives of CRA (adaptation and/or mitigation). Hundreds of technologies and approaches around the world fall under the heading of CRA.

The use of stress tolerant varieties (e.g., submergence, salinity, drought, and heat tolerance), water harvesting technologies (e.g., small water impounding project, alternate wetting and drying, drip irrigation) and integrated crop management (e.g., integrated pest management, site-specific nutrient management) are common among rice farmers in the Western Visayas (moist zone) and Central Luzon (moist-wet zone) regions, and among maize growers in the SOCCSKSARGEN (moist-wet zone) and Cagayan Valley region (moist-wet zone).

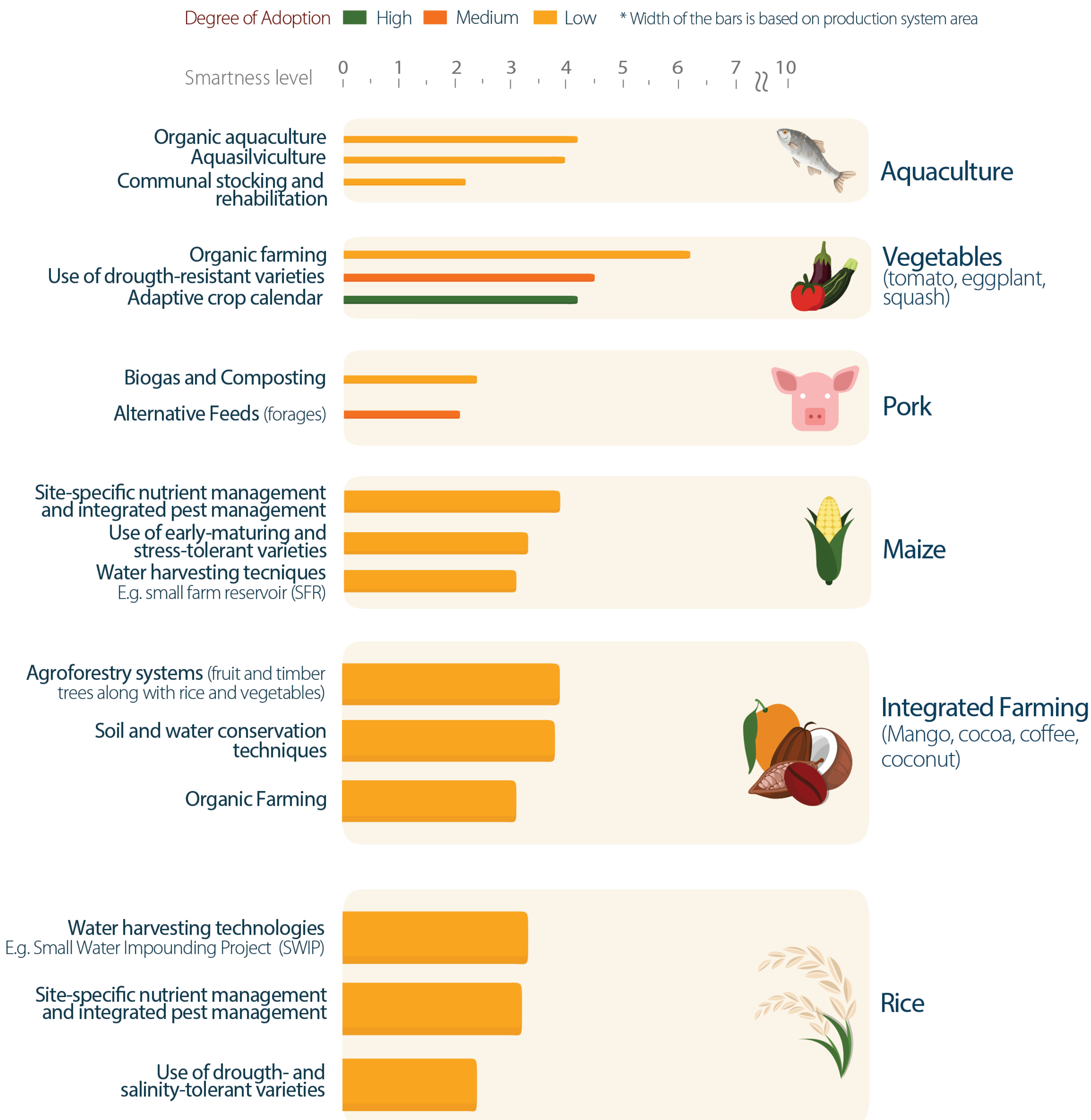
Agroforestry systems on small-scale farms (e.g., fruit and timber trees around rice fields, and vegetable plot/ farms) have been identified mostly in the Southern Luzon (including Bicol and Eastern Visayas) (moist-wet zone) and Southern and Eastern Mindanao regions (moist-wet zone). Although this CRA practice may bring important benefits for increased incomes and yields, resilience to climate shocks and variability, and reduced emissions, many farmers find little incentive to invest in agroforestry systems due to the insecurity of land tenure.

