NATIONAL ADAPTATION PLAN OF THE PHILIPPINES

NAP

2023 - 2050

National Adaptation Plan of the Philippines

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Glossary

10-year return period flooding	Flood that has an exceedance probability of 0.10 or a 10% chance that the flow will exceed in one year.
Adaptation	In human systems, it is the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, it is the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate and its effects.
Adaptive capacity	The assets and abilities of the exposed element to address risk and vulnerability.
Adaptation limit	The point at which an actor's objectives (or system needs) cannot be secured from intolerable risks through adaptive actions.
Adaptation pathway	A planning approach addressing the uncertainty and challenges of climate change decision-making.
Biodiversity	The variability among living organisms from terrestrial, marine, and other ecosystems. Biodiversity includes variability at the genetic, species, and ecosystem levels.
Biodiversity hotspot	Geographic areas that are exceptionally rich in species, ecologically distinct, and often contain geographically rare endemic species. They are thus priorities for nature conservation action.
Capacity building	The practice of enhancing the strengths and attributes of, and resources available to, an individual, community, society, or organization to respond to change.
Cascading impacts	Impacts from extreme weather/climate events that occur when an extreme hazard generates a sequence of secondary events in natural and human systems resulting in physical, natural, social, or economic disruption, whereby the resulting impact is significantly larger than the initial impact.
Climate	The average weather—or more rigorously, the statistical description in terms of the mean and variability of relevant quantities—over a period ranging from months to thousands or millions of years.
Climate change	A change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings such as modulations of the solar cycles, volcanic eruptions, and persistent anthropogenic changes in the composition of the atmosphere or in land use.
Climatic impact-driver	Physical climate system conditions (e.g., means, extremes, events) that affect an element of society or ecosystems.
Co-benefit	A positive effect that a policy or measure aimed at one objective has on another objective, thereby increasing the total benefit to society or the environment.
Community-based adaptation	Local, community-driven adaptation. Community-based adaptation focuses attention on empowering and promoting the adaptive capacity of communities. It is an approach that takes context, culture, knowledge, agency, and preferences of communities as strengths.
Coral bleaching	The loss of coral pigmentation through the loss of intracellular symbiotic algae (known as zooxanthellae) and/or loss of their pigments.
Coral reef	An underwater ecosystem characterized by structure-building stony corals. Warm-water coral reefs occur in shallow seas, mostly in the tropics, with the corals (animals) containing algae (plants) that depend on light and relatively stable temperature conditions. Cold-water coral reefs occur throughout the world, mostly at water depths of 50–500 m. In both kinds of reef, living corals frequently grow on older, dead material, predominantly made of calcium carbonate ($CaCO_3$). Both warm- and cold-water coral reefs support high biodiversity of fish and other groups and are considered to be especially vulnerable to climate change.

Glossary

Coupled Model Intercomparison Project (CMIP)	A climate modelling activity from the World Climate Research Programme (WCRP) which coordinates and archives climate model simulations based on shared model inputs by modelling groups from around the world. The CMIP3 multi-model data set includes projections using the Special Report on Emissions Scenarios (SRES). The CMIP5 data set includes projections using the Representative Concentration Pathways (RCP). The CMIP6 phase involves a suite of common model experiments as well as an ensemble of CMIP-endorsed Model Intercomparison Projects (MIPs).
Cultural Heritage	The totality of cultural property preserved and developed through time and passed on to posterity.
Cultural Impacts	Impacts that are closely related to ecological impacts, especially for iconic and representational dimensions of species and landscapes. Culture and cultural practices frame the importance and value of the impacts of change, shape the feasibility and acceptability of adaptation options, and provide the skills and practices that enable adaptation.
Cultural Property	All products of human creativity by which people and a nation reveals their identity, including churches, mosques and other places of religious worship, schools and natural history specimens and sites, whether public or privately-owned, movable or immovable, and tangible or intangible.
Disaster management	The social processes for designing, implementing, and evaluating strategies, policies and measures that promote and improve disaster preparedness, response, and recovery practices at different organizational and societal levels.
Disaster risk	The likelihood, over a specified period, of severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery.
Disaster risk management (DRM)	Processes for designing, implementing, and evaluating strategies, policies, and measures to improve the understanding of current and future disaster risk, foster disaster risk reduction and transfer, and promote continuous improvement in disaster preparedness, prevention and protection, response, and recovery practices, with the explicit purpose of increasing human security, well-being, quality of life and sustainable development (SD).
Disaster risk reduction (DRR)	It denotes both a policy goal or objective, and the strategic and instrumental measures employed for anticipating future disaster risk; reducing existing exposure, hazard, or vulnerability; and improving resilience.
Downscaling	A method that derives local- to regional-scale information from larger-scale models or data analyses. Two main methods exist: dynamical downscaling and empirical/statistical downscaling. The dynamical method uses the output of regional climate models, global models with variable spatial resolution or high-resolution global models. The empirical/statistical method is based on observations and develop statistical relationships that link the large-scale atmospheric variables with local/regional climate variables. In all cases, the quality of the
Drought	A period of abnormally dry weather long enough to cause a serious hydrological imbalance. The shortage of precipitation during the growing season impinges on crop production or ecosystem function in general (due to soil moisture drought, also termed agricultural drought), and during the runoff and percolation season, it primarily affects water supplies causing hydrological drought. A period with an abnormal precipitation deficit is defined as a meteorological drought. A megadrought is a very lengthy and pervasive drought, lasting much longer than normal, usually a decade or more.

Glossary

Early warning systems (EWS)	The set of technical and institutional capacities to forecast, predict and communicate timely and meaningful warning information to enable individuals, communities, managed ecosystems, and organizations threatened by a hazard to prepare to act promptly and appropriately to reduce the possibility of harm or loss. Dependent upon context, EWS may draw upon scientific and/or indigenous knowledge, and other knowledge types. EWS are also considered for ecological applications, for example, conservation, where the organization itself is not threatened by hazard but the ecosystem under conservation is (e.g., coral bleaching alerts), in agriculture (e.g., warnings of heavy rainfall, drought, ground frost, and hailstorms), and in fisheries (e.g., warnings of storms, storm surges, and tsunamis).
Ecosystem	A functional unit consisting of living organisms, their non-living environment, and the interactions within and between them. The components included in a given ecosystem and its spatial boundaries depend on the purpose for which the ecosystem is defined—in some cases, they are relatively sharp, while in others they are diffuse. Ecosystem boundaries can change over time. Ecosystems are nested within other ecosystems, and their scale can range from very small to the entire biosphere. In the current era, most ecosystems either contain people as key organisms or are influenced by the effects of human activities in their environment.
Ecosystem services	Ecological processes or functions having monetary or non-monetary value to individuals or the society at large. These are frequently classified as (1) supporting services such as productivity or biodiversity maintenance, (2) provisioning services such as food or fibre, (3) regulating services such as climate regulation or carbon sequestration and (4) cultural services such as tourism or spiritual and aesthetic appreciation.
Exposure	People, places, and assets that are in the way of the hazards.
Extreme precipitation	High rates of precipitation resulting in episodic, localized flooding of streams and flat lands.
Extreme sea levels	Acute, temporary, and short-term increase of sea levels such as storm surge, astronomical tides, waves, and swash.
Fluvial flooding	Flooding that occurs when rivers and streams exceed their capacity and overflow their banks due to intense or prolonged precipitation.
Governance capacity	The ability of governance institutions, leaders and non-state and civil society to plan, coordinate, fund, implement, evaluate, and adjust policies and measures over the short, medium, and long term, adjusting for uncertainty, rapid change, and wide-ranging impacts and multiple actors and demands.
Green infrastructure	The strategically planned interconnected set of natural and constructed ecological systems, green spaces, and other landscape features that can provide functions and services including air and water purification, temperature management, floodwater management, and coastal defense often with co-benefits for human and ecological well-being.
Grey infrastructure	Engineered physical components and networks of pipes, wires, roads, and tracks that underpin energy, transport, communications (including digital), built form, water and sanitation, and solid-waste management systems.
Hard adaptation limit	No adaptive actions are possible to avoid intolerable risks.
Hazard	A threat represented by geophysical events and processes that may cause deaths, injuries, damages, loss, and destruction.
Health	A state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity.

Glossary

Heat index	A measure of how hot the air feels to the human body. The index is mainly based on surface air temperature and relative humidity and thus reflects the combined effect of high temperature and humidity on human physiology and provides a relative indication of potential health risks.
Heat stress	A range of conditions in, for example, terrestrial or aquatic organisms when the body absorbs excess heat during overexposure to high air or water temperatures or thermal radiation. In aquatic water-breathing animals, hypoxia and acidification can exacerbate vulnerability to heat. Heat stress in mammals (including humans) and birds, both in air, is exacerbated by a detrimental combination of ambient heat, high humidity, and low wind speed, causing the regulation of body temperature to fail.
Human mobility	The permanent or semi-permanent move by a person for at least one year and involving crossing an administrative, but not necessarily a national, border.
Human security	A condition that is met when the vital core of human lives is protected, and when people have the freedom and capacity to live with dignity. In the context of climate change, the vital core of human lives includes the universal and culturally specific, material and non-material elements necessary for people to act on behalf of their interests and to live with dignity.
Increased temperature	Episodic high surface air temperature events potentially exacerbated by humidity.
Indigenous peoples	Indigenous peoples and nations are those that—having a historical continuity with pre-invasion and pre-colonial societies that developed on their territories—consider themselves distinct from other sectors of the societies now prevailing on those territories, or parts of them. They form, at present, principally non-dominant sectors of society and are often determined to preserve, develop, and transmit to future generations their ancestral territories, and their ethnic identity, as the basis of their continued existence as Peoples, in accordance with their own cultural patterns, social institutions, and common law system.
Informal settlement	A term given to settlements or residential areas that, by at least one criterion, fall outside official rules and regulations. Most informal settlements have poor housing (with widespread use of temporary materials) and are developed on land that is occupied illegally with high levels of overcrowding. In most such settlements, provision for safe water, sanitation, drainage, paved roads, and basic services is inadequate or lacking. The term ‘slum’ is often used for informal settlements, although it is misleading as many informal settlements develop into good-quality residential areas, especially where governments support such development.
Institutional capacity	Building and strengthening individual organizations and providing technical and management training to support integrated planning and decision-making processes between organizations and people, as well as empowerment, social capital, and an enabling environment, including culture, values, and power relations.
Land cover	The biophysical coverage of land (e.g., bare soil, rocks, forests, buildings and roads, or lakes). Land cover is often categorized in broad land-cover classes (e.g., deciduous forest, coniferous forest, mixed forest, grassland, and bare ground). Note: In some literature assessed in this report, land cover and land use are used interchangeably, but the two represent distinct classification systems. For example, the land cover class of woodland can be under various land uses such as livestock grazing, recreation, conservation, or wood harvest.
Land use	The total of arrangements, activities and inputs applied to a parcel of land. The term land use is also used in the sense of the social and economic purposes for which land is managed (e.g., grazing, timber extraction, conservation, and city dwelling). In national greenhouse gas (GHG) inventories, land use is classified according to the IPCC land use categories of forest land, cropland, grassland, wetlands, settlements, and other lands.

Glossary

Land management	The sum of land use practices (e.g., sowing, fertilizing, weeding, harvesting, thinning, and clear-cutting) that take place within broader land use categories.
Livelihood	The resources used and the activities undertaken for people to live. Livelihoods are usually determined by the entitlements and assets to which people have access. Such assets can be categorized as human, social, natural, physical, or financial.
Loss and Damage, and losses and damages	Research has taken Loss and Damage (uppercase) to refer to political debate under the United Nations Framework Convention on Climate Change (UNFCCC) following the establishment of the Warsaw Mechanism on Loss and Damage in 2013, which is to 'address loss and damage associated with impacts of climate change, including extreme events and slow onset events, in developing countries that are particularly vulnerable to the adverse effects of climate change.' Broadly, losses and damages (lowercase) have been taken to refer to harm from (observed) impacts and (projected) risks and can be economic or non-economic.
Maladaptive actions (Maladaptation)	Actions that may lead to increased risk of adverse climate-related outcomes, including via increased greenhouse gas (GHG) emissions, increased or shifted vulnerability to climate change, more inequitable outcomes, or diminished welfare, now or in the future. Most often, maladaptation is an unintended consequence.
Migration	Movement of a person or a group of persons, either across an international border, or within a state. It is a population movement, encompassing any kind of movement of people, whatever its length, composition, and causes; it includes migration of refugees, displaced persons, economic migrants, and persons moving for other purposes, including family reunification.
Multi-level governance	The dispersion of governance across multiple levels of jurisdiction and decision-making, including, global, regional, national, and local as well as trans-regional and trans-national levels.
Nature-based solution	Actions to protect, sustainably manage, and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits.
Pluvial flooding	Inundation of land and urban areas caused by heavy precipitation, where the excess water cannot be efficiently absorbed or drained due to factors such as impermeable surfaces and inadequate drainage systems.
Reforestation	Conversion to forest of land that has previously contained forests but has been converted to some other use.
Risk	The potential loss of life, injury, or destroyed or damaged assets, which could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, and capacity.
Risk assessment	The qualitative and/or quantitative scientific estimation of risks.
Runoff	The flow of water over the surface or through the subsurface, which typically originates from the part of liquid precipitation and/or snow/ ice melt that does not evaporate, transpire, or refreeze, and returns to water bodies.
Sea level rise	Chronic and long-term increase of sea levels considering factors such as sterodynamic sea levels, glaciers, land water storage, icesheets, and subsidence.
Settlements	Places of concentrated human habitation. Settlements can range from isolated rural villages to urban regions with significant global influence. They can include formally planned and informal or illegal habitation and related infrastructure.

Glossary

Shared socio-economic pathways (SSPs)	Shared socio-economic pathways (SSPs) have been developed to complement the Representative Concentration Pathways (RCPs). By design, the RCP emission and concentration pathways were stripped of their association with a certain socio-economic development. Different levels of emissions and climate change along the dimension of the RCPs can hence be explored against the backdrop of different socio-economic development pathways (SSPs) on the other dimension in a matrix. This integrative SSP-RCP framework is now widely used in the climate impact and policy analysis literature (see, e.g., http://iconics-ssp.org), where climate projections obtained under the RCP scenarios are analyzed against the backdrop of various SSPs. As several emission updates were due, a new set of emission scenarios was developed in conjunction with the SSPs. Hence, the abbreviation SSP is now used for two things: On the one hand SSP1, SSP2, …, SSP5 is used to denote the five socio-economic scenario families. On the other hand, the abbreviations SSP1-1.9, SSP1-2.6, …, SSP5-8.5 are used to denote the newly developed emission scenarios that are the result of an SSP implementation within an integrated assessment model. Those SSP scenarios are bare of climate policy assumption, but in combination with so-called shared policy assumptions (SPAs), various approximate radiative forcing levels of 1.9, 2.6, …, or 8.5 W m^{-2} are reached by the end of the century, respectively.
Social infrastructure	The social, cultural, and financial activities and institutions as well as associated property, buildings and artifacts and policy domains such as social protection, health, and education that support well-being and public life.
Social protection	In the context of development aid and climate policy, social protection usually describes public and private initiatives that provide income or consumption transfers to the poor, protect the vulnerable against livelihood risks and enhance the social status and rights of the marginalized, with the overall objective of reducing the economic and social vulnerability of poor, vulnerable, and marginalized groups. In other contexts, social protection may be used synonymously with social policy and can be described as all public and private initiatives that provide access to services, such as health, education or housing, or income and consumption transfers to people. Social protection policies protect the poor and vulnerable against livelihood risks and enhance the social status and rights of the marginalized, as well as prevent vulnerable people from falling into poverty.
Soft adaptation limit	Options are currently not available to avoid intolerable risks through adaptive action.
Sustainable land management	The stewardship and use of land resources, including soil, water, animals, and plants, to meet changing human needs, while simultaneously ensuring the long-term productive potential of these resources and the maintenance of their environmental functions.
Transformative adaptation	Actions aiming at adapting to climate change resulting in significant changes in structure or function that go beyond adjusting existing practices which can be adopted at a large scale, leading to new strategies in a region or resource system.
Tropical Cyclones	Warm-core low pressure systems associated with a spiral inflow of mass at the bottom level and spiral outflow at the top level.
Urbanization	Urbanization is a multi-dimensional process that involves at least three simultaneous changes: (1) land use change—transformation of formerly rural settlements or natural land into urban settlements, (2) demographic change—a shift in the spatial distribution of a population from rural to urban areas, and (3) infrastructure change—an increase in provision of infrastructure services including electricity, sanitation, etc. Urbanization often includes changes in lifestyle, culture, and behavior, and thus alters the demographic, economic, and social structure of both urban and rural areas.

Glossary

Vector-borne diseases	Illnesses transmitted through contact with, or consumption of, unsafe or contaminated water.
Vulnerability	How vulnerable or how much damage potential hazards could do to an exposed area (a product of hazard and exposure).
Water-borne diseases	Illnesses transmitted through contact with, or consumption of, unsafe or contaminated water.
Well-being	A state of existence that fulfils various human needs, including material living conditions and quality of life, as well as the ability to pursue one's goals, to thrive and to feel satisfied with one's life. Ecosystem well-being refers to the ability of ecosystems to maintain their diversity and quality.

Abbreviations

A&R	Adaptation and resilience
ACCELERATE	Active Climate Change Engagement Leading to Resilient, Adaptive, and Transformative Empowerment
ADB	Asia Development Bank
AFD	Agence Française de Développement
AMIA	Adaptation and Mitigation Initiative in Agriculture
AR6	Sixth Assessment Report
ARMM	Administrative Region in Muslim Mindanao
ASEAN	Association of Southeast Asian Nations
BARMM	Bangsamoro Autonomous Region in Muslim Mindanao
BAU	Business as usual
BCG	Boston Consulting Group
BFAR	Bureau of Fisheries and Aquatic Resources
CAR	Cordillera Administrative Region
CAT DDO	Catastrophe Deferred Drawdown Option
CCAP	Cold Chain Association of the Philippines
CCC	Climate Change Commission
CCCAB	Climate Change Commission Advisory Board
CCDR	Climate change and disaster risk
CCET	Climate Change Expenditure Tagging
CDRA	Climate and disaster risk assessment
CFS	Climate-resiliency Field Schools
CGE	Consultative Group of Experts
CHED	Commission on Higher Education
CID	Climatic impact-driver
CIN	Climate Investment Network
CLUP	Comprehensive Land Use Plan
CMEMP	Coastal and Marine Ecosystems Management Program
CMIP	Coupled Model Intercomparison Project
COP	Conference of the Parties
CORE	Communities for Resilience
CPAR	Community-Based Participatory Action Research on Climate
CPH	Census of Population and Housing
CRA	Climate-resilient agriculture

Abbreviations

CREVI	Comprehensive Roadmap for the Electric Vehicle Industry
CRVA	Climate risk vulnerability assessments
CSO	Civil society organization
CWRA	Comprehensive water resource assessment
DA	Department of Agriculture
DA-ATI	Department of Agriculture - Agricultural Training Institute
DA-BAFE	Department of Agriculture - Bureau of Agricultural and Fisheries Engineering
DA-BSWM	Department of Agriculture - Bureau of Soils and Water Management
DAR	Department of Agrarian Reform
DBM	Department of Budget and Management
DENR	Department of Environment and Natural Resources
DENR-MGB	Department of Environment and Natural Resources Mines and Geo-Science Bureau
DepEd	Department of Education
DFA	Department of Foreign Affairs
DFA-UNACOM	Department of Foreign Affairs-UNESCO National Commission of the Philippines
DFI	Development financial institution
DHSUD	Department of Human Settlements and Urban Development
DICT	Department of Information and Communications Technology
DILG	Department of the Interior and Local Government
DKI	Data and knowledge infrastructure
DND	Department of National Defense
DOE	Department of Energy
DOLE DILEEP	Department of Labor and Employment Integrated Livelihood and Emergency Employment Program
DOST	Department of Science and Technology
DPG	Digital public goods
DPI	Digital public infrastructure
DPWH	Department of Public Works and Highways
DRFI	Disaster risk financing and insurance
DRR-CCA	Disaster risk reduction and climate change adaptation
DRRM	Disaster risk reduction and management
DSWD	Department of Social Welfare and Development
DTI	Department of Trade and Industry

Abbreviations

EBA	Ecosystem-based adaptation
ENIPAS	Expanded National Integrated Protected Area System
ENSO	El Niño Southern Oscillation
EO	Executive Order
ESG	Environmental, social, governance
EV	Electric vehicle
EVSA	Expanded vulnerability and suitability analysis
FCDO	UK Foreign, Commonwealth and Development Office
FIES	Family Income and Expenditure Survey
FLEMMS	Functional Literacy, Education, and Mass Media Survey
GAA	General Appropriations Act
GAD	Gender and development
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse gas
GI	Governance and institutions
HEI	Higher education institution
HNRDA	Harmonized National Research and Development Agenda
ICT	Information and communications technology
IP	Indigenous peoples
IPCC	Intergovernmental Panel on Climate Change
JMC	Joint Memorandum Circular
LCCAP	Local Climate Change Action Plan
LGU	Local Government Unit
LNOB	Leaving no one behind
M&E	Monitoring and evaluation
MC	Memorandum Circular
MDB	Multilateral development bank
MEAL	Monitoring, evaluation, accountability, learning
MMDA	Metropolitan Manila Development Authority
MRB	Major River Basin
MSME	Micro, small, and medium enterprise

Abbreviations

NAMRIA	National Mapping and Resource Information Authority
NAP	National Adaptation Plan
NAP-NSC	National Adaptation Plan-National Steering Committee
NBS	Nature-based solution
NCCA	National Commission for Culture and the Arts
NCCAP	National Climate Change Action Plan
NCIP	National Commission on Indigenous Peoples
NCR	National Capital Region (Metro Manila)
NCRMF	National Climate Risk Management Framework
NDC	Nationally Determined Contribution
ND-GAIN	Notre Dame Global Adaptation Initiative
NDRRMC	National Disaster Risk Reduction Management Council
NEDA	National Economic and Development Authority
NFRDI	National Fisheries Research and Development Institute
NFSCC	National Framework Strategy for Climate Change
NGA	National government agency
NGO	Non-government organization
NHCP	National Historical Commission of the Philippines
NIASD	National Innovation Agenda and Strategy Document
NICCDIES	National Integrated Climate Change Database Information and Exchange System
NIPAS	National Integrated Protected Area System
NNC	National Nutrition Council
NPAAAD	Network of Protected Areas for Agricultural and Agro-Industrial Development
NSHP	National Soil Health Program
NSS	National Spatial Strategy
NWRB	National Water Resources Board
OCD	Office of Civil Defense
ODA	Official Development Assistance
PA	Protected area
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PAME	Protected Area Management Enhancement
PAP4SCP	Philippine Action Plan for Sustainable Consumption and Production
PAPs	Programs, Activities, and Projects

Abbreviations

PAR	Philippine Area of Responsibility
PBBM	Program for Bantay-Peste Brigade and Management
PCB	Programs Convergence Budgeting
PCHRD	Philippine Council for Health Research and Development
PDO	Pacific Decadal Oscillation
PDP	Philippine Development Plan
PEG	Progress, Effectiveness, and Gaps
PES	Payment for Ecosystem Services
PGC	Participatory Governance Cluster
PhilHealth	Philippine Health Insurance Corporation
PhilMech	Philippine Center for Postharvest Development and Mechanization
Phil-WAVES	Philippine Wealth Accounting and the Valuation of Ecosystem Services
PhiVolcs	Philippine Institute of Volcanology and Seismology
PHP	Philippine Peso
PIA	Philippine Information Agency
PIPOL	Public investment program
PNRI	Philippine Nuclear Research Institute
POESA	Philippine Ocean Economy Satellite Accounts
PPCR	Pilot Program for Climate Resilience
PPP	Public-private partnership
PRIME	Pest Risk Identification and Management Efficiency
PSA	Philippine Statistics Authority
PSE	Philippine Stock Exchange, Inc.
PSF	People's Survival Fund
PSFR	Private Sector Facilities for Resilience
PTFCC	Philippine Task Force on Climate Change
R&D	Research and Development
RA	Republic Act
RBME	Result Based Monitoring and Evaluation
RBMES	Results-Based Monitoring and Evaluation System
RCP	Representative concentration pathway
RRSP	Risk resiliency and sustainability program
RWHS	Rainwater harvesting system

Abbreviations

S&P	Standard and Poor
SAFDZ	Strategic Agriculture and Fisheries Development Zone
SALINTUBIG	Sagana at Ligtas na Tubig para sa Lahat
SARAI	Smarter Approaches to Reinvigorate Agriculture as an Industry
SCB	Skills and capacity building
SCCF	Special Climate Change Fund
SDG	Sustainable Development Goal
SE	Stakeholder engagement
SEA	Southeast Asia
SEADRIF	Southeast Asia Disaster Risk Facility
SLR	Sea level rise
SMARTSeas	Strengthening Marine Protected Areas to Conserve Marine Key Biodiversity Areas in the Philippines
SNAP	Stocktaking for National Adaptation Planning
SSP	Shared Socioeconomic Pathways
SST	Sea surface temperature
STC4ID	Science and Technology Community-based Program for Inclusive Development
SUCs	State universities and colleges
SWCCO	System-Wide Climate Change Office
TAMD	Tracking Adaptation and Measuring Development
TC	Tropical cyclone
TESDA	Technical Education and Skills Development Authority
TI	Technology and innovation
TWG	Technical working group
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNISDR	United Nations International Strategy for Disaster Reduction
USD	United States Dollar
WAISS	Water Balance-Assisted Irrigation Decision Support System
WASH	Water, sanitation, and hygiene
WEF	World Economic Forum
WNP	Western North Pacific
WQMA	Water Quality Management Area

Zamboanga, Zamboanga Peninsula

Executive Summary

Executive Summary

Necessity and Urgency of Adaptation for the Philippines

Climate change presents a complex and multifaceted threat to the Philippines. The 2023 World Risk Report ranked the Philippines as first among countries with the highest disaster risk exhibiting complex interactions of multiple exposures and high intensities.[1] Economically, it inflicts significant harm by escalating the frequency and intensity of climate-induced events, resulting in costly disaster responses, infrastructure repairs, and other economic repercussions such as business disruptions and reduced productivity of the workforce. Despite being a relatively minor contributor to global warming, the economic toll of climate change on the Philippines is substantial. According to the Philippines Country Climate and Development Report, by 2030, climate change is projected to impact 7.6% of the country's total GDP, amounting to PHP1.4 trillion, and rising to 13.6% by 2040. Climate analytics suggest that the cost of inaction will stem primarily from infrastructure damage due to climate-induced disasters (up to PHP365 billion), productivity losses from extreme heat (up to PHP466 billion), business interruptions (up to PHP527 billion), and relocation-related costs (up to PHP8.9 billion) for communities displaced by climate events. These adverse effects are expected to intensify by 2050, potentially reaching 18% to 25% of GDP.

Socially, climate change severely impacts the population, especially vulnerable groups, who bear the brunt of climate-induced displacement, livelihood loss, and heightened inequality. Additionally, rising temperatures increase the risk of health issues, leading to heat-related illnesses such as heat stroke and cardiovascular stress. Changes in rainfall and temperature patterns also expand breeding grounds for vector-borne diseases like dengue fever and leptospirosis. Climate-induced mobility is a growing concern, as communities in vulnerable regions are compelled to migrate internally or internationally in search of improved living conditions, often lacking the proper support mechanisms to ensure safety and security.

From a natural resource perspective, the Philippines is one of the 17 mega-biodiverse countries in the world, ranked third in marine biodiversity and home to over 25,000 endemic species. The biodiversity of the Philippines faces significant risks from changing ecosystems and habitats, endangering unique species and the critical fisheries sector. Natural assets including forests, mangroves, and coral reefs, which provide substantial ecosystem services to the local community and the world, are at risk of destruction. To date, recurring threats to biodiversity such as forest fires, degraded mangroves, and coral bleaching have been observed.

[1] World Risk Report 2022. Bündnis Entwicklung Hilft, Ruhr University Bochum – Institute for International Law of Peace and Conflict 2023.

As temperatures continue to rise at rates exceeding global averages, the potential impact on the Philippines becomes increasingly dire. Four climatic-impact drivers hold significant adverse potential impacts for the nation: Increased temperature and droughts, Sea level rise and extreme sea levels, Extreme precipitation, and wind patterns and tropical cyclones. If the world continues on its current development path and the Intergovernmental Panel on Climate Change (IPCC) 'worst-case' scenario, SSP5-8.5, becomes a reality, the Philippines could face the following challenges in the next three decades:

- **Increased temperatures and drought**: The number of Filipinos potentially impacted by extreme heat (i.e., at heat indices greater than 42°C), is projected to reach up to 11 million by 2030 and may increase to 74 million by 2050. A heat index above 42 degrees is classified as 'Danger', where heat cramps, exhaustion and heat stroke are likely to be experienced with continued exposure. Moreover, productivity loss due to heat stress may reach up to PHP466 billion within the 2030 decade and soar to PHP870 billion within the 2050 decade. This equates to 3% and 5% GDP in 2030 and 2050, respectively, with outdoor sectors such as Agriculture and Construction being the most affected. Furthermore, drought substantially affects biodiversity, leading to diseases, mortality of plants and animals, and other devastating effects, including coral bleaching.
- **Sea level rise**: The rate of sea level rise is expected to exceed the global average, possibly doubling by 2060. Approximately 150,000 Filipinos could face permanent displacement due to sea-level rise by 2040, leading to potential economic losses of PHP18 billion. The rise in sea levels will also affect natural systems, resulting in impacts like mangrove degradation, coral reef bleaching and saltwater intrusion.
- **Extreme sea levels**: Extreme sea levels (acute, temporary, and short-term increases in sea levels such as storm surge, astronomical tides, waves, and swash) may intensify, potentially rising by 35% within the 2030 decade. This could result in up to 2 million Filipinos being impacted, with PHP80 billion at stake from extreme sea levels.
- **Extreme precipitation**: Rainfall patterns are expected to become more extreme, leading to intensified rainfall throughout the year, especially in the eastern sections of the country. Within the 2030 decade, up to 4.8 million Filipinos could be affected by pluvial flooding (flooding resulting from excessive rainfall) and an additional 250,000 impacted by fluvial flooding (flooding from overflowing rivers and water streams). Additionally, there are potential economic losses of PHP274 billion from pluvial flooding and PHP13 billion from fluvial flooding due to extreme precipitation. A significant 18% of those vulnerable to pluvial flooding belong to lower income groups, potentially lacking the capacity to adequately address these challenges.
- **Wind patterns and tropical cyclones**: While the frequency of tropical cyclones might decrease in a warmer world, their intensity will significantly increase. The average maximum wind speed of typhoons and super typhoons is expected to rise by 29% within the 2030 decade and 33% within the 2050 decade. Approximately six million Filipinos could experience more than one tropical cyclone occurrence with maximum winds exceeding 118 km/h (typhoon and/or super typhoon), leading to estimated infrastructure damages of about PHP83 billion and PHP78 billion in 2030 and 2050, respectively.

In this convergence of economic strain, social vulnerability, and ecological disruption, climate change is expected to exact a heavy toll on the Philippines. This underscores the urgent need for climate action, adaptation, and resilience-building efforts to ensure the sustainable development and well-being of the country and its population.

The Philippine government recognizes the significant challenges posed by climate change and has taken measures to address its impacts, adopting major international conventions and translating these into national policies and programs across various sectors. The creation of the Climate Change Commission (CCC) as the lead policy-making body highlights this commitment. The CCC is tasked with coordinating, monitoring, evaluating, and ensuring the integration of climate change considerations into national, local, and sectoral development plans in collaboration with various stakeholders. However, there are still substantial challenges to overcome in the pursuit of transformative development pathways.

To facilitate effective mid- and long-term adaptation planning and integrate adaptation into relevant policies and programs, the Philippines initiated its National Adaptation Plan (NAP) process in 2023. Formulating this NAP represents a major step in the country's commitment to building adaptive capacity using a whole-of-government and society approach. It provides a guideline for understanding climate risks in the Philippines, grounded on the best available climate science and analytics. This data-driven approach is strengthened by the identification of adaptation strategies and the necessary enablers to mobilize action. The NAP is expected to be further refined and downscaled, recognizing that ground-level actions, consistent with the science-policy-action continuum and supported by adequate investments and capacities, form the cornerstone of long-term climate change planning geared towards a low carbon, inclusive, sustainable, and transformative development path for the Filipino people.

The NAP Vision, Objectives and Approach

The vision of the National Adaptation Plan (NAP) of the Philippines is to establish the country's adaptation priorities at a national level, with the goal of enhancing adaptive capacities and increasing resilience in communities, ecosystems and the economy against natural hazards and climate change. It aims to steadily reduce climate-related losses and damages and optimize opportunities for mitigation, facilitate transformative adaptation, and promote resilient, sustainable development.

The objective of the NAP is to reduce the country's vulnerability to climate change impacts by bolstering adaptive capacity, fostering resilience, and integrating adaptation into relevant policies and programs. It strives to define an adaptation pathway that incorporates sectoral and national development priorities, provides guidance for effective public spending, enables access to multilateral funding, and attracts private capital for adaptation efforts.

The following approach and guiding principles have been applied in the development of the NAP:

- The NAP has been developed in compliance with UNFCCC guidelines and localized to the unique challenges and characteristics of the Philippines.
- It places a strong emphasis on a data-driven approach, utilizing the best available climate science and analytics at the time of writing to better understand the potential impacts of climate change, thus supporting more informed decision-making in the future.
- The plan builds upon existing knowledge and mechanisms within the Philippines, acknowledging ongoing efforts at various levels that contribute to adaptation and the need for consolidation, streamlining and continuous iteration.
- The NAP promotes active and participatory stakeholder involvement and has been developed through extensive consultations, including national expert consultations and workshops. It has benefited from the collective knowledge and experience of diverse stakeholders across the country, ensuring collaboration and collective ownership.
- The NAP focuses on analyses and strategies at the national level, which subsequently will be downscaled at local and sectoral levels.

Adaptation Strategy and Priorities

To effectively build resilience, minimize climate-related loss and damage and enhance adaptive capacity towards achieving resilient and sustainable socioeconomic development, eight (8) key sectors have been identified as the focal points for adaptation action:

1. Agriculture, Fisheries, and Food Security
2. Water Resources
3. Health
4. Ecosystems and Biodiversity
5. Cultural Heritage, Population Displacement, and Migration
6. Land Use and Human Settlements
7. Livelihoods and Industries
8. Energy, Transport, and Communications

While this NAP outlines adaptation priorities per sector, it also recognizes the inextricable links between these sectors. It emphasizes the need for an integrated approach to adaptation, acknowledging that disruptions in any sector can trigger cascading impacts on other interrelated systems. The NAP emphasizes the value of promoting a synergistic approach that maximizes co-benefits across sectors.

There are five (5) thematic cross-sector adaptation strategies that the Philippines will focus on. These themes are reflected in the sector-specific adaptation strategies detailed below.

1. *Strengthen infrastructure resilience*: This strategy focuses on reinforcing critical infrastructure across various sectors to withstand adverse effects and minimize service disruptions caused by climate change impacts.
2. *Safeguard livelihoods with social protection and regulations*: This strategy centers on actions and mechanisms that protect the livelihoods of populations from the impacts of climate change using social safety nets and climate-responsive regulations.
3. *Empower local governments and communities to take adaptation action*: This strategy involves enabling local governments and communities to implement adaptation solutions by enhancing their understanding of adaptation and resilience and equipping them with access to climate data, resources, and tools.
4. *Mainstream integrated adaptation governance*: This strategy underscores the need for fostering coordinated collaboration among stakeholders, policymakers, and institutions across horizontal and vertical chains of command regarding adaptation priorities.
5. *Scale up nature-based solutions*: This strategy emphasizes the importance of prioritizing nature-based solutions where possible to enhance climate resilience and protect vulnerable populations.

The best-available climate analytics, taking into account physical, social, and economic dimensions, was used to understand the potential impact of climate change on each sector. The sections below provide an overview of the sector-specific contexts, historical and future projected climate change impacts, and consequently, priority adaptation outcomes.


Bukidnon, Northern Mindanao Region

1. Agriculture, Fisheries, and Food Security

The production of crops, livestock, aquaculture, and fisheries in the Philippines is critical to food security, as 75% of food consumed in the country is locally produced. Moreover, agriculture and fisheries constitute a significant sector for the economy, recently contributing 8.9% to GDP and employing a quarter of the nation's workforce. However, the sector faces challenges in resource bases, labor, capital, productivity, and policy. As a result, farmers and fisherfolk have the highest poverty incidence rates in the Philippines, at 30% and 30.6%, respectively as of 2021.

Agriculture and Fisheries have historically been among the sectors most vulnerable to climate change and, without intervention, will continue to face severe impacts in the coming decades. Increased temperatures, droughts and erratic rainfall are projected to reduce yield across crops, livestock, and fishery catches. Between 2030 and 2040, yields of rice and corn are expected to decline by 6% and 19% respectively. At the same time, tropical cyclones and extreme rainfall events are poised to damage farmland and fishponds. An estimated 7.5% of agricultural land is projected to be exposed to pluvial floods, and 15% of fishponds are anticipated to face extreme sea levels throughout the 2030s. These cascading impacts, combined with the high poverty incidence rate that can lead to poor nutrition, malnutrition or starvation, and the proximity of fisherfolk to coastlines, intensify the vulnerabilities of Filipinos reliant on agriculture, aquaculture, and fisheries for their livelihood.

With these pressing impacts, the adaptation theme for Agriculture, Fisheries, and Food Security is **Securing Food Supply: Nurture Nature, Sustain Livelihoods**. The strategies identified in this NAP aim to attain three (3) key outcomes:

1. Productive and resilient agriculture and fisheries are achieved.
2. Natural resources critical for agriculture, aquaculture, and fisheries are conserved.
3. Livelihoods of farmers and fisherfolk amidst climate change are secured.

2. Water Resources

Water resources are essential for human survival as well as economic activity, supporting agricultural irrigation, fisheries production, hydropower generation, and industrial production. Due to a rapidly growing population and a lack of appropriate planning and investment into water systems, the national water stress levels have surged to twice the global average—12.4 million Filipinos lacked basic access to drinking water in 2015, while 26 million Filipinos were without access to basic sanitation. This situation is poised to deteriorate with the impacts of climate change, leading to cascading effects across various sectors. For instance, in the health sector, polluted water sources are a major cause of waterborne diseases in the Philippines.

The current state of water supply and quality, combined with the water infrastructure network, makes the nation's water resources particularly vulnerable to climate change. Region VII, for example, is projected to receive over 400 mm less rainfall per year between 2030 to 2040 compared to 1991 to 2020, even though it already faces an absolute water scarcity level of water availability per capita per year and a third of its population lacks access to a safe water source. This indicates that drier dry seasons are likely to exacerbate conditions in areas already under water stress.

On the other hand, wetter wet seasons and more intense cyclone damage could affect water infrastructure. In 2009, the effects of Typhoon Ketsana (Ondoy) on water infrastructure resulted in a 92% decrease in water supply capability. This is expected to continue throughout the decade from 2030 to 2040. During this period, nearly 10% of water infrastructure, which includes water tanks and towers, dams, and treatment plants, is projected to be exposed to pluvial floods and cyclones, leading to direct damages exceeding PHP11 billion annually.

With the vulnerabilities faced by both built and natural water sources across the nation, the adaptation theme for **Water Resources is Safeguard Water Security: Secure and Sanitary Water for All**. Strategies identified in this NAP aim to attain three (3) key outcomes:

1. Inclusivity and resilience are built into water infrastructure.
2. Water supply and quality are protected from shifts in weather patterns.
3. Watersheds and surrounding ecosystems are protected and properly managed.

3. Health

Over 110 million Filipinos rely on the healthcare system to effectively anticipate, respond to, and recover from climate-related disasters and climate-induced diseases. With only 56% of public health facilities sufficiently stocked with selected essential medicines and less than 25% of cities and municipalities having health worker density at internationally recommended levels, the capacity of the health sector to respond effectively to sudden and increased healthcare demands is limited, disproportionately impacting low-income populations who cannot afford private healthcare.

Climate change exacerbates existing health inequalities, having both direct and indirect impacts on human health. Directly, exposure to extreme weather events can lead to an increased incidence of vector-borne diseases, waterborne diseases, and heat-related illnesses. For example, after a heavy rainfall, poor drainage systems can lead to contaminated water, which might result in a projected 58% increase in leptospirosis cases in the 2030s compared to historical rates.

Indirectly, climate risks may damage health networks and infrastructure. By the next decade, it is estimated that 8% of vital healthcare infrastructure will be vulnerable to pluvial floods, which particularly affects primary healthcare facilities in the Philippines that are not designed to withstand extreme climate events. To ensure the continuity of optimal health outcomes, the reliability of interoperable information systems and a strong health governance will be crucial.

Guided by a vision of adopting a holistic approach to improve health outcomes, reduce health inequalities, and achieve universal healthcare—and bolstered by existing programs and policies addressing social determinants of health—the adaptation theme for this sector is **Climate-Adaptive Healthcare for All: Protecting Health & Well-Being of Filipinos**. Strategies identified in this NAP aim to attain four (4) key outcomes:

1. Patient mortality and morbidity from climate-sensitive diseases are minimized through primary care that has been strengthened and community health workers that have been empowered.
2. Seamless access to climate- and gender-responsive health services is underpinned by resilient health networks.
3. An interoperable information system to monitor and evaluate health vulnerability and capacity is developed.
4. Resilient, interconnected, and community-driven health governance at all levels is achieved.

4. **Ecosystems and Biodiversity**

The country is among the 17 mega-biodiverse nations in the world, its natural ecosystems not only providing livelihoods across key local industries like aquaculture, agriculture, fisheries, and tourism but also protecting communities from climate hazards. In particular, coral reefs (~70k PHP/ha annually), forests (~200k PHP/ha annually), and mangroves (~200k PHP/ha annually) are estimated to generate billions of pesos in ecosystem services every year. Over the past decades, these ecosystems have been heavily exploited due to both anthropogenic activities and climatic-impact drivers, placing both the ecosystems themselves and the communities reliant on them for livelihood and protection at risk.


El Nido, Palawan

Ecosystems worldwide are especially vulnerable to climate change, and the Philippines is no exception. The intensification of severe weather events can lead to the deterioration of habitats and disruption of ecological balance, further endangering various species. For instance, sea level rise—known to cause mangrove forests to retreat or even disappear—is projected to affect 32% of the nation's mangroves in the 2030s and 48% in the 2050s. Rising temperatures, which are among the most significant by climatic threats, are expected to impact 19% of Philippine coral reefs during the 2030s. Moreover, over a third of Philippine forests, highly vulnerable to extreme rainfall and its resultant flooding, are anticipated to face pluvial and fluvial floods. This exposure might increase to nearly 50% by the 2050s.

Grounded in national policies and existing programs that aim to maximize and sustain the benefits derived from ecosystems, the adaptation theme for **Ecosystems and Biodiversity is Safeguard and Nurture Biodiversity: Restore and Sustain Natural Assets.** Strategies identified in this NAP aim to attain three (3) key outcomes:

1. Ecosystems accounts are developed and regularly updated to monitor and enhance regulating services for adaptation.
2. Biodiversity within various habitats and ecosystems is protected and rehabilitated.
3. Communities are enabled and empowered to lead ecological management.

