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PHILIPPINE CLIMATE CHANGE AND FOOD SECURITY ANALYSIS

STUDY

November 2021

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Technical Working Group:

DOLE

DSWD
Department of Social Welfare and Development

TASK FORCE ZERO HUNGER

November 2021

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Foreword

Sustainable food systems in the Philippines and the rest of the world are critical now more than ever, as the effects of climate change on water and food security, exacerbated by the economic effects of the COVID-19 pandemic, threatens to reverse years of developmental gains in food and nutrition.

The 2021 Global Food Systems Summit dialogues have underlined the importance of transforming food systems as a critical component in the delivery of all the Sustainable Development Goals. Reaching our collective goal of Zero Hunger by 2030 requires food systems solutions that address systemic inefficiencies, political crises, conflicts and the effects of climate change. This can be achieved by bringing together policymakers, interventions of all stakeholders, linking humanitarian assistance and social protection, developments in infrastructure, and heightened accessibility of innovations and technology — supported by dedicated political leadership and investments.

The United Nations World Food Programme (WFP) in the Philippines embarked on a robust study with the International Center for Tropical Agriculture (CIAT), to aid in the shaping of these policies, resource prioritization, and the crafting of sustainable strategies to mitigate and cope with the effects of climate change on food systems. The Climate Change and Food Security Analysis (CCFSA) analyzes the interconnectedness of climate change and food security, particularly the threats but also to surface the opportunities it presents to food, nutrition, and livelihood in rural and urban areas.

This interconnectedness is extremely important to understand in the context of the Philippines as its geographic position, among other factors, has made it one of the world's most vulnerable countries in terms of climate change impacts and natural hazards. Philippine Government data shows that there are "more Tropical Cyclones (TCs) entering the Philippine Area of Responsibility than anywhere else in the world with an average of 20 TCs in this region per year, and about 8 or 9 of them crossing the Philippines." Meanwhile, the Philippines Statistics Authority data from 2010 to 2019 tallies that the Philippines incurred Php 463 Billion worth of damages due to extreme weather events – 62.7% of that or Php 290 Billion were damages to agriculture. This is a glaring statistic that prevents Filipinos from accessing food and necessary resources for their nutrition and well-being.

The CCFSA study was completed in May 2021. It has produced a set of innovative scenarios that reflect the possible impact of climate change on food security over time – in 2030, 2050, 2070, and 2090. These country-wide scenarios offer stakeholders information and model situations particularly in food production, food accessibility, utilization and consumption patterns, and supply stability.

WFP, together with CIAT and our national government partners, are proud to be able to provide these data sets, for the first time in the Philippines. We have high hopes for providing multi-sectoral stakeholders at all levels – from central government to local governments, actors in the agri-food and fisheries sector, and other industries involved in food systems, including the private sector – key information to introduce adaptation measures that can help to reduce the negative impacts of climate change on the food systems over time.

The analysis utilized WFP's Consolidated Livelihood Exercise for Analyzing Resilience (CLEAR) approach which contains a baseline of major livelihood zones all over the country. CLEAR has provided the backbone to build the Philippines' first livelihood zone maps which aim to provide information for the diversification of economic activities, aimed to ensure that its food systems are secure, peace and hunger are addressed, and that the country is on a continuous path to sustainable development.