Farmers cultivating vegetables (e.g., eggplant, tomato, squash) in the Calabarzon (moist-wet zone) and Cordillera (moist zone) administrative regions have been using adaptive crop calendars (i.e., an adjusted schedule for planting and harvesting, and other critical periods, based on weather forecasts) and stress-tolerant varieties (e.g. drought) given the low investment costs that these practices require. Organic farming is also practiced by a minority of vegetables farmers, mainly due to few commercially available preparations of organic fertilizer. Although these preparations can be easily made by farmers themselves, technical support is needed to improve their shelf life and efficacy.

Most practices analyzed in the study are adopted by small-scale farmers. There is evidence of adoption of aqua-silviculture activities (e.g., fish production in a mangrove reforestation areas), organic aquaculture (e.g., fish production based on the sustainability approach), and communal stocking and rehabilitation of fish (e.g., community-based fish stock enhancement) by some small-scale farmers, especially in the Central Luzon (moist-wet zone) and in the ARMM region (moist-wet zone). These practices are mostly associated with climate risk management but also have significant positive impacts on farm income and the sustainability of fish production. However, adoption levels of such climate-resilient aquaculture practices remain low, due to insufficient access to technology and capacity building (e.g., local mangrove species and natural sources of feed ingredients). CRA practices uptake in the Philippines is also limited by the poor availability and access to improved seeds, insufficient financial resources to cover investment costs (especially in the case of small water impounding projects), and limited extension service coverage.

The following graphics present a selection of CRA practices with high climate smartness scores according to expert evaluations. The average climate smartness score is calculated based on the practice's individual scores on eight climate smartness dimensions that relate to the CRA pillars: yield (productivity); income, water, soil, risks (adaptation); energy, carbon and nitrogen (mitigation). A practice can have a negative/ positive/ zero impact on a selected CRA indicator, with 10 (+/-) indicating a 100% change (positive/ negative) and 0 indicating no change. Practices in the graphics have been selected for each production system key for food security identified in the study. A detailed explanation of the methodology can be found in the Annexes 2 and 3.

Selected CSA practices and technologies for production systems key for food security in the Philippines



Case study: Scaling out CRA in the Philippines through AMIA program

In response to the adverse effects of climate change in agriculture, the Department of Agriculture (DA) in the Philippines launched the Adaptation and Mitigation Initiative in Agriculture (AMIA) program in 2014 and allocated US$ 26.4 million to the initiative. The program seeks to enable climate risk-prone agri-fisheries communities to pursue sustainable livelihoods while effectively managing the likely impacts of climate change. AMIA is anchored in a CRA strategic framework to guide decision-making and actions by key stakeholders. The program combines a science-driven knowledge platform with an integrated suite of institutional support services such as accessing climate finance mechanisms. AMIA is being implemented by the DA's Systems-wide Climate Change Office (SWCCO), in partnership with DA regional field offices (RFOs), state colleges and universities, international organizations, financial institutions, and non-government organizations (NGOs).

AMIA is in compliance with three key national legislations for CRA: Agriculture and Fisheries Modernization Act of 1997 (Republic Act [RA] 8435), the Climate Change Act of 2009 (RA 9729), and the Disaster Risk Reduction and Management Act of 2010 (RA 10121). RA 10121 focuses on adaptation measures while RA 9729 addresses both adaptation and mitigation pillars of CRA. Moreover, AMIA is intended to address deficits identified in the Philippines' NDC. The NDC highlighted that "capacity and capability are needed in the field of climate-related hazard modeling, science-based risk and vulnerability assessment as well as risk management measures including risk sharing and risk transfer mechanisms", which is at the core of the AMIA approach.

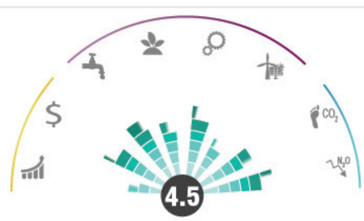
The initial phases of AMIA identified key climate risks and vulnerable areas across the country (see Annex 1 for a detailed vulnerability assessment). It also assessed the current status of CRA in the country as well as the cost and benefits of selected CRA practices and technologies (including but not limited to Alternate Wetting and Drying (AWD), organic farming, biodigesters, and crop rotation). In addition, climate smart villages in Quezon and Capiz provinces served as guides in piloting community action research. Guidelines for the provision of climate information services were also developed.