5. **Cultural Heritage, Population Displacement, and Migration**

Extreme climate events and risks are shaping migration patterns in the country. It is estimated that over 15 million Filipinos were displaced due to 245 climate disaster events between 2020 and 2022. Particularly vulnerable to displacement and migration from sudden-onset climate events (e.g., tropical cyclones, etc.) and slow-onset climate risks (e.g., rising sea levels and associated adverse impacts, etc.) are the 14 to 17 million indigenous peoples who inhabit the Philippines. These IPs belong to 110 different ethnolinguistic groups, with 73% of all IPs falling within the 40% poorest population. Addressing climate-induced human mobility through the lens of cultural heritage preservation is crucial when planning for adaptation measures for the Philippines.

Climate change poses significant threats to the well-being of migrants and indigenous peoples. Among the various climatic-impact drivers, tropical cyclones and pluvial flooding are expected to affect the largest magnitude of populations. In the 2030s, approximately 5.3 million people per year could be exposed to at least one Category 4 or Category 5 tropical cyclone. Notably, 11% of these are impoverished populations with limited resources to resist, adapt, or recover from voluntary or involuntary migration. The displacement of indigenous communities from their cultural lands affects their way of life, as lands are integral to their cultural identity, livelihoods, spiritual practices, social structures, and traditional knowledge systems.

Migration resulting from slow-onset climate events, like sea level rise and its associated adverse impacts also pose a significant climate risk to this sector. In the 2030s, an estimated 150,000 Filipinos per year might be exposed to sea level rise.

With a projected increase in instances of climate-induced human mobility, the adaptation theme for this sector is **Safeguarding Communities & Culture: Durable Solutions for Climate-Induced Mobility.** Strategies identified in this NAP aim to attain three (3) key outcomes:

1. Adaptive physical, social, and economic support is provided, made readily available, and accessible for populations displaced due to sudden-onset events.
2. Robust preparatory and reintegration support is put in place for populations impacted by slow-onset climate events.
3. Cultural heritage is preserved, protected, and rehabilitated, with safeguards against climate risks established.

6. Land Use and Human Settlements

Land use and human settlements play a vital role in the development and sustainability of the Philippines. With 60% of Philippine cities located along the coast, the country's coastal areas and low-lying regions are especially susceptible to climate risks, where an estimated 5.4 million Filipinos live. In addition, rapid urbanization has led to deviations from planned land use and an increase in informal settlements in areas prone to hazards. As a result, this sector currently grapples with complex, compounding challenges concerning capacity, land use, access to shelter and services, connectivity, equity, and justice.

The escalating impacts of climate change directly jeopardizes land and human settlements. By 2040, a projected 160 km2 of land is expected to be permanently inundated due to sea level rise. This means an estimated 85,000 residential homes may be submerged, many of which belong to informal settlements and coastal communities. Tropical Cyclones and pluvial flooding also rank among the CIDs threatening land use and human settlements. More than 80% of land (approximately 180,000 km2) is projected to be exposed to at least one Category 4 or Category 5 cyclone in both the 2030s and 2050s. Additionally, over 55% of land or about 170,000 km2, is projected to experience pluvial flooding in the 2030s. Given these challenges, it is imperative to overhaul the country's approach to land use and settlements planning. The shift should be anchored in transformative multi-level governance, emphasizing the enhancement of community adaptive capacities to withstand climate risks.

Grounded in national policy anchors and existing programs related to this sector, the adaptation theme is **Data-Driven Land Use and Settlements: Conventionalizing Robust, Evidence-Based Planning**. Strategies identified in this NAP aim to attain three (3) key outcomes:

1. Data-driven, climate-focused land use and urban planning is established.
2. Adaptive capacities of communities are improved, and resilient, inclusive, decent, and affordable human settlements are achieved.
3. Transformative and gender-responsive multi-level climate governance is activated.

7. Livelihoods and Industries

Resilience must be built within the Philippines' key industries to protect the country's economic and social stability in the face of increasing climate hazards and risks. The industries that heavily contribute to the Philippines' GDP, particularly Manufacturing (17.2%), Tourism (6.2%), and Professional Services (6.1%), must be prioritized. This is essential in protecting the livelihood of over 12 million Filipinos who rely on these sectors. Focus should be given to MSMEs, which constitute more than 95% of the establishments in the Philippines, and often lack the capacity to invest in climate-resilient infrastructure, technology, and adaptation measures.

Climate change exerts extensive impacts on key industries, which in turn affects the stability of livelihoods of Filipinos. For example, in the manufacturing industry, critical industry infrastructure might become inundated or damaged by extreme weather events, leading to disruptions in production and supply chains. It is projected that 6% of manufacturing infrastructure will be exposed to tropical cyclones and extreme winds during 2030s. Beyond costs associated with physical damage, the stability of this sector is threatened by disruptions in production and supply chains, equipment loss and workforce interruptions.


Davao City

Similar risks are projected for professional services infrastructure (5%) and tourism infrastructure (5%). Rising temperatures and drought are also forecasted to affect labor productivity in these key sectors. The manufacturing industry is projected to face PHP36 billion in productivity losses, with an additional PHP2 billion expected for professional services. Beyond these productivity losses and damages to industry infrastructure resulting in in operational disruptions, it is essential to evaluate the consequences for the livelihoods and well-being of Filipino workers. The continuity of industries is intertwined with the stability of employment opportunities, income sources, and social support systems that back the workforce.

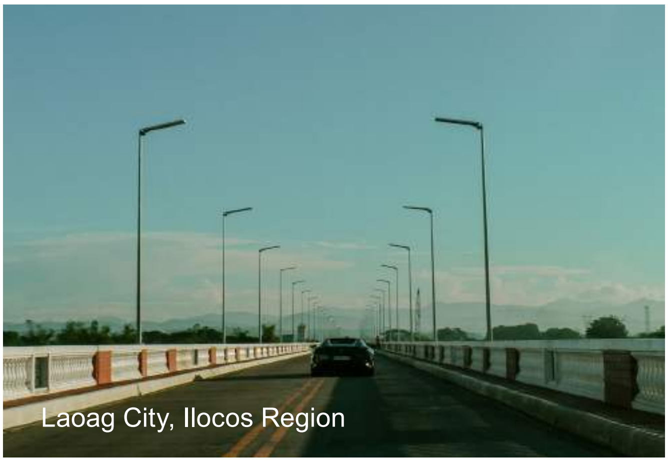
In line with the Philippines' long-term vision to revitalize industries and reinvigorate services, the adaptation theme for this sector is **Embrace Resilience: Fortifying Industry for Economic Prosperity**.

The strategies identified in this NAP aim to attain three (3) key outcomes:

1. Key industry infrastructure and production facilities are protected.
2. Due diligence in occupational safety and hazard regulations is enhanced, and social protection for workers in both the formal and informal economies is strengthened.
3. Industry operations and productivity continuity are sustained amidst climate risks.

8. Energy, Transport, and Communications

The infrastructure sector, comprising energy, transport, and communications, constitutes critical systems that empower and interconnect industries, businesses, and households, facilitating economic activities and growth while offering communities access to essential services. However, rapid economic and population growth, combined with inadequately implemented programs, has led to overloaded infrastructure systems. As a result, the Philippines has only 1/3 the average kWh per capita and one of the highest people-to-telecom tower ratios, exceeding 6,000. These infrastructure systems rank among the most vulnerable to climate change globally, endangering various communities and organizations reliant on these services. Future climate changes may alter the demand for these infrastructure services. Thus, it is crucial to strike a balance between adaptation and mitigation efforts, especially since the current energy and transport systems are major greenhouse gas emitters.


Laoag City, Ilocos Region

Climate change is set to exacerbate vulnerabilities within the Energy, Transport, and Communications sector, as it will impact not only the infrastructure of these services but also the demand profile for services across these systems. In terms of infrastructure, 8% of the energy infrastructure, which includes electric lines and poles, substations, and generators, is projected to face extreme climate events, resulting in over PHP3 billion direct damages annually throughout the 2030s. An estimated 5% of roads, bridges, railways, airports, seaports, and other transport terminals are forecasted to encounter climate hazards in the same period, resulting in around PHP37 billion in direct damages annually. Further, 5% of the communications infrastructure, encompassing telecom towers and data centers, is expected to be at risk from climate hazards, incurring direct damages of PHP350 million annually from 2030 to 2040. Beyond infrastructure challenges, rising temperatures and drought are projected to modify the demand profile for services provided by these systems, potentially reducing the efficiency of infrastructure[2].

Grounded in national policies and existing programs that aim to ensure secure access to the services provided by these infrastructure systems amidst climate change, the adaptation theme for Energy, Transport, and Communication is **Protect Critical Assets: Securing Access and Socioeconomic Connectivity**. Strategies identified in this NAP aim to attain two (2) key outcomes:

1. Comprehensive planning and response mechanisms across energy, transport, and communication infrastructure systems are established.
2. Sufficient capacity of energy, transport, and communication infrastructure services to meet evolving demand induced by climate change is achieved.

A comprehensive estimation of the impacts across the climatic-impact drivers to each sector was conducted to identify the optimal timing and approach the Philippines may take.

The economic cost of inaction, estimated at PHP645 billion per year across these eight sectors, is starkly evident. Four of the eight sectors—Land Use and Human Settlements, Energy, Transport, and Communications, Livelihood and Industries, and Agriculture and Fisheries—face economic costs of inaction sizeable enough to spur immediate action and present a compelling need to accelerate adaptation efforts. However, it is equally crucial to consider the needs of **women, youth, indigenous peoples, local communities, differently abled, and others with special needs**. The indirect social costs of inaction, such as health impacts, loss of ecosystem services, conflict and security risks, and psychological and social stress, should not be overlooked. While these costs are not fully quantified in socioeconomic models, a comprehensive assessment might reveal that these indirect consequences can be as detrimental, if not more, to the Philippines than direct impacts. For sectors such as Water Resources, Cultural Heritage, Population Displacement, and Migration, Ecosystems and Biodiversity, and Food Security, the approach to adaptation action varies. On top of adaptation actions, there is a need for **next-level impact assessments to trace pathways** on how initial climate change impacts trigger secondary and tertiary consequences.

Additionally, key considerations must be integrated as the adaptation priorities are downscaled. First, adaptation strategies in this document that are crafted at a national level are intended to be **tailored to the specific contexts of regions and localities, aligning with localized projected climate impacts**. Second, the NAP recognizes the **critical importance of integrating sectoral adaptation strategies as a cornerstone of effective climate resilience planning.** Isolated sectoral approaches may lead to unintended consequences and potential maladaptation, where efforts in one sector inadvertently undermine progress in another. Lastly, beyond just considering maladaptation, **localized adaptation implementation should consider both soft and hard limits**. Emphasizing the recognition of the spectrum of adaptation actions is essential not only for enhancing the nation's resilience to climate change but also for harnessing co-benefits with climate mitigation efforts.

[2] Such as the 2019 heatwave that led to the reduced cooling capacity of the Calaca coal-fired power plant.

Implementation

Given the NAP's ambitious agenda to foster climate resilience in the Philippines, its implementation will be complex and require a whole of country approach. Collaboration, coordination, and participation will involve various government agencies, levels of government, sectors, and stakeholders.

To ensure effective implementation, six (6) key enablers have been identified as key for success in the Philippines:

1. **Governance and Institutions**: Establishing a purpose-fit governance structure to oversee the NAP and integrate adaptation seamlessly into existing plans, policies, and strategies. This ensures a whole-of-government approach, enhancing accountability, ownership, and optimizing resource allocation.
2. **Stakeholder Engagement**: Identifying and engaging all relevant actors crucial to the NAP's success, including the private sector, local communities, and at-risk groups such as indigenous populations, the elderly, youth, and lower-income groups. It emphasizes that the NAP is gender-responsive and promotes women's empowerment in climate action. This approach ensures inclusivity, collaboration, meaningful engagement, and effective outcomes.
3. **Skills and Capacity Building**: Assessing the skills and capacity gaps among those responsible for advancing the NAP and addressing these gaps through capacity building and knowledge sharing. Capacity building extends to human, institutional, financial, and organizational capacities.
4. **Data and Knowledge Infrastructure**: Establishing a robust foundation of data and knowledge critical for an effective NAP process. This facilitates a comprehensive understanding of exposure, enabling the prioritization of impactful strategies.
5. **Technology and Innovation**: Continuously advancing technology and innovation to address the consequences of climate change. This involves localizing global technology and innovation to suit the Philippine context and scaling up local solutions beyond specific use cases.
6. **Adaptation Financing**: Deploying effective strategies to secure, allocate, and optimize diverse financial resources while balancing considerations such as climate justice, the country's development goals, and the prevailing fiscal constraints. While sources such as domestic public funding, international development funding and private sector might be readily identifiable, several obstacles such as information gaps, limited bankability, and capacity gaps and inadequate policies hinder the progress of adaptation financing today.

Considering the urgency of adaptation in the Philippines, as well as the identified adaptation priorities and necessary enablers, the implementation roadmap for the NAP has outlined the following key initiatives needed:

1. **Clearly define roles, responsibilities, and institutional arrangements** for the NAP to mainstream adaptation and resilience (A&R) in the national agenda.
2. **Enhance stakeholder engagement and communication strategies** to amplify NAP awareness and understanding, and to support gender mainstreaming in adaptation.
3. **Downscale climate analytics and enhance adaptation data management and application** to support more informed decision-making.
4. **Translate adaptation strategies into a sectoral-level program/project portfolio**, prioritizing based on social, economic, and ecosystem benefits for informed decision-making.
5. **Develop a national adaptation investment strategy** to mobilize resources needed for adaptation programs.
6. **Translate adaptation strategies into a provincial-level program/project portfolio**, prioritizing based on social, economic, and ecosystem benefits for informed decision-making.
7. **Enhance capability building, research, and innovation** on the topic of climate change adaptation.
8. **Develop an effective Monitoring, Evaluation, Accountability, and Learning (MEAL) system** for climate change adaptation.

Summary

As a nation that has long grappled with the devastating impacts of climate change, the Philippines recognizes that **prioritizing climate adaptation is an urgent and immediate necessity**. The NAP serves as a foundational framework for fostering a climate-resilient and prosperous future for the nation. It stands as a resounding call to action, urging all stakeholders to unite and chart a transformative course in the face of climate challenges. By making adaptation a priority and implementing the strategies outlined in the NAP, the country aims not only to manage mounting risks but also to harness limited yet tangible opportunities for sustainable economic growth and social development.

The Philippines encourages the active support of other nations, financial institutions, philanthropic organizations, international and regional development banks, and other stakeholders to bolster these efforts through the contribution of resources, expertise, and financial support to the adaptation agenda. This call to action aligns with the principles of climate justice and echoes a fundamental reality: the fight against climate change is a collective effort. **An adaptation plan for the Philippines is, in essence, an adaptation plan for the rest of the world.**

Manila, National Capital Region

Introduction

Introduction

This document offers a comprehensive insight into the potential socioeconomic and physical impacts of climate change on the Philippines, outlines the country's adaptation priorities, and presents a high-level roadmap for implementation.

Chapter 1: This chapter delves into the background and significance of the NAP for the Philippines. It elucidates how the NAP aligns with the country's existing climate change policies and frameworks. It defines the purpose, vision, and objectives of the NAP, introducing a strategic framework that pinpoints the key outcomes in terms of adaptation and resilience for the country. Additionally, it describes the process through which the NAP was developed and the guiding principles that inspired its inception.

Chapter 2: This chapter provides an overview of the national circumstances, including geographical features, population, economy, and governance structures. These create nuances to consider when discussing adaptation and resilience strategies that are fit for purpose.

Chapter 3: In this chapter, the NAP examines the impacts of climate change on the Philippines. It presents a historical perspective on the country's observed climate change and offers insights into future climate scenarios based on the best available climate science and analytics at the time of study. This analysis aids in the understanding of the potential socioeconomic consequences of climate change for the country and identifies the geographical areas within the Philippines that are most impacted.

Chapter 4: Focusing on the most critical sectors for the Philippines as identified in the NAP strategic framework, this chapter outlines the country's adaptation priorities. For each sector, the significance of the sector to the Philippines is discussed, the challenges posed by climate change are explained, and various adaptation strategies tailored to each sector's needs are defined and integrated to avoid maladaptation and acknowledge limits to adaptation.

Chapter 5: This chapter outlines the implementation arrangements necessary for the success of the NAP. It includes key enablers required to drive the NAP forward, a high-level implementation roadmap, and describes future monitoring and evaluation mechanisms necessary to effectively track progress.

A supplementary Appendix document accompanies insights to this main document, providing detailed information on climatic-impact driver model methodologies, validation, and references. It also covers sector-specific programs and policies aligned with the NAP development, stakeholders consulted in the NAP development process, methodologies used for sector-specific impact models, and references to international frameworks and standards.

Developed at a national level, the NAP is envisioned to evolve through an iterative process from analyses and strategies that provide more specific geographical and sectoral contexts, as the Philippines continues its progress on the adaptation agenda.


Banaue Rice Terraces, Ifugao

01

Multidecadal NAP Strategic Framework

1. Multidecadal Strategic Framework

1.1.1 Purpose

The Intergovernmental Panel on Climate Change (IPCC)[3] underscored in its Sixth Assessment Report (AR6) the importance of strengthened adaptation to benefit the most vulnerable in an increasingly warming planet. As a country that consistently ranks high in terms of climate change impacts and disaster risks, it is crucial for the Philippines to prioritize adaptation planning and implementation.

As early as 2010, the Conference of the Parties (COP16)[4] to the United Nations Framework Convention on Climate Change (UNFCCC) established the Cancun Adaptation Framework to guide countries in adopting National Adaptation Plans (NAPs) "as a means of identifying medium- and long-term adaptation needs and developing and implementing strategies and programs to address those needs." Under the Paris Agreement[5], Parties are encouraged to undertake the process of NAP formulation and implementation with consideration to vulnerable peoples, places, and ecosystems. The NAP serves as both a "document" and a "process" to be lodged before the UNFCCC Registry, requiring regular tracking and updating based on the planning, monitoring, and evaluation cycle, as may be driven by lessons learned from progress, effectiveness of early implementation, and feedback, all anchored on the best available science and unique national circumstances.

Bonn Climate Change Conference

[3] IPCC (2023). Summary for Policymakers. In: Climate Change 2023: Synthesis Report. A Report of the Intergovernmental Panel on Climate Change. The report can be accessed through this link.

[4] Held on 29 November to 10 December 2010 in Cancun, Mexico

[5] Article 7 of the Paris Agreement to the UNFCCC (2015). Full text can be accessed through this link.

The main objective of the NAP is to reduce vulnerability to the impacts of climate change by building the adaptive capacity and resilience of communities. It also aims to facilitate the coherent integration of climate change adaptation into relevant new and existing policies, programs, and activities. The NAP should mainstream adaptation across many sectors at different levels (national, subnational, regional, and local), incorporate both medium- and long-term strategies, and strengthen policies and frameworks through collaborative partnership and cooperation.

The IPCC AR6 highlighted the gaps in adaptation for some ecosystems and regions that have reached their soft and hard limits[6] in terms of adaptability. **Further, the increasing evidence of maladaptation across regions and sectors impels multi-sectoral, multi-actor, and inclusive planning for long-term climate change to minimize maladaptation.**

It is crucial that the NAP process should be country-driven, gender-responsive, participatory, fully transparent, and inclusive of all stakeholders, including civil society, the private sector, academia and science, indigenous peoples, communities, ecosystems, and other vulnerable groups.

Through the NAP, countries can effectively guide the public sector and partner stakeholders on the needed speed and scale for providing and delivering the means of implementation (MOI) and support in the form of climate finance, technology transfer and development, and capacity building, to be provided by developed country Parties under the UNFCCC and the Paris Agreement.

In the Philippines, the NAP process is spearheaded by the Climate Change Commission (CCC). Pursuant to Republic Act No. 9729 or the Climate Change Act, the CCC is the lead policy-making body of the government responsible for coordinating, monitoring, and evaluating government programs on climate change. It is tasked to ensure the mainstreaming of climate change in national, local, and sectoral development plans, in coordination with relevant government agencies, partners, and stakeholders.

The Climate Change Act established the National Framework Strategy for Climate Change (NFSCC), a policy framework that emphasizes the Philippines' approach to climate change. It focuses on adaptation as the anchor strategy, with mitigation being pursued as support to adaptation efforts.

As part of the NFSCC, the National Climate Change Action Plan (NCCAP) was formulated to outline the long-term program and strategies for climate change adaptation within the national development plan. Building on the NCCAP, the NAP process pursues the National Climate Risk Management Framework (NCRMF), which acknowledges the importance of risk profiling, assessment, and management needed to increase the adaptive capacity of communities. This includes technology development and transfer, capacity building and the projection of future and multiple impact scenarios.

1.1.2 Vision

The Philippine NAP establishes the adaptation priorities of the country at the national level geared towards enhancing the adaptive capacities and increasing resilience of communities and ecosystems to natural hazards and climate change, while steadily reducing climate-related loss and damage, and optimizing mitigation opportunities.

People's Survival Fund (PSF) Awarding

[6] Soft limits to adaptation are those solutions that may not be currently available but could be made available in the future through enabling conditions such as finance and technology while hard limits to adaptation are those already unattainable.

1.1.3 Objectives

The overarching goal of the NAP is to reduce the country's vulnerability to climate change impacts by building its adaptive capacity and resilience and integrating adaptation measures into relevant policies and programs. It aims to delineate an adaptation pathway that integrates sectoral and national development priorities, providing a framework for public spending planning, multilateral funding access, and raising private capital for adaptation.

Specifically, the NAP aims to:

a. **Identify priority high-risk climate change vulnerable areas in the Philippines**, based on solid data and evidence, which will then serve as the basis for conducting detailed risk assessments and developing adaptation programs;

b. **Provide guidance on integrating adaptation considerations into planning**, coordination, and implementation processes at all levels of government and across society and ecosystems, and

c. **Harmonize national strategies with international commitments** for developing robust medium- and long-term adaptation plans to build the country's adaptive capacity and resilience.

Conference of Parties (COP) Convention

1.1.4 Objectives

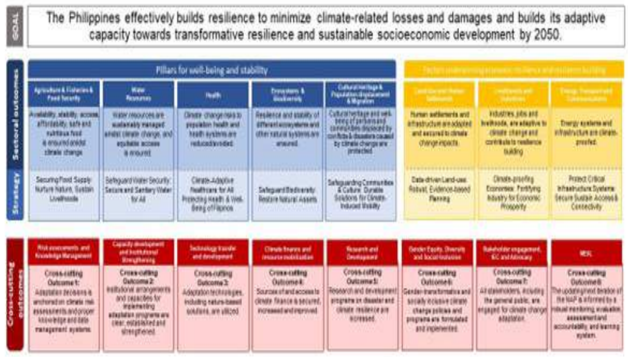


Figure 1.1.4.1 NAP Strategic Framework

Note: A larger version of the figure is available in Appendix 6

The NAP Strategic Framework builds on the principles, priorities, concepts, structure, strategies, and approaches outlined in the NFSCC 2010 to 2022 and the NCCAP 2011 to 2028.

Notably, the adaptation[7] and mitigation[8] pillars under the NFSCC, alongside the seven (7) thematic priorities of the NCCAP[9] serve as bases for the identification of the Sectoral Outcomes 1 to 8 of the NAP given the importance of goods and services in achieving the overall objective of "steadily reducing climate-related loss and damage and to build the country's adaptive capacity towards transformative resilience and sustainable economic development by 2050."

The aspirational period of 2050[10] aligns with the country climate change scenario considered under the NFSCC. Consequently, the SF endeavors to incorporate the UNFCCC-recommended convergence[11] in adaptation planning among the post-2050 frameworks such as the Paris Agreement, Sendai Framework on Disaster Risk Reduction, and Sustainable Development Goals in ensuring that the NAP acts as a reference instrument for the country's long-term development agenda, moving beyond reactive approach towards proactive, progressive, and anticipatory one.

[7] Adaptation Pillars, NFSCC: Enhanced Vulnerability and Adaptation Assessments, Integrated Ecosystems-based Management, Climate-Responsive Agriculture, Water Governance and Management, and Disaster Risk Reduction Management

[8] Mitigation Pillars, NFSCC: Energy Efficiency and Conservation, Renewable Energy, Environmentally Sustainable Transport, Sustainable Infrastructure, National REDD+ Strategy, and Waste Management

[9] Thematic Priorities of the NCCAP: Food Security, Water Sufficiency, Ecological and Environmental Stability, Human Security, Climate-Friendly Industries and Services, Sustainable Energy, and Knowledge and Capacity Development

[10] NFSCC, p.9, citing a document prepared by PAGASA for the Philippines' Second National Communication on Climate Change

[11] UNFCCC. Opportunities and options for integrating climate change adaptation with the Sustainable Development Goals and the Sendai Framework for Disaster Risk Reduction 2015–2030. Technical paper by the secretariat. / UNFCCC/TP/2017/3.

The SF also promotes locally led efforts while acknowledging the impacts of regional and global dynamics.

With the application of scientific guidance and utilizing appropriate methodologies, the NAP intends to lay down challenges and opportunities for innovative and transformative actions on sectoral outcomes through the support mechanism under **Cross-Cutting Outcomes 1-8**.

This approach embodies the science-policy-action continuum which emphasizes the importance of synergy rather than a trade-off between adaptation and mitigation actions.

The value chain of vital goods and services that supports human systems (e.g., food, water, health, community, and ecosystems nexus) is at risk due to uncertainties and severity of adverse climate change impacts and limits of adaptation. Human Security, therefore, emerged as a prime consideration in climate change actions. As a result, its core elements under the NCCAP are now addressed as separate sectoral outcomes. Health, for instance, is now treated distinctly, with emphasis on its path to post-pandemic recovery. Other outcomes include jobs and livelihoods sector, with focus on just transition concerns, as well as the land use and human settlements sector, concentrating on mobility and displacement, with their nexus to conflict and DRRM.

Aside from the necessity for experts and academia to provide knowledge base and capacity building, efforts also should be directed in nurturing future climate experts, leaders, and actors, thus ensuring intergenerational equity.

The utilization of methods such as probabilistic risk assessment, along with interoperable and user-friendly data analytics and tools like the GeoRiskPH platform of the Department of Science and Technology (DOST), will facilitate the engagement of various segments of the population—from policymakers to citizens, industry stakeholders, and development partners—in a solutions-oriented NAP process.

In moving towards a "societal transformation-focused NAP," it is vital to align with the National Innovation Agenda and National Security Policy, framed within the context of social and climate justice, inclusivity, and the pursuit of lasting peace across the country to ensure that **no one, even the smallest unit of governance, is left behind**.

1.2 NAP Guiding Principles

The NAP is envisioned as:

- Compliant with the UNFCCC guidelines on NAP development.
- Aligned with existing national policies, programs, and international agreements including the UNFCCC and the Paris Agreement, the UN Sustainable Development Goals, Sendai Framework for Disaster Risk Reduction, and Kunming-Montreal Biodiversity Framework.
- Formulated based on the best available science and technologies, integrating strategies from scientific contributions and community-based best practices, and, where appropriate, traditional knowledge, indigenous peoples' knowledge, and local knowledge systems while addressing diverse local climate adaptation needs.
- Evidence-based and risk-informed, with fit-for-purpose adaptation actions formulated based on the causes, magnitude, and impacts of identified risks.[12] Long-term strategies also account for intersecting vulnerabilities and complexities in addressing such risks.
- Promotes a rights-based, integrated/cross-sectoral, and multidisciplinary approach to climate change adaptation and climate justice. This approach is grounded in the principle of Leaving No One Behind (LNOB), ensuring a participatory, inclusive planning process that prioritizes the most vulnerable populations.

[12] National Climate Change Action Plan (NCCAP 2011-2028). Retrieved from this link.

- Guided by the Precautionary Principle[13] in dealing with the urgent need for effective climate actions, recognizing the inherent limits to adaptation. This principle promotes proactive policies to minimize climate-related losses and damages without allowing the lack of full scientific certainty to be used as a reason to delay the implementation of adaptation measures.
- Anchored on the principles of the Paris Agreement, emphasizing the principle of equity and common but differentiated responsibilities and respective capabilities, considering different national circumstances.[14] This alignment gives special importance to equal and equitable protection of women, children, youth, indigenous peoples, local communities, differently abled, and senior citizens, and highlights the need to enhance their adaptive capacities.

- Aligned with long-term strategies focused on well-being. Adaptation actions aim to increase income and job opportunities, enhance public health, and promote local empowerment, among others.[15]

- Cognizant of the value of a multi-stakeholder inclusivity and participatory approach to ensure effective and sustainable adaptation strategies. This includes partnerships with civil society, the private sector, international community, local governments, the academe, indigenous peoples, specific subgroups of persons with disabilities (like the deaf and blind), and other marginalized groups most vulnerable to climate change.
- Guided by the principles for locally led adaptation[16] which recognized local communities as front liners of climate change impacts and the need to develop flexible and inclusive programs, accessible funding, and transparent and collaborative practices, ensuring that adaptation is increasingly driven and sustained by local stakeholders.
- Embodies an intergenerational and inclusive commitment to safeguard present and future generations from gradual but persistent impacts of climate change.
- Cognizant of the distinction between incremental adaptation,[17] which is moving towards disaster resilience and transformational adaptation,[18] which is moving towards climate resilience.

[13]"Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures, taking into account that policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost." Source: United Nations Framework Convention on Climate Change (UNFCCC). (1992). Retrieved from: https://unfccc.int/resource/docs/convkp/conveng.pdf / UNFCCC Handbook. (2006). Retrieved from: https://unfccc.int/resource/docs/publications/handbook.pdf.

[14]The Paris Agreement on Climate Change (2015).

[15]PDP 2023-2028. Chapter 15. Retrieved from this link.

[16]Principles of Locally Led Adaptation (2022). Global Commission on Adaptation. https:///www.wri.org/initiatives/locally-led-adaptation/principles-locally-led-adaptation

[17]Incremental adaptation are interventions that preserve the essence and integrity of the prevailing technological, institutional, governance, and value systems e.g. introduction of new cropping systems, altering planting times, and establishing efficient irrigation systems.

[18]Transformational adaptation refers to the body of interventions that, to the extent of greater magnitude than incremental interventions, alter the systems' basic characteristics in response to actual or expected climate and its effects.

1.3 NAP Processes and approach

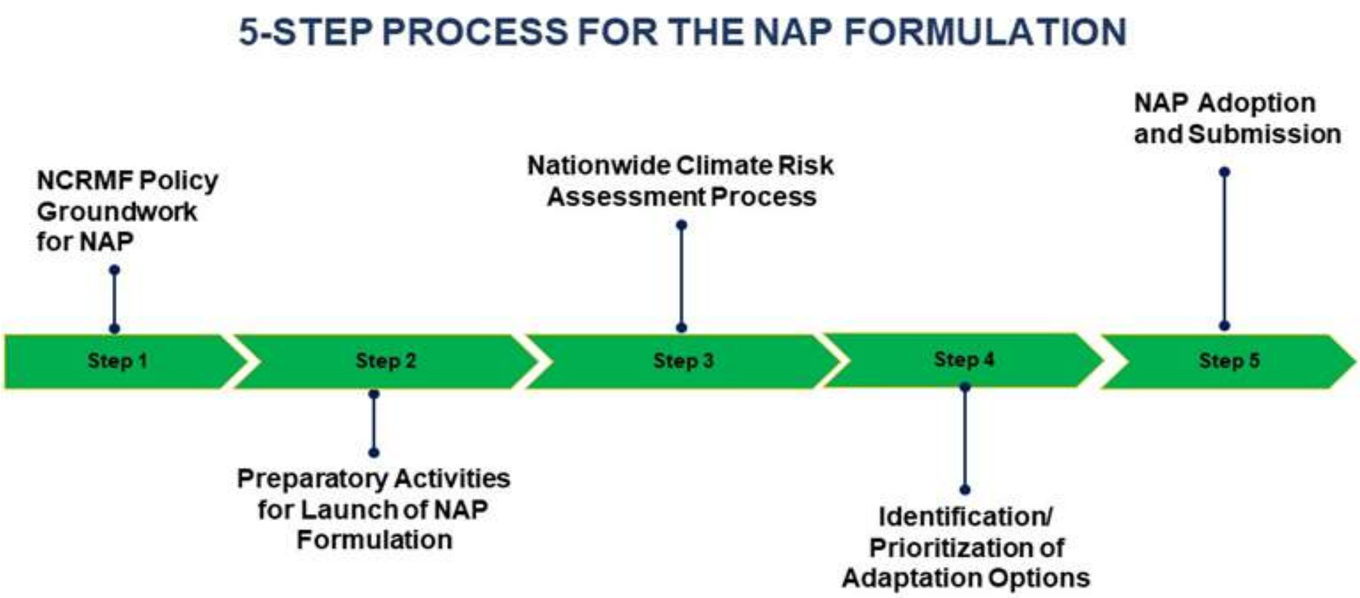


Figure 1.3.1 The 5-step Process for the NAP Formulation in the Philippines

As a national policy, **Climate Change Commission Resolution No. 2019-001 on the National Climate Risk Management Framework (NCRMF)** provides evidence-based guidance to the public sector to undertake risk profiling, assessment, and management needed to increase the adaptive capacity of communities through technology development and transfer and capacity building, utilizing probabilistic risk assessment methods to consider future scenarios on impacts.

The NCRMF aims to address the challenging aspect of the NAP formulation by establishing a clear and organized framework of action to enable systematic characterization—including risk and impact quantification—and identify and organize adaptation measures addressing both actual and potential impacts of climate change. Consultations were conducted and a national stock take survey was completed, capturing available climate risk datasets, information, tools, methodologies, capacities, and mechanisms. This process involved National Government Agencies (NGAs), Local Government Units (LGUs), Academe, Civil society organizations (CSOs)/ Non-government organizations (NGOs) from Luzon, Visayas, and Mindanao. While not every agency, organization and stakeholder were covered, the survey results offer a snapshot of data generation (i.e., slow and sudden onset) across various governance levels and sectors in the country.

The second step entails the **Preparatory Activities for the Launch of the NAP formulation**. This involves **technical discussions and scoping activities** to identify climate risks and vulnerabilities in the Philippines. As a follow-up process, sectoral plans and adaptation measures will be revisited through the NCCAP Monitoring & Evaluation (M&E) tools.

The third step involves the **Nationwide Climate Risk Assessment Process**—gathering and analyzing available data and information to develop country-specific climate risk models. **Parameters, methodology, and limitations for risk assessment** are identified and coordinated with concerned agencies through continuous consultations.

[19] CCC Commission Resolution No. 2019-001. Retrieved from this link.

Upon adoption, a strategic NAP rollout communications plan will be released for its wide dissemination to all stakeholders, including development partners, to help guide them in channeling resources where these are most needed.

Recognizing the need to strengthen the scientific and policy grounding for the NAP process, the Consultative Group of Experts (CGE) has been established to provide top-tier scientific and technical advisory support to the Philippine government during the NAP development.

Specifically, the CGE is expected to:

a. provide guidance on reports, tools, approaches, and other considerations for incorporating the best available science and technologies into the NAP development,

b. eview the NAP drafts, and

c. ensure that the NAP final output aligns with international scientific standards/peer review.

Furthermore, a multi-stakeholder coordination mechanism, through a dedicated NAP-National Steering Committee (NAP-NSC) was created to provide recommendations, overall guidance, and strategic direction, including but not limited to the following:

1. Risk assessment (i.e., baseline and evidence basis for adaptation planning; climate risks and impact drivers; tools, methodologies, and approaches to use)
2. Planning and development (i.e., sectoral SF or set of indicators, outcomes, and targets; identification and/or prioritization of sectors and adaptation solutions; resource mobilization)
3. Implementation (i.e., stakeholder engagement, communication, and capacity-building strategies)
4. Monitoring, Evaluation, Accountability, and Learning (i.e., reporting and updating; results-based M&E systems and information/knowledge management).

The NAP-NSC undertakes to harmonize and integrate the execution of its tasks, roles, and responsibilities in the formulation and implementation of the NAP.

Preparatory Activities for the Launch of the NAP formulation

[19] CCC Commission Resolution No. 2019-001. Retrieved from this link.

Baguio City

02 National Circumstances

2. National Context

2.1 Geography

The Philippines is an archipelago composed of 7,641 islands within three (3) major island groups: Luzon, Visayas, and Mindanao. It has a total land area of 298,170 km2 and a coastline of 36,289 km.[20]

Surrounded by bodies of water, the Philippines is bordered by the Pacific Ocean on the east, the West Philippine Sea on the west, Basha Channel on the north, and the Sulu and Celebes Seas on the south.

In terms of topography, the islands of Luzon and Mindanao are characterized by alluvial plains, narrow valleys, rolling hills, and high mountains. Most of the smaller islands, such as those in the Visayas, have a mountainous interior surrounded by narrow strips of discontinuous flat lowlands on the coastal rims. The shorelines of both large and small islands are irregular.

Due to its unique environment and geographical features, the Philippines stands as one of the world's mega-biodiverse countries. It is home to plant and animal species representing 70 to 80% of the world's biodiversity.[21]

The country's fertile land contributes to its rich biodiversity. In terms of fauna, an estimated 49% of terrestrial wildlife species are considered endemic, including highly endangered species such as the Philippine eagle, tarsier, and mouse deer.

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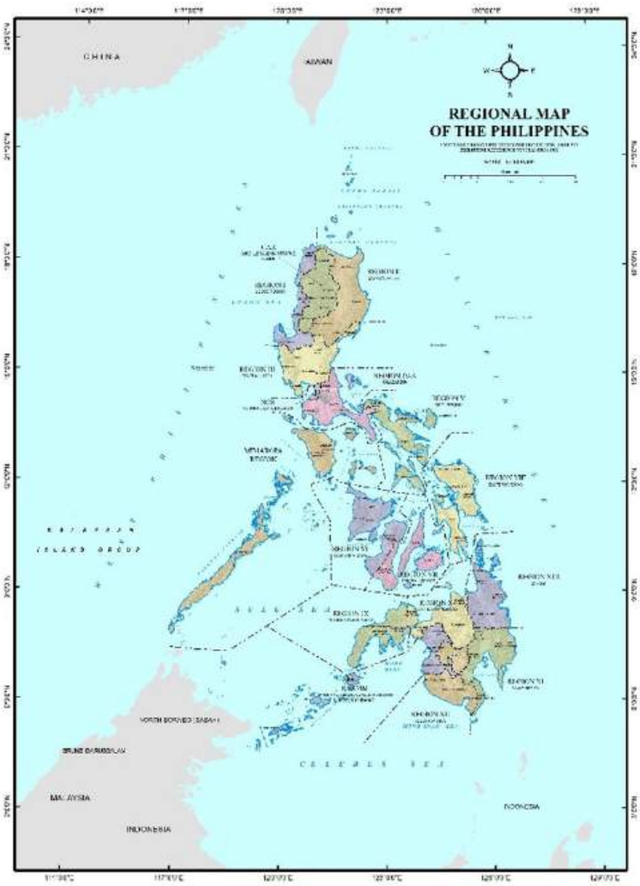


Figure 2.1.1 Location map

Being in the Tropical Cyclone belt and the Pacific Ring of Fire, the country is extremely vulnerable to climate-related and geological hazards, with around 20 tropical cyclones a year and almost daily seismic shocks. These result in losses and damage for the country at an average of 0.5% of GDP annually.[22]

[20] Water Environment Partnership in Asia (WEPA)

[21] Convention on Biological Diversity. Philippine Country Profile. Retrieved from https://www.cbd.int/countries/profile/?country=ph

[22] The Philippines' Nationally Determined Contribution (NDC) as submitted in 2021, and 2011 Philippine Disaster Risk Reduction and Management Plan (PDRRMP)

Metro Manila, the country's largest metropolis comprising 16 cities (including the capital, Manila City) and one municipality, is strategically located in the middle of Luzon. It is bounded by Manila Bay on the west and Laguna de Bay on the southeast. The Pasig River, a major waterway, runs through the metropolis. The 633-square-kilometer metropolis sits in the middle of a floodplain, one of the biggest in the country. Metro Manila has a population of 13.48 million as of 2020.[23]

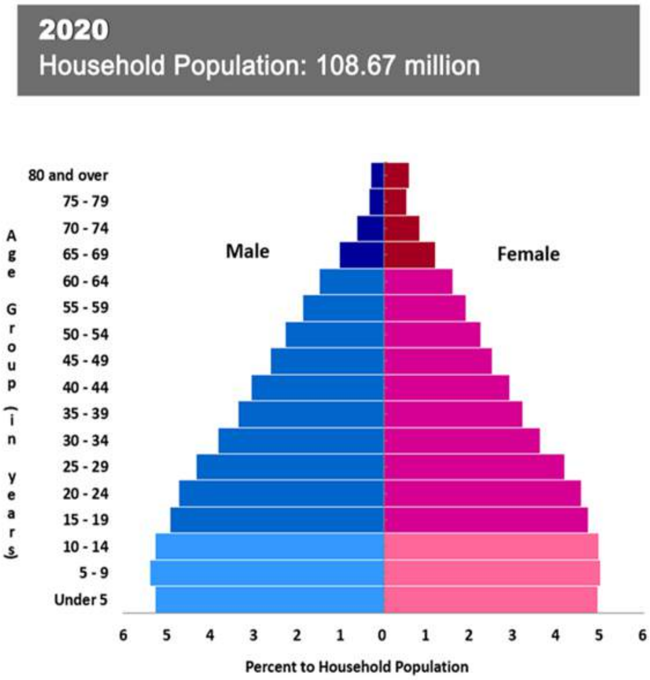
Other major metropolitan areas in the Philippines are Metro Cebu and Metro Davao as indicated under the Philippine Development Plan (PDP) 2017-2022.[24]


Banaue Rice Terraces, Ifugao

2.2 Population

Based on the 2020 Census of Population and Housing conducted by the Philippine Statistics Authority (PSA), the national population is 109,035,343. With an increase of 8,053,906 persons from the 2015 Census, the average annual population growth rate is at 1.63%. Given this growth, by 2045, the Philippines is estimated to have a population of 142 million.[25]

In terms of age and sex disaggregation of the household population, the Philippine population consists of 50.6% males and 49.4% females. This translates to a sex ratio of 103 males per 100 females.



In terms of age distribution, 33.4 million Filipinos (30.7%,) are under 15 years old and are considered young dependents, while 5.86 million (5.4%) are over 65 years old and are regarded as old dependents. These age groups are the most vulnerable to climate change. Conversely, almost 60.40 million Filipinos (64%) are between 15 to 65 years old, representing the working age or in the economically active population. The overall dependency ratio in the Philippines declined in 2020 to 57 dependents per 100 working-age population, down from 58 dependents per 100 working-age population in 2015.

The country's functional literacy rate stands at 91.6% based on the 2019 Functional Literacy, Education and Mass Media Survey (FLEMMS) , a rate that is generally higher than the results from the 2013 survey. A high functional literacy rate indicates a population equipped with skills beyond basic reading and writing, implying a better ability to function fully and efficiently.

[25] Based on projected population from 2010 Census of Population and Housing, PSA

In terms of population distribution, Region IV-A CALABARZON has the highest concentration, with 15% of the population residing in the region. It is followed by the National Capital Region (12%), and Region III Central Luzon (11%). The least populous regions are the Cordillera Administrative Region (2%), Region XIII CARAGA (2.5%), and Region IV-B MIMAROPA (3%).

Drawing from the report of the Philippine Ocean Economy Satellite Accounts (POESA), out of the 1,500 municipalities, 832 (55.47%) are located along the coast. Additionally, 57 (48.72%) of the 117 cities are coastal and 64 (81.01%) of the 72 provinces have coastal domains.