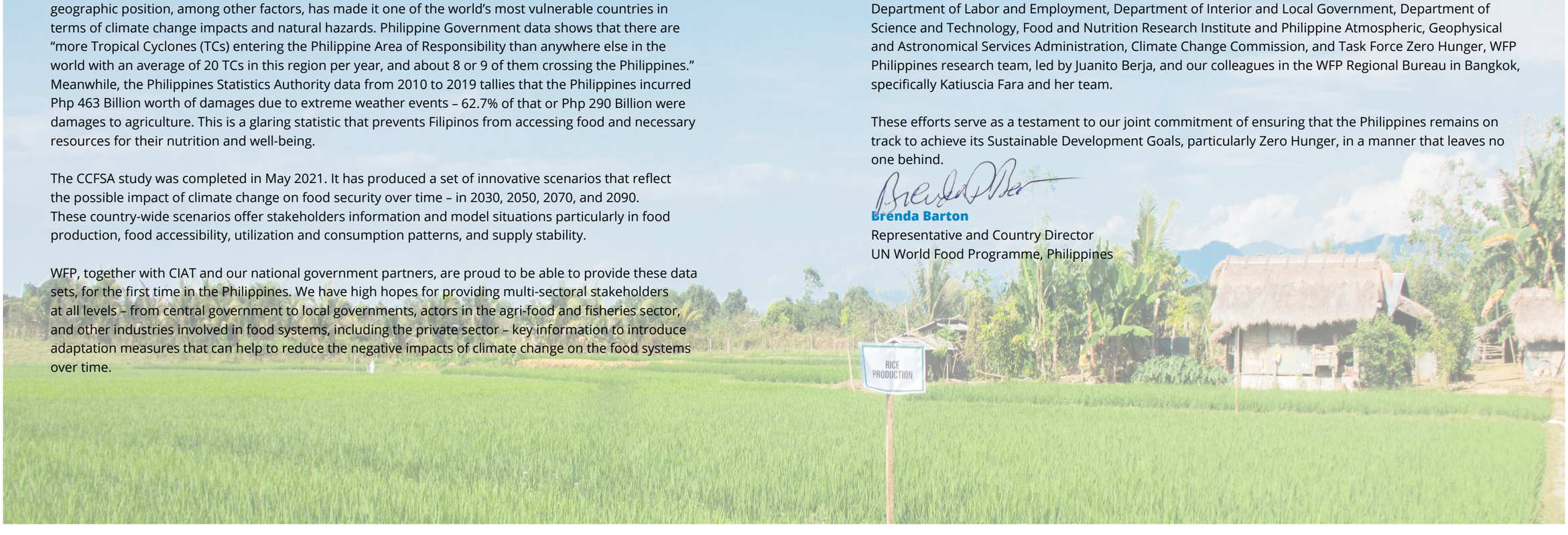
Concretely, these products are envisioned to provide government and non-government partners with technical inputs to various development and action plans such as the National and Local Climate Change Action Plans. In addition, the livelihood zone maps that model scenarios in rural and urban settings can assist government and development partners in the targeted mobilization of resources to increase community resilience.

This study's information just scratches the surface of what the data can provide. As more sectors have access to this study, it is WFP's aim that more multi-sectoral interventions aimed at promoting climate change adaptation and livelihood resilience are developed and prioritized.

WFP would like to extend our gratitude to our partners without whom this project would not be a success, namely CIAT and the 10 national government offices that comprise the project's technical working group: the Department of Agriculture, Department of Tourism, Department of Social Welfare and Development, Department of Labor and Employment, Department of Interior and Local Government, Department of Science and Technology, Food and Nutrition Research Institute and Philippine Atmospheric, Geophysical and Astronomical Services Administration, Climate Change Commission, and Task Force Zero Hunger, WFP Philippines research team, led by Juanito Berja, and our colleagues in the WFP Regional Bureau in Bangkok, specifically Katiuscia Fara and her team.

These efforts serve as a testament to our joint commitment of ensuring that the Philippines remains on track to achieve its Sustainable Development Goals, particularly Zero Hunger, in a manner that leaves no one behind.

Brenda Barton
Representative and Country Director
UN World Food Programme, Philippines



A science-driven approach to building climate resilience in the Philippines

Globally, we are challenged by the impacts of climate change. At this rate, it is threatening different segments and aspects of the food system at various scales making food and nutrition security elusive.

This timely work of the Alliance of Bioversity International and the International Center for Tropical Agriculture (CIAT) and the World Food Programme puts forward how climate vulnerability and climate change are affecting livelihoods in the Philippines. We believe that this assessment is key for actors in both the government and private sector to understand the current trends and potential risk of climate change on food and nutritional security in the Philippines and interweave it with key social issues that serve as barriers for effective adaptation.