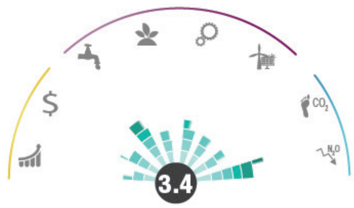
Building on these initiatives, AMIA is now establishing community-level research and development interventions in 17 pilot sites. These pilot sites will be provided integrated decision-support tools (e.g., ICT-based farmer/fisherfolk advisory services, crop and nutrient manager application, and a cost-benefit analysis online tool) and government services (e.g., training, credit, insurance, and market linkage support). A participatory approach is being employed to respond to the needs and demands of the community and is expanding on previous capacity building activities.

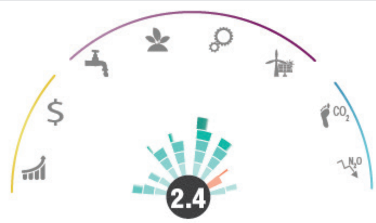
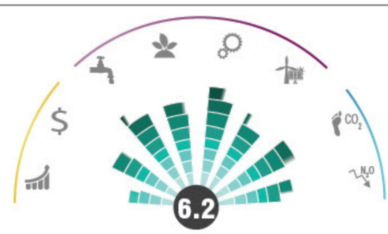
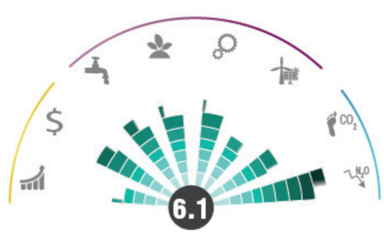
SWCCO is exploring external financial support, in addition to the national budget, to continue the introduction and scaling-out of CRA innovations across the country. The program aims to increase the capacity of over nine million individual farmers and fisherfolks by 2022 to use and apply climate information and support services that would: (i) address their food and nutrition security and livelihood security; (ii) promote the use of climate-resilient and sustainable production and management practices and technologies; (iii) develop and adopt risk-transfer and risk-pooling mechanisms to protect their income and livelihoods from sudden and slow-onset climate-related stresses and shocks; and (iv) support the development of climate-resilient agricultural and fisheries infrastructure.

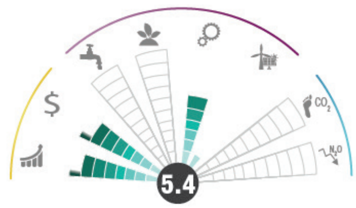
Photo by AMIA Knowledge Management Team

Table 1. Detailed smartness assessment for top ongoing CSA practices by production system as implemented in the Philippines

CRA practice	Region and adoption rate (%) <30 30-60 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CRA Pillars
Rice (32% of total harvested area)				
Water harvesting technologies E.g. Small Water Impounding Project (SWIP)	Western Visayas <30%	S		**Productivity** Increases yield and revenues. **Adaptation** Ensures water availability, therefore increases resilience to drougth. **Mitigation** Mantains or improves soil carbon stocks and soil organic matter content.
	Central Luzon <30%	S		
Site-Specific Nutrient Management (SSNM) and Integrated Pest Management (IPM)	Western Visayas <30%	S		**Productivity** Reduces economic losses due to pests and diseases. Increases in productivity and food availability. **Adaptation** Adequate source, timing, amount and placement of fertilizers can reduce negative effects of excessive fertilization. Reduces soil salinity and nutrient leaching. Reduces incidence of pests and diseases. **Mitigation** Reduces emission of methane and other GHG related with rice production and excesive use of pesticides.
	Central Luzon <30%	S		
Integrated farming (27% of total harvested area)				
Agroforestry systems (fruit and timber trees along with rice and vegetables)	Southern Luzon incl. Bicol and Eastern Visayas <30%	S		**Productivity** Reduces use of inputs per unit of product. Diversifies sources of income. Enhances food availability and access. **Adaptation** Improves soil fertility and water conservation. Enhances above- and below-ground biodiversity.Reduces occurrence of pests and diseases. **Mitigation** Enhances above- and below-ground carbon stocks and organic matter content. Minimizes use of inorganinc fertilizers, and improves energy use efficiency.
	Southern and Eastern Mindanao <30%	S		