In terms of urbanization, 54% of the population resides in urban barangays, representing an increase of 2.8% or 7.2 million people moving from rural to urban areas since the 2015 CPH.

Based on the 2018 National Migration Survey by the PSA and the University of the Philippines, the primary regional destinations for lifetime migrants—individuals who have moved and relocated from their place of birth or their usual residence and have no intention of returning—include NCR (National Capital Region), Region IV-A CALABARZON, Central Luzon, Davao Region, and Central Visayas.

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Although no national data is available regarding population displacement from extreme weather events, the IPCC states that Asia has the highest number of individuals displaced by such events.

Population growth, characteristics, and distribution are significant considerations in policy development, planning, and implementation. It is crucial to incorporate these factors when evaluating the needs and gaps in ecosystem services, as well as the broader requirements of the population, aligning with national economic and sustainable development goals.

Population growth and migration trends need careful examination, especially in the context of movements towards high-risk and disaster-prone areas. These factors highlight the need for proactive measures and strategies to tackle challenges arising from population dynamics and their interplay with the effects of climate change.

Bangui, Ilocos Norte

The breakdown of age groups and the dependency ratio reveal which portions of the population are vulnerable to climate hazards and which might present an additional dependency burden. Consequently, any adaptation measures implemented should consider the context of these groups. Additionally, given the presented sex ratio, it is vital that adaptation measures are gender-responsive and guarantee inclusive and equal representation in the decision-making process.

2.3 Economy

The Philippines has shown overall significant progress in economic development despite challenges caused by geopolitical conflicts, the COVID-19 pandemic, and domestic issues in the previous years. Before the pandemic, the Philippines gross domestic product (GDP) had an average growth rate of 5%.[28] There was a notable progress, with the GDP growing at 7.6 percent in 2022, surpassing the target of 7.5%. Additionally, there was a decline in both the unemployment and underemployment rates during the same period.[29]

The country's economy is largely attributed to three (3) key industry sectors: (1) agriculture, hunting, forestry, and fishing; (2) industry; and (3) services.

In the first quarter of 2023, services contributed 61.1% of the total GDP, while the industry and the agriculture, hunting, forestry, and fishing sectors contributed 29.9% and 9.1%, respectively.[30]

The country has garnered positive assessments from credit rating agencies. As of 2022, S&P Global gave the Philippines a credit rating of BBB+, while Fitch and Moody's Investor Service assigned BBB and Baa2 ratings, respectively. These investment grade ratings reflect the Philippines' robust economic outlook, supported by strong domestic spending from both the public and private sectors, rapid economic growth, a flourishing service sector, reduced inflation, currency appreciation, increased foreign exchange reserves, and a lower proportion of government debt to GDP.

In terms of economic performance, the Philippines achieved an impressive 6.4% GDP growth in the first quarter of 2023, placing it among the fastest-growing economies globally.[32] Furthermore, in the fourth quarter of 2022, the Philippines recorded a 7.2% growth in GDP, demonstrating its resilience as one of the better-performing economies in the region.[32]

Currency dynamics have played a significant role in shaping the economic landscape. In 2022, the Philippine peso depreciated from PHP51.23 per US dollar in January to a rate of PHP58.82 in October.[33] Meanwhile, the gross international reserves of the Philippines increased to USD102 billion by the end of March 2023, up from USD98.2 billion in February of the same year. The government's debt-to-GDP ratio reached 60.3% at the end of 2022, up from 39.6% in 2019. This ratio is in line with countries like Thailand, while Malaysia and Singapore have even higher ratios. The Philippine Stock Exchange, Inc. (PSE), anticipates a rebound in local shares in 2023, banking on the further economic reopening after a 7.8% drop in the main index in 2022.


Mayon Volcano, Albay

[28] Extracted from PSA Openstat: https://openstat.psa.gov.ph/

[29] NEDA Annual Report 2022: Stewarding the Transition from Recovery to Socioeconomic Transformation

[30] Extracted from PSA: https://psa.gov.ph/national-accounts/sector/Services; https://psa.gov.ph/national-accounts/sector/Industry; https://psa.gov.ph/national-accounts/sector/Agriculture,%20Forestry%20and%20Fishing

[31] Extracted from PSA: https://psa.gov.ph/content/gdp-expands-64-percent-first-quarter-2023#:~:text=The%20Philippine%20Gross%20Domestic%20Product,the%20second%20quarter%20of%202021

[32] Extracted from PSA: https://psa.gov.ph/content/gdp-expands-72-percent-fourth-quarter-2022-and-76-percent-full-year-2022

[33] Bangko Sentral ng Pilipinas. Retrieved from: https://www.bsp.gov.ph/statistics/external/Table%2012.pdf

The Philippines remains highly vulnerable to natural hazards, particularly those linked to climate and weather. This vulnerability is not just due to the direct impacts of changing climate patterns. The population's limited capacity to protect, adapt to, and manage their environment—stemming from poverty, lack of knowledge, and insufficient resources—also contributes. Furthermore, the country's heavy reliance on coastal areas and the exploitation of natural resources from the sea, land, and forests by many Filipino families heightens its susceptibility to the adverse effects of climate change.

Guided by the Ambisyon Natin 2040 or the long-term vision of the Philippine government for socioeconomic development, the administration of President Ferdinand Romualdez Marcos, Jr. adopted the Philippine Development Plan (PDP) 2023-2028 with specific actions to achieve the 8-point socioeconomic agenda of the national government:

1. Protect purchasing power and mitigate socioeconomic scarring by ensuring food security, reducing transportation and logistics costs, and lowering energy expenses for households.
2. Reduce vulnerability and long-term adverse effects of the COVID-19 pandemic by addressing health concerns, strengthening social protections, and tackling learning losses.
3. Ensure sound macroeconomic fundamentals by enhancing bureaucratic efficiency, implementing robust fiscal management practices, and fostering a resilient and innovative financial sector.
4. Create more job opportunities by promoting trade and investments, improving infrastructure, and attaining energy security.
5. Create high-quality jobs by enhancing employability, promoting research and development, fostering innovation, and strengthening the digital economy.
6. Create green jobs by pursuing a green economy and establishing livable and sustainable communities.
7. Uphold public order, safety, peace, and security
8. Ensure a fair and competitive environment by strengthening market competition and reducing barriers to entry and entrepreneurship.

Baseline information provided in the PDP includes the total accounted loss and damage of PHP673.3 billion from tropical cyclones from 2011 to 2021.[38] Under the business-as-usual (BAU) scenario, the loss and damage from climate change is anticipated to increase, potentially account for up to 7.6% of the nation's GDP by 2030 and 13% by 2040.[39]

As sustainable development is an integral part of the long-term climate change adaptation planning, the impact to poverty eradication is a crucial indicator of NAP effectiveness, a significant motivator to ensure inclusive transformation of both the economy and society.

The preliminary results showed that 19.99 million Filipinos (18.1%) are living below the poverty threshold, and 3.50 million families (13.2%) were considered poor.[40]

The highest poverty incidence was recorded in the Bangsamoro Autonomous Region in Muslim Mindanao (BARMM), while the lowest was in the National Capital Region, followed by the Cordillera Administrative Region, Region III Central Luzon, and Region IV-A CALABARZON.

[38] Philippine Development Plan 2023-2028.
[39] Philippines Country Climate and Development Report 2022, World Bank Group.
[40] Preliminary 2021 Full Year Official Poverty Statistics of the Philippines, PSA.

These realities underscore the imperative for the Philippines to enhance its resilience and preparedness in the face of climate-related challenges, ensuring sustainable development and safeguarding the well-being of its population. Under the PDP 2023-2028,

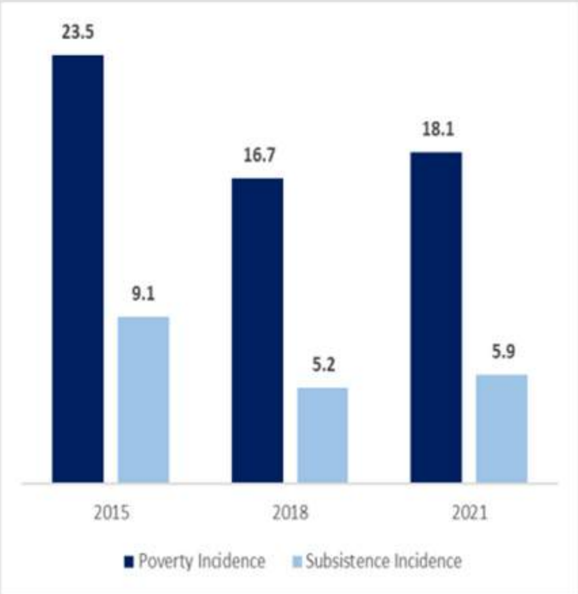


Figure 2.3.1 presents information on poverty incidence in the Philippines based on the preliminary results of the 2021 Family Income and Expenditure Survey (FIES).

it is a priority of the government to accelerate poverty eradication and bring the poverty incidence to a single digit, building on strategies that were sustained in the past years including increasing human capital investments and further expansion of the conditional cash transfers or the Pantawid Pamilyang Pilipino Program (4Ps).

Part of achieving deep economic and societal transformation is the attainment of the Philippines' vision of becoming an upper middle-income country by 2025, and further sustained high levels of growth until 2040.

2.4 Governance

The Philippines is a democratic republic with a presidential system of government. The powers of the government are equally divided among three (3) sovereign yet interdependent branches: Executive, Legislative, and Judicial. This system ensures checks and balances while adhering to the doctrine of separation of powers.

- **Executive branch.** Executive power resides in the President of the Philippines as Head of State and Head of Government. The President exercises control over the executive departments, bureaus, and offices. The executive branch exercises supervision over local government units.
- **Legislative branch.** Legislative power is vested in the Congress of the Philippines, with its two chambers the Senate and the House of Representatives, in enactment of national laws and statutes including the annual national budget.
- **Judicial branch.** Judicial power rests in the Supreme Court, and its appellate and lower tribunals as established by law. The judiciary exercises the power of judicial review.

Overview of Climate Change
and the Comission Conference

[38] Philippine Development Plan 2023-2028.

[39] Philippines Country Climate and Development Report 2022, World Bank Group.

[40] Preliminary 2021 Full Year Official Poverty Statistics of the Philippines, PSA.

At the local level, the territorial and political subdivisions of the Philippines are provinces, cities, municipalities, barangays, special metropolitan subdivisions, and autonomous regions. Moving towards decentralization, Congress enacted Republic Act No. 7160, also known as the Local Government Code in 1991. This code empowered LGUs to enjoy local autonomy and exercise specific powers that were decentralized and devolved by the national government. The President of the Philippines exercises general supervision over LGUs.

To further the autonomy of LGUs, Executive Order No. 138, s. 2021 was issued. This supports the efficient implementation of the Supreme Court Ruling on the Mandanas-Garcia case and strengthens the autonomy and empowerment of LGUs. The order directs the full devolution of certain functions from the Executive Branch to the LGUs.

In terms of **local administrative jurisdictions**, the country is divided into 17 administrative regions, with a total of 82 provinces, 148 cities, 1,486 municipalities, and 42,047 barangays, the smallest political unit.[41]

The 1987 Philippine Constitution mandates that it is the policy of the State to afford full protection and the advancement of the right of the people to a balanced and healthful ecology… to fulfill human needs while maintaining the quality of the natural environment for current and future generations.

Anchored on the above, the Philippine government established the Climate Change Commission (CCC), with the President as its Chairperson, as the lead policy-making body of the government tasked to coordinate, monitor, and evaluate the programs and action plans relating to climate change. The CCC is created by virtue of Republic Act No. 9729 or the 'Climate Change Act of 2009', later amended by Republic Act No. 10174.

Specific functions of the CCC are as follows[42]:

a. Coordinate and synchronize climate change programs in consultation with national government agencies and other stakeholders

b. Formulate a Strategic Framework on Climate Change to serve as the basis for a program for climate change planning, research and development, extension, and monitoring of activities on climate change

c. Exercise policy coordination to ensure the attainment of goals set in the strategic framework and program on climate change

d. Recommend legislation, policies, strategies, programs on and appropriations for climate change adaptation and mitigation and other related activities

e. Recommend key development investments in climate-sensitive sectors, such as water resources, agriculture, forestry, coastal and marine resources, health, and infrastructure to ensure the achievement of national sustainable development goals

f. Create an enabling environment for the design of relevant and appropriate risk-sharing and risk-transfer instruments


Climate Change Commission
Vice Chairperson and Commissioners

[41] Philippine Standard Geographic Code as of 31 March 2023, PSA
[42] Section 9 of the RA No. 9729 as amended

g. Create an enabling environment that shall promote broader multi-stakeholder participation and integrate climate change mitigation and adaptation
h. Formulate strategies for mitigating GHG emissions, anthropogenic sources and enhance removal by sinks
i. Coordinate and establish a close partnership with the National Disaster Risk Reduction and Management Council to increase efficiency and effectiveness in reducing the people's vulnerability to climate-related disasters
j. In coordination with the Department of Foreign Affairs, represent the Philippines in climate change negotiations, constitute and lead the Philippine panel of negotiators to the UNFCCC and the formulation of official Philippine positions on climate change negotiation issues, and decision areas in the international negotiation arena
k. Formulate and update guidelines for determining vulnerability to climate change impacts and adaptation assessments and facilitate the provision of technical assistance for their implementation and monitoring
l. Coordinate with local government units (LGUs) and private entities to address vulnerability to climate change impacts of regions, provinces, cities, and municipalities
m. Facilitate capacity building for local adaptation planning, implementation, and monitoring of climate change initiatives in vulnerable and marginalized communities and areas
n. Promote and provide technical and financial support to local research and development programs and projects in vulnerable and marginalized communities and areas
o. (o) Oversee the dissemination of information on climate change, local vulnerabilities and risks, relevant laws and protocols, and adaptation and mitigation measures
p. (p) Establish a coordination mechanism with the concerned government agencies and other stakeholders to ensure transparency and coherence in the administration of climate funds taking into consideration the official Philippine position in international negotiations
q. (q) Perform such other functions as may be necessary for the effective implementation of this Act.

Since its establishment, the CCC developed policy frameworks and national planning documents that guide the formulation and implementation of climate change programs by relevant NGAs, LGUs, institutions, and stakeholders:

- **National Framework Strategy on Climate Change (NFSCC)**. Formulated in 2010, sets the country's agenda for climate change adaptation as an anchor strategy while capitalizing on mitigation opportunities. The Framework served as a basis for the national program on climate change. It identified Key Result Areas to be pursued in key climate-sensitive sectors in addressing the adverse effects of climate change both under adaptation and mitigation.
- **National Climate Change Action Plan (NCCAP)**. Formulated in 2012, the NCCAP serves as the operational plan of the NFSCC. It outlines the country's long-term agenda for adaptation and mitigation for 2011 to 2028. It outlines key strategies to enhance the adaptive capacity and resilience of vulnerable communities and ecosystems to climate change.

- A NCCAP Result Based Monitoring and Evaluation (RBMES) was implemented to comprehensively monitor and evaluate the NCCAP Implementation. The RBMES was built on government initiatives to integrate climate and disaster risk into the planning process. Using the RBMES, the Philippines conducted the NCCAP M&E report for FY 2011-2016. The report examined the government's actions in mainstreaming climate change through enabling policies, plans, programs, institutional capacities, and knowledge management systems. The M&E findings highlighted the need to improve the institutional capacity of the government and enhance convergence amongst government institutions to implement and monitor climate programs on the ground.

- National Climate Risk Management Framework (NCRMF). Adopted in 2019 through a Commission Resolution, it underpins the Philippines' climate change adaptation and loss and damage management work seeking to advance the risk assessment methodology in view of the increasing uncertainty surrounding climate change.
- Nationally Determined Contribution (NDC). Submitted to the UNFCCC in April 2021, it sets the country's 75 percent[43] greenhouse gas emission reduction and avoidance target for the Agriculture, Waste, Industry, Processing, and Product Use, Transport, and Energy sectors for 2020 to 2030.

Furthermore, the CCC developed the Philippine Country Programme for the Green Climate Fund for the period 2019 to 2023 considering the need for the Philippines to access the GCF for the implementation of the adaptation and mitigation programs and projects for the achievement of climate resilience and green growth. The PCP was developed in alignment with the GCF's strategic result areas and investment criteria, particularly country ownership and sustainable development potential, and aimed at ensuring gender-responsiveness and compliance with environmental and social safeguards. There were nine (9) thematic areas classified for the programs and project concepts in the PCP namely:

1. Enabling the overall environment for green finance and climate investments
2. Development and promotion of climate-resilient frameworks, practices, and business systems in the agriculture and fisheries sectors
3. Promotion of sustainable energy and transport
4. Integration of resource- and energy-efficient designs and systems in domestic, commercial, and industrial use
5. Promotion of green, sustainable, and livable cities
6. Development of climate-resilient ecosystems
7. Promotion of climate-responsive social protection programs
8. Provision of climate information services
9. Integration and active involvement of indigenous peoples in Climate Change Adaptation and Mitigation- Disaster Risk Reduction (CCAM-DRR) initiatives.

Figure 2.4.1 shows the timeline of climate change-related laws and policies since 1987. Prior to enacting the Climate Change Act, several climate-related policies and laws were already in place that aimed to address the impacts of climate change, promote environmental protection, and preserve and conserve natural resources.

- **Administrative Order No. 220 s. 1991** established an Inter-Agency Committee on Climate Change tasked to formulate climate change policies and response strategies, identify information needs for UN negotiations, establish working groups to monitor and assess local climate change, environment, and socio-economic impacts, and appoint a focal point to engage with international organizations.
- **Administrative Order No. 171 s. 2007** created the Philippine Task Force on Climate Change (PTFCC) to assess and address the impacts of climate change, implement measures to prevent and reduce greenhouse gas emissions and compliance with air emission standards, conduct public awareness and coordination with international partners, and mainstream climate change in government policies, programs, and plans.

[43] Attaining 72.29% of the target is conditional and contingent upon availability of access to support from developed countries while the remaining 2.71% is unconditional and implemented mainly using domestic resources.

- **Executive Order No. 774 s. 2008** reorganized the PTFCC and established task groups to implement adaptation and mitigation measures in environmental protection, water management, agriculture and fisheries, transport and energy sectors, information and education, international relations, and economic development.
- **Proclamation No. 1667 s. 2008** declared the celebration of the "Global Warming and Climate Change Consciousness Week" on November 19 to 25 of every year.
- **Executive Order No. 785 s. 2009** mandates the PTFCC to develop a National Climate Change Framework and coordinate, monitor, and review the country's climate change adaptation and mitigation programs. The EO also instructs for the development of a National Information, Education, and Communication Program on climate change.
- **Republic Act No. 8435** – Agriculture and Fisheries Modernization Act aims to modernize the agriculture and fisheries sector by advancing new technology, promoting equitable access to resources, pursuing a market-driven approach, increasing profitability, ensuring food security and promoting sustainability, and empowering small farmers and fisherfolk. The act required the regular monitoring and consideration of the effects of climate change, weather disturbances, and the annual productivity cycle in developing agriculture and fisheries production programs.
- **Republic Act No. 8749** – Clean Air Act of 1999 established the country's air quality management program to prevent emissions and to meet the prescribed air emission standards. The Act also required the development of national plans to reduce greenhouse gas emissions in the country.
- **Republic Act No. 9003** – Ecological Solid Waste Management Act of 2000 aims to establish a comprehensive national and local solid waste management and implement measures to reduce and manage the growing solid waste problem in the country. The Act mandates establishing and operationalizing sanitary landfills as a final disposal site. The act was later amended by RA 11898 or the Extended Producer Responsibility Act of 2022.
- **Republic Act No. 9275** – Philippine Clean Water Act of 2004 was enacted for the purpose of protecting and preserving, and management of the country's water resources from pollution and meeting the set water quality standards and regulations.
- **Republic Act No. 9513** - Renewable Energy Act of 2008 was enacted to support the mainstreaming, adoption, development, and increased utilization of renewable energy sources into the country's energy mix.
- **Republic Act No. 10174, amending Republic Act No. 9729** – The People's Survival Fund of 2012 was established to provide long-term finance streams to enable the government to effectively address the problem of climate change.

Other enacted climate-related laws highlight the commitment of the country to strengthen disaster preparedness, response, and recovery, scale up environmental conservation and protection, and just transition to a green economy.

- **Republic Act No. 10121** – Philippine Disaster Risk Reduction and Management Act of 2010 was enacted to strengthen the capacity of national and local governments in implementing measures to prepare, respond, and recover from disasters. The Act also established the National Disaster Risk Reduction Management Council (NDRRMC), composed of representatives from the government, private sectors, civil society organizations, and other stakeholders, which served as oversight in the formulation of Disaster Risk Reduction policies, plans, and measures.
- **Republic Act No. 10771** – Philippine Green Jobs Act of 2016 aims to scale up and promote sustainable growth and decent job creation and guide the transition into a green economy. The Act established incentive mechanisms for companies to generate and sustain green jobs.
- **Republic Act No. 11038** – Expanded National Integrated Protected Areas System Act of 2018 was enacted to further enhance efforts in the conservation and protection of Protected Areas (PA).

- **Republic Act No. 11285** – Energy Efficiency and Conservation Act of 2019 was enacted to institutionalize energy efficiency and conservation measures in the country.
- **Republic Act No. 11697** – Electric Vehicle Industry Development Act was enacted to provide an enabling environment in the development, promotion, and adoption of the use of electric vehicles (EV) in the country. The act also mandates the formulation of the Comprehensive Roadmap for the Electric Vehicle Industry (CREVI), which outlines the EV industry's plan to accelerate the development, commercialization, and utilization of EVs in the country.
- **Republic Act No. 11898** – Extended Producer Responsibility Act of 2022 was enacted to reduce the amount of plastic waste. The Act requires companies to implement programs to recover a percentage of their plastic packaging waste and submit an annual compliance report.

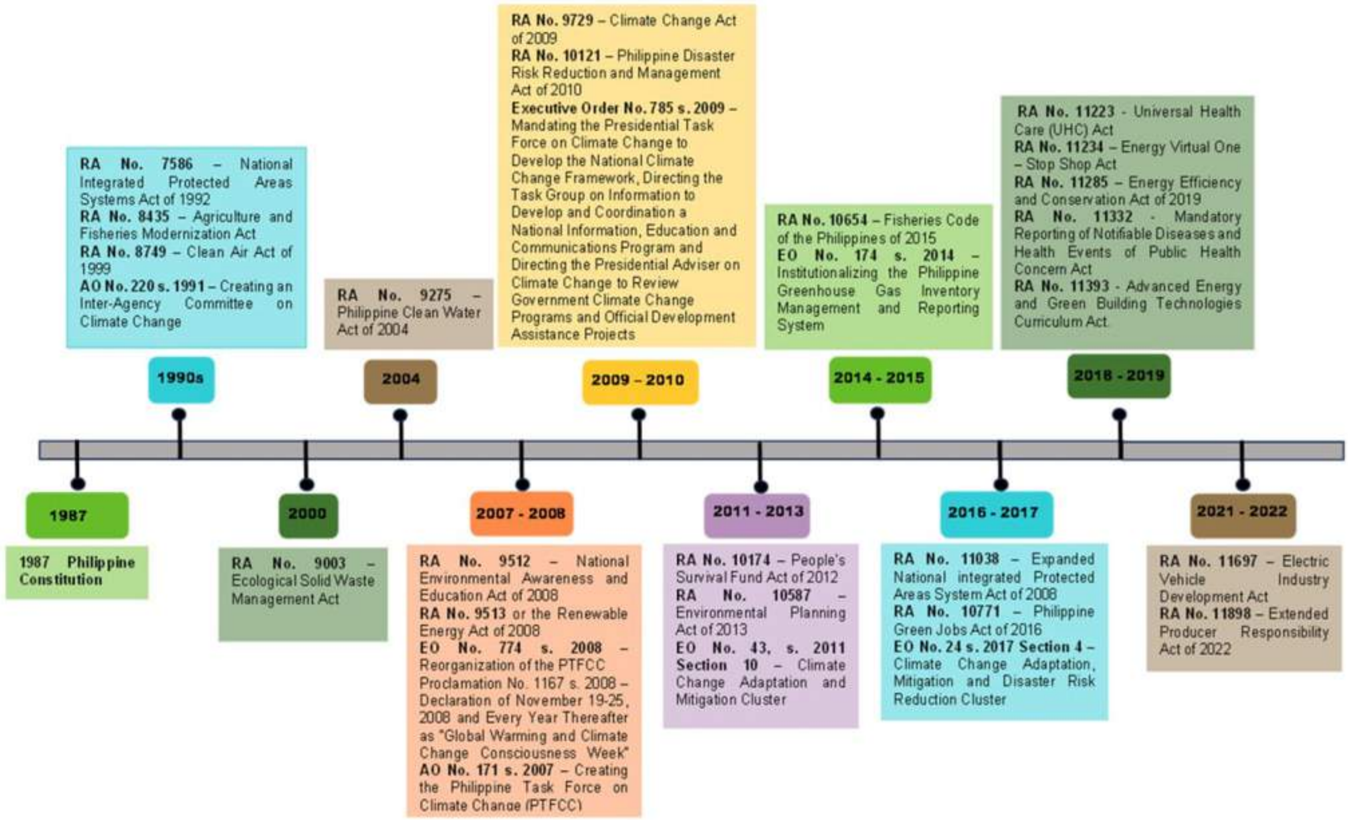
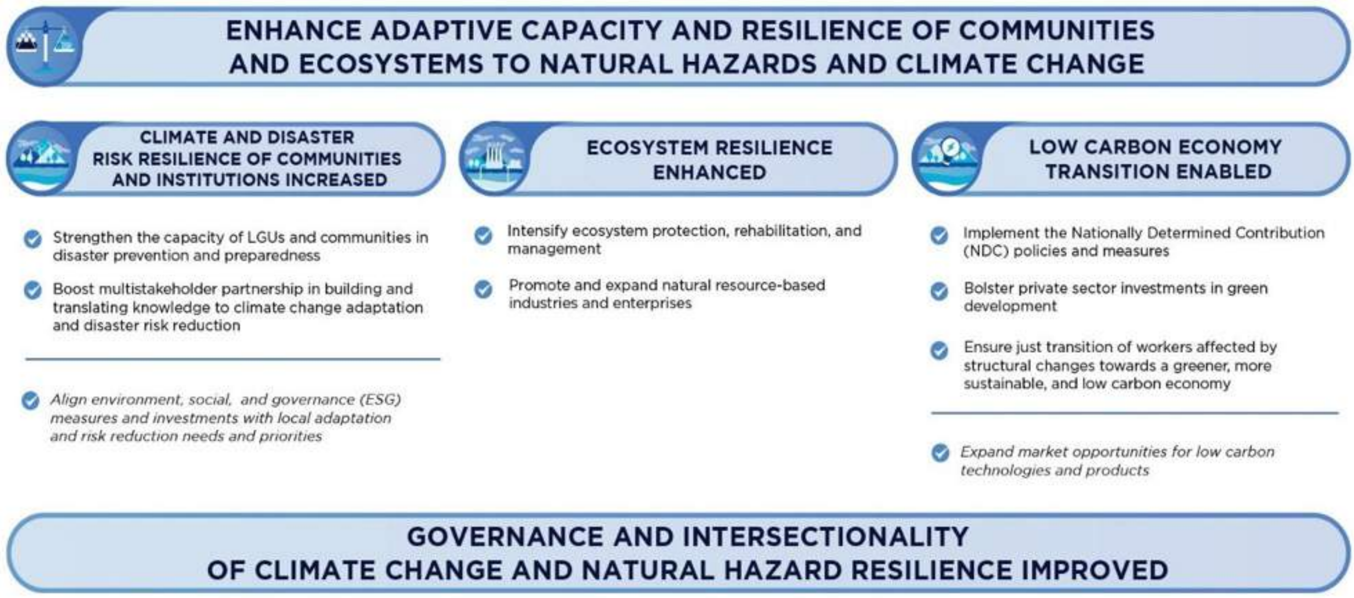


Figure 2.4.1 Philippine Climate Change-Related Laws and Policies (1987 - 2022)[44]

The Philippine government has adopted the Philippine Development Plan (PDP) 2023-2028 as the guide in development planning and socio-economic policies, strategies, and programs. It has a dedicated chapter for climate change—Chapter 15: Accelerate Climate Action and Strengthen Disaster Resilience, which outlines strategies for enhanced adaptive capacity and resilience through: (1) increased climate and disaster risk resilience of communities and institutions, (2) enhanced ecosystem resilience, and (3) enabling low carbon economy transition.

[44] Note: The list of climate-related laws and policies is not exhaustive



Note: Strategies above the dashed lines require action by government entities, and those below by non-government entities.

Figure 2.4.2 PDP 2023-2028 Chapter 15 Strategy Framework

Figure 2.4.3 illustrates how the NAP aligns with various climate change plans and frameworks of the Philippines, considering their respective timeframes.

The PDP, guided by the Ambisyon Natin 2040, functions as a medium-term socioeconomic blueprint updated every six years. The updated PDP is expected to incorporate climate change considerations, aligning development goals with climate adaptation and resilience.

The NFSCCC articulates the country's approach to climate change and serves as a long-term framework. It is expected to evolve into a Long-term Strategy (LTS) that aligns with shifting climate priorities, especially after the completion of the NDC Implementation Plan (NDCIP) and the NAP. Both documents have targeted strategies set for long-term horizons.

From an operational perspective, the elements of the updated NCCAP will be managed using iterative results and practical evidence from the NDC and NAP. Specifically, the evaluation results from the NDC and NAP will guide the review and updating of subnational, sectoral, and local plans, such as the Local Climate Change Action Plan (LCCAP). This approach ensures that adaptation strategies align with the broader national climate action agenda, encompassing both mitigation and adaptation efforts.


Manila, National Capital Region

[44] Note: The list of climate-related laws and policies is not exhaustive

In conclusion, the Philippines follows a multi-tiered approach to climate change planning and policy development, ranging from short-term to long-term. This allows the country to address both immediate and future climate challenges while integrating climate considerations into broader development objectives.

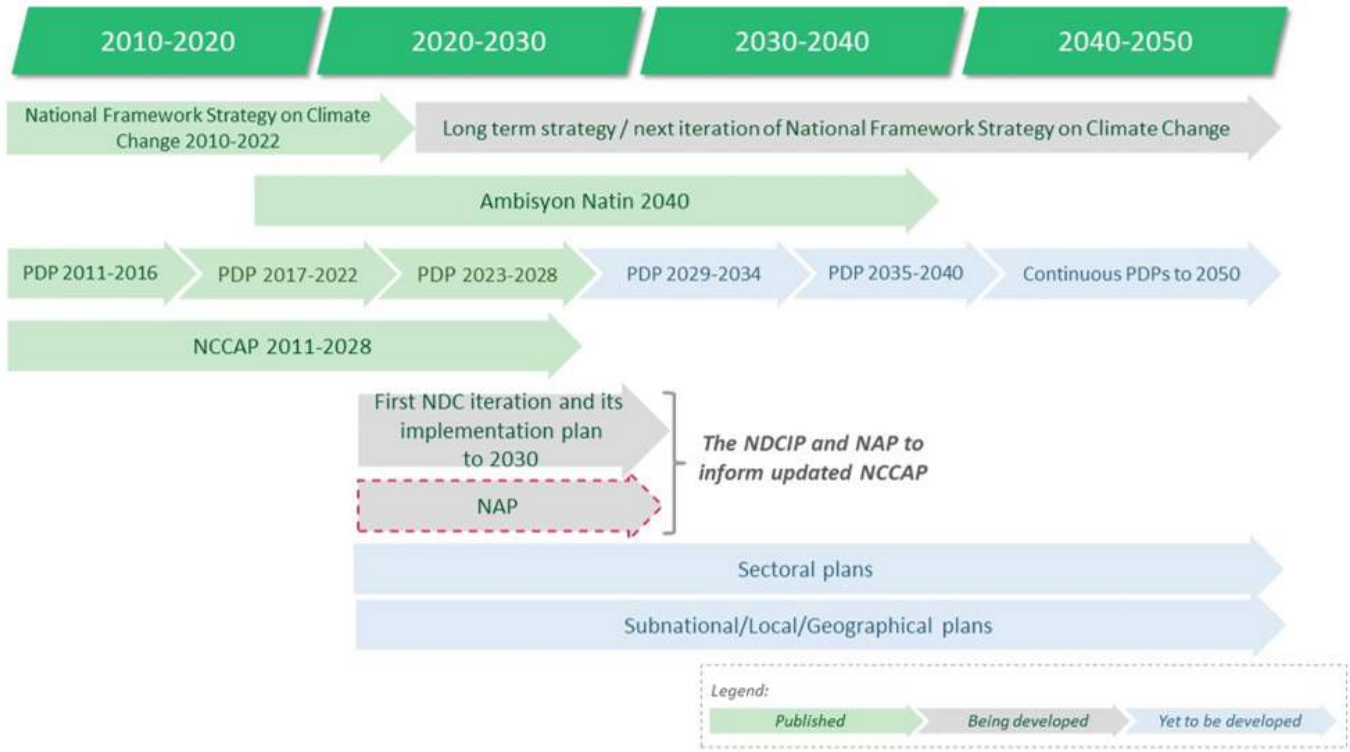


Figure 2.4.3 Philippine Climate Change Plans and Frameworks

03

Climate Change in the Philippines

3. Climate Change in the Philippines

3.1 Introduction

Chapter 3 presents historical climate trends, possible future climate scenarios, and the implications to the Philippines from a physical, social, and economic perspective.

To comprehensively grasp the implications of climate change in the Philippines, climate trends and extreme events that have had the most impact on the country were considered, specifically concentrating on four climatic impact-drivers (CIDs) deemed most critical to the Philippines' vulnerability (see figure 3.1.1). These CIDs have also been identified in consultation with national climate experts (i.e., National Panel of Technical Experts and Consultative Group of Experts for the Philippines' NAP development). **These CIDs are increased temperatures and drought, sea level rise and extreme sea levels, extreme precipitation, and extreme wind and tropical cyclones (see table 3.1.1).**

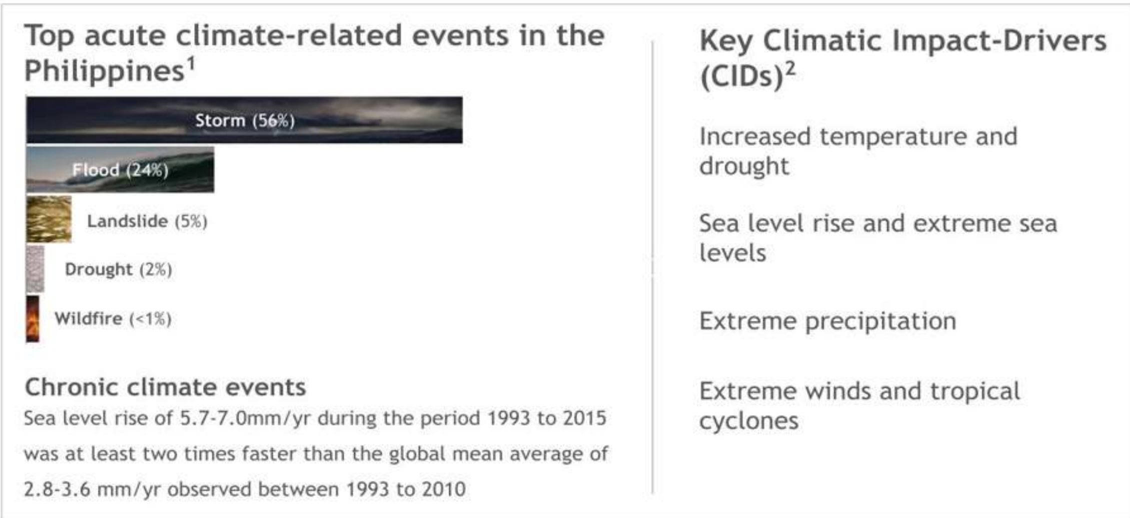


Figure 3.1.1: Climatic Impact Drivers relevant for the Philippines[45]

1: Size of bar corresponds to % of total annual natural hazards occurrence during 1990 to 2018;

2. Aligned with NPTE's identified top climate risks for the Philippines; 3. Based on satellite observations (AVISO altimetry data) taken from 1993 to 2015, the sea level has risen by as much as 5.7-7.0 mm/yr over the Philippine Sea. Such rate is approximately double the highest global average rate of 2.8-3.6 mm/yr, which was observed between 1993 to 2010.

[45] BCG analysis on based on Climate Watch. (n.d.). Philippines (PHL) Country Profile; PAGASA. (2018). Observed Climate Trends and Projected Climate Change in the Phils 2018 [Report]

Aftermath of Typhoon Rolly in Catanduanes, 2020

Table 3.1.1 Description and importance of selected CIDs in the Philippines

CID	Brief Description	Importance in the Philippines
Increased temperature and drought	Increased temperature—episodic high surface air temperature events potentially exacerbated by humidity Drought—an exceptional period of water shortage for existing ecosystems and the human population (due to low rainfall, high temperature and/or wind)	The Philippines, with substantial outdoor activities, faces the ramifications of increased temperature events and droughts, bearing significant socio-economic consequences. These span from human well-being, labor efficiency, and economic operations. Furthermore, any further temperature escalation pushes people into the hazardous range of the heat index, intensifying the urgency of addressing these challenges.
Sea level rise and extreme sea levels	Sea level rise—chronic and long-term increase of sea levels considering factors such as sterodynamic sea levels, glaciers, land water storage, icesheets, and subsidence Extreme sea levels—acute, temporary, and short term increase of sea levels such as storm surge, astronomical tides, waves, and swash	The Philippines has a vast coastline and numerous low-lying areas, making it vulnerable to sea level rise and extreme sea levels, which can result in coastal flooding (flooding driven by episodic high coastal water levels that results from a combination of relative sea level rise, tides, storm surge, and wave setup) and coastal erosion(long term or episodic change in shoreline position caused by relative sea level rise, nearshore currents, waves and storm surge).

CID	Brief Description	Importance in the Philippines
Extreme precipitation	An exceptional period of water shortage for existing ecosystems and the human population (due to low rainfall, high temperature and/or wind) Pluvial flooding—inundation of land and urban areas caused by heavy precipitation, where the excess water cannot be efficiently absorbed or drained due to factors such as impermeable surfaces and inadequate drainage systems Fluvial flooding—occurs when rivers and streams exceed their capacity and overflow their banks due to intense or prolonged precipitation	The Philippines experiences heavy precipitation, especially during the monsoon season. Extreme precipitation events can cause floods and landslides, leading to loss of life, property damage, loss of agriculture production, and disruption of infrastructure.
Extreme winds and tropical cyclones	Warm-core low pressure systems associated with a spiral inflow of mass at the bottom level and spiral outflow at the top level	The Philippines is highly vulnerable to tropical cyclones, which can cause significant damage to infrastructure, agriculture, and coastal areas, posing a threat to lives.

In this chapter, historical trends and future climate risks for each CID are examined from both global and country-specific perspectives. This approach enhances the understanding of climate risks in the country, which helps support adaptation planning and decision-making processes through identifying the most impacted areas in the Philippines.

3.2 Historical climate trends

Human-induced climate change is already affecting many weather and climate extremes in every region across the globe. This discussion will specifically focus on historical climate trends, particularly those related to the identified key climatic impact-drivers (CIDs). Evidence of observed changes in extremes such as heatwaves, heavy precipitation, droughts, and intensifying tropical cyclones, and their attribution to human influence, has become more compelling. As the urgency of addressing human-induced climate change grows to meet the goals of the Paris Agreement, the impacts are being felt across various regions and climates, including the Philippines.

The Philippines is one of the world's most vulnerable countries to the impacts of climate change. Ranked 1st on the World Risk Index in 2023 among 193 countries worldwide, the country is continuously exposed to often catastrophic extreme weather events, such as devastating tropical cyclones (Luz, 2022). Most areas of the country and 74 percent of the population are at risk and vulnerable to climate-induced disasters. High levels of disaster risk are associated with more intense tropical cyclones, including heavy precipitation and floods, sea level rise, and extreme heat and droughts. As a result, both rural and agricultural systems, along with numerous other sectors in the country, are facing a growing vulnerability to climate-related risks, including the cascading impacts of extreme weather events, leading to substantial losses and damages.

In general, the country has four major climate types based on rainfall distribution (see Figure 3.2.1).

[45] World Bank Climate Change Knowledge Portal

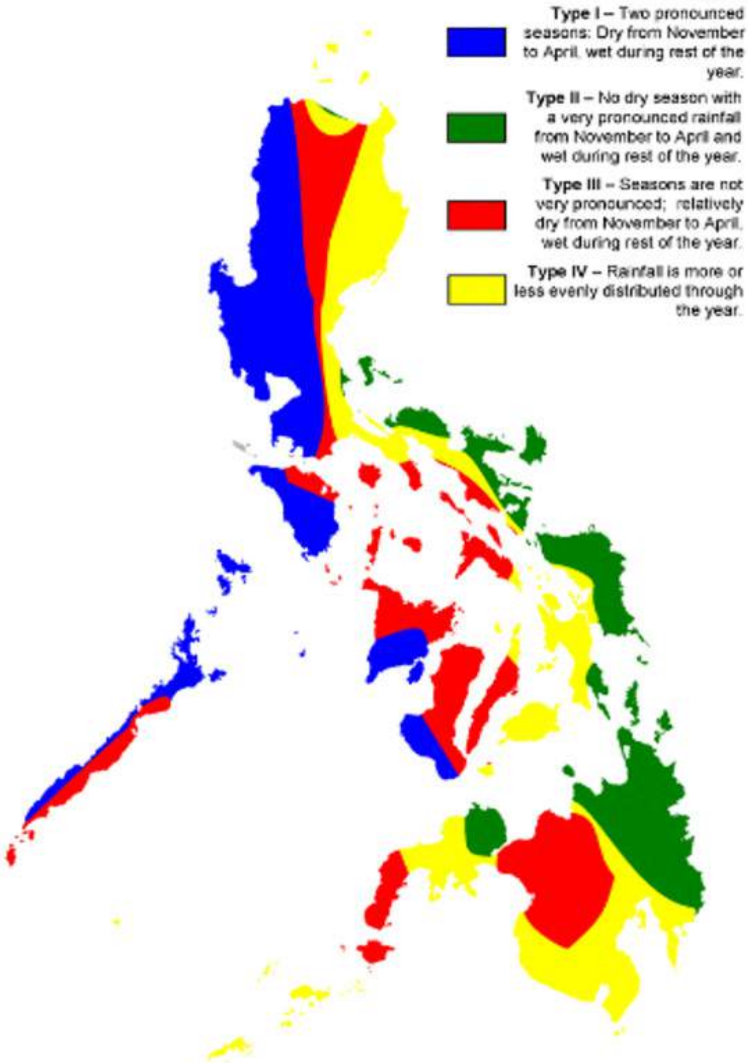


Figure 3.2.1: Four climate types of the Philippines based on Modified Coronas Classification System

The country has an extensive coastline of 36,289 km surrounded by the Philippine Sea and the Pacific Ocean on the east, the West Philippine Sea on the west, and the Sulu and Celebes Seas on the south. The islands of Luzon and Mindanao have a complex topography consisting of plains, hills, valleys, and high mountains ranging up to 3 km (~2.95 km for Mt. Apo). Most of the smaller islands also have mountainous areas. All these geographic features play an important role in defining the climate profile of the country.

[47] Oscar M. Lopez Center for Climate Change Adaptation and Disaster Risk Management Foundation, Inc. (Oscar M. Lopez Center) and Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), 2023. State of the 2020 Philippine Climate, January 2023.]