By mapping the impacts at the municipal level using near-medium and far-future scenarios, the project was able to capture the dynamic impacts of climate change in space and time. This information enables next-users to effectively target and prioritize packages of interventions that increase livelihood resilience and develop proactive plans and programs geared towards adaptation options based on livelihood, socioeconomic conditions, and climate risk information.

The Alliance hopes that the results of the analysis will be able to support initiatives in designing and shaping policies, programs, and climate-proof investments at the local and national level that involve different sectors to mitigate the effects of climate change and subsequently improve livelihoods and the resilience of many Filipinos in the years to come.

Stephan Weise
Managing Director for Asia
Alliance of Bioversity International and CIAT

Executive Summary

Impacts of climate change on water

- Historically, increased rainfall variability has been one of the most significant impacts of climate change in the Philippines. Future projections indicate that seasonal rainfall volumes will exceed historical averages by approximately 40% across the nation.
- Analysis of flood risk and livelihood mapping suggests that rainfall is likely to increase in frequency and severity in many parts of the Philippines from 2020 to 2050, resulting in moderate to high exposure of rice and vegetable production zones under various management types, from irrigated to rainfed to annual crop zones.
- Sea-based hazards, such as sea-level rise (SLR), storm surge (SS), and saltwater intrusion (SWI), will have significant impacts on coastal and freshwater fisheries, especially those located in coastal communities of Visayas and Mindanao that are less accessible and have high incidences of poverty.

Impacts of climate change on crop productivity

- Future climate scenarios show more conducive environments for rice production throughout the country. This is especially true for Luzon, but not for inland pockets in Mindanao.
- The impact of climate change on future maize production is more variable, with some areas seemingly more suitable than others.
- For banana, suitability is quite regionally determined, with enhanced conditions in southern Luzon, Visayas, and southern Mindanao, but poorer conditions in northern Luzon.
- Vegetable production potential is mixed: garlic conditions remain similarly suitable, while the requirements for onion production will be positively affected and eggplant will be negatively affected.

Impacts of climate change on crop diseases

- The areas that depend on rice and vegetable production as the primary livelihood source are the most likely to be impacted by an increased incidence of plant diseases.
- By 2050, the temperature is expected to continue to rise, resulting in heat stress (temperature greater than 30 °C) for most of the areas producing rice and annual crops, which is conducive to the spread of plant diseases.

Impacts of climate change on livestock

- Increased temperature can negatively affect livestock performance, including stunted growth, more deficient good-quality meat and by-products, and decreased reproductive capacity, in addition to diminishing the quality and quantity of feed supply.
- The majority of the livestock sector that will be affected by an increase in temperature is in mainland Luzon and the islands of Mindoro.
- The top three main livelihood zones threatened by climate change associated with livestock farming are pasture mixed with urban zones, pasture mixed with perennial commodity zones, and pasture mixed with vegetable farming zones.

Impact model analysis across key food commodities

- Currently, the diets of urban households constitute a higher demand for rice, while rural households' diets mainly depend on vegetables and root and tuber crops.
- The demand for maize for animal feed is expected to increase significantly from 68% to 89% from 2020 to 2050.
- Livestock in the Philippines is expected to experience major growth from 2020 to 2050 under the RCP 4.5 scenario, while poultry production will increase by a projected 86%, beef by 90%, and pork by 42%.

Impacts of climate change across social sectors

- The Philippines is predominantly rural and dominated by the agricultural and fishing sectors, for which livelihoods are inextricably linked to food production.
- The agricultural sector is the most vulnerable sector in the country to almost all climate-related hazards, rendering rural communities especially vulnerable to climate change.