CRA practice	Region and adoption rate (%) <30 30-60 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CRA Pillars
Soil and water conservation techniques	Southern Luzon incl. Bicol and Eastern Visayas <30%	S		**Productivity** Enhances food availability and access, due to improved soil fertility. **Adaptation** Increases soil moisture conservation and water availability. Prevents erosion. Builds soil fertility by improving physical and bio-chemical soil characteristics. **Mitigation** Maintains or improves soil above- and below-ground carbon stocks and organic matter content.
	Southern and Eastern Mindanao <30%	S		
Maize (18% of total harvested area)				
Site-Specific Nutrient Management (SSNM) and Integrated Pest Management (IPM)	Cagayan Valley <30%	S		**Productivity** Reduces economic losses due to pests and diseases. Increases in productivity and food availability. **Adaptation** Adequate source, timing, amount and placement of fertilizers can reduce negative effects of excessive fertilization. Reduces soil salinity and nutrient leaching. Reduces incidence of pests and diseases. **Mitigation** Reduces emission of methane and other GHG related with rice production and excesive use of pesticides.
	Soccskargen <30%	S		
Use of early-maturing and stress-tolerant Varieties	Cagayan Valley <30%	S		**Productivity** Increases land productivity, produce quality and income. **Adaptation** Increases efficient use of nutrient and water. Increases crop's resilience to climate shocks. **Mitigation** Contributes to reduced GHG emissions, primarily through reduction of energy and agrochemicals.
	Soccskargen <30%	S		

CRA practice	Region and adoption rate (%) <30 30-60 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CRA Pillars
Livestock (5% of total harvested area)				
Alternative Feeds (forages)	Central Luzon 30-60%	S M L		**Productivity** Reduces production costs by reducing external inputs. Reduces yiled variability **Adaptation** Increases food availability during extreme wheter coditions. **Mitigation** Increases carbon capture. Reduces GHG emissions per unit of product.
	Calabarzon 30-60%	S M L		
Biogas and composting	Central Luzon <30%	S M L		**Productivity** Increased land productivity and income. **Adaptation** Increases livestock system's resilience to climate shocks. Reduces electrical cost for cooking or lighting. Facilitates the elimination of pathogens. **Mitigation** Reduces the use of nitrogen fertilizer, and methane and other GHG emissions from manure. Proveides an on-farm alternative energy source.
	Calabarzon <30%	S M L		
Vegetables (5% of total harvested area)				
Organic farming	Cordillera Administrative Region <30%	S		**Productivity** Reduces costs of production through reduction in input use. Increases in income through high quality an healty produce. **Adaptation** Builds soil fertility by improving physical and bio-chemical soil characteristics. Increases biodiversity. Reduces the occurrence of pests and diseases. **Mitigation** Reduces GHG emissions due to reduction energy and in inputs needs.Enhance soil-carbon stocks.
	Calabarzon and Northern Mindanao <30%	S		

CRA practice	Region and adoption rate (%) <30 30-60 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CRA Pillars
Use of drougth-resistant varieties	Cordillera Administrative Region 30-60%	S		**Productivity** Increase soil fertility, less cost of inputs, improved product quality. **Adaptation** Enhanced food availability and access, enhanced biodiversity, pyramid soil and water conservation, reduced occurrence of pest and diseases **Mitigation** Less emissions of release, enhance soil-carbon deposit
	Calabarzon and Northern Mindanao 30-60%	S		

Yield | Income | Water | Soil | Risk/Information | Energy | CO_2 Carbon | N_2O Nutrient

Institutions and policies for CRA

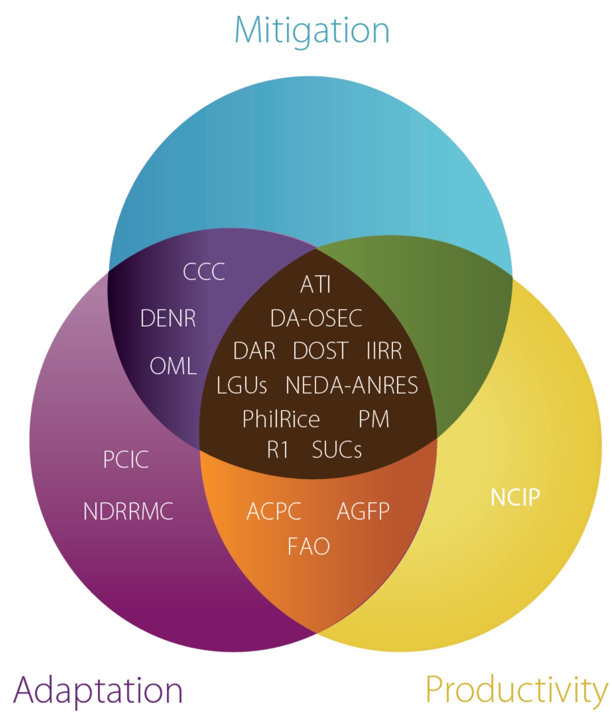
Climate change adaptation is a key priority for the government and is reflected in a number of policies and institutions set up and engaged in adaptation activities. The Philippines' Climate Change Commission (CCC) was created by virtue of RA 9729 and is the lead policy-making body responsible for coordinating, monitoring, and evaluating the country's climate change programs and action plans. The CCC's advisory board is composed of government agencies (e.g., DA, Department of Environment and Natural Resources, Department of Science and Technology, and the National Economic Development Authority [NEDA]), Local Government Units (LGUs) and representatives from academia, the business sector, and non-governmental organizations (NGOs). The Commission meets once every three months and is currently focusing on helping LGUs in developing their own climate change action plans. The CCC also supports efforts for reducing GHG emissions, and, together with the National Disaster Risk Reduction and Management Council (NDRRMC), promotes activities to increase resilience to natural disasters (e.g., the use of early warning systems). The food security work of the CCC is being led by the DA. Through the CCC, the Philippines submitted its NDC, which identified both mitigation and adaptation measures.