3.2.1 Increased temperature and drought

Global trends

Human influence since the 1950s has significantly increased the likelihood of compound extreme events, such as simultaneous heatwaves and droughts, as well as elevated fire weather in specific regions across all inhabited continents.

According to IPCC, over the past four decades, each decade has been consistently warmer than the one preceding it. The global surface temperature from 2001 to 2020 was approximately 0.99°C higher than during 1850 to1900 (range: 0.84 to 1.10°C). Specifically, the temperature increases from 2011 to 2020 were around 1.09°C higher than 1850-1900 (range: 0.95 to 1.20°C), with greater land warming (approximately 1.59°C, range: 1.34 to 1.83°C) compared to ocean warming (about 0.88°C, range: 0.68 to 1.01°C). This rise is primarily due to continued warming from 2003 to 2012 (+0.19°C, range: 0.16 to 0.22°C).

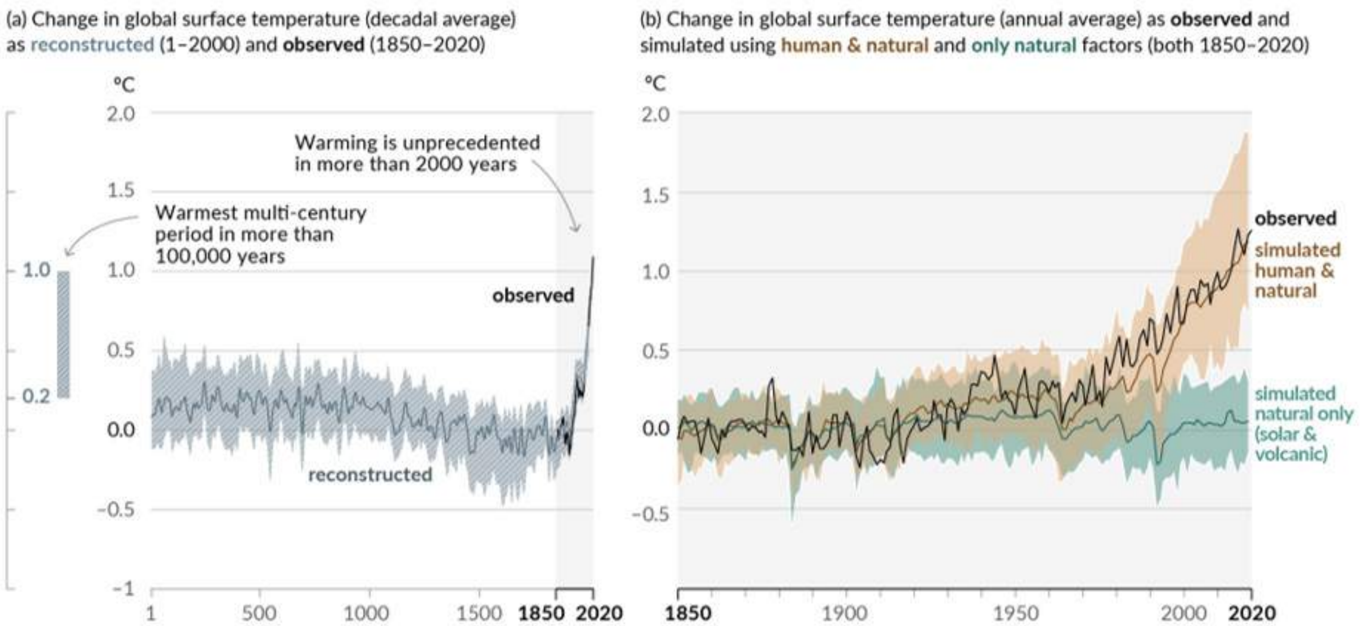


Figure 3.2.1.1: Changes in global surface temperature relative to 1850–1900[48]

Consequently, the average temperature has been increasing more in recent years. Globally, the year 2020 ranked as the second warmest year on record. The warmest years on record have all taken place consecutively (2015 to 2020) and within the past decade. In Asia, 2020 is also notable for recording the region's first temperature anomaly exceeding 2°C. Except for 2007, Asia's warmest years have also taken place recently.[49]

[49] Oscar M. Lopez Center & PAGASA, 2023 World Meteorological Organization, 2023

Rank	Global Baseline Period: 1901-2000	Asia Baseline Period: 1901-2010	Philippines Baseline Period: 1991-2010
1	2016	2020	1998
2	2020	2015	2016, 2010
3	2019	2017	2019, 2020
4	2015	2007	2015, 2006
5	2017	2019	2018, 2012, 2007, 2005, 1988

Figure 3.2.1.2: Top warmest years globally, and specifically for Asia and the Philippines[50]

The impacts of this warming trend can evidently be observed through the occurrence of hot extremes and droughts in nearly all regions worldwide, including Southeast Asia (SEA hexagon in Figure 3.2.1.3). Many of these extreme events can be attributed to human influence.

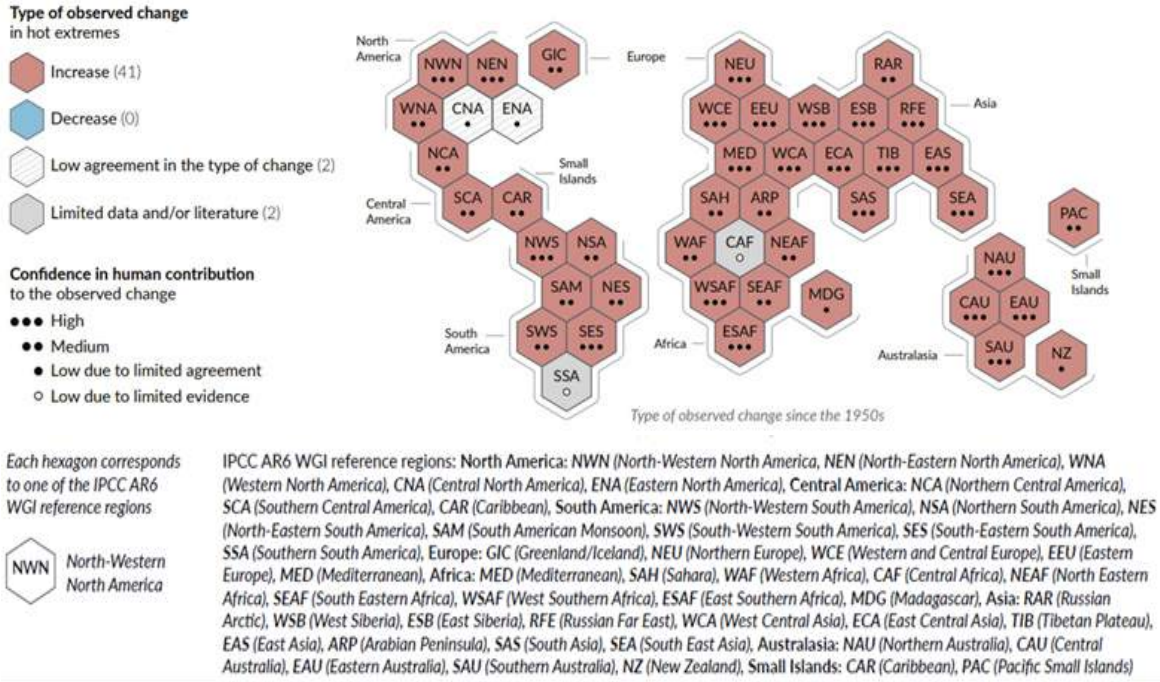


Figure 3.2.1.3: Observed change in hot extreme[51] with confidence in human contribution in each of the world's region[52]

The Philippines has experienced significant impacts from extreme heat.

[50] Oscar M. Lopez Center for Climate Change, Adaptation and Disaster Risk Management Foundation, Inc. (Oscar M. Lopez Center) and Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), 2023. State of the 2020 Philippine Climate, January 2023.

[51] The evidence for hot extremes primarily relies on the analysis of metrics related to daily maximum temperatures. In addition, regional studies that examine indices such as heatwave duration, frequency, and intensity are considered. Regions with observed increases in hot extremes, indicated by red hexagons, demonstrate at least a medium level of confidence.

[52] IPCC, 2021: Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (Figure SPM.3)

The country is experiencing a 0.1°C increase in temperature per decade. Since the 1980s, the Philippines has been observing higher-than-normal temperatures. Over the past 69 years, the country's annual mean temperature has risen by 0.75 °C (Oscar M. Lopez Center & PAGASA, 2023). There is also an interannual variability but with an increasing trend of 0.1°C per decade (see Figure 3.2.1.4).

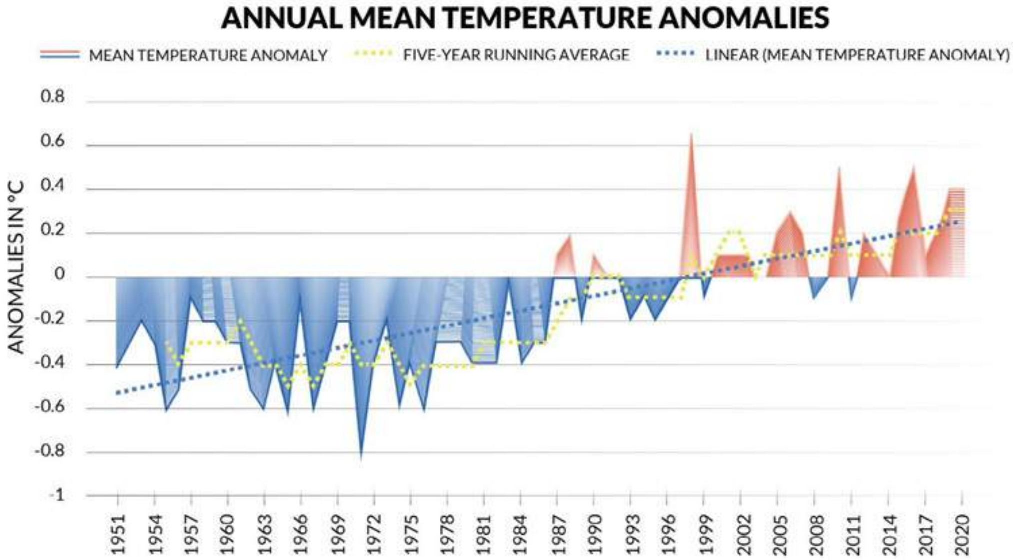


Figure 3.2.1.4: National annual average mean temperature anomalies from 1951 to 2020 (relative to 1991-2020 normal)[53]

While daytime (maximum) and nighttime (minimum) temperature anomalies also display variability, both continue to exhibit an increasing trend as shown in Figure 3.2.1.5. However, the annual maximum temperature has experienced a slower rate of increase, at approximately 0.1°C per decade over the last four decades. On the other hand, the annual minimum temperature has seen a more rapid increase of 0.15°C per decade. In the country, 1998 remains to be the hottest year since 1950 with a 1°C temperature anomaly, due to the 1997-98 El Niño. Year 2020 ranked 4th along with 2019. The country's warmest years all occurred in the last two decades.

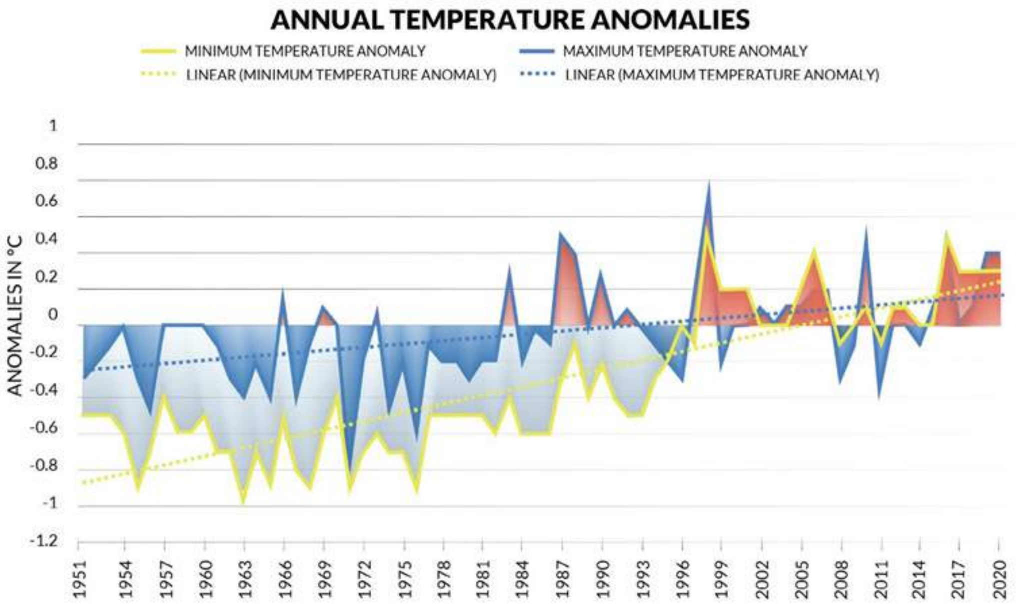


Figure 3.2.1.5: National annual maximum and minimum temperature anomalies from 1951 to 2020 (relative to 1991-2020 normal)[54]

[53] Data source: Oscar M. Lopez Center for Climate Change Adaptation and Disaster Risk Management Foundation, Inc. and DOST-PAGASA's State of the 2020 Philippine Climate, January 2023.

[54] Oscar M. Lopez Center for Climate Change Adaptation and Disaster Risk Management Foundation, Inc. and DOST-PAGASA's State of the 2020 Philippine Climate, January 2023.

Droughts are intensified by El Niño events and threaten critical economic activities such as agricultural production. In the Philippines, droughts have been intensified by El Niño events resulting in significant losses in many types of crops in which water availability limits yield. A notable example of this impact is the 1997 to 1998 El Niño episode. During this period, a substantial shortage of precipitation caused by El Niño led to a significant decline in rice production nationwide.

This drought period, experienced from late 1997 to early 1998, shows that El Niño-driven droughts and losses in rice production affected both rainfed and irrigated rice ecosystems in the Philippines (see Figure 3.2.1.6).[55] Implementing effective measures to address and mitigate the impacts of droughts and El Niño events is crucial for safeguarding rice production and ensuring food security in the country.

The El Niño season also has adverse economic consequences. In 2010, El Niño triggered droughts that resulted in approximately USD240 million (PHP13 billion) worth of damage to rice crops in the Philippines.[56]

During the 2015 to 2016 period, prolonged El Niño conditions lasting 18 months affected approximately one-third of the country. Over 400,000 farmers and 550,000 hectares of land were directly impacted by El Niño-induced drought. The event caused agricultural production losses amounting to USD327 million (PHP17.78 billion), and national GDP losses of USD3.3 billion (PHP179 billion).[57]

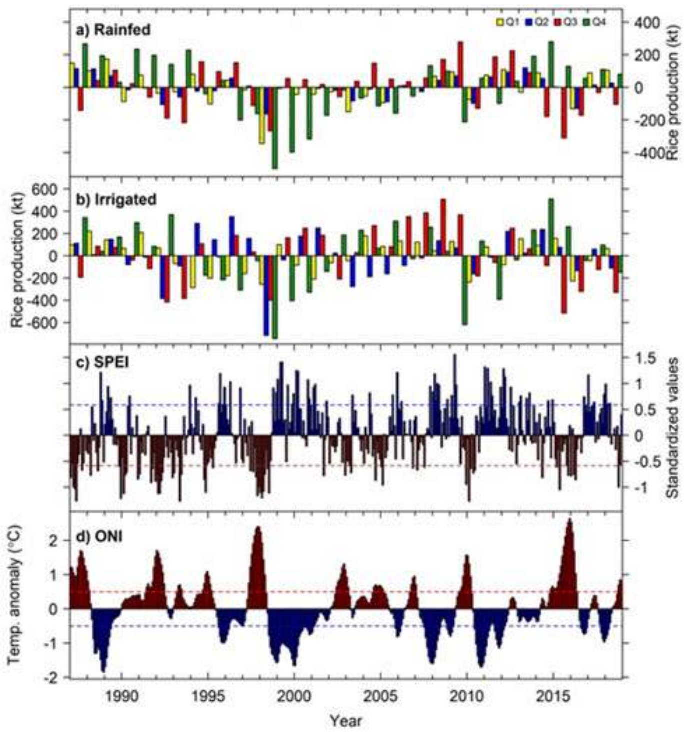


Figure 3.2.1.6: Time series of detrended seasonal rice production in a) rainfed ecosystem and b) irrigated ecosystem aggregated across all the provinces of the Philippines. The time series of monthly SPEI is also shown in c) in which positive (negative) SPEI values indicate rainfall surplus (deficit) in the country. The oceanic Niño 3.4 index in d) The "Q1" in a) and b) refers to the first quarter of the year (i.e., January–March), "Q2" as the second quarter (i.e., April–June), "Q3" (July–September), and "Q4" (October–December).[58]

[55] Villafuerte M et al., 2021.

[56] Baclig, 2023

[57] Ibid.

[58] Villafuerte M et al. 2021. ClimDatPh: an Online Platform for Philippine ClimateData Acquisition (Figure 5)

Impact of increased temperature and drought to the Philippines

The rising temperatures in the Philippines pose significant risks to both public health and the economy, as indicated by the impacts observed in recent years. Table 3.2.1.1 shows the estimated number of Filipino children exposed to extreme heat in both low and high emission scenarios.

According to UNICEF, in 2020, an estimated 1.1 million children in the Philippines were affected by frequent high heat occurrences, with 4.5 or more heatwaves per year. Furthermore, at least 1.9 million children experienced prolonged heatwaves lasting 4.7 days or more. These numbers are expected to increase by 2050, with an anticipated 33.5 million Filipino children (99% of all children in the country) experiencing five or more heatwaves. Additionally, 26.3 million children (77% of the estimated total) are projected to endure extended heatwave durations. This places the Philippines at rank 31 of 163 countries in terms of UNICEF's climate risk index of countries where children are most at risk from climate and environmental factors.

In March 2023, the Department of Health (DOH) recorded at least 118 cases of heat exhaustion in Manila alone, with 33 cases originating from four high schools in Valenzuela City.[59]

PH Children Exposed To Extreme Heat		
Date	Children exposed to high heatwave frequency (4.5 or more heatwaves each year)	Children exposed to high heatwave (4.7 days or longer heatwave)
2020	1.1. million (3%)	1.9 million (5%)
2050*	33.5 million (99%)	26.3 million (77%)
2050**	33 million (99%)	30.6 million (92%)

*Low greenhouse gas emission scenario: **1.7 degrees warming in 2050**

Very high greenhouse gas emission scenario: **2.4 degrees warming in 2050

Table 3.2.1.1: Filipino children's exposure to extreme heat[60]

Moreover, drought has substantial impacts on the well-being of biodiversity leading to the death of plants and animals, potentially including those on the endangered list. The ENSO can cause different than normal wind pattern that increases sea surface temperatures, and thereby causes coral bleaching. Estimates for the 1997 to 1998 drought report show that coral bleaching was widespread, reaching as high as 80% of coral cover in Bolinao.[61] Red tide outbreaks and fish kills were reported during the 1982 to 1983, 1991 to 1992, and 1997 to 1998 El Niño periods. Forest fires are also regular in the Philippines during droughts, leading to species loss, increased erosion and dam sedimentation, river siltation, and air pollution.[62]

[61] Burke et al. 2002

[62] Philippines National Drought Plan (2020)

Conclusion

In conclusion, human influence has amplified the occurrence of compound extreme events globally, including concurrent heatwaves and droughts. Evidently, each successive decade since 1850 has been warmer than the previous one, with noticeable temperature rises in the first two decades of the 21st century.

In the Philippines, temperatures have been increasing at a slightly faster rate than the global average, with variations in temperature anomalies across the country. This warming trend has resulted in adverse impacts on public health, with millions of individuals experiencing heatwaves. Moreover, the economy has been significantly impacted, especially during El Niño-induced droughts, leading to substantial agricultural losses and negative GDP impacts. These circumstances highlight the need for mitigation and adaptation measures.

3.2.2 Sea level rise (SLR) and extreme sea levels

Global trends

Over the course of history, global sea levels have experienced significant changes, as stated in the IPCC Sixth Assessment Report. Global mean sea level has risen faster since 1900 than over any preceding century in at least the last 3000 years. From 1901 to 2018, the global mean sea level rose by 0.20 m [0.15 to 0.25], with varying rates observed during different periods. Between 1901 and 1971, the average rate of sea level rise was 1.3 mm per year, which then increased to 1.9 mm per year from 1971 to 2006. However, from 2006 to 2018, the rate surged to 3.7 mm per year, indicating a faster pace of increase.

Human influence has been identified as the primary driver of sea level rise since at least 1971. The impacts of climate change, such as the warming of the oceans and the melting of ice sheets, have contributed to this phenomenon. The consequences of sea level rise are expected to persist for centuries to millennia due to ongoing processes like deep ocean warming and ice sheet melt.

As a result, global mean sea level will continue to rise, with significant regional variations projected along most coastlines. This is true even if global temperature increases were to stop immediately because of the inherent time lag in the Earth's climate system.

Philippine trends

According to the DOST-PAGASA, Southeast Asia is often considered especially vulnerable to the impacts of sea-level rise and local areas of the Philippines have been experiencing relatively high rates of sea-level rise. About 60% of the Philippine population and over 50% of Philippine municipalities, including the country's capital, Manila, are in the coastal zone.[63]

[63] ONEOCEAN Infomations, n.d.

SLR in the Philippines is double the global average

Satellite observations (AVISO altimetry data) spanning 1993 to 2015 reveal a significant sea level rise of 5.7-7.0 mm/yr over the Philippine Sea. This rate is approximately twice the highest global average rate of 2.8-3.6 mm/yr observed between 1993 to 2010. The disparity can be attributed to natural climate-related phenomena, such as the El Niño Southern Oscillation (ENSO), which directly impacts the tropical Pacific region.

Heightened SLR in specific locations

Diverse patterns emerge when examining coastal areas in the Philippines, highlighting notable differences in sea level rise rates. Specifically, the eastern islands of Leyte and Samar, as well as the southwestern coasts of the Central and Western Visayas, and areas east of Mindanao and south of Zamboanga, face a significant annual sea level rise ranging from 4.5 to 5 mm (see Figure 3.2.2.1).

Moreover, specific coastal regions exhibit distinct changes, Manila has experienced a rapid increase in sea level, primarily attributed to long-term land subsidence caused by excessive groundwater extraction. In contrast, Legazpi and Davao have witnessed gradual sea level rises, while no clear trend has been observed in Cebu and Jolo, Sulu (see Figure 3.2.2.2).

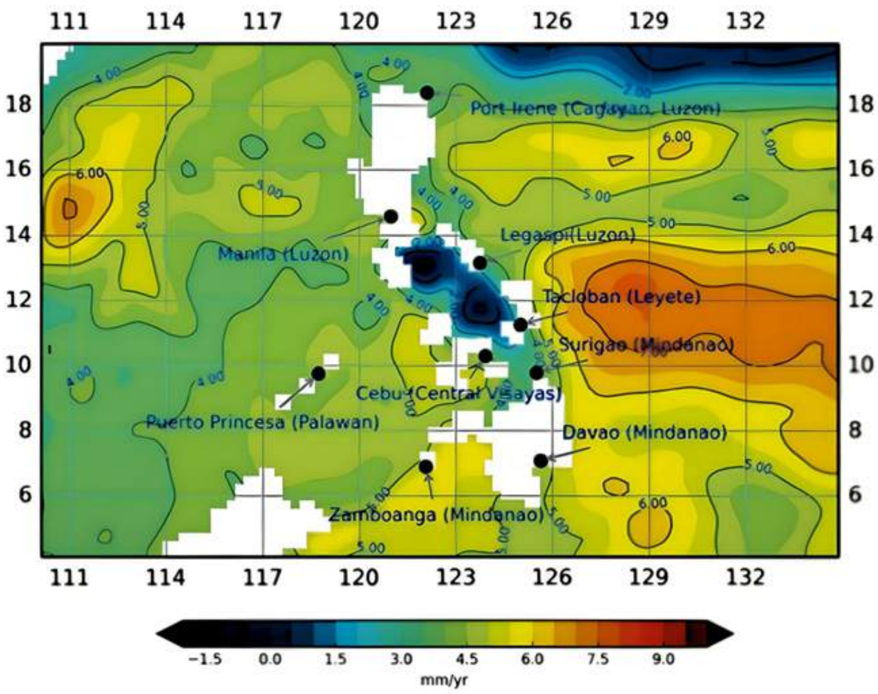


Figure 3.2.2.1: Sea level changes in the Philippines region from 1993-2015[64]

[63] ONEOCEAN Infomations, n.d.

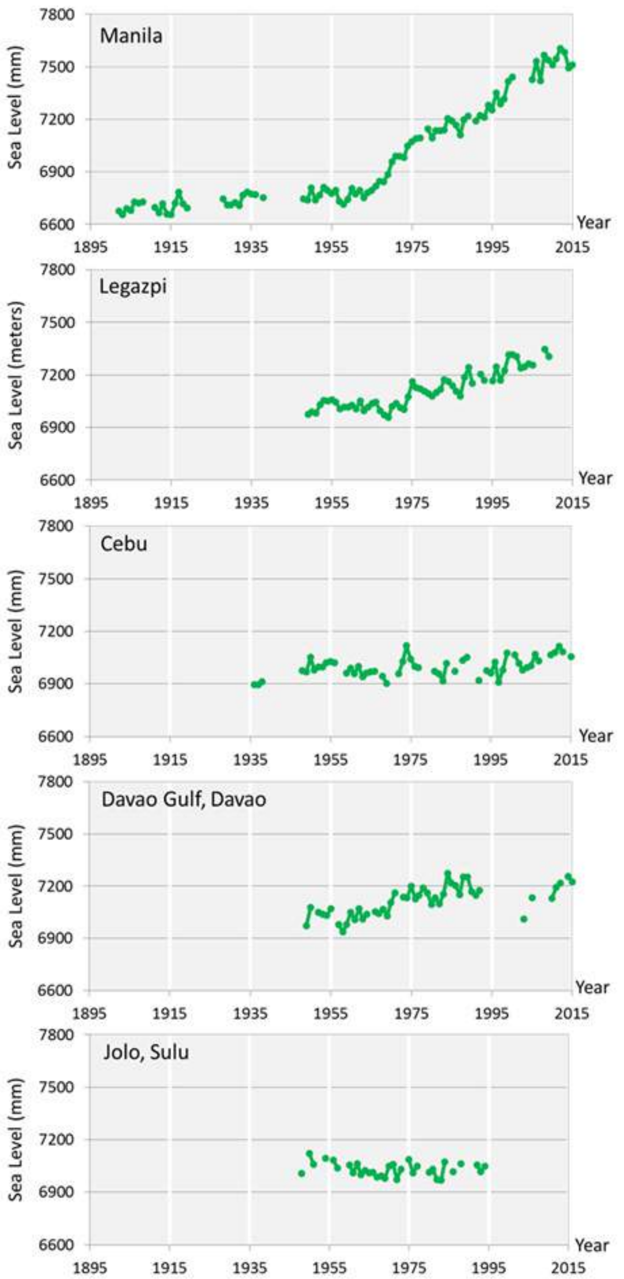


Figure 3.2.2.2: Sea level rise in selected areas (in mm) above the Revised Local Reference level (7,000 mm) Data source: DOST-PAGASA, 2018: Observed and Projected Climate Change in the Philippines. Philippine Atmospheric, Geophysical and Astronomical Services Administration, Quezon City, Philippines, 36 pp.

Based on the Philippine Climate Change Assessment (2016), the mean sea level in Manila has been increasing at an average rate of 1.3 mm per year since the 1900s, which increased to about 2.6 cm per year in the 1960s. Figure 3.2.2.3 shows the increasing trends in sea level and groundwater use in Metro Manila that has enhanced the risk of sea level rise in the country's capital.

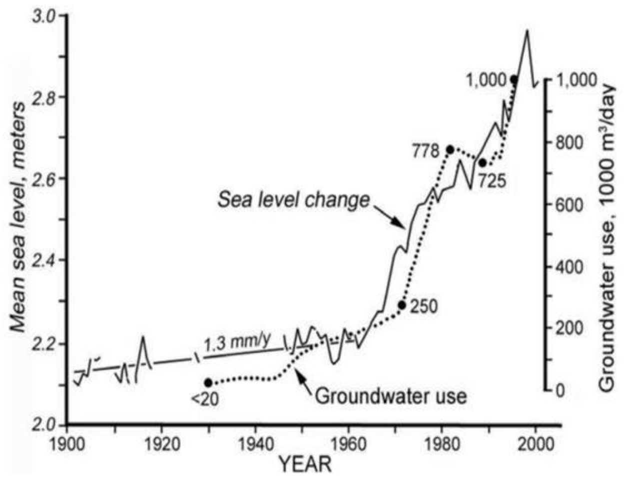


Figure 3.2.2.3: Combined plot of sea level change at Manila South Harbor and groundwater use in Metro Manila from 1902 to 2000[65]

Land subsidence exacerbates the impact of SLR

The implications of rising sea levels are compounded by the occurrence of land subsidence in certain areas, exacerbating the impact of sea level rise and leading to increased vulnerability to flooding and extreme sea levels. This relationship becomes apparent when considering the subsidence zones identified in the Philippines. Research utilizing satellite data at an approximate resolution of 80 m has revealed a significant correlation between subsidence zones and regions with high groundwater usage (refer to Table 3.2.2.1 and Figure 3.2.2.4). Notably, regions IV-B (MIMAROPA), III (Central Luzon), VII (Central Visayas), and XI (Davao Region) exhibit multiple clusters of subsidence zones, indicating the vulnerability of these areas to land subsidence. Given this understanding, an important adaptation strategy for reducing the effects of sea level rise and flooding in these vulnerable areas would be to manage water (including groundwater) usage effectively.

[63] Philippine Climate Change Assessment. (2016). In climate.gov.ph. The Oscar M. Lopez Center for Climate Change Adaptation and Disaster Risk Management Foundation Inc. (Figure 5.4)

Table 3.2.2.1: Top regions in terms of groundwater usage from 2021-2023[66]

Water resources region	Allocated water (MCM/YR) (Consumptive Use)
IV-B: MIMAROPA	838
III: Central Luzon	733
VII: Central Visayas	205
VI: Western Visayas	190
XI: Davao Region	183
XII: SOCCSKARGEN	150
X: Northern Mindanao	108
II: Cagayan Valley	64
V: Bicol Region	55
I: Ilocos Region	53
VIII: Eastern Visayas	30
IX: Zamboanga Peninsula	20

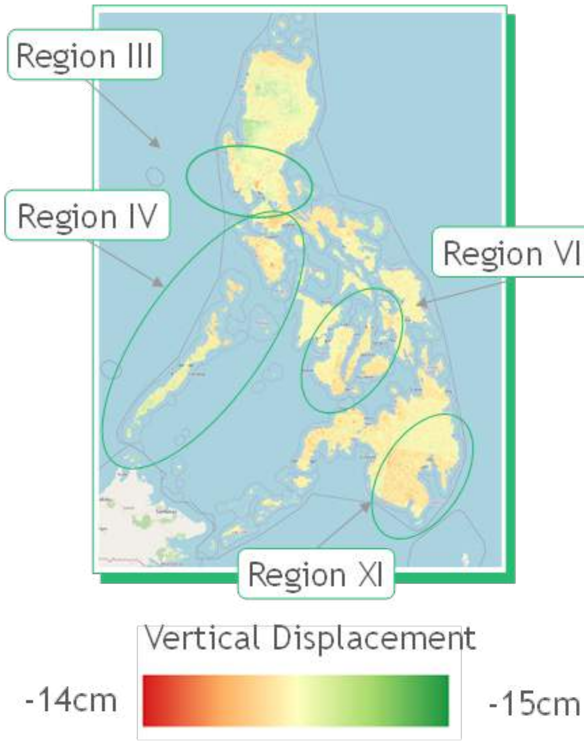


Figure 3.2.2.4: Subsidence Zones in the Philippines from 2021-2023[67]

Impact of SLR on the Philippines

Sea level rise poses a significant threat to the Philippines, particularly in terms of inundation. Even at a lower estimate of one meter sea level rise, approximately 7,000 km2 across 2,490 barangays (villages) would be affected, impacting an estimated 1.8 million people. If sea levels were to rise by two meters, the impact would extend to nearly 8,000 km2 across 2,730 barangays, affecting an estimated 2.3 million people. The most catastrophic scenario, with a three-meter sea level rise, would have far-reaching consequences, affecting over 15,000 km2 across 5,387 barangays and impacting an estimated 3.4 million people. Sea level rise also affects natural systems, such as mangrove degradation, coral reef bleaching, and saltwater intrusion. The scale of these potential impacts underscores the urgency of addressing and mitigating the risks associated with rising sea levels (Lauren, 2013).

[67] Boston Consulting Group. (2023). Data Model on Land subsidence [Data model]. Retrieved from Alaska satellite facility database.

Conclusion

The analysis of global sea level trends and the specific context of the Philippines highlight the pressing challenges posed by sea level rise. The IPCC Sixth Assessment Report reveals that global mean sea level has risen at an unprecedented rate since 1900. Human-induced factors, such as climate change and the subsequent warming of the oceans and melting of ice sheets, are primarily responsible for this phenomenon. The Philippines, with its extensive coastline and numerous coastal cities, is especially vulnerable to the impacts of sea level rise. Specific areas with noticeably high population density, such as Manila, experience higher rates of sea level rise. These changes have the potential to inundate vast areas and affect millions of people, emphasizing the urgent need to address the risks associated with rising sea levels. By implementing effective adaptation strategies, the Philippines can work towards safeguarding its coastal communities and preserving its natural and economic resources for future generations.

3.2.3 Extreme precipitation

Extreme precipitation refers to unusually heavy rainfall over a set duration compared to the normal value in a certain region. This can lead to landslides, pluvial and fluvial floods, and significant water accumulation, posing risks to infrastructure, communities, and ecosystems.

Global trends

The changing climate has had a significant impact on precipitation patterns across the globe, with observable trends indicating an increase in the frequency and intensity of heavy precipitation events since the 1950s. Extensive observational data supports this trend analysis, providing high confidence that human-induced climate change is the primary driver of these changes, as reported by the IPCC in its Sixth Assessment Report.

Furthermore, scientific studies focusing on event attribution and physical understanding have consistently shown that human-induced climate change plays a crucial role in intensifying heavy precipitation associated with tropical cyclones. The link between human activities and the increased intensity of these extreme weather events is supported by high confidence.

On a global scale, there is medium confidence that precipitation over land has experienced a likely increase since 1950, with an even faster rate of increase observed since the 1980s. This pattern of precipitation changes since the mid-20th century is believed to be influenced by human activities. Human influence has likely contributed to the observed changes in precipitation patterns, although the level of confidence varies across regions.

Specifically, in Southeast Asia, including countries like the Philippines, there is evidence to suggest that precipitation has increased. The observed changes in precipitation in this region are associated with human influence, although the level of confidence in this contribution may vary (see Figure 3.2.3.1).

These findings highlight the global impact of climate change on precipitation patterns, particularly in relation to heavy precipitation events. The scientific consensus supports the notion that human activities are the main driver behind these changes, emphasizing the urgent need for adaptation strategies to address the challenges posed by these shifting precipitation patterns.

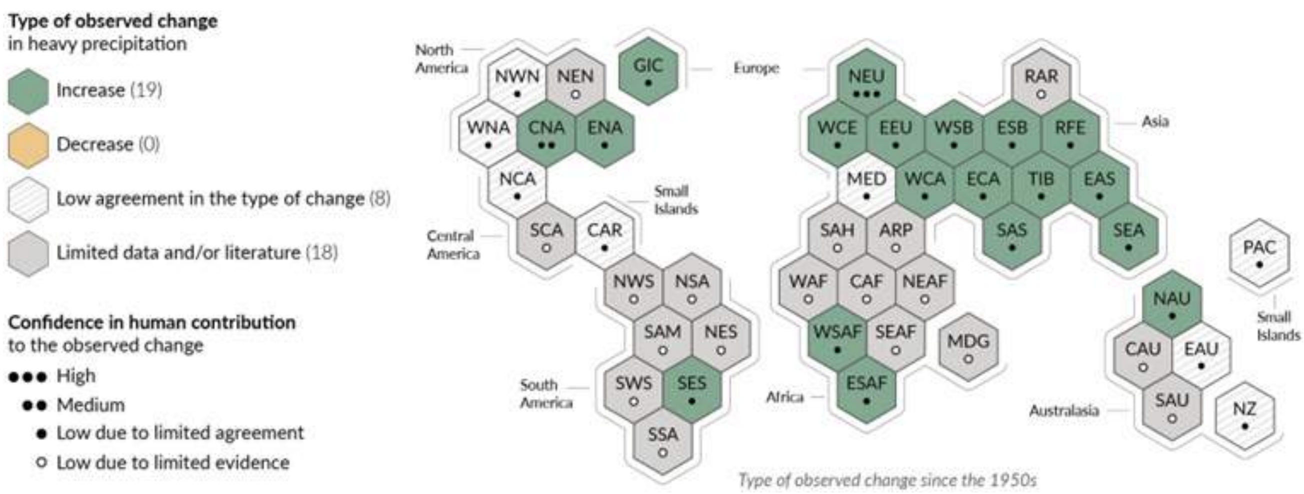


Figure 3.2.3.1: Synthesis of assessment of observed change in heavy precipitation and confidence in human contribution to the observed changes in the world's regions (since 1950s). Green hexagons indicate regions where there is at least medium confidence in an observed increase in heavy precipitation[68]

Philippine trends

The precipitation patterns in the Philippines exhibit geographic and seasonal variations. The precipitation in the Philippines exhibits a diverse landscape. Historically, DOST-PAGASA observed noticeable changes and trends in precipitation patterns. From 1951 to 2010, an increasing trend in precipitation was observed in the northeastern section of Mindanao and eastern portions of Visayas during the months of December to February, which coincides with the northeast monsoon season. These areas are at an increased risk of flooding during this time. Similar increasing precipitation trends were observed in central portions of Luzon and northeastern sections of Mindanao in March to May. In the following seasons of June to August and September to November, increasing precipitation trends were observed in Ilocos Region, as well as the northeastern and southern parts of Mindanao. However, most parts of the country experienced a decreasing trend in precipitation (see Figure 3.2.3.2).

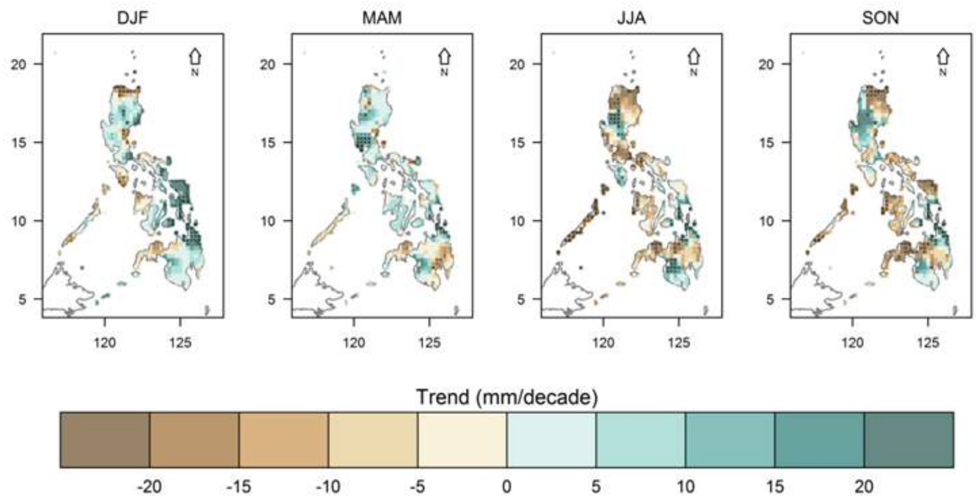


Figure 3.2.3.2: Observed trends in seasonal total precipitation in the Philippines from 1951-2010. Areas marked with dots denote statistical significance at 5% based on Mann-Kendall test[69]

[69] IPCC, 2021: Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (Figure SPM.3)

According to the Philippines' Climate Risk Country Profile (ADB), the country receives around 2,348 mm of average annual precipitation. However, there is significant geographic variation, as the mean annual rainfall of the Philippines varies from 965 to 4,064 mm annually. This distribution varies seasonally as well. During the months of June to September, heavy precipitation is concentrated in the western regions of the country, marking a period of increased total precipitation. Conversely, between October and March, heavy precipitation is predominantly observed in the eastern regions, coinciding with a decrease in the overall precipitation across the country (see Figures 3.2.3.3 and 3.2.3.4).

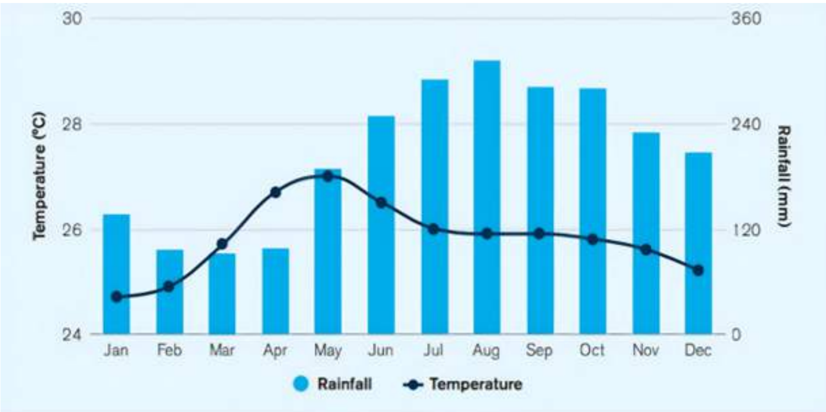


Figure 3.2.3.3: Average monthly precipitation and temperature in the Philippines (1991-2020)[70]

Note: Temperature axis begins at 24˚C to enhance visibility of temperature trends and variations.

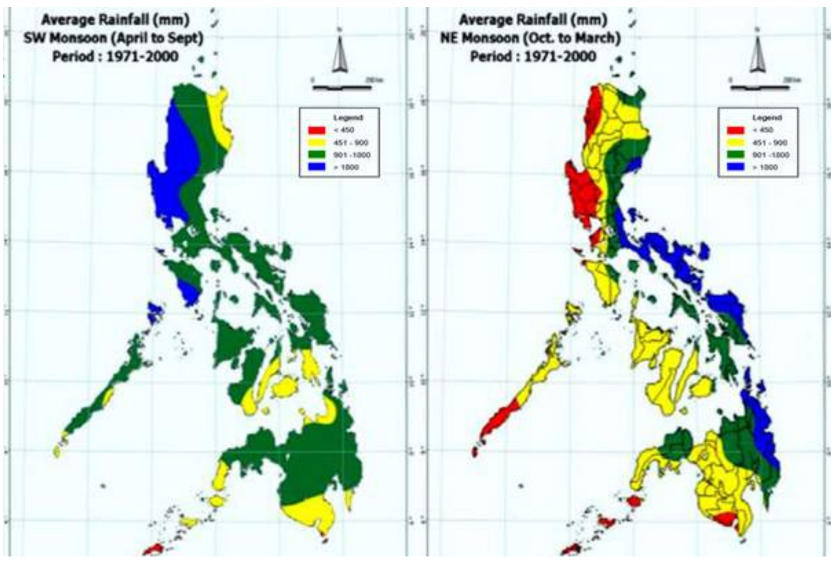


Figure 3.2.3.4: Seasonal precipitation distribution in the Philippines 1971–2000, (left) April to September and (right) October to March[71]

[71] Climate Risk Country Profile: Philippines (2021): The World Bank Group and the Asian Development Bank (Figure 2)
[72] Climate Risk Country Profile: Philippines (2021): The World Bank Group and the Asian Development Bank (Figure 3)

ENSO events greatly influence seasonal and interannual precipitation in the Philippines. Precipitation patterns in the Philippines are influenced by synoptic systems such as monsoons and the El Niño Southern Oscillation (ENSO). ENSO events, specifically El Niño and La Niña, greatly influence seasonal and interannual precipitation in the Philippines. Mature El Niño events often lead to drought and water resource stresses, while La Niña events bring heavy precipitation.[72] The impact of ENSO on precipitation varies depending on the interaction between the ENSO life cycle and the seasonal variability of precipitation in specific regions.