Climate-sensitive food security zones in the Philippines

- The spatial distribution, incidence, and risk of climate-related hazards in the Philippines vary across geographic areas. To capture this spatial variability, a hazard risk map was developed at the municipal level to match the data on livelihood zones and socioeconomic datasets.
- The results indicate that combined climate hazards such as typhoon, flood, and drought will cause serious threats to food security.
- One of the major risks associated with the occurrence of these climate-related hazards is price volatility of food items, such as an increase in the prices of basic goods, largely due to the disruption of food production in the affected areas.

Climate-sensitive nutrition zones

- The areas exposed to climate hazards that pose the greatest risks to nutrition security were identified based on geographic and demographic information related to food security and nutrition, such as poverty, stunting, wasting, and accessibility.
- The analysis found that, across the Philippines, the very low-density population cluster is characterized by very high poverty with the greatest prevalence of stunting and wasting. These vulnerabilities are likely largely linked to a lack of diversity in sources of income.

1. Context

1.1. Climate change in the Philippines

Climate change poses critical and complex challenges to global food security. However, the potential impacts across the various elements of food security are particularly acute in the Philippines, where hundreds of thousands of households depend on natural resource-based livelihoods such as agriculture, fisheries, livestock, etc. The Philippines has been classified as the third most vulnerable country to climate change across 67 countries and is considered to have the highest sensitivity to extreme weather events vis-à-vis other Asian countries (Paun et al., 2018). The impact of climate change on the incidence and intensity of extreme weather is acutely felt across the country and in particular by the agricultural sector.

Historical trends of change across the region show a general warming (0.14 °C to 0.2 °C per decade), with an increased number of warm days and decreased number of cool days, and varied signals on precipitation trends depending on the location (Hijioka et al., 2014; Manton et al., 2001). A regional study found stronger trends during the last two decades and during summer for warm days and nights (compared with trends for cool days/nights) (Choi et al., 2009). Although historical precipitation trends showed no regional pattern (Choi et al., 2009), data generated from various weather stations in the Philippines have shown decreases in the number of rain days and in fewer cases an increase in total rainfall from extreme events (Manton et al., 2001). Luzon and Visayas showed decreased/increased trends in total annual precipitation and increased average precipitation on wet

ever recorded in the world. Moreover, the Emergency Events Database indicates, globally, a steady increase in tropical cyclone occurrences from the 1900s, with a notably higher number of occurrences after the 1990s (although highly variable). This increase in the number of extreme flood and storm events is significantly correlated with increasing atmospheric carbon dioxide (CO_2) (Lopez et al., 2020).

Future climate scenarios (multi-model average by the end of the century, 2080 – 2100) across Southeast Asia (SEA) show higher temperatures (relatively lower increases over coastal areas) and increased total annual precipitation (0-6%) (Collins et al., 2013). Increased precipitation trends are found greater than 50% of the Coupled Model Intercomparison Project 5 (CMIP5) models with anomalies relatively small compared to the historical variability in precipitation across the 21st century and across seasons, except for models showing the largest precipitation increases (models with anomalies above the 75th percentile) under Representative Concentration Pathway (RCP[1]) 4.5 (van Oldenborgh et al., 2013). Under RCP 8.5, precipitation trends are similar but anomalies are larger than the historical variability following a southeast (SE) to northwest (NW) axis (i.e., Indonesia and the Philippines show larger anomalies than their historical variability) (van Oldenborgh et al., 2013). Future scenarios show no significant difference between CMIP3 and CMIP5 temperature changes over the Philippines. They also show increased minimum and maximum daily temperatures and in the number of tropical nights (more than 20 °C) (Collins et al., 2013). Annual maximum 5-day precipitation and the number of consecutive dry days will also increase, although only the former will have significant changes in future scenarios. CMIP5 scenarios show a delayed seasonal cycle across the region models but lack a

the historical variability (Collins et al., 2013). Hydrological simulations under future climate change scenarios in the Philippines indicate increased river flow and variability across seasons (Tolentino et al., 2016).