In the DA, SWCCO acts as a catalyst, coordinating, and oversight body for the mainstreaming of climate change in agriculture. It also leads the resilient agri-fisheries sector initiative through AMIA by supporting local communities to plan and implement strategies in managing climate risks in partnership with the RFOs. At the local level, RFOs are in charge of implementing national programs (e.g., AMIA, the rice program) in close cooperation with the LGUs. These field offices are mainly engaged in information sharing and extension for farmers, while only few, like the Agricultural Credit Policy Council (ACPC) and the Philippine Crop Insurance Corporation (PCIC), are providing financial incentives for CRA. The majority of the institutions identified in the study are government structures, while the participation of the private sector, NGOs, and research institutions in CRA interventions is remains limited.

The institutional environment for CRA in the Philippines is characterized by several persistent deficiencies. For example, there is considerable duplication in the provision of training interventions within the DA extension system. It is likewise evident that research results are not systematically shared, even among DA agencies. Thus, there is a need for improved coordination among commodity-based national programs at local levels and strategies for inter-institutional coordination of intervention planning and implementation. The role of RFOs and LGUs are crucial for CRA adoption and scale-out. However, these institutions are constrained by limited resources and capacity to operationalize their objectives. Decentralization of extension functions and services to LGUs, through the Local Government Code of 1991 (RA 7160), for example, does not include financial decentralization. Agricultural extension programs of LGUs are still dependent on national government funding leading to the disproportionate investment in infrastructure projects within the LGU budget.

The following graphic highlights key institutions whose main activities relate to one, two or three CRA pillars (adaptation, productivity and mitigation). More information on the methodology is available in Annex 4.

Institutions for CRA in the Philippines



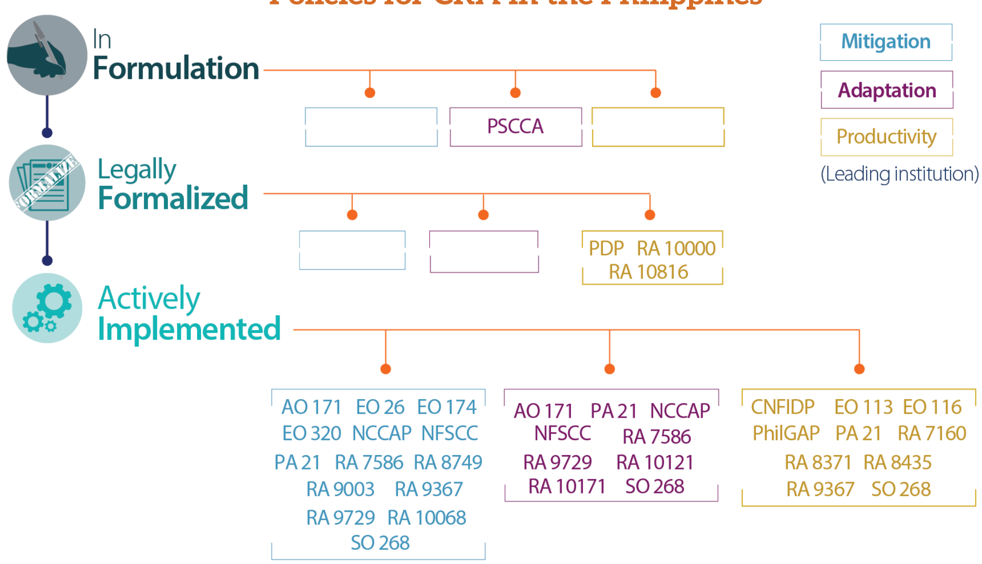
ACPC Agricultural Credit Policy Council **AGFP** Agricultural Guarantee Fund Pool **ATI** Agricultural Training Institute **CCC** Climate Change Commission **DA-OSEC** Department of Agriculture - Office of the Secretary **DAR** Department of Agrarian Reform **DENR** Department of Environment and Natural Resources **DOST** Department of Science and Technology **FAO** Food and Agriculture Organization of the United Nations **IIRR** International Institute for Rural Reconstruction **LGUs** Local Government Units **NCIP** National Commission on Indigenous Peoples **NDRRMC** National Disaster Risk Reduction and Management Council **NEDA-ANRES** Agriculture, Natural Resources and Environment Staff - National Economic and Development Authority **OML** Oscar M. Lopez Center for Climate Change Adaptation and Disaster Risk Management Foundation **PCIC** Philippine Crop Insurance Corporation **PhilRice** Philippine Rice Research Institute **PM** Philip Morris Foundation **R1** Rice Watch and Action Network **SUCs** State Universities and Colleges