Analyzing observational data further supports the influence of ENSO on precipitation patterns. Specifically, during July to September of El Niño years, above-average precipitation occurs over north-central Philippines, preceding the expected below-average conditions in the subsequent October-December period. In contrast, during La Niña years, below-average precipitation is observed in July-September over north-central Philippines, followed by wetter than normal conditions in the following October-December period. These findings provide additional insights into the complex relationship between ENSO and precipitation variability in the country.

Certain areas are more susceptible to precipitation-induced flooding and landslides. Floods in the Philippines commonly occur during monsoon surges and slow-moving tropical cyclones within the Philippine Area of Responsibility (PAR), with the intensity of the monsoon also influenced by La Niña events. One notable recent flooding event was caused by Super Typhoon Egay (internationally known as Doksuri) in July 2023, which unleashed 0.4 to 0.5 m of rain from its 680 km rainband (see Figure 3.2.3.5).[73]

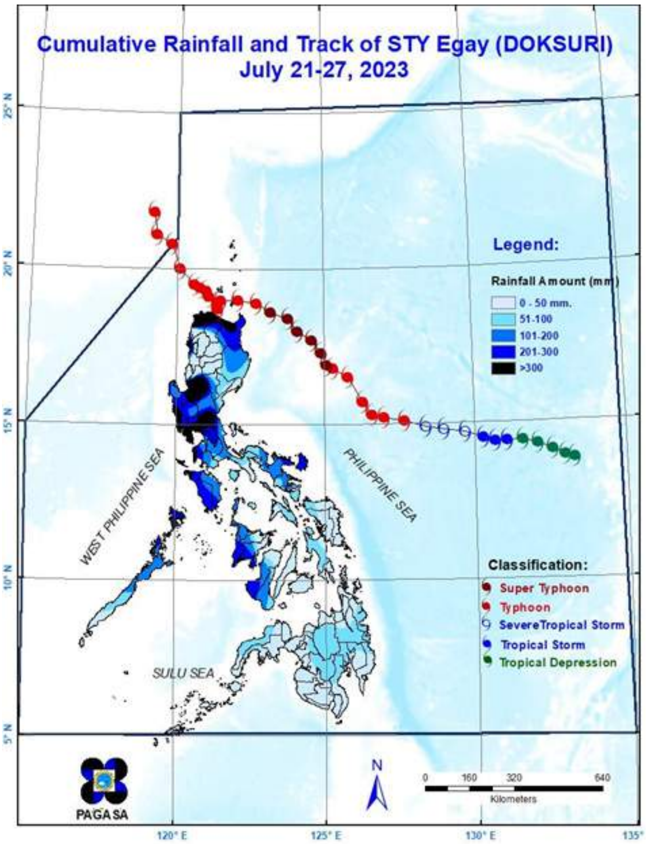


Figure 3.2.3.5: Cumulative rainfall during Super Typhoon Egay (July 21-27, 2023)[74]

[72] 2016 Philippine Climate Change Assessment

[73] Magramo, 2023

[74] Tropical Cyclone Associated Rainfall. (2023). pagasa.dost.gov.ph.

The Department of Environment and Natural Resources-Mines and Geosciences Bureau (DENR-MGB) spearheaded a Geohazard Mapping and Assessment Program, which resulted in a list of the top ten flood-prone and landslide-prone areas in the country (see Figure 3.2.3.6). The selection of these provinces is based on various factors related to their geography and topography.

Several provinces are strikingly the most flood-prone: Pampanga, Nueva Ecija, Tarlac, and Bulacan are among the provinces listed by the DENR-MGB. These areas are susceptible to flooding due to their proximity to rivers and bodies of water, as well as other factors such as topography, land characteristics, and subsidence. Metro Manila, being a highly urbanized region, is also included in the list due to its low-lying coastal areas and insufficient drainage systems.

Additionally, provinces like Maguindanao, North Cotabato, Oriental Mindoro, and Ilocos Norte have specific geographical features that make them prone to flooding.

Landslides typically occur in areas with mountains and high elevation. In the top ten landslide-prone areas identified by the DENR-MGB, all provinces in the Cordillera Administrative Region (CAR) are included. The CAR is situated "on and around the Cordillera Mountain ranges," making the entire region susceptible to landslides after periods of heavy rains, typhoons, or earthquakes.

Similar conditions exist in other listed provinces such as Southern Leyte, characterized by relatively flat lands where people reside, but rugged and mountainous toward the interior. The topography of Cebu and Catanduanes is also described as rugged and mountainous. Landslides can be triggered by heavy precipitation, earthquakes, volcanic eruptions, as well as human activities like mining and commercial developments.

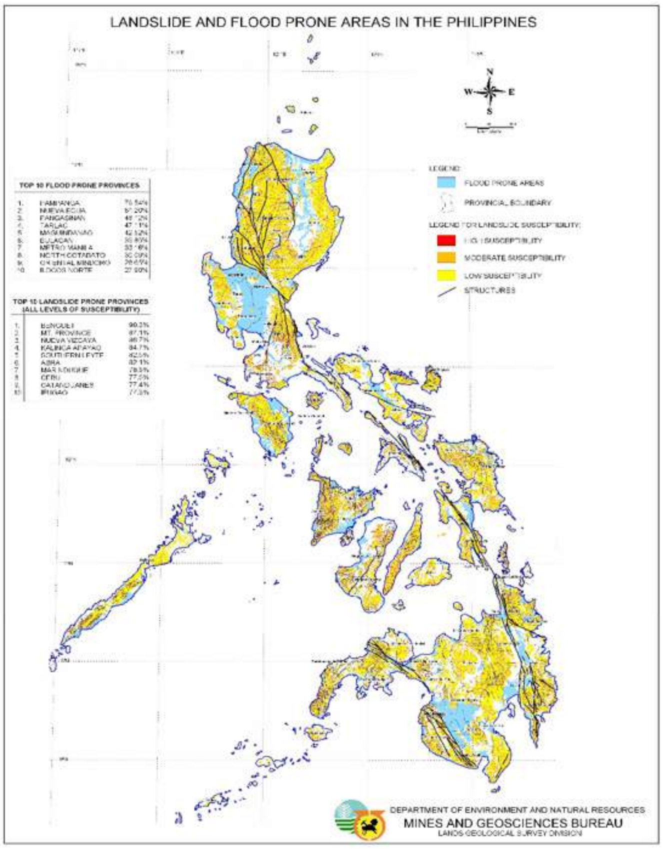


Figure 3.2.3.6: Map of landslides and flood prone areas in the Philippines[74]

Philippine trends

The Philippines faces significant challenges when it comes to flooding that is heavily attributed to high exposure to severe tropical cyclones and heavy precipitation.

According to the World Resources Institute's AQUEDUCT Global Flood Analyzer, as of 2010, an estimated 176,000 people are affected by flooding annually in the country, with expected damages reaching USD625 million for events up to a 1 in 25-year magnitude. The UNISDR reports a slightly lower average annual loss of approximately USD500 million associated with flooding in the Philippines. Historically, the estimated median number of people in the Philippines affected by an extreme river flood (defined as being in the 90th percentile in terms of numbers of people affected) in the historic period 1971-2004 is 1,943,597. These figures are expected to increase due to both development and climate change.

[75] National Framework Strategy on Climate Change 2010-2022

The escalation of flood damage in the Philippines is attributed to a rise in the frequency and intensity of tropical cyclones. The risks posed by flooding are further exacerbated by factors such as land use changes, including urbanization and logging. The Second National Communication to the UNFCCC acknowledges that while climate change may contribute to the unusual amount of precipitation, the damage and loss of lives caused by floods are often amplified by the clogging of sewers and waterways with waste materials.[76]

Conclusion

The evidence presented demonstrates the significant impact of climate change on precipitation patterns globally, including the Philippines. The increase in the frequency and intensity of heavy precipitation events, particularly associated with tropical cyclones, can be attributed to human-induced climate change with high confidence. The observed changes in precipitation patterns, such as the likely increase in global averaged precipitation over land since 1950, further suggest a human influence.

Within Southeast Asia, the Philippines experiences diverse precipitation patterns influenced by monsoons and the ENSO, and rainfall associated with tropical cyclones. The country has seen both increasing and decreasing trends in precipitation across different regions and seasons. Floods, often triggered by monsoon surges and tropical cyclones, pose a significant challenge, exacerbated by factors such as land use changes and inadequate infrastructure.

The identification of flood-prone and landslide-prone areas in the Philippines, through the Geo Hazards Mapping and Assessment Program, provides valuable insights into the regions that are most susceptible to these hazards. Provinces near rivers, with inadequate drainage systems, and mountainous regions are particularly vulnerable.

The findings presented here underscore the urgency of addressing climate change and implementing robust adaptation strategies to manage the shifting precipitation patterns, particularly the increasing frequency of heavy precipitation events and associated flooding.

3.2.4 Extreme wind and tropical cyclone

Extreme wind refers to winds significantly exceeding normal wind speeds for a given region. Tropical cyclones, also known as hurricanes, or cyclones depending on the region, are intense low-pressure systems and can bring destructive winds, storm surges, and torrential precipitation, posing a significant threat to coastal areas and inland regions in their path. Extreme wind events are frequently associated with tropical cyclones, as these systems generate powerful winds capable of causing widespread destruction and impact towards communities, agriculture, and critical infrastructure.

Global trends

Tropical cyclones (TCs) present a threat to human life and livelihoods in tropical coastal regions around the world. Recent studies by the IPCC have provided valuable insights into the historical trends of TCs. These investigations have revealed significant findings, including the occurrence of intense TCs making landfall in East and Southeast Asia in recent decades.

Moreover, there has been an observed increase in the proportion of global hurricanes reaching Category 4 or 5 intensity (>118km/h sustained wind speed) over the years.[77]

Philippine trends

The Philippines is highly exposed to TCs generated in the western North Pacific (WNP) region, with an average of 20.2 TCs entering the Philippines Area of Responsibility (PAR) each year and an annual average of 8.4 tropical cyclones to make landfall in the Philippines (see Figure 3.2.4.1).[78]

[77] Collins et al., 2019
[78] PAGASA & DOST, 2023

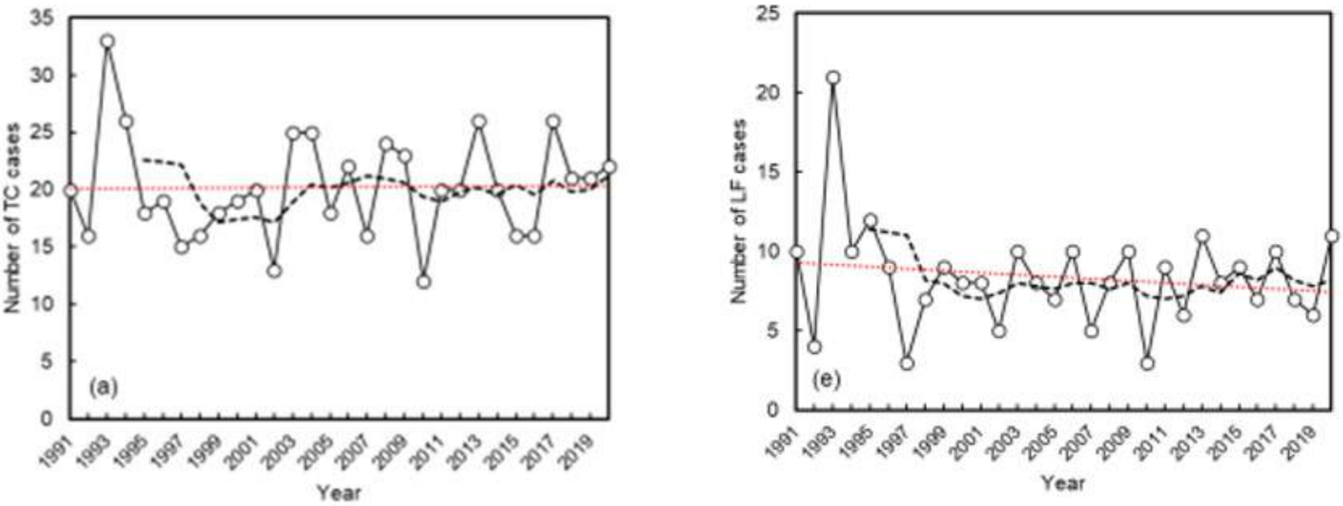


Figure 3.2.4.1: (Left) Total number of TCs that occurred in PAR region from 1991-2019; (Right) Total number of TCs that crossed or made landfall in the Philippines from 1991-2019[79]

Tropical cyclones are systematically classified based on the intensity of their associated winds, following established protocols. In the Philippines, DOST-PAGASA employs a comprehensive categorization system that encompasses five distinct categories. These categories are determined by assessing the 10-minute average wind strengths accompanying the cyclones (see Table 3.2.4.1).

Table 3.2.4.1: Categories of TC used by PAGASA[80]

Category of TC	Maximum sustained winds near the center			
	Beaufort	kt	km/h	m/s
Tropical Depression (TD)	BF6 to BF7 (Strong winds)	22 to 33	39 to 61	10.8 to 17.1
Tropical Storm (TS)	BF8 to BF9 (Gale-force winds)	34 to 47	62 to 88	17.2 to 24.4
Severe Tropical Storm (STS)	BF10 to BF11 (Storm-force winds)	48 to 63	89 to 117	24.5 to 32.6
Typhoon (TY)	BF12 (Typhoon-force winds)	64 to 99	118 to 184	32.7 to 51.2
Super Typhoon (STY)	BF12 (Typhoon-force winds)	≥ 100	≥ 185	≥ 51.3

Decreasing frequency of TCs but very strong TCs becoming more frequent

An analysis of tropical cyclone data in the Philippines shows that while there has been a slight decline in the overall number of tropical cyclones, there is an observable upward trajectory in the occurrence of 'very strong TCs', characterized by maximum sustained wind speeds greater than 170 km/h (see Figure 3.2.4.2). Furthermore, the number of typhoons (TY and STY) in the last 30 years have accounted for about half of the total TCs in the nation (see Figure 3.2.4.3) (DOST-PAGASA, 2018). Both these findings underscore the evolving nature of tropical cyclones in the country and necessitate a proactive and adaptive approach to climate resilience, including robust strategies for risk reduction, preparedness, and response to effectively address the intensifying threats posed by these extreme weather events.

[79] DOST PAGASA's Annual Report on the Philippine Tropical Cyclones, 2020.
[80] DOST PAGASA's Annual Report on the Philippine Tropical Cyclones, 2020.

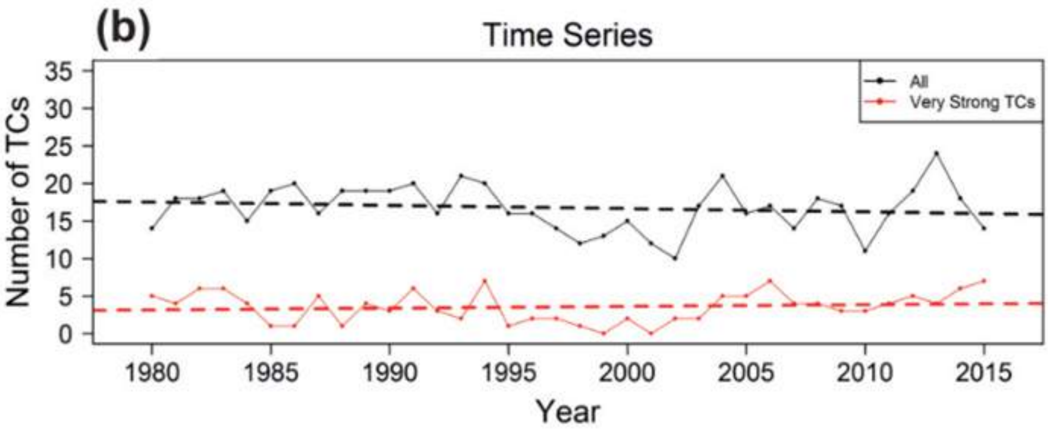


Figure 3.2.4.2: Time series of annual count of all (black line) and very intense tropical cyclones (maximum sustained winds >170kph, red line) that entered the PAR from 1980 to 2015[81]

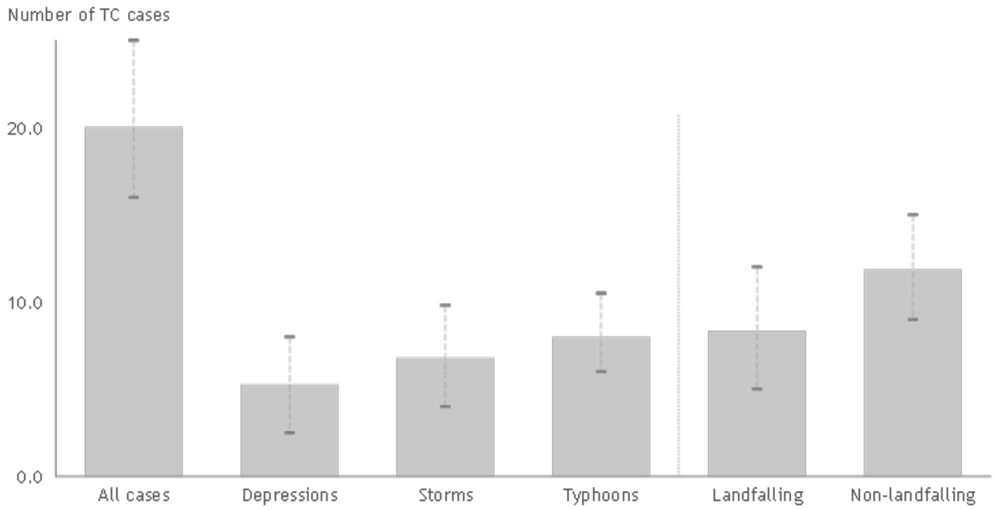


Figure 3.2.4.3: Climatological normal of all TC occurrences within the PAR in the last 30 years, for depressions, storms, and typhoons (both landfalling and non-landfalling TCs) with error bars that represent +-1 standard deviation from the climatological normal[82]

Pronounced concentration of TCs in the northeastern regions

Furthermore, a spatial analysis was undertaken to identify the geographical areas within the Philippines that were most significantly impacted by TCs, as illustrated in Figure 3.2.4.4. The findings revealed a pronounced concentration of TC occurrences in the northeastern region of the country, denoted by the shaded regions in the figure. In contrast, the southwestern part of the country experienced notably fewer TCs, as indicated by the horizontally hatched sections in the same figure.[83]

[81] DOST-PAGASA's Observed and Projected Climate Change in the Philippines, 2018

[82] DOST PAGASA's Annual Report on the Philippine Tropical Cyclones, 2020.

[83] 2016 Philippine Climate Change Assessment

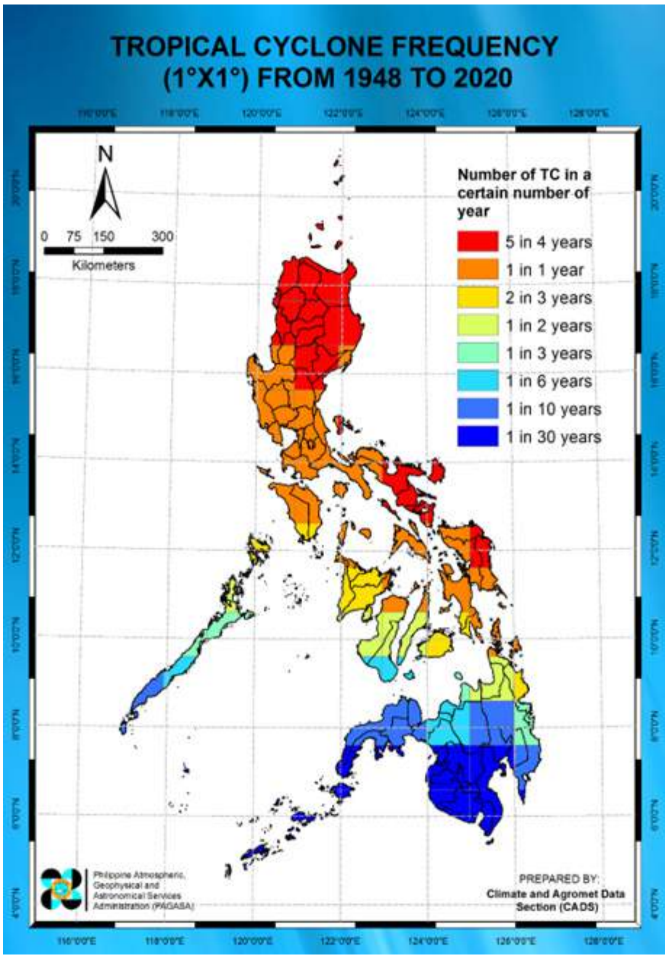


Figure 3.2.4.4: Total number of TCs in the Philippines per 1° x 1° grid, for the period 1948-2020

El Niño-Southern Oscillation (ENSO) affects behavior of TCs

The findings of the spatial analysis and the examination of wind speed data emphasize the pressing need for effective measures to address the long-standing and escalating impact of tropical cyclones on the Philippines. It must also be noted that the frequency of tropical cyclones (TCs) can vary from season to season and year to year, influenced by factors such as the El Niño and La Niña events.[84]

The frequency of TCs can change from season to season and year to year due to factors like El Niño and La Niña events.

During El Niño (La Niña) years from July to September, TC activity tends to increase (decrease) due to higher (lower) atmospheric moisture, but this reverses during October to December.

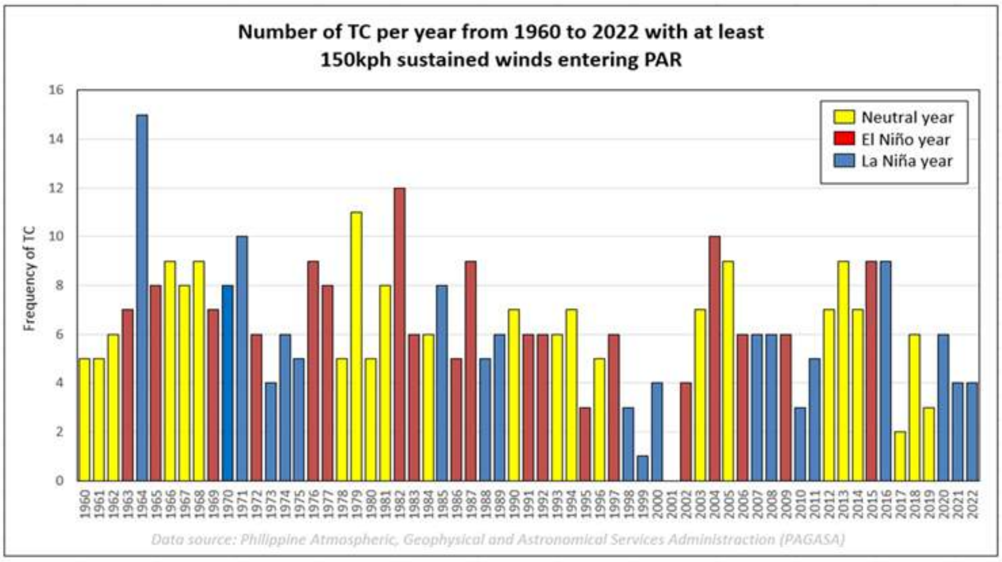


Figure 3.2.4.5: Number of typhoons per year from 1960-2022 with at least 150 kph sustained winds entering the PAR. Years are labeled according to El Niño, La Niña, or neutral conditions. Note that there were no such typhoons in 2001[85]

Climate Changes in the Philippines

[84] DOST-PAGASA, 2023
[85] DOST-PAGASA, 2023

Studies also indicate that the genesis location of TCs shifts southeastward (northwestward) during El Niño (La Niña) years, affecting their track, intensity, and lifespan. Moreover, more typhoons hit the northern Philippines in La Niña years compared to El Niño years. These variations in TC behavior during different ENSO phases have significant implications for the affected regions. Figure 3.2.4.5 shows the annual number of TCs that are affected by the El Niño Phenomenon.

Understanding the relationship between ENSO, Pacific Decadal Oscillation (PDO), and TC activity is crucial for anticipating and preparing for the potential impacts of these weather phenomena. By studying these patterns and their effects, scientists and policymakers can enhance their ability to forecast and respond to TC events, ultimately contributing to better disaster preparedness and risk reduction strategies.

Impact of TCs on the Philippines

Over the past five decades, TCs have inflicted a significant toll on the Philippines, resulting in the loss of 34,435 lives and leaving 75,034 individuals injured since 1970.[86] These devastating events have underscored the urgent need for effective measures to mitigate their impact and enhance the country's resilience.

It is worth noting that some of the most severe storms in the Philippines have occurred within the past 15 years, marking a worrying trend for a nation accustomed to an average of 20 storms each year. These notable storms include Typhoon Haiyan, Typhoon Ulysses, and Typhoon Egay, to name a few, all of which have posed significant damage to agriculture, houses, and critical infrastructure and have garnered international attention.

Seven notable TCs—Ambo, Ofel, Pepito, Quinta, Rolly, Ulysses, and Vicky—were mostly responsible for a combined total of 733 casualties, including 112 deaths, 610 injuries, and 11 missing individuals. Among these, Typhoon Ulysses emerged as the deadliest, claiming the lives of 51 people. Furthermore, the economic consequences of the 2020 TC season were substantial. The aggregated cost of damage to agriculture and infrastructure reached PHP44.222 billion, with infrastructure accounting for the majority (63.6%) of the total cost.

It is important to note that the aggregated cost of damage due to TC events has exhibited a steady increase since 1970. This upward trend (see Figure 3.2.4.6) serves as a clear indication of the growing vulnerability of the Philippines to these natural disasters.

[86] DOST-PAGASA, 2023

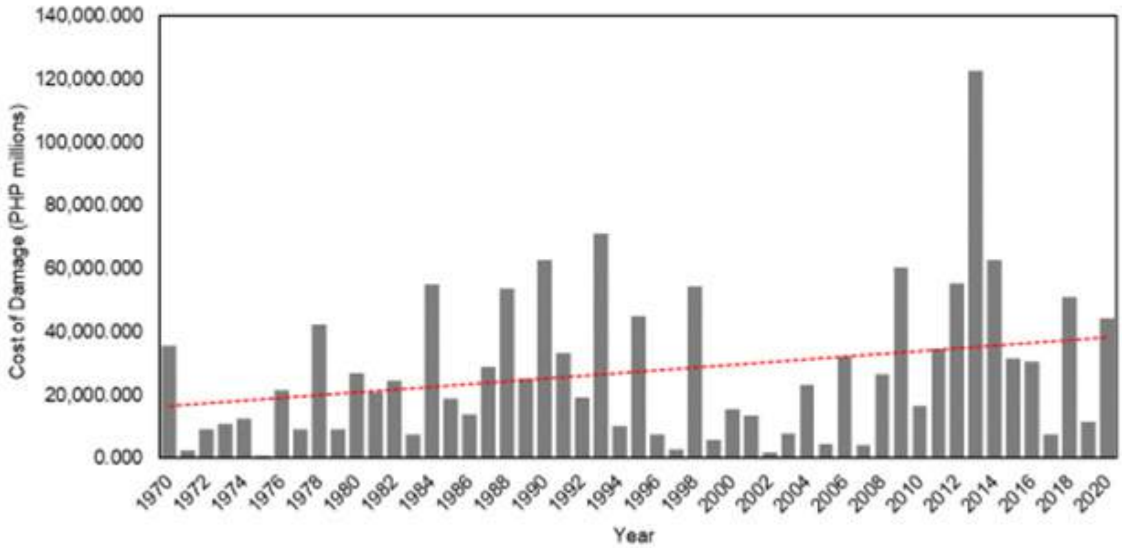


Figure 3.2.4.6: Yearly total cost of damage (in PHP millions) caused by tropical cyclones in the PAR region from 1970 to 2020. The cost values are adjusted to 2020-equivalent values to account for inflation using the annual average CPIs published by the Philippine Statistics Authority. The red dash line presents the linear trend of the adjusted cost of damage[87]

Conclusion

The Philippines, like many other regions across the globe, is experiencing the impacts of human-induced climate change. The country is particularly vulnerable to extreme weather events, such as tropical cyclones. While there has been a slight decline in the overall number of tropical cyclones, the occurrence of 'very strong TCs' with maximum sustained wind speeds greater than 170km/h has been on the rise.

Spatial analysis has shown that the northeastern part of the Philippines is most significantly impacted by TC, emphasizing the need for targeted strategies to mitigate their effects. Furthermore, the frequency and behavior of tropical cyclones can vary due to factors like El Niño and La Niña events, which underscores the importance of understanding these patterns for effective forecasting and disaster preparedness. The Philippines has experienced significant human and economic losses due to tropical cyclones, emphasizing the urgency to address their impact and enhance the country's resilience. The increasing cost of damage over the years serves as a stark reminder of the growing vulnerability of the Philippines to these natural disasters.

3.2.4 Extreme wind and tropical cyclone

The CCC, in consultation with DOST-PAGASA and national climate experts, based the analysis on the SSP2-4.5 and SSP5-8.5 scenarios, and for 2030 and 2050. These scenarios offer a balanced perspective by encompassing both moderate and high-emission trajectories, allowing for a comprehensive assessment of the country's future climate conditions and preparation to build resilience against the worst impacts of climate change.

The Middle of the Road scenario (SSP2-4.5) reflects moderate challenges to mitigation and adaptation, aligning with historical trends. In this scenario, sustainable development progresses with efforts to reduce GHG emissions and transition towards sustainable practices, albeit with persistent environmental degradation and income inequality.

[87] DOST-PAGASA'S Annual Report on the Philippine Tropical Cyclones, 2020.
[88] Cinco, et al., n.d.

This scenario represents moderate emissions and aims to limit warming to 2°C by 2100, resulting in a projected global average warming of 1.7 to 3.2°C. It focuses on coordinated action and total radiative forcing stabilization before 2100.

On the other hand, the Fossil-fueled Development scenario (SSP5-8.5) envisions a future where there is limited global effort to mitigate greenhouse gas emissions. It anticipates continued reliance on fossil fuel resources and energy-intensive lifestyles, driving rapid economic growth. This scenario is associated with high emissions, featuring a continuous increase in greenhouse gas emissions over time. Atmospheric CO2 stabilizes at a substantial level of 30GT, compared to the 8GT recorded in 2000. The projected average global warming under this scenario ranges from 4.2 to 5.4°C.

It is important to note that the future climate outcomes for the Philippines, as projected under the SSP2-4.5 and SSP5-8.5 scenarios, are subject to uncertainties and depend on various factors such as policy choices, technological advancements, and global cooperation in reducing GHG emissions. Nonetheless, these scenarios provide valuable insights into potential climate futures, enabling stakeholders to consider a range of possibilities and take proactive measures to address climate change challenges in the Philippines.

Anchored on these scenarios and timelines, the Future Climate Risks and Scenarios sub-chapter covers comprehensive projections of CIDs and their effects in the coming decades, built upon three critical layers of analyses.

First, an analysis is conducted on how climate change is projected to evolve at a global level. Second, attention is given to the physical impacts that climate change may bring to the Philippines. Lastly, the translation of these physical impacts into socio-economic metrics is carried out to understand potential effects on the population and economy.

The analysis in this chapter focuses on four specific climatic impact-drivers—increased temperature and droughts, sea level rise and extreme sea levels, extreme precipitation, and intense wind and tropical cyclones, which have caused, and are projected to continue causing a vast majority of impact to the Philippines in the coming decades. It also assumes that no actions are taken to curb damages brought upon the nation by these CIDs, projecting the potential impacts across physical, social, and economic domains. A summary of projected estimates and ranges of these are highlighted in the following tables and write-ups.

Table 3.3.1. Estimated range of CID-driven physical impacts in the Philippines, SSP5-8.5

Physical Impact	Impact Across 2030 Decade (2030-2040 average)	Impact Across 2050 Decade (2050-2060 average)
Temperature rise may place PH in "Danger" heat index category	Average heat index of 38.9°C (+5% vs 1991-2020 averages)	Average heat index of 41.2°C (+11% vs 1991-2020 averages)
PH sea levels may rise[89] >2x faster in 2050 than current global average	Seas rising by +6.6 mm/year, causing ~0.25m increase	Seas rising by +8.9 mm/year, causing ~0.5m increase
Precipitation projected to become more erratic regionally	Precipitation levels projected to increase in Eastern areas in mid-section of the country (historically climate type II[90]) and central and eastern areas of Luzon (historically climate types I, III, and IV), and decrease in Northeastern portions of Luzon and southern areas of Mindanao (historically encompassing areas climate type III or IV)	
Tropical cyclones projected to intensify by almost a third[91]	+29% average max tropical cyclone wind speed	+33% average max tropical cyclone wind speed

[89] Compared with 1995-2014 average sea levels

[90] Climate types based on Modified Coronas Classification System: Type I – Two pronounced seasons: Dry from November to April, wet during the rest of the year; Type II – No dry season with a very pronounced rainfall from November to April and wet during the rest of the year; Type III – Seasons are not very pronounced; relatively dry from November to April, wet during the rest of the year; Type IV – Rainfall is more or less evenly distributed through the year.

[91] Compared with 2010-2020 historical average

Table 3.3.2. Estimated range of CID-driven social impacts in the Philippines, SSP5-8.5

Social Impact	Impact Across 2030 Decade (2030-2040 average)	Impact Across 2050 Decade (2050-2060 average)
Dangerous temperature exposure to 50%+ of the PH population in 2050	~11M exposed to “Dangerous” heat index levels[92]	~74M exposed to “Dangerous” heat index levels[93]
Rising sea levels projected to impact 2M+ Filipinos per year	~150k permanently displaced by sea level rise ~1.9M exposed to extreme sea levels	~420k permanently displaced by sea level rise ~2M exposed to extreme sea levels
Extreme precipitation[94] may expose 5M+ Filipinos to floods and landslide annually	~4.8M exposed to pluvial flooding ~250k exposed to fluvial flooding ~200k exposed to landslides	~5.2M exposed to pluvial flooding ~300k exposed to fluvial flooding ~200k exposed to landslides
Severe tropical cyclones[95] projected to impact 5-6M Filipinos per year	~5.3M exposed to a typhoon and/or super typhoon	~6M exposed to a typhoon and/or super typhoon

From a social perspective, 11 million Filipinos are projected to be exposed to heat indices above 42°C, at which point heat cramps, exhaustion and heat stroke are probable with continued exposure—this number is expected to increase to up to 74 million Filipinos in 2050. Sea level rise may permanently displace 150,000 and 420,000 Filipinos in 2030 and 2050, respectively—extreme sea levels, whose heights are projected to intensify as sea levels rise, may impact 1.9 million Filipinos in 2030, increasing to two million in 2050. Extreme precipitation causes pluvial and fluvial floods, as well as landslides—4.8 million Filipinos may be affected by pluvial flooding and an additional 250,000 impacted by fluvial flooding in 2030, growing to 5.2 million and 300,000 in 2050, with rain-induced landslides potentially impacting up to 200,000 Filipinos annually throughout this period. Lastly, approximately 5.3 million Filipinos may face more than one typhoon and/or super typhoon in 2030, climbing to 6 million in 2050.

From an economic perspective, severe impacts are projected from these climatic impact-drivers, with potential economic losses equating to damages of roughly 7.6% and 13.6% of GDP in 2030 and 2040[96], and potentially increasing to 18 to 25% of GDP by 2050 [97,98,99].

[92] Category of heat indices greater than 42°C, where heat cramps, exhaustion and heat stroke are probable with continued exposure

[93] Category of heat indices greater than 42°C, where heat cramps, exhaustion and heat stroke are probable with continued exposure

[94] Impact averaged between 2020-40, 2040-60 for social impacts driven by extreme precipitation

[95] Typhoon: > 118 km/h & < 184 km/h; Super Typhoons: > 185 km/h

[96] The World Bank Group. (2022). Philippine Country Climate and Development Report

[97] Swiss Re Institute. (2021). The economics of climate change: no action not an option

[98] Andrijevic, M., Ware, J. (2021). Lost & Damaged: A study of the economic impact of climate change on vulnerable countries.

[99] Given the wide range of possible outcomes, this range of values was chosen as a rough indication of total impacts the Philippines may face in 2050.

Of this, costs occurring from infrastructure damage, productivity loss due to extreme heat, and relocation of populations are projected to sum up to PHP0.8 trillion in 2030 and PHP1.3 trillion in 2050. The range of projected cost of inaction and its components in 2030, SSP5-8.5 is visualized in Figure 3.3.1 below.

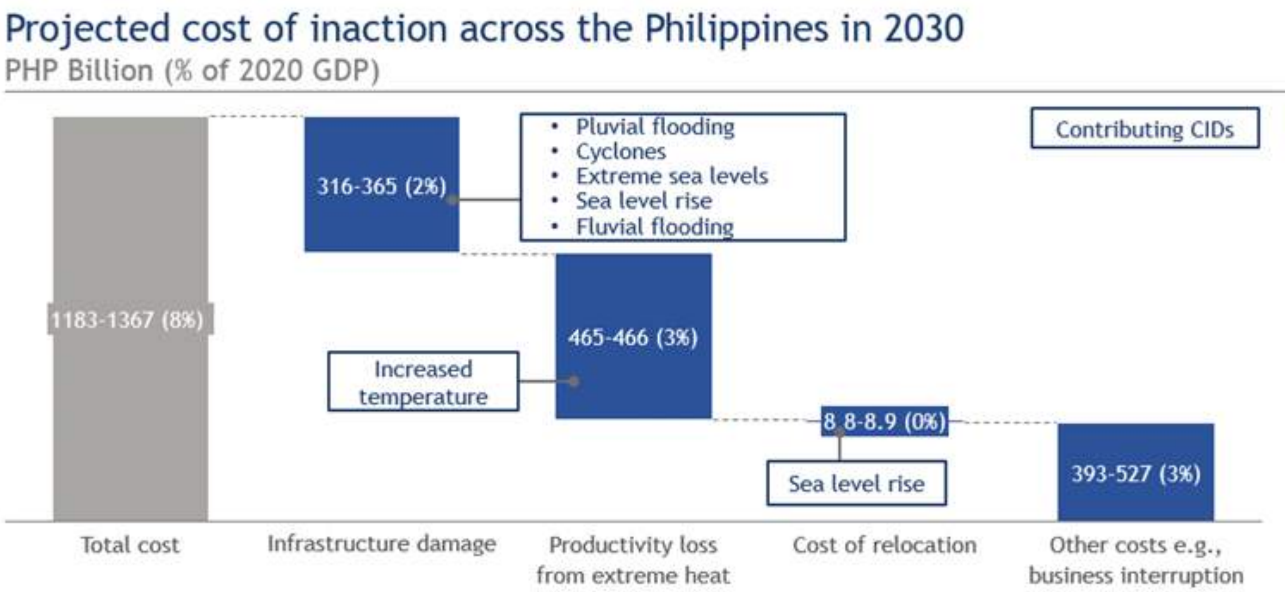


Figure 3.3.1. Range of possible cost of inaction, and contributing CIDs in 2030, SSP5-8.5

From a climatic impact-driver perspective, productivity loss from extreme heat is a significant driver of cost, projected to reach up to PHP466 billion annually by 2030 and soar to PHP870 billion annually by 2050. Annual losses arising from sea level rise and extreme sea levels, stemming from impacts such as damage of infrastructure or relocation of populations, are projected to hit PHP98 billion and PHP129 billion in 2030 and 2050, respectively. Due to extreme precipitation, pluvial and fluvial floods are projected to cause annual economic losses of PHP287 billion in 2030, and PHP312 billion in 2050. Lastly, intense wind and tropical cyclones may generate annual infrastructure damages of PHP83 billion and PHP78 billion in 2030 and 2050, respectively.

Further detailed analyses on global and Philippine-specific trends for each CID can be found in the following sub-sections in this chapter.

3.3.1 Increased temperature and drought

Future Global Trends

Key takeaways

For every additional 0.5°C of global warming, extreme weather events intensify and occur more frequently, including heatwaves, droughts (both meteorological and hydrological), with more regions experiencing increases than decreases (IPCC, 2021).

Temperatures are projected to be 1.2°C to 1.8°C (SSP2-4.5) and 1.3°C to 1.9°C (SSP5-8.5) higher in 2030 and 1.6°C to 2.5°C (SSP2-4.5) and 1.9°C to 3.0°C (SSP5-8.5) higher in 2050 compared to 1850 to 1900 figures (IPCC, 2021).

Multiple studies suggest that global surface temperature will continue to rise until at least mid-century in all emissions scenarios. In the near term, including the year 2030, temperatures are projected to be 1.2°C to 1.8°C (SSP2-4.5) and 1.3°C to 1.9°C (SSP5-8.5) higher compared to 1850 to 1900 figures In the mid-term, including the year 2050, temperatures are projected to increase by 1.6°C to 2.5°C (SSP2-4.5) and 1.9°C to 3.0°C (SSP5-8.5) compared to 1850 to 1900 (see Table 3.3.1.1 and Figure 3.3.1.1).[100]

[100] IPCC Sixth Assessment Report

Table 3.3.1.1: Near-, mid-, and long-term changes in global surface temperature relative to 1850-1900[101]

	Near term, 2021–2040		Mid-term, 2041–2060		Long term, 2081–2100	
Scenario	Best estimate (°C)	*Very likely* range (°C)	Best estimate (°C)	*Very likely* range (°C)	Best estimate (°C)	*Very likely* range (°C)
SSP1-1.9	1.5	1.2 to 1.7	1.6	1.2 to 2.0	1.4	1.0 to 1.8
SSP1-2.6	1.5	1.2 to 1.8	1.7	1.3 to 2.2	1.8	1.3 to 2.4
SSP2-4.5	1.5	1.2 to 1.8	2.0	1.6 to 2.5	2.7	2.1 to 3.5
SSP3-7.0	1.5	1.2 to 1.8	2.1	1.7 to 2.6	3.6	2.8 to 4.6
SSP5-8.5	1.6	1.3 to 1.9	2.4	1.9 to 3.0	4.4	3.3 to 5.7

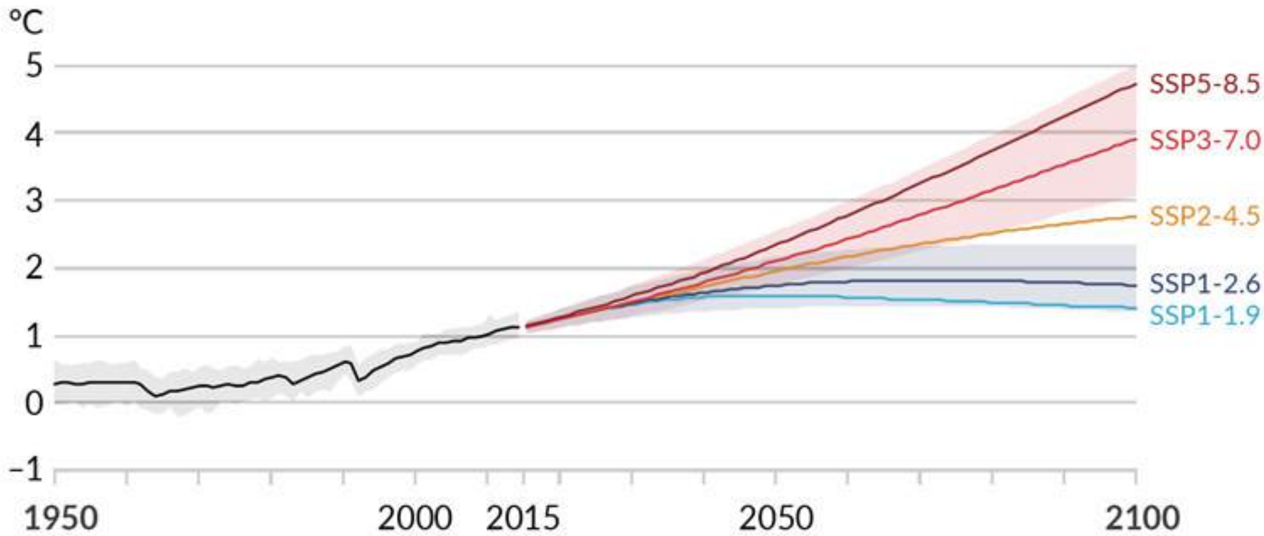


Figure 3.3.1.1: Annual changes in global surface temperature relative to 1850-1900[102]

3.3.1 Increased temperature and drought

Future Global Trends

With each incremental rise in global warming, the effects on extreme weather events become more pronounced. According to the IPCC Sixth Assessment Report, an increase of 0.5°C leads to noticeable intensification and frequency of hot extremes, such as heatwaves, as well as agricultural and ecological droughts in certain regions. Meteorological droughts show discernible changes in intensity and frequency, with more regions experiencing increases than decreases, for every additional 0.5°C of global warming. In some regions, he frequency and intensity of hydrological droughts also escalate with rising global temperatures.