Studies on observed and projected climate change impacts for the SEA region have mostly focused on human settlements, infrastructure, and industry concerns while fewer studies exist for other issues except for major river runoff, coral reefs, health concerns, and rice productivity (Hijioka et al., 2014). Hirabayashi et al. (2013) used a multi-model approach to simulate changes in the return period of flood events under climate change and found a return period of less than 25 years by the end of this century for events with a magnitude with a 100-year return period from 1971 to 2000 (without accounting for the effect of flood regulation infrastructure). Furthermore, the region showed a trend consistency in at least 9 out of 11 future climate model runs. A follow-up study from Arnell and Gosling (2014) using a larger number of climate models, with coarser resolution and without a water flow routing scheme, found similar trends for 2050 and estimated an increase in flood risk (in 4 out of 7 models) for at least 30% of the population and greater than 40% of the cropland areas in SEA.

1.2. Food security, nutrition, and climate change in the Philippines

Food security is a multi-dimensional concept, considering how food can meet individuals' energy nutritional needs, but also its ability to fulfill social purposes and uphold cultural meanings. Although objective indicators of food and nutrition security are important, they do not always correspond to how people subjectively value food and perceive food security. Maxwell and Smith (1992) distinguished four conceptual aspects of food security: (i) sufficiency – defined as the calories needed for an active and healthy life; (ii) access – defined by entitlements to produce, purchase, or exchange food; (iii) security – defined as the balance between vulnerability, risk, and insurance; and (iv) stability – a temporal aspect in which food insecurity can be chronic, transitory, or cyclical. These four aspects apply to food security for a population or individual, whether food is from own production, market purchase, exchange, borrowing, or receipt as a gift. A fifth important aspect is the concept of utilization, or how food is assimilated through an adequate diet, clean water, sanitation, and health care to support a state of nutritional well-being (FAO, 2006). Utilization becomes increasingly significant considering the challenges posed by climate-related hazards to food production, infrastructure and distribution, and consumption.

This study aims to understand the impact that climate-related changes and hazards will have on food security in the Philippines. In doing so, it will be necessary to consider the breadth of agricultural supply chains from production to consumption and across urban and rural sectors, as well as accounting for differences among households and individuals therein. To this end, this project considers the impact of climate-related changes and disasters on food security and nutrition from both the standpoint of food production in rural agricultural communities and food consumption in rural, urban, and peri-urban centers. In this section, we outline several aspects of food systems in the Philippines that are vulnerable to the impacts of climate change.

PRODUCTION SHOCKS: At the production level, the Philippines is vulnerable to the impact of climate change and natural hazards on the production of staple crops, livestock, and fisheries, which generates market disruptions and compromises the availability of food. Several studies have investigated the connection between an increased incidence and intensity of climate-related hazards, namely, typhoons, increased precipitation (rainfall and/or flooding), and increased temperature (drought), and the productivity of key dietary and commodity crops, namely, rice and maize (corn). Although the findings regarding precipitation are less generalizable, the consensus is that climate-related changes have (and are projected to continue having) a negative effect on staple crop yields in the Philippines. One study estimates the total value of agricultural damage to crops, livestock, and fisheries due to typhoons, floods, and droughts in the Philippines from 2000 to 2010 to reach US$219 billion. Considering specific crops, the study estimated annual yield losses from 1995 to 2010 and found losses of up to 5.9% for maize, 4.2% for rice, and 3.0% for high-value cash crops (Israel and Briones, 2012).

Beyond the macroeconomic implications, climate-related productivity losses have far-reaching implications. The impact of climatic changes on agricultural production is experienced by rural households in several ways: (i) in terms of food consumption in their inability to consume the food that they produce; (ii) as producers due to the decreased income from productivity losses; and (iii) as market consumers due to the unavailability and higher prices of food. The yield losses that result from climate shocks lead to scarcity, disrupted supply chains, and food price inflation that are experienced by both rural and urban consumers. Globally, Satterthwaite et al. (2010)