The Philippines is a global pioneer in mainstreaming climate change into its national laws and policies. As early as 1991, the Philippines promoted the creation of laws designed to promote increased productivity and adaptation in the face of climate change. For instance, the RA 8435 (1997) required the DA and other agencies to incorporate considerations of climate change, weather disturbances, and annual productivity cycles when formulating agricultural and fisheries programs. RA 8435 also mandated the DA to formulate an Agriculture and Fisheries Modernization Plan (AFMP), specifically targeting food security, poverty alleviation and social equity, income enhancement and profitability, global competitiveness, and sustainability.

RA 10121 (2010) and RA 9729 (2009), meanwhile, both strengthen the institutional foundation for disaster risk management and climate change adaptation in the country. These laws establish local disaster risk reduction management mechanisms and enable the creation of local disaster risk reduction management plans. Specifically, RA 10121 shifts the focus from a purely reactive approaches like emergency response to proactive measures like early warning systems in an effort to reduce risk from disasters. RA 9729 identified the key initiatives required for addressing climate impacts and challenges in the country and set the stage for the formulation of a National Framework Strategy on Climate Change (NFSCC). In 2012, this RA was amended through the People's Survival Fund Law (RA 10171), which establishes long-term financial support—at least US$ 20 million—to climate change adaptation programs and projects specified in the NFSCC. Following the adoption of the NFSCC in 2010, the National Climate Change Action Plan (NCCAP) was formulated, outlining the country's agenda for adaptation and mitigation for the period from 2011 to 2028. The objectives of the NCCAP related to food security are to ensure availability, stability, accessibility, and affordability of safe and healthy food in the face of climate change. The country's NDC is consistent with the Philippine Development Plan, the NFSCC, the NCCAP, and the National Disaster Risk Reduction and Management Plan. Among the important measures identified in the NDC was the strengthening of the country's adaptive capacity and overall resilience. Financial resources, technology transfer, and capacity building support for adaptation will ensure that the country's committed emission reduction, approximately 70% by 2030 relative to business-as-usual of 2000-2030 across the entire economy, will be attained.

These key policies highlight the government's commitment to enable local communities to manage climate risks while pursuing sustainable livelihoods. However, harmonization is needed to ensure synergistic outcomes at the local level. Full implementation of policies is also necessary to sustain ongoing initiatives of different institutions involved in CRA. Moreover, several laws affecting CRA practices require modification or revision. One example is the Agri-Agra

Policies for CRA in the Philippines



AO 171 Creation of Presidential Task Force on Climate Change (2007) (DENR, DOST, DA) **CNFIDP** Comprehensive National Fisheries Industry Development Plan (2016) (BFAR) **EO 26** National Greening Program (2011) (DENR) **EO 113** Creation of Agricultural Credit Policy Council (1986) (ACPC) **EO 116** Reorganization Act of the Ministry of Agriculture and Food (1886) (DA) **EO 174** Institutionalizing the Philippine Greenhouse Gas Inventory Management and Reporting System (2014) (DA, PSA, DOE, DENR, DOTC) **EO 320** Designation of DENR as the National Authority for Clean Development Mechanisms (2004) (DENR) **NCCAP** National Climate Change Action Plan (2011) (CCC) **NFSCC** National Framework Strategy on Climate Change (2010) (CCC) **PA 21** Philippine Agenda 21 (1992) (PCSD) **PDP** Philippine Development Plan (2017) (NEDA) **PhilGAP** Philippine Good Agricultural Practices (BPI) **PSCCA** Philippine Strategy on Climate Change Adaptation (2010) (DENR) **RA 10121** Disaster Risk Reduction and Management Act (2010) (NDRRMC) **RA 7160** Local Government Code (1991) (LGUs) **RA 7586** National Integrated Protected Areas System Act (1992) (DENR) **RA 8371** Indigenous People's Rights Act (1997) (NCIP) **RA 8435** Agriculture and Fisheries Modernization Act (1997) (DA) **RA 8749** Clean Air Act (1997) (DENR) **RA 9003** Ecological Solid Waste Management Act (2016) (DENR) **RA 9367** Biofuels Act (2006) (DOE) **RA 9729** Climate Change Act (2009) (CCC) **RA 10000** Agri-Agra Reform Credit Act (2009) (FIs) **RA 10068** Organic Agriculture Act (2010) (DA) **RA 10121** Disaster Risk Reduction and Management Act (2010) (NDRRMC) **RA 10171** People's Survival Fund (2012) (CCC) **RA 10816** Farm Tourism Development Act (2016) (DA/DOT) **SO 268** Creation of Systems-Wide Climate Change Office (2013) (DA)

Reform Credit Act of 2009, which mandates financial institutions allocate 25% of their loan portfolio to agriculture and agrarian reform beneficiaries. Most banks do not allocate the loanable funds for these purposes, however, because of perceived risks to qualified borrowers. Instead, they prefer to pay the penalties, which is low in relation to the perceived risk associated with some lending activities in agriculture.