[101] Intergovernmental Panel on Climate Change Sixth Assessment Report Summary for Policy Makers (2021) Figure SPM.1 p.14.

[102] Fyfe, John; Fox-Kemper, Baylor; Kopp, Robert; Garner, Gregory, 2023, AR6 SYR Data for Figure SPM.4(a): Global surface temperature changes in °C relative to 1850–1900

Projected Philippine trends

Key takeaways

The average nationwide temperature is projected to increase up to 0.9°C in the near term (2021 to 2040 annualized average) and up to 1.7°C in the longer term (2041 to 2060 annualized average) compared to 1991 to 2020.

By 2050 decade, the national average heat index, which accounts for the combined effects of temperature and humidity and reflects the impact on the human body, is projected to increase by up to 4.2°C, reaching up to 41.2°C and placing the country very near the 'Danger' heat index category.

The average number of consecutive dry days is projected to see a slight increase from 22 days per year to 22 to 24 days during the 2030 to 2040 period and 23 to 25 days in the 2050 to 2060 timeframe. Prolonged periods of dry days can have consequences for agriculture, water supply, and the overall economy.

The average number of unproductive days[103] due to extreme heat is projected to escalate from the current level of 28 days annually to 64 to 77 days by 2030 and reach a range of 133 to168 days by 2050.

Average temperature projected to increase up to 0.9°C by 2030 and up to 1.7°C by 2050 compared to 1991 to 2020

Average temperature (°C) is projected to increase across the Philippines. In the near term, (2021 to 2040 annualized average), nationwide average temperature is projected to increase by approximately 0.8°C (SSP2-4.5) to 0.9°C (SSP5-8.5), resulting in an absolute average nationwide temperature of 26.7°C to 26.8°C compared to 25.8°C baseline average from 1991to 2020[104]. In the longer term (2041 to 2060 annualized average), nationwide average temperature by 2050 is projected to further increase to 27.4°C under SSP2-4.5 scenario and 27.6°C under SSP5-8.5 scenario, which is a 1.5°C to 1.7°C increase from the baseline years of 1991 to 2020 (see Table 3.3.1.1).

Table 3.3.1.2[105]: Nationwide average temperature, temperature increase by 2030 and 2050 decades under SSP2-4.5 and SSP5-8.5 scenarios[106]

Region	1991 - 2020 (baseline)	2021-2040 Annualized Average		2021-2040 Annualized Average	
		SSP2-4.5	SSP5-8.5	SSP2-4.5	SSP5-8.5
Nationwide average temperature (°C)	25.8	26.7	26.8	27.4	27.6
Nationwide average projected temperature increase (°C)		0.8	0.9	1.5	1.7

Note: The methodology employs 30-year baselines for historical variability when possible. In cases with only a decade of data available, 10-year baselines are used, maintaining forecast consistency with 10-year ranges.

[103] Unproductive days is characterized by heat index temperatures exceeding 42°C.
[104] Baseline of 2010 to 2020 used due to data limitations on socio-economic modelling.
[105] Methodology provided in appendix.
[106] Boston Consulting Group. (2023). Data Model on Extreme Heat and Droughts [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) database.

Average heat index[107] projected to increase up to 1.7°C by 2030 and up to 4.2°C by 2050 compared to 2010 to 2020

The country's heat index is anticipated to undergo a significant increase in the coming decades. Projections indicate that by the 2030 decade, the national average heat index will increase from 37°C to 38.4°C to 38.9°C, remaining within the 'Extreme Caution' heat index group. However, by the 2050 decade, the heat index is projected to near 'Danger' zone, with temperatures ranging from 40.3°C to 41.2°C (see Table 3.3.1.2).

Average number of consecutive dry days projected to slightly increase

The projected increase in the average number of consecutive dry days[108] from 22 days per year to 22 to 24 days in the 2030 to 2040 period and 23 to 25 days in the 2050 to 2060 period, has implications for drought conditions, indicating a potential impact on water resources and agricultural activities (see Table 3.3.1.2).

Table 3.3.1.3[109] : Nationwide average heat index and consecutive dry days by 2030 and 2050 decades under SSP2-4.5 and SSP5-8.5 scenarios[110]

Region	2010 - 2020 (Baseline)	2030 Decade (2030 - 2040 Annualized Average)		2050 Decade (2050 - 2060 Annualized Average)	
		SSP2-4.5	SSP5-8.5	SSP2-4.5	SSP5-8.5
Nationwide average heat index (°C)	37.0	38.4	38.9	40.3	41.2
Nationwide average consecutive dry days	22	24	22	25	23

Note: The methodology employs 30-year baselines for historical variability when possible. In cases with only a decade of data available, 10-year baselines are used, maintaining forecast consistency with 10-year ranges.

The number of unproductive days in a year due to extreme heat will soar[111]

The number of unproductive days, characterized by days with heat index temperatures exceeding 42°C, is projected to rise significantly (see Figure 3.3.1.2). Currently averaging 28 days per year (2010 to 2020), unproductive days may increase up to 64 to 77 days by the 2030 decade and further to 133 to 168 days by the 2050 decade. Moreover, the maximum number of unproductive days nationwide is projected to surge from the current level of 148 days to 254 to 274 days by the 2030 decade and 337 to 344 days by the 2050 decade.

[107] The heat index is a measure that considers both air temperature and relative humidity to determine the level of discomfort or danger due to heat. The heat index categories used for classification (based on PAGASA classification) is as follows:

- Caution: Heat index ranging from 27-32°C
- Extreme caution: Heat index ranging from 33-41°C
- Danger: Heat index ranging from 42-51°C
- Extreme danger: Heat index of 52°C and above

[108] Consecutive Dry Days: Maximum number of consecutive days with precipitation below 1 mm in a year.

[109] Methodology provided in appendix.

[110] Boston Consulting Group. (2023). Data Model on Extreme Heat and Droughts [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) database.

[111] Methodology provided in appendix.

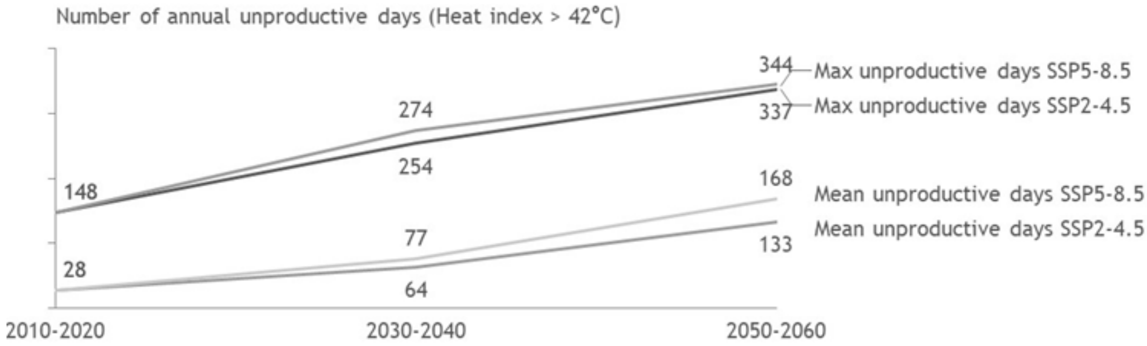


Figure 3.3.1.2 Mean and maximum number of annual unproductive days by 2030 and 2050 decades under SSP2-4.5 and SSP5-8.5 scenarios[112]

Note: The methodology employs 30-year baselines for historical variability when possible. In cases with only a decade of data available, 10-year baselines are used, maintaining forecast consistency with 10-year ranges.

Potential socio-economic impact

Key takeaways

By 2030, up to 11 million Filipinos are projected to be exposed to heat indices greater than 42°C, with this number expected to increase to up to 74 million by 2050.

Labor productivity loss or reduced work capacity due to heat stress is projected to reach up to PHP466 billion by 2030 and a staggering PHP870 billion by 2050.

Table 3.3.1.4: Social and economic impact of increased temperature[113]

Region	2030 Decade (2030 - 2040 Annualized Average)		2050 Decade (2050 - 2060 Annualized Average)	
	SSP2-4.5	**SSP5-8.5**	**SSP2-4.5**	**SSP5-8.5**
Social impact: Population exposed	4 million	11 million	73 million	74 million
Economic Impact: Labor productivity loss (PHP)	465 billion	466 billion	645 billion	870 billion

Note: Figures provided are approximations; Population exposed to extreme heat defined as population located in area exposed to heat index with a yearly average greater than 42°C; labor productivity lost due to extreme heat defined as reduced work capacity arising from slower work, or a complete suspension of work, due to heat stress.

[112] Boston Consulting Group. (2023). Data Model on Extreme Heat and Droughts [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) database.ws

[113] Boston Consulting Group. (2023). Data Model on Extreme Heat and Droughts [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) database.

Up to 74 million Filipinos and PHP870 billion on the line by 2050[114] due to extreme heat

The potential impact of extreme heat on Filipinos is a growing concern. By 2030, up to 11 million people could be affected by heat indices exceeding 42°C. This number could potentially skyrocket to 74 million by 2050, particularly under the SSP5-8.5 scenario (see Table 3.3.1.4).

This increase is largely driven by a nationwide average heat index that could reach 41.2°C by 2050 under SSP5-8.5, affecting a larger portion of the population. Furthermore, the economic consequences of reduced work capacity due to heat stress are substantial, with potential losses ranging from PHP465-466 billion by 2030 to PHP645-870 billion by 2050.

Most impacted regions

Key takeaways

- Mindanao is projected to be most impacted by temperature increase overall, experiencing:
  - **The highest increase in average temperature—up to 1.1°C (+4%) in the near term (2021 to 2040 annualized average) and 2.0°C (+8%) in the long term (2041 to 2060 annualized average) versus 1991 to 2020 (Boston Consulting Group, 2023).**
  - **Unproductive days may reach as high as 274 days in 2030 and 344 days in 2050 in some areas in Mindanao under SSP5-8.5.**
- Both Visayas and Mindanao are projected to experience an increasing number of consecutive dry days. Visayas with up to +58% by 2030 (from 15 to 24 days) and +54% by 2050 (from 15 to 23 days) and Mindanao with up to +39% by 2030 (from 14 to 19 days) and +44% (from 14 to 20 days) by 2050 compared to 2010 to 2020.
- On a regional level, NCR and CAR in Luzon and Region XIII (Caraga Region) in Mindanao are projected to have the highest temperature increases in the near term, reaching up to 6.3% (NCR), 6.2% (CAR), and 6.1% increase compared to 1991 to 2020 baseline (Region XIII).
- Regions IX (Zamboanga) in Mindanao, VIII (Eastern Visayas), and VI (Western Visayas) are projected to hold 63% (~7 million of ~11 million) of total Filipinos impacted by extreme heat, or heat indices greater than 42°C by 2030 under SSP5-8.5 scenario.
- Regions IV-A (Calabarzon), III (Central Luzon), and NCR in Luzon face 36% (around PHP ~167 billion out of PHP ~466 billion) of Philippines' Labor Productivity Loss Due to Extreme Heat by 2030 under SSP5-8.5

Mindanao projected to experience highest increase in average temperature and have areas with the highest number of unproductive days

It is crucial to emphasize the spatial variability in temperature changes throughout the country, as different regions will encounter more pronounced shifts compared to the 1991 to 2020 average. Notably, the southern region of the country, Mindanao, is projected to experience the most substantial increase in average temperature by both 2021 to 2040 and 2041 to 2060 (see Table 3.3.1.4).

Consequently, Mindanao is also projected to have certain areas with the highest number of maximum unproductive days in the country during the 2030 and 2050 decades (see Table 3.3.1.5) and a substantial increasing percent change of average number of consecutive dry days by 2030 and 2050 versus 2010 to 2020 (see Table 3.3.1.6).

[114] Methodology provided in appendix.

Table 3.3.1.5: Average temperature change (%) versus historical baseline (1991 to 2020) by island group in years 2021 to 2040 and 2041 to 2060 under SSP2-4.5 and SSP5-8.5 scenarios[115]

Island Group	2021 - 2040 Decade Average temperature change versus 1991-2020		2041 - 2060 Decade Average temperature change versus 1991-2020	
	SSP2-4.5	SSP5-8.5	SSP2-4.5	SSP5-8.5
Luzon	0.7°C (+3%)	0.8°C (+3%)	1.4°C (+6%)	1.6°C (+7%)
Visayas	0.8°C (+3%)	0.9°C (+3%)	1.5°C (+6%)	1.7°C (+6%)
Mindanao	1.1°C (+4%)	1.1°C (+4%)	1.7°C (+7%)	2°C (+8%)
Nationwide	0.8°C (+3%)	0.9°C (+4%)	1.5°C (6%)	1.7°C (+7%)

Note: The methodology employs 30-year baselines for historical variability when possible. In cases with only a decade of data available, 10-year baselines are used, maintaining forecast consistency with 10-year ranges.

[115] Boston Consulting Group. (2023). Data Model on Extreme Heat and Droughts [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) database.

Table 3.3.1.6: Maximum number of unproductive days by island group in 2010, 2030, and 2050 decades under SSP2-4.5 and SSP5-8.5 scenarios; Unproductive days defined as days with heat index temperatures exceeding 42°C[116]

Island Group	2010 - 2020 Maximum Unproductive Days	2030 - 2040 Maximum Unproductive Days		2050 - 2060 Maximum Unproductive Days	
		SSP2-4.5	SSP5-8.5	SSP2-4.5	SSP5-8.5
Luzon	137	190 (+39%)	208 (+52%)	250 (+82%)	259 (+89%)
Visayas	143	199 (+39%)	229 (+60%)	264 (+85%)	280 (+89%)
Mindanao	148	254 (+72%)	274 (+85%)	337 (+128%)	344 (+132%)
Nationwide	148	254 (+72%)	274 (+85%)	337 (+128%)	344 (+132%)

Note: The methodology employs 30-year baselines for historical variability when possible. In cases with only a decade of data available, 10-year baselines are used, maintaining forecast consistency with 10-year ranges.

Table 3.3.1.7: Number and percent change (versus 2010 to 2020 historical baseline) of consecutive dry days island group in 2030 and 2050 decades under SSP2-4.5 and SSP5-8.5 scenarios; Consecutive Dry Days (CDD): Maximum number of consecutive days with precipitation below 1 mm in a year. If a dry spell extends beyond one year, the accumulated dry days are carried forward until the spell ends.[117]

Island Group	2010 - 2020 Average number of consecutive dry days	2030 - 2040 Average number of consecutive dry days (% change versus 2010 to 2020 figures)		2050 - 2060 Average number of consecutive dry days (% change versus 2010 to 2020 figures)	
		SSP2-4.5[8]	SSP5-8.5	SSP2-4.5	SSP5-8.5
Luzon	27	27 (+2%)	27 (0%)	30 (+13%)	29 (+7%)
Visayas	15	24 (+58%)	21 (+41%)	23 (+54%)	21 (+37%)
Mindanao	14	19 (+39%)	16 (+22%)	20 (+44%)	17 (+28%)
Nationwide	20	24 (+19%)	23 (+12%)	26 (+26%)	23 (+16%)

Note: The methodology employs 30-year baselines for historical variability when possible. In cases with only a decade of data available, 10-year baselines are used, maintaining forecast consistency with 10-year ranges.

[116] Boston Consulting Group. (2023). Data Model on Extreme Heat and Droughts [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) database.

[117] Boston Consulting Group. (2023). Data Model on Extreme Heat and Droughts [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) database.(Coupled Model Intercomparison Project Phase 6) database.

Regions IX (Zamboanga), VIII (Eastern Visayas), and VI (Western Visayas) are projected to hold 63% (~7 million of ~11 million) of total Filipinos impacted by extreme heat by 2030

Regions IX (Zamboanga), VIII (Eastern Visayas), and VI (Western Visayas) are projected to have about 2.7 million, 2.1 million, and 1.8 million (total of ~7 million) people impacted by extreme heat, or heat indices greater than 42°C by 2030 under SSP5-8.5 scenario.

Regions IV-A (Calabarzon), III (Central Luzon), and NCR face 36% of Philippines' Labor Productivity Loss Due to Extreme Heat by 2030

In terms of economic impact, as measured by labor productivity loss due to extreme heat (defined as reduced work capacity resulting from slower work or complete work suspension due to heat stress), specific regions stand out. Regions IV-A (Calabarzon), III (Central Luzon), and NCR collectively account for a significant portion of the Philippines' labor productivity loss due to extreme heat by 2030. Specifically, these three regions are projected to contribute approximately 36% (around PHP ~167 billion out of PHP ~466 billion) of the total economic impact resulting from reduced work capacity due to heat stress in the country, as per the SSP5-8.5 scenario (see Table 3.3.1.8 for the summary of results).

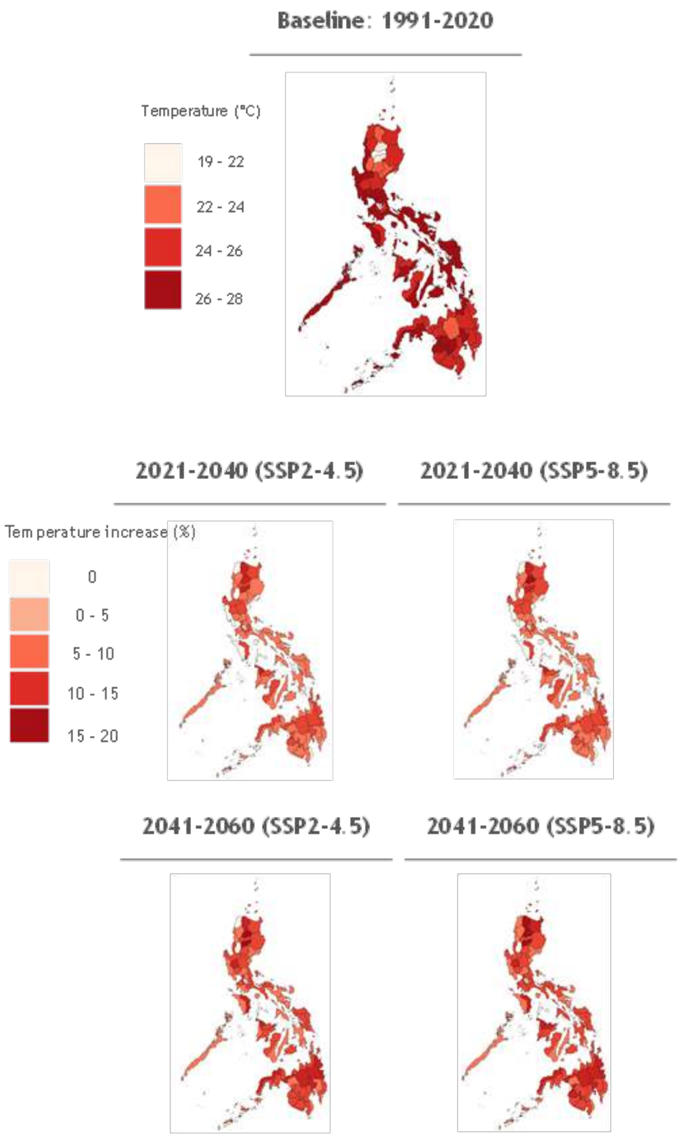


Figure 3.3.1.3: 1991-2020 Historical annualized average temperature and average annualized temperature increase (%) under SSP2-4.5 and SSP5-8.5 scenario by 2021-2040 and 2041-2060[118]

Note: The methodology employs 30-year baselines for historical variability when possible. In cases with only a decade of data available, 10-year baselines are used, maintaining forecast consistency with 10-year ranges.

[118] Boston Consulting Group. (2023). Data Model on Extreme Heat and Droughts [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) database

Table 3.3.1.8: Average temperature change (% and °C), average temperature (°C), population impacted, annualized population impacted in 2030 to 2040 as a percent of total population (based on 2020 population figures), annualized economic impact (Billion PHP) in 2030 to 2040 by region, under SSP5-8.5 scenario[119]

REGION	Temperature Change (%)	Temperature Change (°C)	1991-2020 Average Temperature (°C)	2021-2040 Average Temperature (°C)	Pop. Impacted (k people) by 2030	% of Total Population Impacted 2020 Population)	Economic Impact (Bn PHP) by 2030
National Capital Region	6.3	1.7	26.9	28.6	-	-	45
Cordillera Administrative Region	6.2	1.3	21.9	23.3	-	-	3
Region XIII	6.1	1.6	26.1	27.7	740	26%	14
Region VI	5.9	1.5	26.1	27.6	1,820	23%	38
Region XII	5.8	1.5	25.6	27.1	-	-	23
Region X	5.1	1.3	25.2	26.4	570	11%	24
Region II	4.3	1	24.4	25.5	-	-	10
Region IX	4.2	1.1	26.4	27.5	2,680	69%	30
Region XI	3.6	0.9	25.6	26.5	620	12%	22
Region IV-A	3.6	0.1	26.4	27.4	-	-	71
Region III	2.5	0.6	26.1	26.8	-	-	51
Region V	2.4	0.6	26.8	27.4	640	10%	31
Region VII	2.1	0.6	26.9	27.5	150	2%	37
Bangsamoro Autonomous Region in Muslim Mindanao	2.1	0.5	26.5	27	600	14%	17
Region VIII	1.9	0.5	26.7	27.2	2,120	47%	24
Region I	1.8	0.5	26.2	26.7	280	5%	14
Region IV-B	-0.3	-0.1	26.2	26.1	370	12%	12

Top metrics under each category

Note: Table sorted based on temperature change (%); Figures highlighted indicate top figures under respective metrics; Population exposed to extreme heat defined as population located in area exposed to heat index with a yearly average greater than 42°C. The methodology employs 30-year baselines for historical variability when possible. In cases with only a decade of data available, 10-year baselines are used, maintaining forecast consistency with 10-year ranges.

[119] Boston Consulting Group. (2023). Data Model on Extreme Heat and Droughts [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) database

3.3.2 Sea level rise and extreme sea levels

Future global trends

Key takeaways

- Sea level rise will persist, with the extent and rate influenced by future emission scenarios (IPCC, 2021).
- The IPCC projects a global mean sea level rise of 0.20 to 0.29 m by 2050 under the SSP5-8.5 scenario, compared to the 1995-2014 baseline (IPCC, 2021).
- By 2050, the frequency of extreme sea levels is projected to increase 20 to 30 times compared to 1900 (IPCC, 2021).
- Approximately one billion people globally potentially exposed to the impacts of sea level rise by 2050 (IPCC, 2021).

According to the IPCC Sixth Assessment Report, global mean sea level rise is projected to have significant impacts by 2050. Relative to the period of 1995 to 2014, the likely rise by 2050 ranges from 0.15 to 0.23 m in the very low GHG emissions scenario (SSP1-1.9) and 0.20 to 0.29 m in the very high GHG emissions scenario (SSP5-8.5).

Figure 3.3.2.1 provides a comprehensive visualization of observed and projected global mean sea level changes, potential impacts, and time frames for coastal risk management. It also highlights that by 2050, extreme sea levels will become 20 to 30 times more frequent.

In addition to the scientific perspective, the human dimension cannot be ignored. Currently, approximately 896 million people, nearly 11% of the global population, reside in low-lying coastal zones. By 2050, this number is projected to exceed one billion people exposed to sea level rise across all socioeconomic pathways (SSPs). This underscores the importance of implementing adaptation measures and coastal risk management strategies to protect vulnerable communities around the world.

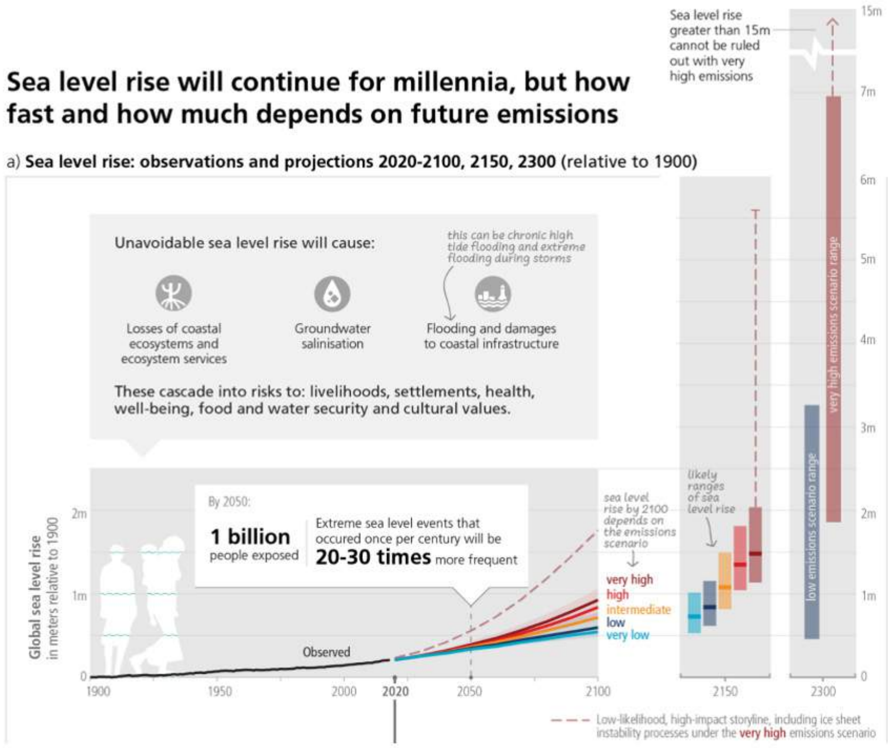


Figure 3.3.2.1: Global mean sea level change in meters relative to 1900. The historical changes (black) are observed by tide gauges before 1992 and altimeters afterwards. The future changes to 2100 and for 2150 (colored lines and shading) are assessed consistently with observational constraints based on emulation of CMIP, ice-sheet, and glacier models, and median values and likely ranges are shown for the considered scenarios.[120]

[120] Intergovernmental Panel on Climate Change Sixth Assessment Report Longer Report (2021) Figure 3.4 p.45

Projected Philippine Trends

Key takeaways

Sea level rise

- The projected highest rate of sea level rise in the Philippines for the 2030 decade is 13 mm per year, with an average of 5.4 mm (SSP2-4.5) to 6.6 mm (SSP5-8.5) per year. This represents a doubling of the global average rate documented in previous reports that is 2.8-3.6 mm per year from 1993 to 2010. By 2050, the rate is projected to increase further to 8.0 (SSP2-4.5) to 8.9 (SSP5-8.5) mm per year.
- In terms of absolute sea level rise, projections indicate a maximum increase of 0.25 m by 2030 and 0.5 m by 2050, relative to the 1995 to 2014 baseline. These figures represent a doubling of the projected global sea level rise of 0.20 to 0.29 m by 2050, relative to the 1995 to 2014 period.

Extreme sea levels

- In terms of absolute sea level rise, projections indicate a maximum increase of 0.25 m by 2030 and 0.5 m by 2050, relative to the 1995 to 2014 baseline. These figures represent a doubling of the projected global sea level rise of 0.20 to 0.29 m by 2050, relative to the 1995 to 2014 period.
- The 2030 decade is anticipated to bring the possibility of extreme sea levels leading to a substantial increase in sea level, reaching up to 3 m in the 10-year period. This magnitude is 12 times that of the sea level rise projection of 0.25 m. Similar results are projected for the 2050 timeframe.

Sea level rise is a multifaceted phenomenon that encompasses both sea level rise and the occurrence of extreme sea levels. Sea level rise refers to the long-term increase in the average level of the oceans, while extreme sea levels are additional events that can exacerbate the impacts of sea level rise, such as storm surges and high tides. Sea level rise and extreme sea levels require different adaptation actions and hence, impacts of each will be displayed separately.

The main driver of sea level rise is a complex interplay of various factors. Factors contributing to sea level rise include Sterodynamic sea level, glaciers, land water storage, ice sheets, and subsidence.[121]

In addition to sea level rise, extreme sea levels aggregate the overall impact. These events are characterized by their intensity and are measured in terms of their projected frequency of occurrence within specific return periods, such as one year, 10 years, or 100 years. Some components of extreme sea levels include astronomical tides, storm surge (including storm surges from typhoons and El Niño–Southern Oscillation), Waves, and Swash.[122]

The combination of permanent sea level rise and extreme sea events amplifies the risks and impacts faced by coastal areas.

[120] Oceanic Variability: Sea level change can arise from the natural variability in the ocean's circulation, temperature, and salinity. Large-scale climate signals like the seasonal cycle, El Niño Southern Oscillation (ENSO), North Atlantic Oscillation (NAO), and Pacific Decadal Oscillation (PDO) can influence sea level patterns.

Glaciers: Glaciers outside of the ice sheets, although accounting for only about 1% of total ice trapped on land, contribute to sea level rise. As these glaciers melt and discharge water into the oceans, it contributes to the overall rise in sea level.

Land Water Storage: Changes in the global water cycle, including groundwater withdrawal and water impoundment, can impact sea level. Variations in the transfer of water between land and ocean can influence the overall sea level measurements.

Ice Sheets: The Greenland and Antarctic ice sheets are massive reservoirs of ice. When these ice sheets melt or experience increased ice discharge into the ocean, it contributes to rising sea levels.

Subsidence: The movement of land at the coast, which can either be downward or upward. This movement can occur due to various physical processes, including groundwater and hydrocarbon withdrawal, tectonic activities, and glacial isostatic adjustment.

[121] Oceanic Variability: Sea level change can arise from the natural variability in the ocean's circulation, temperature, and salinity. Large-scale climate signals like the seasonal cycle, El Niño Southern Oscillation (ENSO), North Atlantic Oscillation (NAO), and Pacific Decadal Oscillation (PDO) can influence sea level patterns.

Glaciers: Glaciers outside of the ice sheets, although accounting for only about 1% of total ice trapped on land, contribute to sea level rise. As these glaciers melt and discharge water into the oceans, it contributes to the overall rise in sea level.

Sea levels in the Philippines are projected to rise at ~2x of historical global average by 2030[123]

The projected rate of sea level rise for the period between 2030 decade (2030 to 2040) is a maximum of 13 mm/year (see Figure 3.3.2.5) within certain areas of the country, while the national average is projected to be between 5.4 mm (SSP2-4.5) to 6.6 mm (SSP5-8.5) per year (see Figure 3.3.2.2), double the global average rate of 3.2 to 4.2 mm/year between 2006 and 2018.[124]

The rate of sea level rise by 2050 decade (2050 to 2060) is projected to increase, with a nationwide average annual rate of SLR rising to 8.0 (SSP2-4.5) to 8.9 (SSP5-8.5) mm per year (see Figure 3.3.2.2), higher than the rates of both the historical and 2030 projections, indicating a generally faster pace of sea level rise felt across the country.[125]

In terms of absolute SLR, projections show an increase of sea levels up to 0.25 m (see Figure 3.3.2.6), with a national average of 0.1 m (see Figure 3.3.2.3), projected by 2030 compared to the baseline average sea level recorded in the Philippines from 1995 to 2014.

By 2050, the absolute SLR is estimated to reach up to 0.5 m (see Figure 3.3.2.6) compared to the baseline average sea level recorded from 1995 to 2014, which is double the 2030 projection of 0.25 m, and double the projected global sea level rise of 0.20 to 0.29 m by 2050 in comparison to 1995 to 2014.[126]

By 2050, the absolute SLR is estimated to reach up to 0.5 m (see Figure 3.3.2.6) compared to the baseline average sea level recorded from 1995 to 2014, which is double the 2030 projection of 0.25 m, and double the projected global sea level rise of 0.20 to 0.29 m by 2050 in comparison to 1995 to 2014.[127]

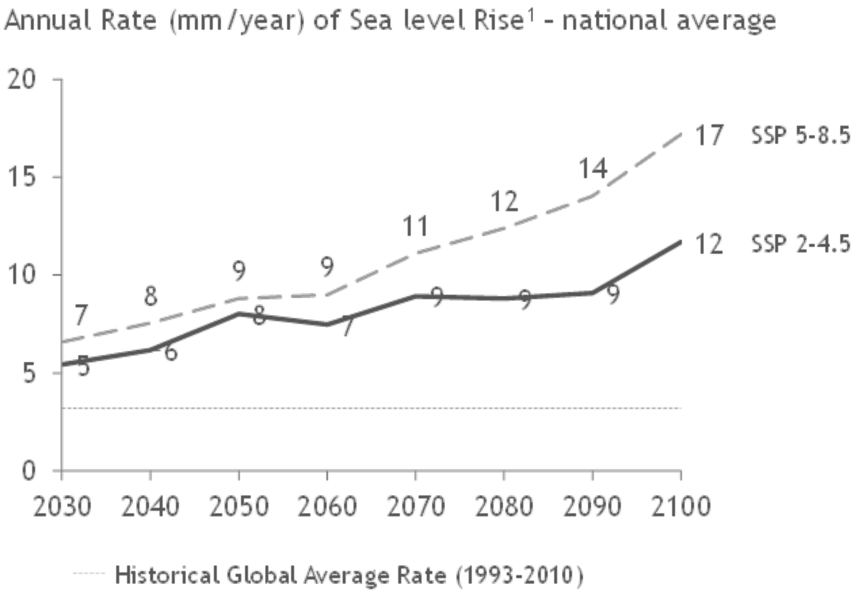


Figure 3.3.2.2: Annual rate of sea level rise (mm/year) in the Philippines up to 2100 under SSP2-4.5 and SSP5-8.5 scenarios (excluding vertical land motion)[128]

[123] Methodology provided in appendix.
[124] IPCC Sixth Assessment Report Working Group 1
[125] Boston Consulting Group's analytics
[126] Boston Consulting Group's analytics
[127] IPCC Sixth Assessment Report 2023
[128] Boston Consulting Group. (2023). Data Model on Sea Level Rise and Extreme sea levels [Data model]. Retrieved from IPCC AR6 Sea Level Projections, Coastal Futures, Nasa Earth data, and Alaska satellite facility databases.

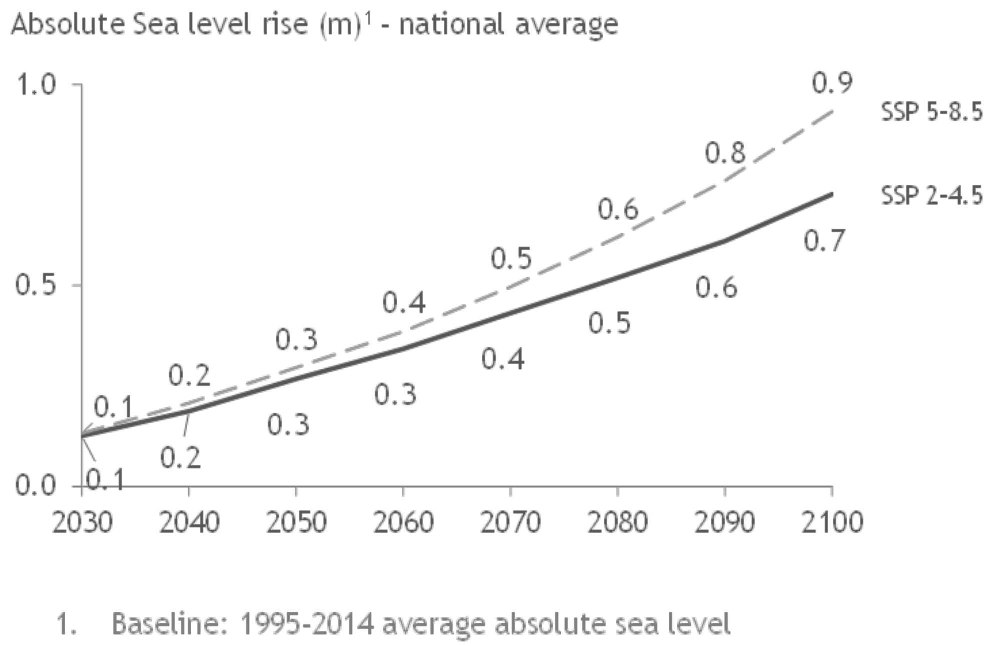


Figure 3.3.2.3: Absolute sea level rise (meters) in the Philippines compared to country 1995-2014 baseline up to 2100 under SSP2-4.5 and SSP5-8.5 scenarios[129]

Magnitude of extreme sea levels 12x greater than that of sea level rise by 2030

Regarding extreme sea levels, the sea level rise during a 10-year return period is projected to reach up to 3 m (see Figure 3.3.2.8). This implies that in the 2030 decade, an extreme sea event could lead to a substantial increase in sea level of up to 3 m, the magnitude of which is 12x that of the SLR (0.25 m) in 2030 (see Figure 3.3.2.6).[130]

By 2050, the impact of extreme sea levels is projected to remain consistent with the 2030 projections. The potential 3-meter increase from an extreme event (see Figure 3.3.2.8) is 3x greater than the projected 0.5-meter increase in SLR (see Figure 3.3.2.6).

Potential socio-economic impact

Key takeaways

Sea level rise

By 2030 and 2050, up to 154,000 and 423,000 Filipinos, respectively, will be at risk from permanent displacement due to sea level rise, with potential economic losses of PHP18 billion and PHP41 billion, respectively (see Table 3.3.2.1).

Extreme sea levels

Approximately 2 million people in the Philippines could be impacted by extreme flooding events by 2030 and 2050, translating to about PHP80 billion and PHP88 billion in infrastructure damage (see Table 3.3.2.1).

[129] Boston Consulting Group. (2023). Data Model on Sea Level Rise and Extreme sea levels [Data model]. Retrieved from IPCC AR6 Sea Level Projections, Coastal Futures, Nasa Earth data, and Alaska satellite facility databases.

[130] Boston Consulting Group's analytics

Table 3.3.2.1: Social and economic impact of sea level rise and extreme sea events[131]

Socioeconomic Impact Sea Level Rise	2030 Decade (2030 - 2040 Annualized Average)		2050 Decade (2050 - 2060 Annualized Average)	
	SSP2-4.5	SSP5-8.5	SSP2-4.5	SSP5-8.5
Social impact: Population exposed	75K to 151K	77K to 154K	240K to 387K	252K to 423K
Economic Impact: Infrastructure damage (PHP)	18 billion	18 billion	40 billion	41 billion

Socioeconomic Impact Sea Level Rise	2030 Decade (2030 - 2040 Annualized Average)		2050 Decade (2050 - 2060 Annualized Average)	
	SSP2-4.5	SSP5-8.5	SSP2-4.5	SSP5-8.5
Social impact: Population exposed	1.7 million to 1.9 million	1.7 million to 1.9 million	1.8 million to 2.0 million	1.9 million to 2.0 million
Economic Impact: Infrastructure damage (PHP)	80 billion	80 billion	86 billion	88 billion

Note: Figures provided are approximations.

Note: Population impacted is defined as the population located in an area flooded with at least 30 cm to 50 cm of water for sea level rise.

The coastal flooding analysis was conducted using a comprehensive approach that integrated key factors (see Figure 3.3.2.4). These factors include the absolute increase in sea level rise, land elevation, land subsidence, and the projected occurrence of extreme sea levels. By combining these inputs, a detailed assessment of potential flood depth was obtained.

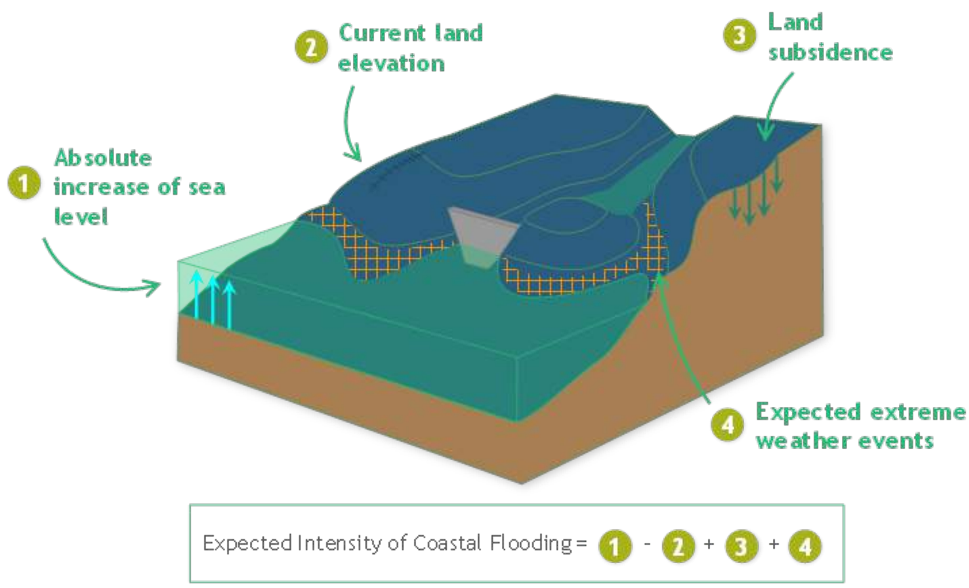


Figure 3.3.2.4: Coastal flooding model methodology to calculate projected intensity of coastal flooding in the Philippines[132]

[131, 132] Boston Consulting Group. (2023). Data Model on Sea Level Rise and Extreme sea levels [Data model]. Retrieved from IPCC AR6 Sea Level Projections, Coastal Futures, Nasa Earth data, and Alaska satellite facility databases.

Up to 154,000 and 423,000 Filipinos exposed to sea level rise, with potential economic losses of about PHP18 billion and PHP41 billion by 2030 and 2050[133]

Overall, by 2030, flooding from sea level rise translates to potentially 77,000 to 154,000 people impacted (SSP5-8.5); defined as an area flooded with at least 30 cm to 50 cm of water for sea level rise.[134] Looking towards 2050, the number of people affected is projected to increase to around 252,000 to 423,000 individuals (SSP5-8.5).

Sea level rise is forecasted to cause PHP18 billion in infrastructure damage by 2030, which escalates to PHP41 billion by 2050. These figures highlight the growing magnitude of the challenges posed by SLR and the urgent need for effective adaptation and mitigation measures.

Up to two million potential Filipino population impacted by extreme flooding events, with potential economic losses of about PHP80 billion and PHP88 billion by 2030 and 2050[135]

Overall, floods from extreme sea levels would result in the displacement and disruption of up to two million individuals by 2030 and 2050 (SSP5-8.5).

Extreme sea levels are forecasted to cause up to PHP80 billion in infrastructure damage by 2030 and nearly PHP88 billion by 2050. These figures underscore the ongoing and escalating challenges posed by extreme flooding events, highlighting the urgent need for robust adaptation and mitigation strategies to safeguard vulnerable communities and regions.

[133] Methodology provided in appendix
[134] Boston Consulting Group's analytics
[135] Boston Consulting Group's analytics. Methodology provided in appendix.

Most impacted regions

Key takeaways

Sea level rise

- Sea levels are projected to rise at an increasing rate of up to 13mm per year across Philippines. The north experiences higher sea level rise than southern Philippines as highlighted by Figure 3.3.2.5.
- Luzon, particularly provinces facing the West Philippine Sea, will experience a 1.5 times faster pace of SLR compared to the national average, with up to 8.0 mm/year by 2030 and up to 10.3 mm/year by 2050.
- Regions in Luzon to bear highest average flooding depths:
  - Regions III (Central Luzon), IV-A (CALABARZON), and II (Cagayan Valley) are projected to bear the highest average flooding levels of about 0.27-0.29 m, while regions III, IV-B (MIMAROPA), and I (Ilocos Region) are projected to experience the highest maximum flooding depth of 0.7 to 1.0 m by 2030 under the SSP8-5.8 scenario.
- Socioeconomic impacts of sea level rise highest in Luzon regions:
  - By 2030 under the SSP5-8.5 scenario, up to 74% (114k of 154k) of the total impacted population by SLR flooding will come from regions III (Central Luzon), IV-A (CALABARZON), and I (Ilocos Region) (Boston Consulting Group, 2023).
  - Regions III (Central Luzon), I (Ilocos Region), and V (Bicol Region) in Luzon are projected to collectively account for 68% (PHP12 billion of PHP18 billion) of the total infrastructure damage attributed to SLR by 2030 under SSP5-8.5 scenario.

Extreme sea levels

- The effects of extreme sea levels are projected to be more pronounced in the eastern regions, specifically in regions V (Bicol Region), II (Cagayan Valley), and VIII (Eastern Visayas). However, from 2030 to 2050, the National Capital Region (NCR) and region IV-B (MIMAROPA) are projected to experience significant increases in sea level from extreme events.
- Regions VIII (Eastern Visayas), II (Cagayan Valley), and XIII (Caraga) primarily located in the eastern areas of the country are projected to experience the highest average flood intensity levels of about 0.9 to 1.0 m by 2030 under the SSP5-8.5 scenario. In terms of maximum flooding, regions V (Bicol Region), II (Cagayan Valley), and VIII (Eastern Visayas) are projected to have the highest levels from extreme sea levels.
- Socioeconomic impact of extreme sea events is highest in the Visayas region
  - By 2030 under the SSP5-8.5 scenario, 34% (648k of 1.9 million) of the total impacted population by extreme sea levels is projected to come from regions VII (Central Visayas), VI (Western Visayas), and VIII (Eastern Visayas) in Visayas.
  - Regions VII (Central Visayas) and VIII (Eastern Visayas), along with Region V (Bicol region) in southeastern Luzon, are projected to bear 37% (PHP30 billion of PHP80 billion) of infrastructure damage from extreme sea events.

Luzon faces accelerated sea level rise compared to the rest of the country.

Luzon is experiencing a significantly faster rate of sea level rise compared to the national average. In particular, the provinces of NCR, Bulacan, Zambales, and Batangas, all with coastal areas facing the West Philippine sea are projected to experience high rates of SLR (see Table 3.3.2.2).

This trend continues into the 2050 decade, with Luzon projected to experience a rate of sea level rise that is approximately 1.1 times faster than the national average. By the 2050 decade, the projected annual rate of SLR in Luzon is estimated to be 9.4 mm/year (SSP2-4.5) to 10.3 mm/year (SSP5-8.5), surpassing the projected national average of 8.8 to 8.9 mm/year.

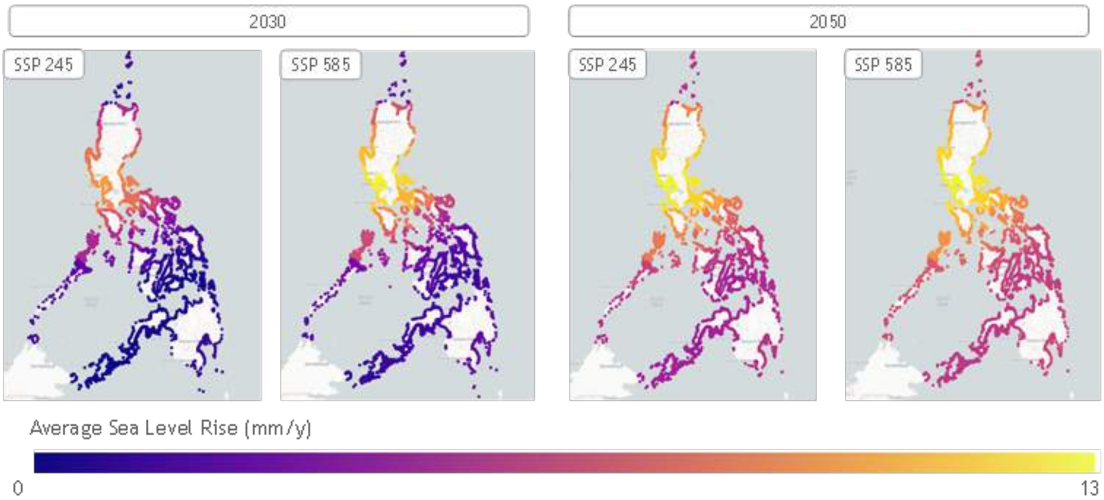


Figure 3.3.2.5: Average sea level rise (mm/year) across areas in the Philippines by 2030 (2030-2040 rate) and 2050 (2050-2060 rate) decades under SSP2-4.5 and SSP5-8.5 scenarios[136]

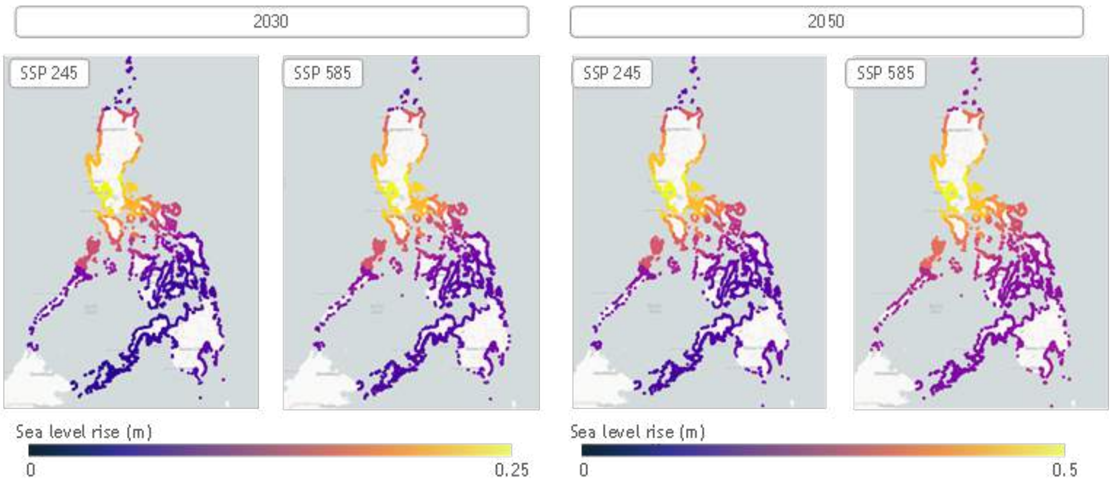


Figure 3.3.2.6: Absolute sea level rise (meters) across areas in the Philippines by 2030 and 2050 under SSP2-4.5 and SSP5-8.5 scenarios compared to 1990-2014 baseline[137]

[136, 137] Boston Consulting Group. (2023). Data Model on Sea Level Rise and Extreme sea levels [Data model]. Retrieved from IPCC AR6 Sea Level Projections, Coastal Futures, Nasa Earth data, and Alaska satellite facility databases.

Table 3.3.2.2: Rate of sea level rise (mm/year) across key areas in the Philippines by 2030 (2030 to 2040) and 2050 (2050 to 2060) under SSP2-4.5 and SSP5-8.5 scenarios[138]

AREA	SLR RATE 2030 DECADE mm/year (SSP2-4.5 to SSP5-8.5)	SLR RATE 2050 DECADE mm/year (SSP2-4.5 to SSP5-8.5)
Nationwide	5.4 to 6.6	8.9 to 8.8
Luzon	6.9 to 8.0	9.4 to 10.3
NCR	9.6 to 10.7	12.1 to 12.9
Bulacan	9.7 to 10.8	12.0 to 13.0
Zambales	9.4 to 11.9	12.1 to 12.9
Batangas	9.2 to 10.3	11.8 to 12.6
Visayas	4.0 to 5.2	6.7 to 7.4
Cebu	3.9 to 5.1	6.6 to 7.3
Mindanao	3.8 to 5.0	6.4 to 7.2
Davao	4.2 to 4.5	6.8 to 7.5
Sulu	0.1	0.2

Sea level rise flooding depth highest in Luzon regions[139, 140]

Taking sea level rise into account and incorporating current land elevation and land subsidence data, it is projected that by 2030, Regions III (Central Luzon), IV-A (CALABARZON), and II (Cagayan Valley) are expected to face the highest average flooding levels of about 0.27 to 0.29 m. Additionally, regions III (Central Luzon), IV-B (MIMAROPA), and I (Ilocos) are projected to experience the highest maximum flooding depth (0.7 m to 1.0 m), indicating their heightened vulnerability to SLR (see Figure 3.3.2.7).

Socioeconomic impacts of sea level rise highest in Luzon regions

In terms of population impacted, regions III (Central Luzon), IV-A (CALABARZON), and I (Ilocos Region) in Luzon are projected to have the largest number of people impacted by SLR flooding by 2030 under the SSP5-8.5 scenario, representing 74% (114K of 154K) of the total impacted population exposed to sea levels of at least 30 cm (see Table 3.3.2.3).

Regions III (Central Luzon), I (Ilocos Region), and V (Bicol Region), all located in Luzon, are collectively estimated to account for PHP12 billion of PHP18 billion, or 68%, of the total infrastructure damage attributed to sea level rise by 2030 under the SSP5-8.5 scenario. This underscores the imperative for heightened preparedness measures in these regions (see Table 3.3.2.3).

[138] Boston Consulting Group. (2023). Data Model on Sea Level Rise and Extreme sea levels [Data model]. Retrieved from IPCC AR6 Sea Level Projections, Coastal Futures, Nasa Earth data, and Alaska satellite facility databases.

[139] Note: Flooding projections do not consider existing adaptive capacity and man-made barriers on SLR inland propagation

[140] Methodology provided in the appendix.

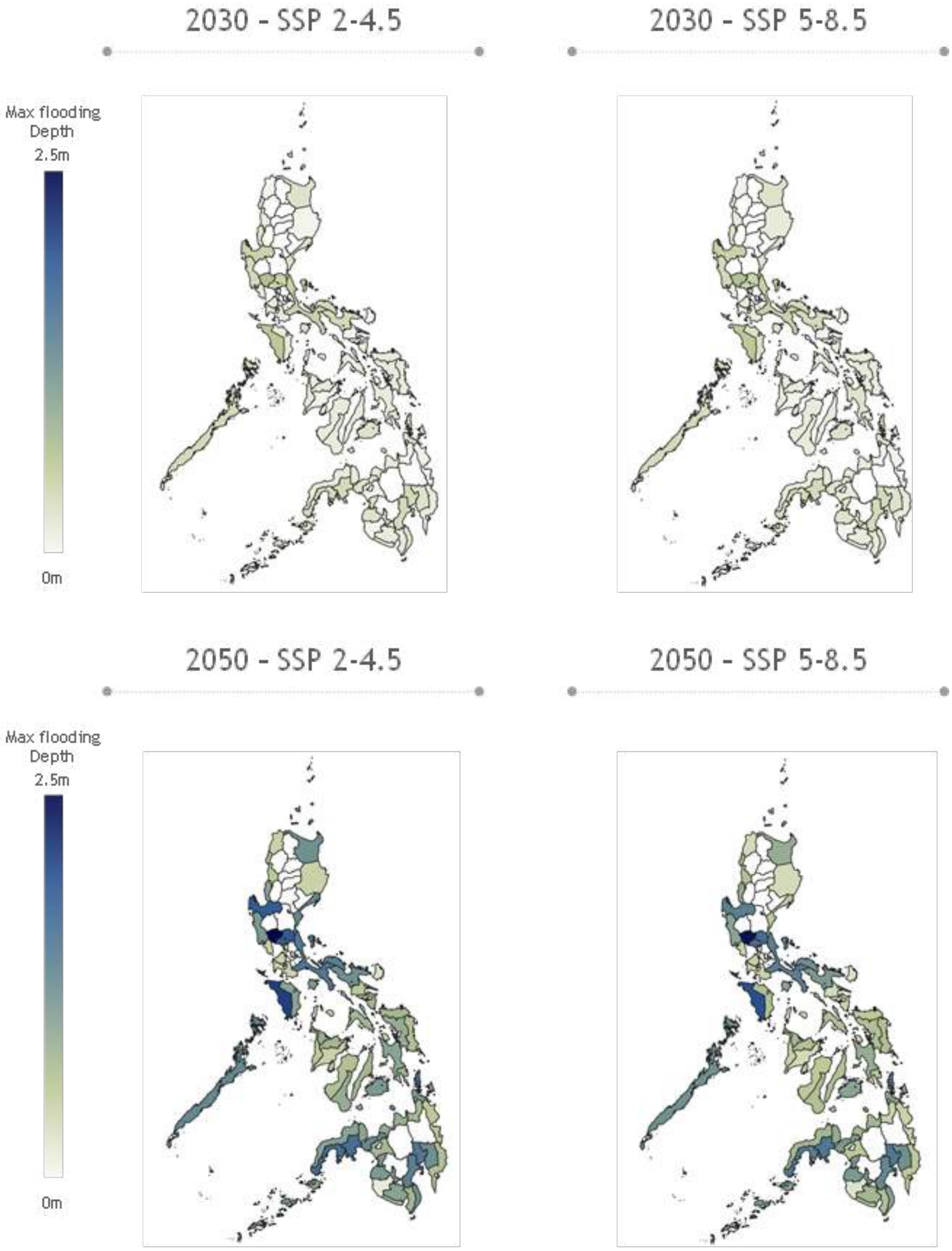


Figure 3.3.2.7: Maximum flooding depth (meters) from sea level rise under SSP2-4.5 and SSP5-8.5 scenario by 2030-2040 and 2050-2060 decades[141]

[141] Boston Consulting Group. (2023). Data Model on Sea Level Rise and Extreme sea levels [Data model]. Retrieved from IPCC AR6 Sea Level Projections, Coastal Futures, Nasa Earth data, and Alaska satellite facility databases.

Table 3.3.2.3: Average depth of areas flooded (meters) within regions due to sea level rise, maximum depth of areas flooded (meters), population impacted range, percent of total population impacted using 2020 population figures, area impacted, percent of total area impacted, and economic impact under SSP5-8.5 scenario by 2030 to 2040 decade[142]

REGION	Average Flooding (meters)	Max Flooding (meters)	Pop. Impacted	2021-2040 Average Temperature (°C)	Pop. Impacted (k people) by 2030	% of Total Population Impacted 2020 Population)	Economic Impact (Bn PHP) by 2030
Region III	0.29	1.04	30-69	0.2%-0.6%	16-35	0%	3.4
Region IV-A	0.28	0.63	23-24	0.1%-0.2%	8-11	0%	1.3
Region II	0.27	0.57	2-2	0.1%	4-7	0%	0.2
National Capital Region	0.24	0.24	0-0	0.0%	0-1	0%	0.3
Region IV-B	0.23	0.75	3-3	0.1%	7-13	0%	0.3
Region XIII	0.22	0.48	0-0	0.0%	0-1	0%	0.1
Region XI	0.22	0.45	0-1	0.0%	1-2	0%	0.4
Region I	0.21	0.72	0-21	0.0%-0.4%	2-10	0%	1.9
Region V	0.18	0.46	3-8	0.1%	7-11	0%	7.0
Region X	0.16	0.44	0-1	0.0%	2-3	0%	0.4
Region IX	0.15	0.48	7-8	0.2%	9-10	0%	0.3
Region VIII	0.15	0.38	1-6	0.0%-0.1%	3-10	0%	0.7
Bangsamoro Autonomous Region in Muslim Mindanao	0.14	0.40	4-4	0.1%	6-7	0%	0.2
Region VI	0.13	0.42	1-2	0.0%	1-3	0%	0.7
Region VII	0.13	0.41	3-5	0.0%-0.1%	2-4	0%	0.8
Region XII	0.09	0.09	0-1	0.0%	0-1	0%	0.0

Top metrics under each category

Note: Table sorted based on average flooding (meters); CAR region not impacted by sea level rise or extreme sea levels; figures highlighted indicate top figures under respective metrics; population and area impacted defined as population and area located in area flooded with at least 30cm to 50cm of water; Flooding projections do not consider existing adaptive capacity and man-made barriers on SLR inland propagation

[142] Boston Consulting Group. (2023). Data Model on Sea Level Rise and Extreme sea levels [Data model]. Retrieved from IPCC AR6 Sea Level Projections, Coastal Futures, Nasa Earth data, and Alaska satellite facility databases.

Extreme sea levels to be more intense in eastern regions of the country[143]

While the impact of sea level rise is primarily concentrated in the central and northern areas of the Philippines, the effects of extreme sea levels are more pronounced in the eastern regions, specifically in regions V (Bicol Region), II (Cagayan Valley), and VIII (Eastern Visayas), where the sea level rise from extreme events are more sizable (see Figure 3.3.2.9).

In 2050, the effects of extreme levels will continue to be predominantly felt in the eastern areas of the Philippines. However, it is important to note that regions in Luzon, particularly the National Capital Region (NCR) and region IV-B (MIMAROPA), are projected to experience significant increases in sea level from extreme levels (see Figure 3.3.2.9) (Boston Consulting Group, 2023). These regions are projected to have sea level rises of approximately 8-13% and 9-12%, respectively, by 2030 and 2050.

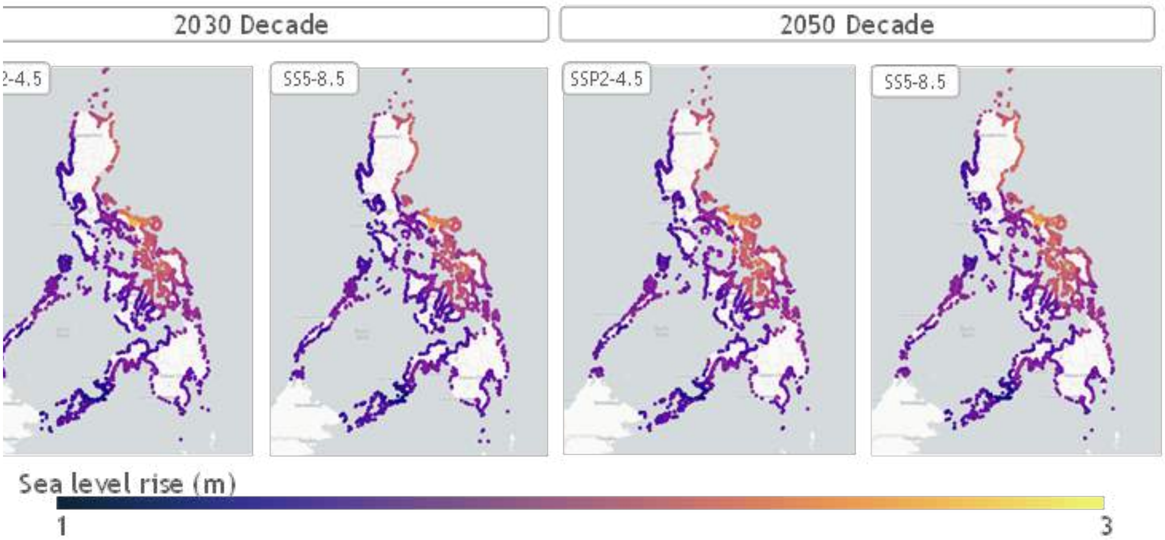


Figure 3.3.2.8: Extreme sea level rise (meters) across areas in the Philippines in 2030-2040 and 2050-2060 under SSP2-4.5 and SSP5-8.5 scenarios[144]

Extreme sea levels which include astronomical tides, storm surges, waves and swash are projected to increase up to 3m by the 2050 decade. Areas of highest increase are portrayed in Figure 3.3.2.8.

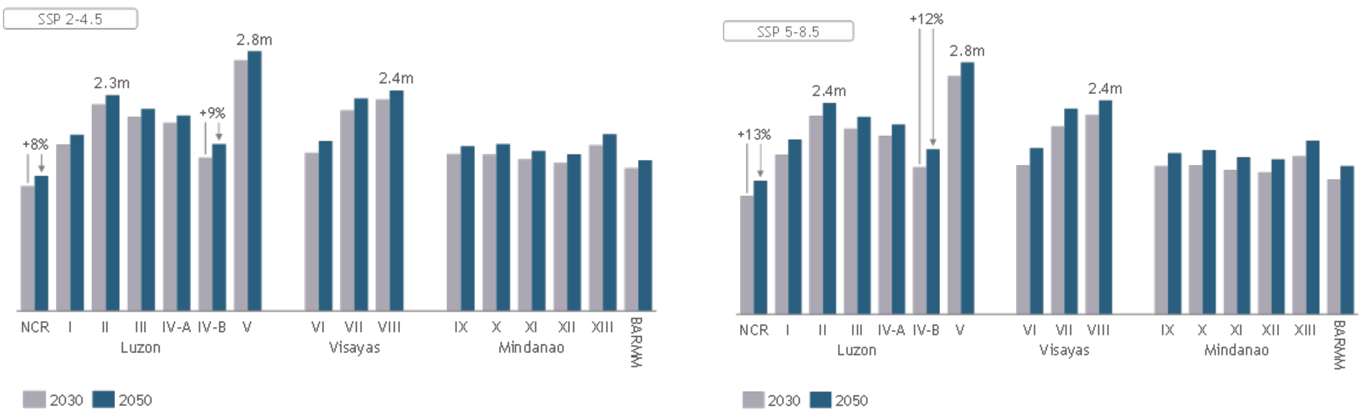


Figure 3.3.2.9: Extreme sea level rise (meters) per region within 2030-2040 and 2050-2060 decades under SSP2-4.5 and SSP5-8.5 scenarios[145]

[143] Methodology provided in appendix.

[144, 145] Boston Consulting Group. (2023). Data Model on Sea Level Rise and Extreme sea levels [Data model]. Retrieved from IPCC AR6 Sea Level Projections, Coastal Futures, Nasa Earth data, and Alaska satellite facility databases.

Extreme sea levels flooding depth projected to concentrate in the eastern regions

In the coming decade of 2030, regions VIII (Eastern Visayas), II (Cagayan Valley), and XIII (Caraga), primarily on the eastern areas of the country, are projected to experience the highest average flood intensity levels of about 0.9 to 1.0 m by 2030 under the SSP5-8.5 scenario. In terms of maximum flooding, regions V (Bicol Region), II (Cagayan Valley), and VIII (Eastern Visayas) are projected to have the highest maximum flooding levels from extreme sea levels (see Figure 3.3.2.10).

The Visayas regions, specifically Regions VII (Central Visayas), VI (Western Visayas), and VIII (Eastern Visayas), are anticipated to shoulder the most significant socioeconomic repercussions arising from extreme sea levels.

By 2030 under the SSP5-8.5 scenario, these regions are projected to account for 34% (648k out of 1.9 million) of the total population impacted. Furthermore, regions VII, VIII, in conjunction with Region V (Bicol Region) in southeastern Luzon, are expected to bear 37% of the infrastructure damage resulting from extreme sea levels, amounting to nearly PHP30 billion out of PHP80 billion, by 2030 under the SSP5-8.5 scenario (see Table 3.3.2.4).

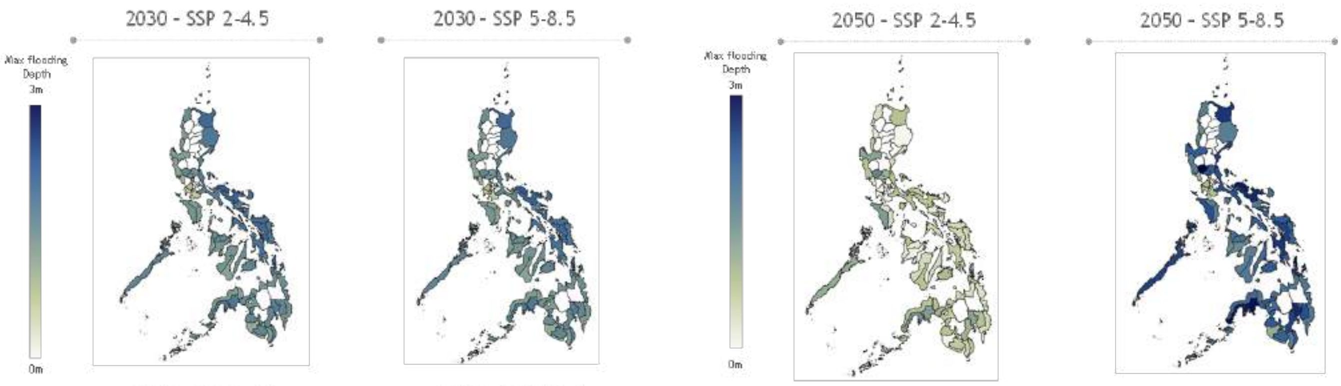


Figure 3.3.2.10: Maximum flooding depth (meters) from extreme sea levels under SSP2-4.5 and SSP5-8.5 scenario by 2030-2040 decade[146]

[146] Boston Consulting Group. (2023). Data Model on Sea Level Rise and Extreme sea levels [Data model]. Retrieved from IPCC AR6 Sea Level Projections, Coastal Futures, Nasa Earth data, and Alaska satellite facility databases.

Table 3.3.2.4: Average depth of areas flooded (meters) within regions due to extreme sea events, maximum depth of areas flooded (meters), population impacted range, percent of total population impacted using 2020 population figures, area impacted, percent of total area impacted, and economic impact under SSP5-8.5 scenario by 2030 to 2040 decade[147]

REGION	Average Flooding (meters)	Max Flooding (meters)	Pop. Impacted (K People)	% of Total Population (2020 Population)	Area Impacted (sq km)	% of Total Area Impacted	Economic Impact (PHP)
Region VIII	1.00	2.26	181-183	4%	210-230	0% - 1%	9
Region II	0.95	2.30	18-18	0%	60-60	0% - 0%	1
Region XIII	0.93	1.97	44-44	2%	70-70	0% - 0%	2
Region V	0.92	2.75	155-161	3%	260-290	1% - 2%	10
Region VII	0.78	1.97	253-280	3%	90-120	1% - 1%	10
Region XI	0.74	1.70	88-94	2%	30-50	0% - 0%	3
Region IX	0.72	1.92	96-105	2%-3%	160-200	1% - 1%	3
Region VI	0.71	1.83	146-185	2%	120-190	1% - 1%	7
Region XII	0.68	1.41	37-40	1%	10-20	0% - 0%	1
Region I	0.67	1.79	116-125	2%	90-200	1% - 2%	6
Region IV-B	0.67	1.78	65-84	2%-3%	90-150	0% - 1%	4
Region III	0.64	1.90	167-176	1%	140-300	1% - 1%	8
Region X	0.63	1.76	112-126	2%	30-50	0% - 0%	4
Bangsamoro Autonomous Region in Muslim Mindanao	0.62	1.61	60-81	1% - 2%	60-100	0% - 1%	2
Region IV-A	0.61	2.16	120-140	1%	80-100	0% - 1%	5
National Capital Region	0.46	1.09	69-84	1%	2-10	0%- 2%	5

Top metrics under each category

Note: Table sorted based on average flooding (meters); Figures highlighted indicate top figures under respective metrics; CAR region not impacted by sea level rise or extreme sea levels; population and area impacted defined as population and area located in area flooded with at least 30cm to 60cm of water; Flooding projections do not consider existing adaptive capacity and man-made barriers on SLR inland propagation

[147] Boston Consulting Group. (2023). Data Model on Sea Level Rise and Extreme sea levels [Data model]. Retrieved from IPCC AR6 Sea Level Projections, Coastal Futures, Nasa Earth data, and Alaska satellite facility databases.

3.3.3 Sea level rise and extreme sea levels

Future global trends

Key takeaways

- Extreme daily precipitation events projected to intensify by about 7% for every 1°C increase in global temperature (IPCC, 2021). At 1.5°C of warming, Asia will experience intensified heavy precipitation and increased flood risks. These changes will become more widespread and significant at 2°C or higher global warming.
- Rain-generated local flooding is projected to increase with heavier precipitation events.

Based on the IPCC Sixth Assessment Report, one key impact of global warming is the projected intensification and increased frequency of heavy precipitation events worldwide. According to the AR6 report by the IPCC, projected changes in heavy precipitation are larger in frequency and intensity with every additional increment of global warming (see Figure 3.3.3.1). Heavy precipitation will become more severe with additional global warming, with extreme daily precipitation events projected to intensify by about 7% for every 1°C increase in global temperature. At 1.5°C of warming, Asia, including the Philippines, will experience intensified heavy precipitation and increased flood risks. These changes will become more widespread and significant at 2°C or higher global warming. Consequently, rain-generated local flooding is projected to increase as heavy precipitation events become more frequent.

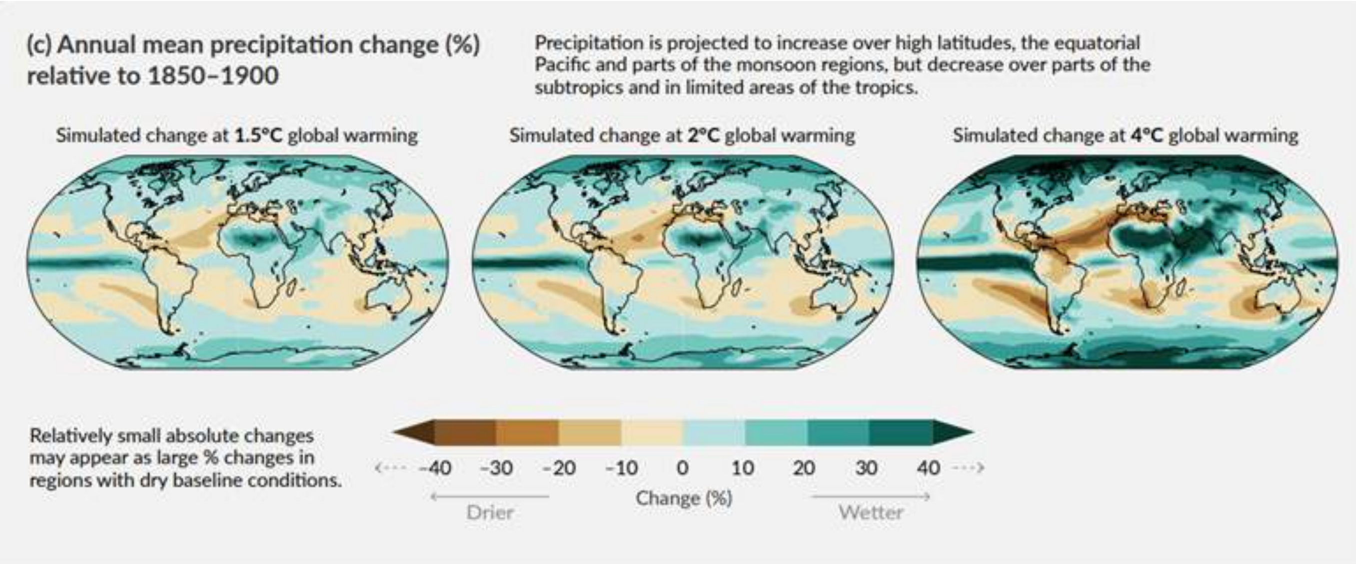


Figure 3.3.3.1: Annual mean precipitation change (%) relative to 1850–1900 across global warming scenarios[148]

[148] Intergovernmental Panel on Climate Change Sixth Assessment Report Summary for Policy Makers (2021) Figure SPM.5 p.17

[149] Climate types based on Modified Coronas Classification System: Type I–Two pronounced seasons: dry from November to April, wet during the rest of the year; Type II–No dry season with a very pronounced rainfall from November to April and wet during the rest of the year; Type III–Seasons are not very pronounced; relatively dry from November to April, wet during the rest of the year; Type IV–Rainfall is more or less evenly distributed through the year.

Variable precipitation patterns predicted, with potentially increasing intensity

The projections for precipitation patterns in the Philippines indicate that the overall average annual precipitation level will remain in the range of 2500 mm (see Figure 3.3.3.2). Based on the World Bank's Philippine Country Climate and Development Report (2022), the behavior of precipitation is projected to become more variable, with the number of days with more intense precipitation potentially increasing. As shown in Figure 3.3.3.2, the Philippines historically had between 20 to 25 days with precipitation exceeding 20 mm/day, and rarely more than 40 days. Under most scenarios, the average number of such days will increase to 22 to 27 days under SSP2-4.5 and SSP5-8.5 scenarios and by 2050, and in some years may even approach 50 days.

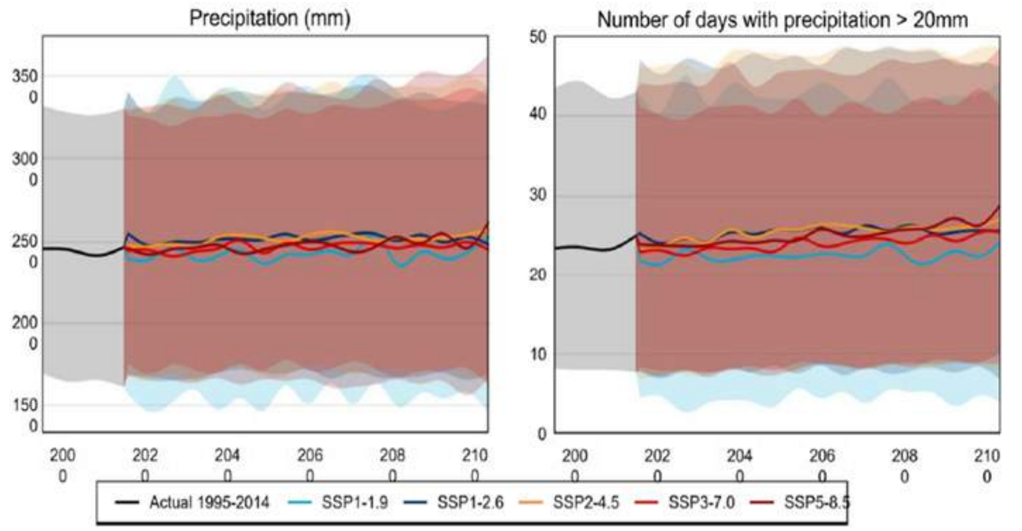


Figure 3.3.3.2: Historical and projected average precipitation in the Philippines (mm) across scenarios (Left); Historical and projected number of days with precipitation greater than 20mm across scenarios (Right)[150]

Variable precipitation patterns predicted, with potentially increasing intensity

The spatial distribution of precipitation behavior will also experience variations. (see Figure 3.3.3.5).

Areas prone to increased precipitation (greater average total rainfall compared to the baseline) include:

- Eastern areas located in the mid-section of the country. These regions have traditionally been categorized as climate type II due to their consistent rainfall distribution, resulting in the absence of dry seasons. The projections indicate a further intensification of precipitation in these already wet regions.
- Central and eastern areas of Luzon, designated as a mix of climate type I, III, and IV (see Figure 3.3.3.3) characterized by approximately half the year experiencing a wet season and the other half a dry spell. These regions are anticipated to undergo heightened levels of precipitation.

[150] World Bank Group. (2022). Philippines Climate Change and Disaster Risk (CCDR) full report. Washington, D.C.: World Bank. Figure A.2 page 75

[150] Climate types based on Modified Coronas Classification System: Type–Two pronounced seasons: dry from November to April, wet during the rest of the year; Type II–No dry season with a very pronounced rainfall from November to April and wet during the rest of the year; Type III–Seasons are not very pronounced; relatively dry from November to April, wet during the rest of the year; Type IV–Rainfall is more or less evenly distributed through the year.Figure A.2 page 75

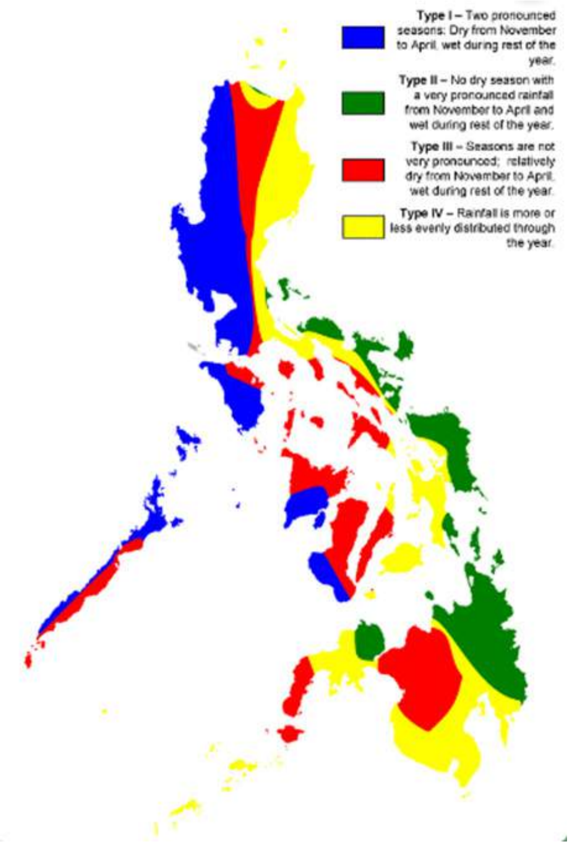


Figure 3.3.3.3: Four climate types of the Philippines based on Modified Coronas Classification System

Source: Oscar M. Lopez Center for Climate Change Adaptation and Disaster Risk Management Foundation, Inc. (Oscar M. Lopez Center) and Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), 2023. State of the 2020 Philippine Climate, January 2023

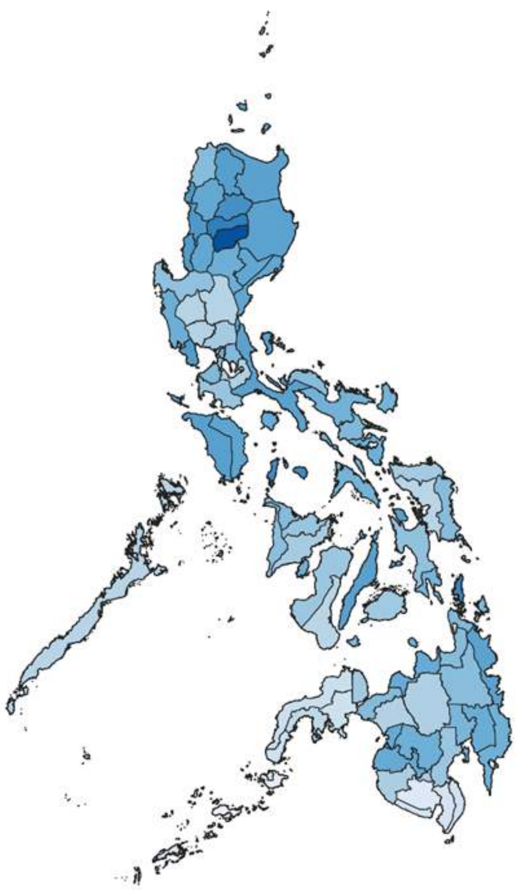


Figure 3.3.3.4: Historical annual precipitation in the Philippines (mm) from 1991-2020

Note: The methodology employs 30-year baselines for historical variability when possible. In cases with only a decade of data available, 10-year baselines are used, maintaining forecast consistency with 10-year ranges.[152]

[152] Boston Consulting Group. (2023). Data Model on Extreme Precipitation [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) database.

Historical annual precipitation in Philippines vary from an average of 800 mm to 4000 mm annually. Precipitation varies spatially as shown in Figure 3.3.3.4

Increasing overall precipitation by 2030 and 2050, with drier dry seasons expected by 2050.

With projected variability in annual precipitation comes varying distribution of precipitation across seasons, potentially impacting water resource management, agriculture, and ecosystems that rely on seasonal precipitation patterns.

By 2030 (2021 to 2040 annualized average), the projections suggest an overall increase in precipitation all year round, with the highest projected increase expected to happen in September-October-November (see Table 3.3.3.1).

Increasing trend in rainfall is observed pronouncedly over the eastern sections of Visayas and southeast areas of Luzon in December-January-February (corresponding to the northeast monsoon) in both 2030 and 2050. During March-April-May, or the driest period in the country, the northern and western sections of the country are projected to experience a noticeable drying trend by 2050. In June-July-August, concentrated precipitation increases in central areas of Luzon, western Visayas, and western Mindanao are projected (corresponding to the southeast monsoon), while a decreasing trend is found in the rest of the country. An increase trend is found mostly in the eastern regions and southwestern regions of the country in September-October-November.

Table 3.3.3.1: Quarterly historical (1991 to 2020) and projected precipitation in the Philippines (mm) across SSP2-4.5 and SSP5-8.5 scenarios in 2030 (2021 to 2040) and 2050 (2041 to 2060)[153]

QUARTER	1991-2020 Average Precipitation (mm)	2021-2040 Average Precipitation (mm) (% change vs. baseline)		2041 - 2060 Average Precipitation (mm)	
		SSP2-4.5	SSP5-8.5	SSP2-4.5	SSP5-8.5
December-January-February	360	393 (+9%)	382 (+6%)	385 (+7%)	415 (+15%)
March-April-May	300	339 (+13%)	326 (+9%)	275 (-8%)	292 (-3%)
June-July-August	792	885 (+12%)	886 (+12%)	923 (+17%)	950 (+20%)
September-October-November	576	800 (+39%)	821 (+43%)	830 (+44%)	800 (+39%)
Total	2,028	2,417 (+19%)	2,415 (+19%)	2,413 (+19%)	2,457 (+21%)

Note: The methodology employs 30-year baselines for historical variability when possible. In cases with only a decade of data available, 10-year baselines are used, maintaining forecast consistency with 10-year ranges.

[153] Boston Consulting Group. (2023). Data Model on Extreme Precipitation [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) database.