The previous graphic shows a selection of policies, strategies and programs that relate to agriculture and climate change topics and are considered key enablers of CRA in the country. The policy cycle classification aims to show gaps and opportunities in policy-making, referring to the three main stages: policy formulation (referring to a policy that is in an initial formulation stage/consultation process), policy formalization (to indicate the presence of mechanisms for the policy to process at national level) and policy in active implementation (to indicate visible progress/outcomes toward achieving larger policy goals, through concrete strategies and action plans). For more information on the methodology, see Annex 5.

Financing CRA

Climate finance plays a key role in supporting those most vulnerable to climate change. To date, international donors have supported the government in addressing climate change, mostly in the areas of capacity building and GHG mitigation activities. Some of these funded projects identified mitigation options and provided training to various government institutions to prepare an initial national communication to the UNFCCC. Only recently has climate change adaptation received financing from international donors [2].

Financial instruments accessed by the Philippines for mitigation include the Global Environment Facility and the United Nations Reducing Emissions from Deforestation and Forest Degradation Pogramme. Financial instruments accessed for both adaptation and mitigation include the United Nations Environment Programme and the United Nations Development Programme (UNDP). One initiative on mainstreaming climate change adaptation is the NEDA project on integrating disaster risk reduction and climate change adaptation into local development planning and decision-making processes. This initiative is jointly funded by UNDP and the Australian Agency for International Development.

Despite the fact that climate change financing has been integrated into national development planning (e.g., RA 9729), a limited number of national financial institutions are available to support CRA activities in the country. Examples of national public financing institutions are the CCC and PCIC. The People's Survival Fund of the CCC supports LGUs and accredited community organizations to implement climate change adaptation projects at the community level and serve as guarantee for risk insurance needs for farmers, agricultural workers, and other stakeholders. Projects include water resources and land management and infrastructure development. LGUs with high incidences of poverty, elevated exposure to climate risks, and that possess important biodiversity area are prioritized. The PCIC is currently piloting weather index-based insurance, where insured farmers are entitled to payments if PAGASA rules that rainfall in a given area exceeds or falls below average indexed levels. . To participate, farmers pay a 5% premium tied to the value per hectare of farmland.

Agricultural public spending, meanwhile, is increasing and is largely directed to production subsidies and large-scale irrigation systems as well as rice importation, stock keeping, and distribution. These production subsidies (largely to the rice sector) and irrigation investments (also serving the rice sector) accounted for 60% of the DA expenditures. The allocation of public expenditure for the agricultural sector has reflected a policy bias toward traditional commodities, especially for the rice self-sufficiency program. This has served to divert scarce financial resources from other necessary public goods that benefit farmers and agribusinesses that do not cultivate or sell rice [56].

Potential Finance

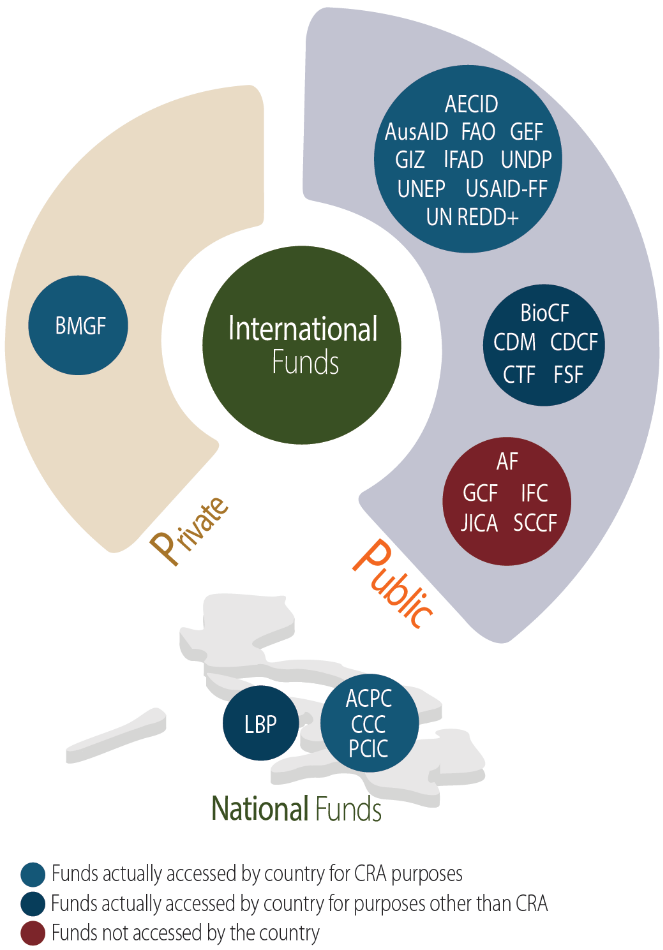
Despite the sources mentioned in the previous section, insufficient access to finance represents a major constraint for advancing agricultural development the Philippines. Yet there exists several sources of funding that have not yet been fully exploited.

For example, together with the SWCCO, the ACPC helps farmers and farmer groups to access the pre- and post-disaster financing programs available. The current funding available for the pre-disaster financing scheme is approximately US$ 3 million annually. The funds are already disbursed to ACPC-accredited cooperative banks across 13 regions and PCIC and SWCCO are assisting the RFOs to develop proposals in order to access these funds. If scaled-out, this could represent a considerable source of funding for CRA activities.

Another potential finance not yet accessed by the country is the UNFCCC Green Climate Fund (GCF), a global financing mechanism that aims to mobilize funding to address mitigation and adaptation needs in developing countries. The GCF resources are aimed at funding low-emission and climate-resilient projects and offer opportunities to leverage funds for scaling- up CRA throughout the country.

The graphic highlights existing and potential financing opportunities for CRA in the Philippines. The methodology can be found in Annex 6.

Financing opportunities for CSA in the Philippines



ACPC Agricultural Credit Policy Council **AECID** Spanish Agency for International Development **AF** Adaptation Fund **AusAID** Australian Agency for International Development **BioCF** Bio Carbon Fund of the World Bank **BMGF** Bill & Melinda Gates Foundation **CCC** Climate Change Commision **CDCF** Community Development Carbon Fund **CDM** Clean Development Mechanism **CTF** Clean Technology Fund **FAO** Food and Agriculture Organization of the United Nations **FSF** Japan's Fast-Start Finance **GCF** Green Climate Fund **GEF** Global Environment Facility **GIZ** German Society for International Cooperation **IFAD** International Fund for Agricultural Development **IFC** International Finance Corporation **JICA** Japan International Cooperation Agency **LBP** Landbank of the Philippines **PCIC** Philippine Crop Insurance Corp **SCCF** Special Climate Change Fund **UNDP** United Nations Development Programme **UNEP** United Nations Environmental Programme **UN REDD** United Nations Programme on Reducing Emissions from Deforestation and Forest Degradation **USAID-FF** United States Agency for International Development – Feed the Future

Outlook

The Philippines has taken major steps in addressing climate change vulnerability and impacts through an ambitious policy and institutional framework that focuses on food security, resilience building, and disaster risk reduction. However, further promotion and scale-out of CRA technologies and practices to ensure greater impact and the delivery of benefits to a larger number of small-scale farmers requires addressing several key bottlenecks:

- Investments in water management and irrigation infrastructure are key for addressing crop yield gaps, especially where weather is expected to become more variable and unpredictable and with increased and more intense climate shocks. Moreover, decentralized seed systems, seed buffer stocks, and the expansion of small-scale mechanization are necessary to improve crop yields.

- To ensure adequate targeting of adaptation and mitigation investments at local levels, more efforts should be to establish integrated decision support structures and extension systems that compile and analyze weather, agronomic, and market information, delivering timely results to a range of stakeholders and decision makers.

- Additional national and international public and private resources are required to fill existing financial gaps for climate action.

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For further information and online versions of the Annexes

Annex 1: Detailed vulnerability assessment in the Philippines.
Annex 2: Selection of agriculture production systems key for food security in the Philippines (methodology)
Annex 3: Methodology for assessing climate smartness of ongoing practices
Annex 4: Institutions for CRA in the Philippines (methodology)
Annex 5: Policies for CRA in the Philippines (methodology)
Annex 6: Assessing CRA finances (methodology)

This publication is a product of the collaborative effort of the International Center for Tropical Agriculture (CIAT) – lead Center of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), the Philippine Department of Agriculture Systems-wide Climate Change Office and Bureau of Agricultural Research to identify enabling environments for CRA in the Philippines. The document is based on the previous work commissioned and led by the World Bank Group to identify country-specific baselines and entry points for scaling out CSA, through data analysis and series of dialogues with national stakeholders. The work complements the CSA Profiles series developed since 2014 by the World Bank, CIAT and CCAFS for countries in Latin America, Asia, Eastern and Central Europe, and Africa.

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