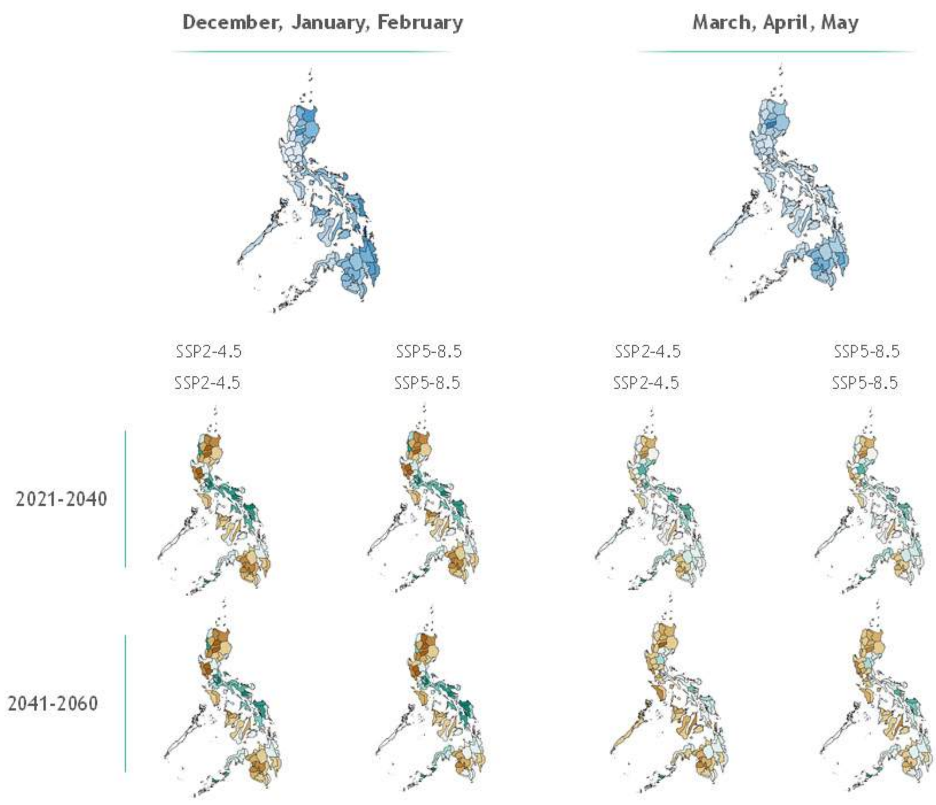


Figure 3.3.3.6: Seasonal and spatial historical (1991-2020) and projected precipitation in the Philippines (mm) across SSP2-4.5 and SSP5-8.5 scenarios in 2030 (2021-2040) and 2050 (2041-2060);

Note: The methodology employs 30-year baselines for historical variability when possible. In cases with only a decade of data available, 10-year baselines are used, maintaining forecast consistency with 10-year ranges.[154]

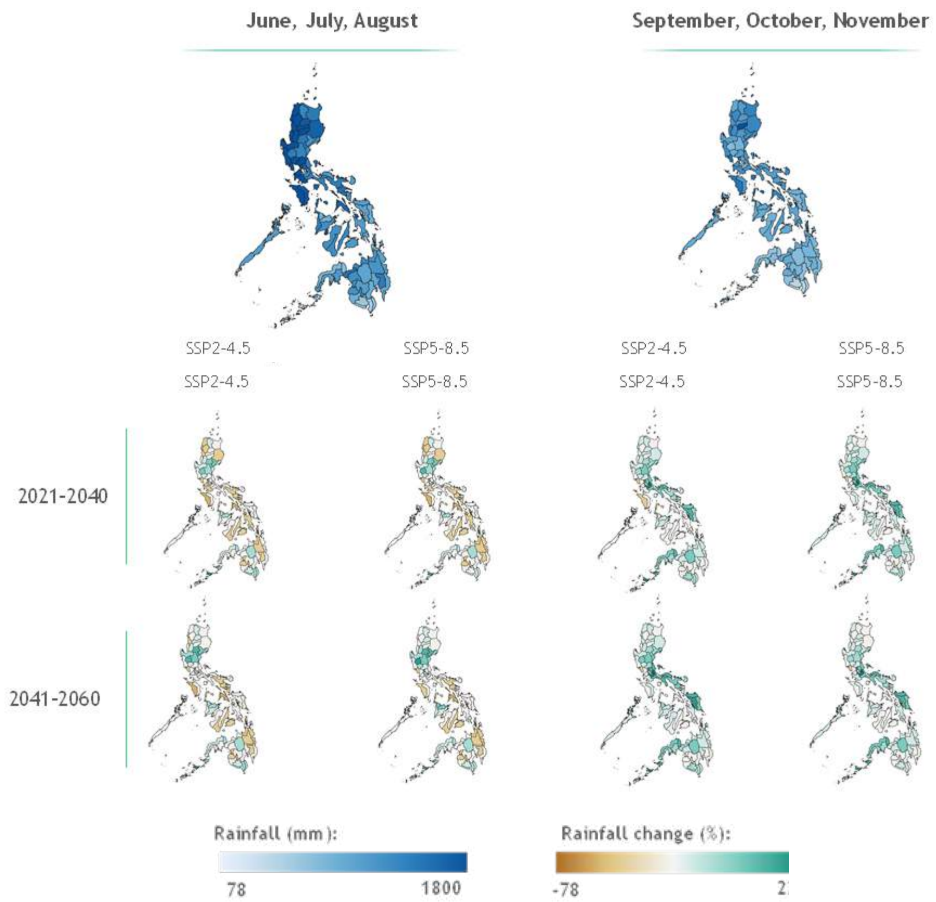


Figure 3.3.3.6: Seasonal and spatial historical (1991-2020) and projected precipitation in the Philippines (mm) across SSP2-4.5 and SSP5-8.5 scenarios in 2030 (2021-2040) and 2050 (2041-2060);[155]

Note: The methodology employs 30-year baselines for historical variability when possible. In cases with only a decade of data available, 10-year baselines are used, maintaining forecast consistency with 10-year ranges.[154]

[155] Boston Consulting Group. (2023). Data Model on Extreme Precipitation [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) database.

Potential socio-economic impact

Key takeaways

Pluvial flooding

About five million Filipinos affected, with economic losses of about PHP275 to 300 billion due to pluvial flooding in the near term (2020 to 2040 annualized average) and long term (2040 to 2060 annualized average)

Fluvial flooding

About 250K and 300K Filipinos exposed, with potential economic losses of about PHP 13 to 16 billion due to fluvial flooding in the near term (2020-2040 annualized average) and long term (2040 to 2060 annualized average)

Landslides

Approximately two million Filipinos may face exposure to at least one significant rain-induced landslide[156] event per decade.

Table 3.3.3.2: Social and economic impact of pluvial and fluvial flooding[157]

Socioeconomic Impact Pluvial Flooding	**2020 - 2040 Annualized Average**		**2040 - 2060 Annualized Average**	
	SSP2-4.5	**SSP5-8.5**	**SSP2-4.5**	**SSP5-8.5**
Social impact: Population exposed	2.3 million to 4.8 million	2.3 million to 4.8 million	2.4 million to 5.1 million	2.5 million to 5.2 million
Economic Impact: Infrastructure damage (PHP)	273 billion	274 billion	285 billion	296 billion

Socioeconomic Impact Fluvial Flooding	**2020 - 2040 Annualized Average**		**2040 - 2060 Annualized Average**	
	SSP2-4.5	**SSP5-8.5**	**SSP2-4.5**	**SSP5-8.5**
Social impact: Population exposed	177 K to 250 K	179 K to 254 K	200 K to 280 K	216 K to 297 K
Economic Impact: Infrastructure damage (PHP)	13 billion	13 billion	15 billion	16 billion

Note: Figures provided are approximations; Population impacted by pluvial and fluvial floods: defined as the population located in an area flooding with at least 30-60cm flooding depth (lower bound figure represents 60cm, higher bound figure represents 30cm flooding); Assumes 1 in 10 year return period

Pluvial and fluvial floods are two types of floods that occur in response to extreme precipitation events. Pluvial flooding refers to the inundation of land and urban areas caused by heavy precipitation, where the excess water cannot be efficiently absorbed or drained due to factors such as impermeable surfaces and inadequate drainage systems. On the other hand, fluvial flooding occurs when rivers and streams exceed their capacity and overflow their banks due to intense or prolonged precipitation.

[157] Boston Consulting Group. (2023). Data Model on Extreme Precipitation [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) database. Boston Consulting Group. (2023). Data Model on Pluvial and Fluvial Flooding [Data model]. Retrieved from Fathom Global release 3.0 database.

Pluvial and fluvial flooding predictions are generated using hydraulic models based on shallow water equations. These models account for variables like water height, flow dynamics, and coastal topography.

About five million Filipinos affected, with economic losses of about PHP275 to 300 billion due to pluvial flooding in the near and long term[158]

Overall, pluvial floods, or flooding that happens due to excessive precipitation overwhelming the local drainage capacity, result in the disruption of approximately 4.8 million individuals in the near term (2020 to 2040 annualized average) and 5.2 million individuals in the long term (2040 to 2060 annualized average) (SSP5-8.5 scenario), defined as the population located in an area flooding with at least 30 cm flooding depth (see Table 3.3.2.2).

Pluvial flooding is forecasted to cause up to PHP274 billion in infrastructure damage in the near term and nearly PHP300 billion in the long term, representing the largest contributor to infrastructure among the key climatic-impact drivers.

About 250K and 300K Filipinos exposed, with potential economic losses of about PHP 13 to 16 billion due to fluvial flooding in the near and long term[159]

The number of Filipinos potentially impacted by fluvial floods, or flooding that occurs due to the overflowing of rivers and streams, is projected to reach 254,000 Filipinos in the near term and reaching 297,000 Filipinos impacted by fluvial floods with at least 30 cm flooding depth in the long term (SSP5-8.5 scenario). Damage to infrastructure caused by fluvial flooding is projected to reach PHP13 billion in the near term and PHP16 billion in the long term.

Increased precipitation intensity raises landslide occurrence, potentially affecting two million Filipinos[160]

Rain-induced landslides[161] are another significant concern associated with extreme precipitation events. Understanding the occurrence and characteristics of pluvial and fluvial floods and landslides allows one to assess the vulnerability of different regions to extreme precipitation events.

Through initial analysis (see Figure 3.3.3.7), it has been determined that, on average, approximately every five years, 1.1% of the population and 1.6% of the Philippine territory may face exposure to at least one significant landslide event. Over the span of a decade, these numbers increase to 1.8% of the total population (two million individuals) and 3% of the total area potentially exposed.

When considering a longer timeframe, such as a 100-year return period, the exposure of the Philippine territory escalates to 9%, while the population exposure rises to 18%. This highlights the increasing vulnerability to landslides over time.

[158, 159] Methodology provided in appendix.

[160] Methodology provided in appendix; Economic damages from landslides not calculated due to data availablility

[161] Significant landslides are those which are likely to have been reported had they occurred in a populated place. Landslide as defined by Cruden (1991) - the movement of a mass of rock, earth or debris down a slope, with the qualification that landslides are not confined to the land, nor to simple sliding failure.

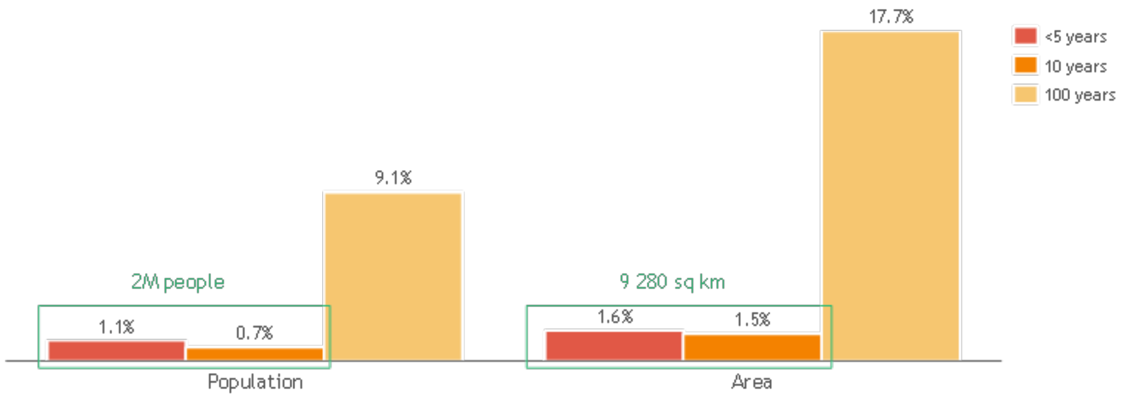


Figure 3.3.3.7: Population and Area exposed to landslide occurrence for 5-, 10-, and 100- year return periods[162]

Note: Population impacted if less than 500m away from area with an average projected landslide occurrence in 10-year period that is > 0%

Most impacted regions

Key takeaways

Pluvial flooding

- Regions in Luzon are projected to face the highest pluvial flooding depths and overall population impact, while Visayas regions must prepare for escalating pluvial flooding threats and adapt accordingly.
- CAR, Region IV-B (MIMAROPA), and Region II (Cagayan Valley) in Luzon are projected to experience the highest average and maximum flooding depths by 2030 (2020 to 2040 annualized average) under SSP5-8.5 scenario. Regions IV-A (CALABARZON) and III (Central Luzon) in Luzon, are projected to experience the highest number of people impacted by pluvial flooding by 2030 (SSP5-8.5 scenario), with up to 880,000 and 520,000 individuals, respectively.
- Regions IV-A (CALABARZON), III (Central Luzon), and V (Bicol Region) in Luzon are projected to account for 40% (PHP110 out of PHP274 billion) of the total projected infrastructure damage from pluvial flooding in the country by 2030 under SSP5-8.5.

Fluvial flooding

- Fluvial flood risk remains persistent in Mindanao regions, namely regions XII (SOCCSKSARGEN), X (Northern Mindanao), and XI (Davao Region), and emerging vulnerability in regions IX (Zamboanga Peninsula), VIII (Eastern Visayas), and VII (Central Visayas).
- Projections indicate substantial increases in average flooding depth for regions IX (Zamboanga Peninsula), VIII (Eastern Visayas), and VII (Central Visayas) compared to the historical baseline, with projected increases of 68%, 31%, and 30%, respectively.
- Regions I, II, and III are projected to bear the brunt of fluvial flooding impacts, with the highest number of people affected, totaling up to 130,000 individuals, and the most significant infrastructure damage, reaching up to PHP6 billion, which constitutes a substantial 47% share of the total fluvial infrastructure damage in 2030.

Landslides

- Benguet, La Union, and Ilocos Sur provinces are most susceptible to the occurrence of landslides in a 10-year return period with a respective 30%, 21%, and 18% projected occurrence in a 10-year return period.

[162] Boston Consulting Group. (2023). Data Model on Landslides [Data model]. Retrieved from Global Landslide Hazard map – precipitation trigger from the World Bank, NASA Global Landslide Catalogue, NASA Global Susceptibility Map, NOAA CPC Precipitation Data, and WorldPop population databases.

Regions in Luzon are projected to face the highest pluvial flooding depths and overall population and economic impact.

The regions in Luzon, especially the Cordillera Administrative Region (CAR), have long been prone to high pluvial flooding depths, and this susceptibility is expected to persist in the coming decades. Projections indicate a potential increase of up to 20% in average pluvial flooding heights by 2050 (see to Figure 3.3.3.8). Among these regions, CAR, Region IV-B (MIMAROPA), and Region II (Cagayan Valley) stand out as areas with the highest average and maximum flooding heights anticipated by 2030 under the SSP5-8.5 scenario (see Table 3.3.3.3).

Additionally, regions in Luzon, particularly regions IV-A (Calabarzon) and III (Central Luzon), are expected to experience the highest number of people impacted by pluvial flooding by 2030 (SSP5-8.5 scenario), with approximately up to 880,000 and 520,000 individuals, respectively (Boston Consulting Group, 2023). For the purposes of this assessment, the population impacted is defined as people located in an area flooded with at least 30 to 60 cm of water (30 cm as the upper range of the number of people impacted).

While Luzon regions will be significantly impacted by pluvial floods, Visayas regions, particularly Regions VIII (Eastern Visayas) and VII (Central Visayas), are projected to undergo the highest change (~3%) in average flooding by 2030 (SSP5-8.5 scenario), underscoring the need for additional adaptation efforts in those areas.

The spatial pattern of pluvial flooding aligns with the regions' susceptibility, as Luzon historically experiences the most extensive flooding. This is measured by the area within a location with flooding with at least 30 cm to 60cm of water. Regions II and III are expected to have the largest affected areas in square meters, along with notable percentage changes by 2030 compared to historical baseline (see Table 3.3.3.3).

In terms of economic impact from pluvial flooding damages to infrastructure, regions IV-A, III, and V (Bicol Region) in Luzon are expected to incur up to PHP56 billion, PHP33 billion, and PHP 21 billion, respectively. These three regions collectively account for 40% (PHP110 billion out of PHP274 billion) of the total projected infrastructure damage in the country by 2030 under SSP5-8.5.

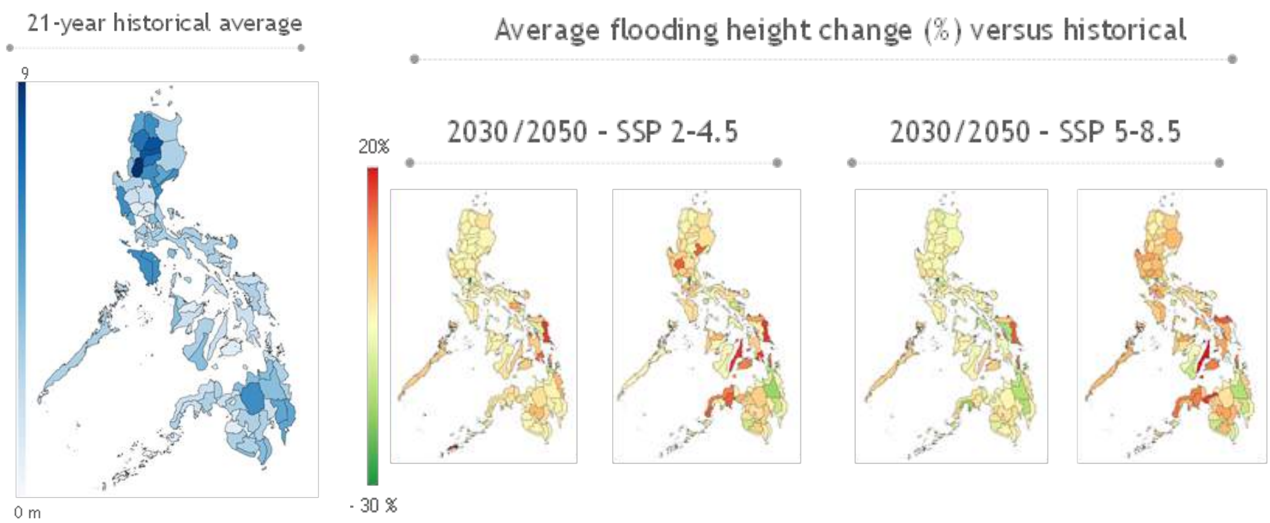


Figure 3.3.3.8: Map of 21-year historical average pluvial flooding height (meters) and projected 2030 (2020-2040) and 2050 (2040-2060) pluvial flooding height change (%) in a 10-year return period[163]

Note: Historical figure is limited based on river and rain gauge availability within any historical 21-year period (treated as an uncertain variable); Flooding height change in 2030 (2020-2040) and 2050 (2040-2060) compared to 21-year baseline

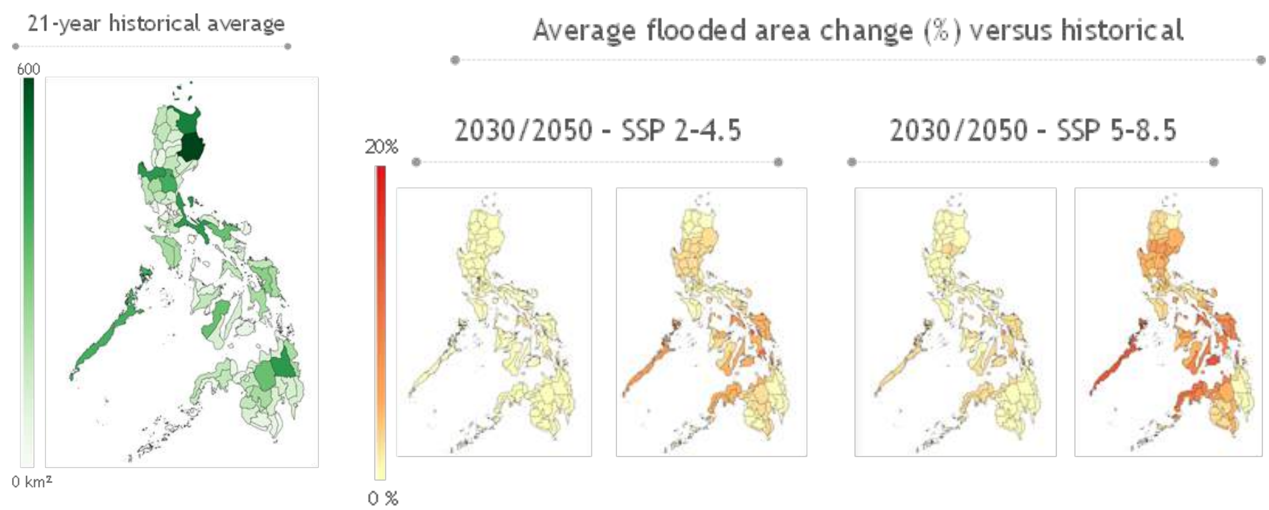


Figure 3.3.3.9: Map of 21-year historical area impacted from pluvial flooding (square kilometers) and projected 2030 (2020-2040) and 2050 (2040-2060) pluvial flooding height change (%) in a 10-year return period[164]

Note: Historical figure is limited based on river and rain gauge availability within any historical 21-year period (treated as an uncertain variable); Area impacted defined as located in area flooding with at least 30 cm to 60 cm of water

[163, 164] Boston Consulting Group. (2023). Data Model on Landslides [Data model]. Retrieved from Global Landslide Hazard map – precipitation trigger from the World Bank, NASA Global Landslide Catalogue, NASA Global Susceptibility Map, NOAA CPC Precipitation Data, and WorldPop population databases.

Areas affected by pluvial flooding are projected to increase. In SSP5-8.5 by 2050, Palawan as well as provinces in Visayas and Mindanao are projected to have the highest increase in areas flooded with up to 20% increase for 10-year return period flooding.

Table 3.3.3.3: Average depth of areas flooded (meters) due to pluvial flooding, percent change in region average flooding versus 21-historical baseline, population impacted (range of 30 to 60 cm of flooding), percent of total population impacted using 2020 population figures, area impacted, change in region area impacted versus 21-year historical baseline, and economic impact (infrastructure damage) under SSP5-8.5 scenario by 2030 in a 10-year return period.[165]

REGION	Average Flooding (meters)	Average Flooding % Change vs. Historical	Pop. Impacted (K People)	% of Total Population Impacted (2020 Population)	Area Impacted (sq km)	Area Impacted (sq km)	Economic Impact (PHP Bn)
Cordillera Administrative Region	7.9	0%	110-140	6-8%	759	1%	7
Region IV-B	4.6	2%	70-150	2-5%	922	2%	10
Region II	4.3	0%	110-220	3-6%	1379	1%	13
Region I	4.2	1%	150-300	3-6%	872	1%	18
Region X	4.2	0%	160-320	3-6%	621	2%	13
Region XI	4.0	-1%	70-170	1-3%	516	1%	11
Region XII	3.7	1%	60-170	1-3%	523	1%	10
Region XIII	3.6	-2%	50-130	2-5%	868	1%	8
Region V	3.6	0%	210-410	3-7%	937	2%	21
Region IV-A	3.6	0%	480-880	3-6%	868	1%	56
Region III	3.4	1%	220-520	2-4%	1358	1%	33
Region VI	3.1	0%	170-410	2-5%	815	2%	21
Region VIII	2.8	3%	110-280	2-6%	1032	3%	16
Region IX	2.8	1%	80-200	2-5%	453	3%	8
Region VII	2.2	3%	130-320	2-4%	363	3%	18
Bangsamoro Autonomous Region in Muslim Mindanao	2.1	2%	80-160	2-4%	433	1%	7
National Capital Region	0.4	-27%	20-50	0-0%	5	21%	4

Top metrics under each category

[165] Boston Consulting Group. (2023). Data Model on Landslides [Data model]. Retrieved from Global Landslide Hazard map – precipitation trigger from the World Bank, NASA Global Landslide Catalogue, NASA Global Susceptibility Map, NOAA CPC Precipitation Data, and WorldPop population databases.

Note: Table sorted based on average flooding (meters). Figures in highlight top figures under respective metrics; Figures are approximations; Population impacted rounded; Population and area impacted defined as population or area located in area flooding with at least 30cm-60cm of water (table excludes regions that do not meet parameters)

Note: Historical figure is limited based on river and rain gauge availability within any historical 21-year period (treated as an uncertain variable); Area impacted defined as located in area flooding with at least 30cm-60cm of water

Regions in Luzon are projected to face the highest pluvial flooding depths and overall population and economic impact.

Fluvial floods have historically been prevalent in Mindanao regions due to the presence of several river basins in the area, including the Mindanao, Agusan, Tagum-Libuganon, Davao, Agus, Cagayan De Oro, Tagoloan, and Buayan basins, among others.[166]

Projections indicate that Mindanao regions will continue to face significant fluvial flood challenges, with the highest levels of average flooding found in regions XII (SOCCSKSARGEN), X (Northern Mindanao), and XI (Davao Region) in Mindanao, where average fluvial flooding depths are expected to reach between 4 to 5 m by 2030 (SSU5-8.5 scenario) (see Table 3.3.3.4).

However, it is crucial to highlight the growing vulnerability of regions IX (Zamboanga Peninsula), VIII (Eastern Visayas), and VII (Central Visayas), as these regions are projected to experience the largest increase in average flooding, emphasizing the need for robust preparedness and resilience strategies to address the potential impacts of fluvial flooding in the coming decades (see Figure 3.3.3.10 and Table 3.3.3.4).

Luzon Regions I (Ilocos region), II (Cagayan Valley), and III (Central Luzon) are expected to have the highest population exposure to fluvial floods and the most significant infrastructure damages.

While the average flooding depth is projected to increase most significantly in certain regions of Mindanao, the socioeconomic impact of fluvial flooding is most pronounced in Regions I (Ilocos Region), II (Cagayan Valley), and III (Central Luzon) in Luzon. These regions bear the heaviest burden, with up to 130k people impacted and PHP6 billion in damages, accounting for 47% of the total fluvial infrastructure damage (PHP6 billion of 13 billion) in 2030 under the SSP5-8.5 scenario.

By recognizing the unique challenges faced by the Mindanao regions, as well as the emerging vulnerabilities in regions IX (Zamboanga Peninsula), VIII (Eastern Visayas), and VII (Central Visayas), and the socioeconomic impact in regions I (Ilocos Region), II (Cagayan Valley), and III (Central Luzon), stakeholders can develop targeted strategies to enhance resilience, reduce risks, and protect communities from the devastating impacts of fluvial flooding in the years to come.

[166] DOST-PAGASA, 2023

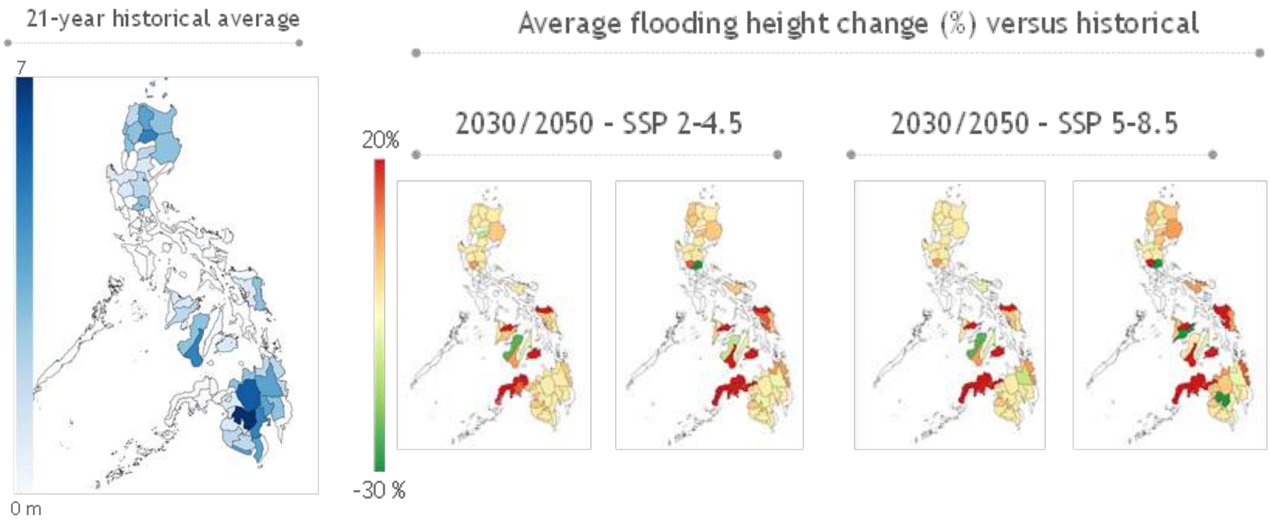


Figure 3.3.3.10: Map of 21-year historical average fluvial flooding height (meters) and projected 2030 (2020-2040) and 2050 (2040-2060) pluvial flooding height change (%) in a 10-year return period[167]

Note: Historical figure is limited based on river and rain gauge availability within any historical 21-year period (treated as an uncertain variable); Flooding height change in 2030 (2020-2040) and 2050 (2040-2060) compared to 21-year baseline

The average projected fluvial flood height (river flooding) is projected to increase most in certain provinces in Visayas and Mindanao due to the rugged and mountainous terrain, which contributes to faster water runoff during heavy rain events.

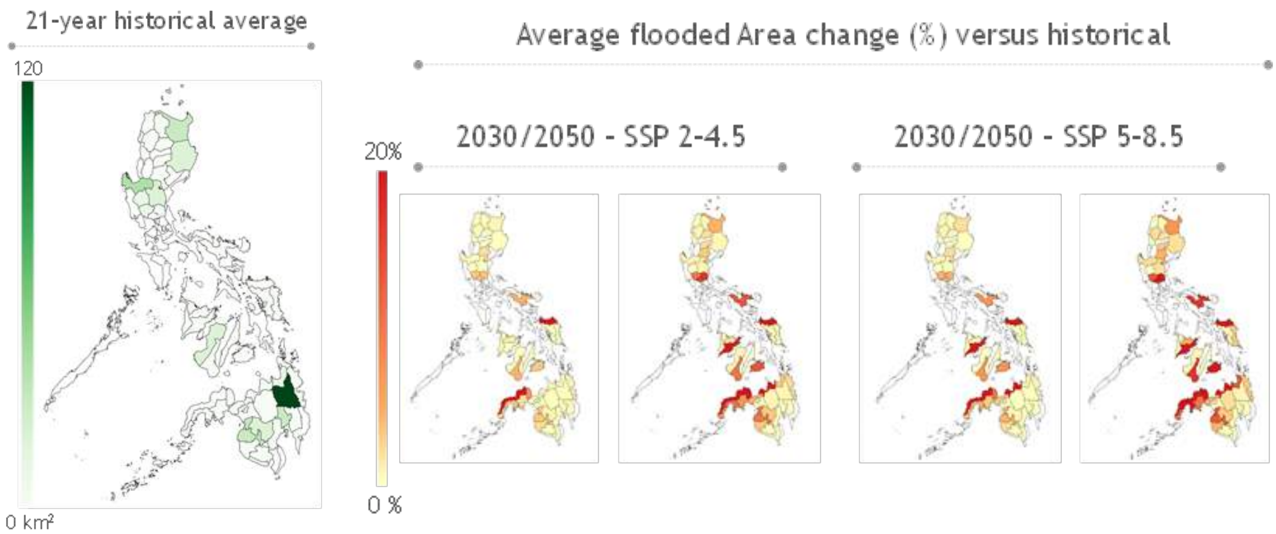


Figure 3.3.3.11: Map of 21-year historical area impacted from fluvial flooding (square kilometers) and projected 2030 (2020-2040) and 2050 (2040-2060) pluvial flooding height change (%) in a 10-year return period[168]

Note: Historical figure is limited based on river and rain gauge availability within any historical 21-year period (treated as an uncertain variable); Area impacted defined as located in area flooding with at least 30 cm-60 cm of water

[167, 168] Boston Consulting Group. (2023). Data Model on Landslides [Data model]. Retrieved from Global Landslide Hazard map – precipitation trigger from the World Bank, NASA Global Landslide Catalogue, NASA Global Susceptibility Map, NOAA CPC Precipitation Data, and WorldPop population databases.

The projected area impacted by fluvial flooding (river flooding) is projected to increase most in certain provinces in Visayas and Mindanao due to the rugged and mountainous terrain, which contributes to faster water runoff during heavy rain events.

Table 3.3.3.4: Average depth of areas flooded (meters) due to fluvial flooding, percent change in region average flooding versus 21-historical baseline, population impacted (range of 30 to 60 cm of flooding), percent of total population impacted using 2020 population figures, area impacted, change in region area impacted versus 21-year historical baseline, and economic impact (infrastructure damage) under SSP5-8.5 scenario by 2030 in a 10-year return period[169]

REGION	Average Flooding (meters)	Average Flooding % Change vs. 2020	Pop. Impacted (K People)	% of Total Pop. Impacted (2020 Population)	Area Impacted (sq km)	Area Impacted % Change vs. 2020	Economic Impact (PHP)
Region XII	4.8	4%	10-20	0-0%	44	16%	1
Region X	4.5	-5%	10-20	0-0%	15	18%	1
Region XI	4.4	2%	10-20	0-0%	53	4%	1
Region XIII	3.9	-1%	20-30	1-1%	155	7%	2
Region VII	3.8	30%	3-3	0-0%	1	42%	0
Cordillera Administrative Region	3.8	0%	10-10	0-0%	24	9%	0
Region II	3.6	4%	40-50	1-1%	82	18%	2
Region I	2.1	2%	20-30	0-0%	54	12%	2
Region III	2.1	1%	30-50	0-0%	62	17%	2
Region VIII	1.8	31%	3-5	0-0%	14	15%	0
Region VI	1.7	-18%	20-20	0-0%	44	13%	1
Bangsamoro Autonomous Region in Muslim Mindanao	1.1	6%	5-10	0-0%	51	37%	1
Region IX	0.9	68%	2-2	0-0%	11	41%	0
Region V	0.5	-2%	1-1	0-0%	2	52%	0

Top metrics under each category

Note: Table sorted based on average flooding (meters). Figures in highlight top figures under respective metrics; Figures are approximations; Population impacted rounded; Population and area impacted defined as population or area located in area flooding with at least 30 cm to 60 cm of water (table excludes regions that do not meet parameters); Historical figure is limited based on river and rain gauge availability within any historical 21-year period (treated as an uncertain variable); Area impacted defined as located in area flooding with at least 30 cm to 60 cm of water

[169] Boston Consulting Group. (2023). Data Model on Landslides [Data model]. Retrieved from Global Landslide Hazard map – precipitation trigger from the World Bank, NASA Global Landslide Catalogue, NASA Global Susceptibility Map, NOAA CPC Precipitation Data, and WorldPop population databases.

Benguet, La Union, and Ilocos Sur provinces most susceptible to occurrence of landslides

Table 3.3.3.5 presents the provinces with the highest average projected occurrence to landslides, indicating notable occurrence potential in Benguet, La Union, and Ilocos Sur. These regions have consistently shown elevated levels of susceptibility to landslides based on historical data and the main drivers that contribute to such incidents (see Figure 3.3.3.12). These drivers include factors such as vegetation cover, infrastructure development, slope steepness, and precipitation intensity.

It is also important to note that Benguet, La Union, and Pangasinan provinces are projected to have the greatest number of people impacted by landslide occurrence in a 10-year return period.

Table 3.3.3.5: Top 10 provinces with highest average projected occurrence of landslides in a 10-year return period, maximum projected occurrence of landslides in a 10-year return period, population impacted, population impacted, percent of total population impacted using 2020 population figures, area impacted, percent of total area impacted, and economic impact[170]

REGION	Province	Average Flooding % Change vs. 2020	Average projected occurrence in a 10-year return period	Maximum projected occurrence in a 10-year return period	Pop. Impacted (k people) / % of total population (2020 population)	Area Impacted % (sq km)
CAR	Benguet	30%	62%	0.83 (100%)	3 005 (100%)	16%
Region I	La Union	21%	45%	0.63 (79%)	1 283 (86%)	18%
Region I	Ilocos Sur	18%	52%	0.37 (55%)	2 092 (79%)	4%
CAR	Abra	7%	27%	0.19 (74%)	3 695 (88%)	7%
CAR	Mountain Prov.	7%	44%	0.12 (78%)	1 561 (69%)	42%
CAR	Ifugao	4%	19%	0.13 (62%)	1 570 (59%)	9%
Region I	Pangasinan	3%	48%	0.55 (18%)	2 229 (41%)	18%
Region I	Ilocos Norte	3%	12%	0.23 (40%)	2 389 (68%)	12%
Region II	Nueva Vizcaya	3%	21%	0.28 (55%)	2 888 (66%)	17%
Region III	Zambales	3%	20%	0.57 (68%)	2 472 (63%)	15%

Top metrics under each category

Note: Table sorted based on projected occurrence—estimated annual frequency of significant landslides per square kilometer; Significant landslides are those which are likely to have been reported had they occurred in a populated place; Figures highlighted indicate top three figures under respective metrics; Population and area impacted defined as: population and area impacted if less than 500m away from area with an average projected landslide occurrence in 10-year period that is > 0%

[170] Boston Consulting Group. (2023). Data Model on Landslides [Data model]. Retrieved from Global Landslide Hazard map – precipitation trigger from the World Bank, NASA Global Landslide Catalogue, NASA Global Susceptibility Map, NOAA CPC Precipitation Data, and WorldPop population databases.

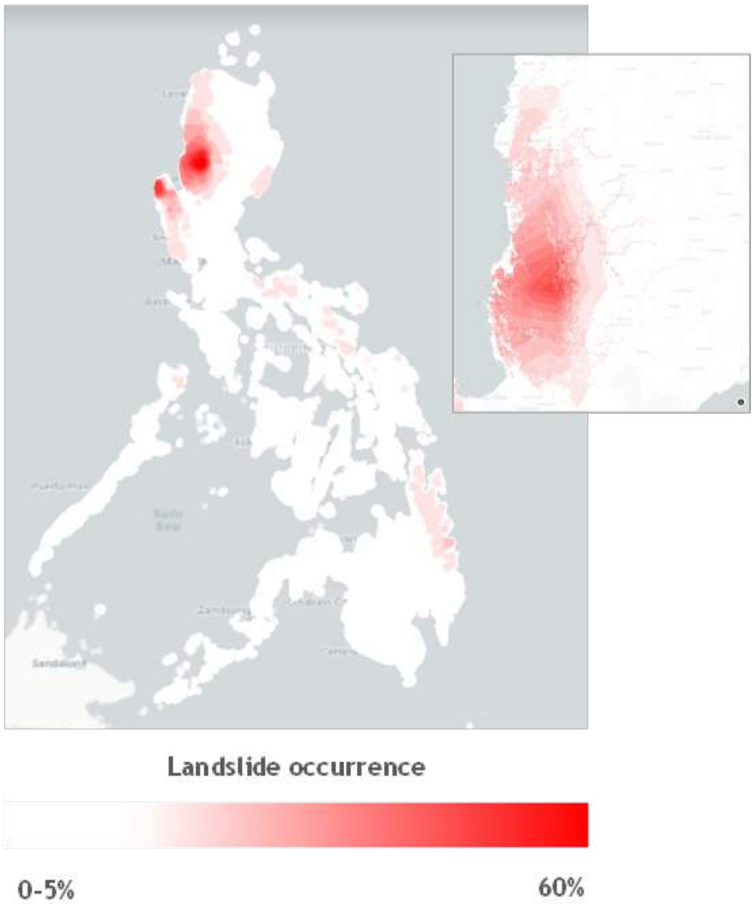


Figure 3.3.3.12: Map of average landslide occurrence in a 10-year return period (%)[171]

Note: Projected occurrence—estimated annual frequency of significant landslides per square kilometer; Significant landslides are those which are likely to have been reported had they occurred in a populated place

3.3.4 Extreme wind and tropical cyclone

Future global trends

Key takeaways

Globally, the IPCC in its Special Report on the Ocean and Cryosphere in a Changing Climate report projects an increase in the proportion and peak wind speeds of intense tropical cyclones in future scenarios. The said Special Report also indicates that the proportion of tropical cyclones reaching category 4 to 5 levels is projected to rise by approximately 1 to 10% with a 2°C global temperature increase.

Average intensity of Tropical Cyclones (TCs) will increase.

Tropical Cyclones (TCs), characterized by their powerful winds and devastating impacts, are among the principal hazards and risks associated with climate change. At the global scale, the IPCC in its Special Report on the Ocean and Cryosphere in a Changing Climate Chapter 6 on Extremes, Abrupt Changes and Managing Risks report indicates high level of confidence among climate scientists regarding the increased proportion and peak wind speeds of intense tropical cyclones in future scenarios. Tropical cyclones are projected to intensify with rising global temperatures, leading to an elevated potential of extreme TCs. According to IPCC, there is medium confidence that the proportion of TCs that reach Category 4 to 5 levels will increase, that the average intensity of TCs will increase (by roughly 1 to 10%, assuming a 2°C global temperature rise), and that average TCs precipitation rates (for a given storm) will increase by at least 7% per degree Celsius SST warming, owing to higher atmospheric water vapor content.[172]

[172] IPCC, 2019

Projected Philippine trends

Key takeaways

While the frequency of TCs within the Philippine Area of Responsibility (PAR) is projected to slightly decrease by up to -11% (~2TCs) in 2030 and up to -13% (~2.5TCs) in 2050 compared to historical (2010 to 2020) data, the decrease in the number of landfalling TCs is more pronounced, with projections showing a potential decrease of up to -51% to -52% (~3.5TCs) in 2030 and 2050.

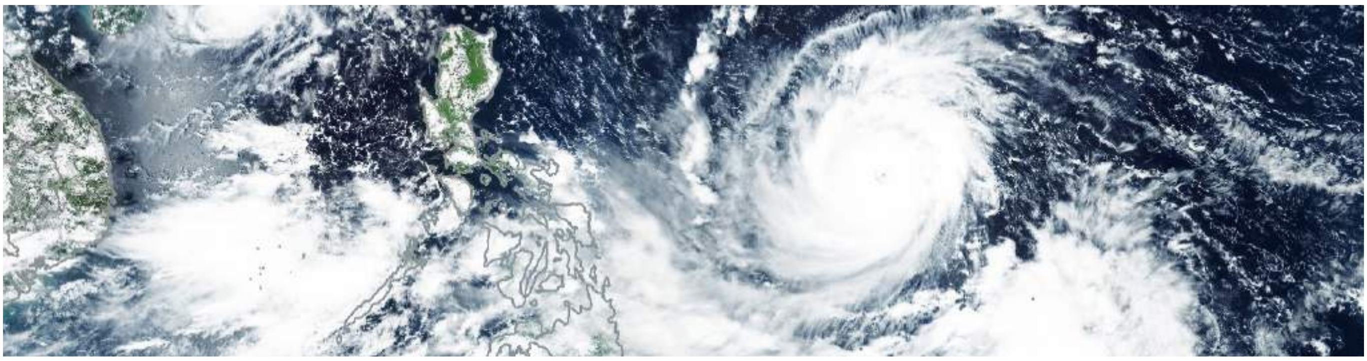
- Despite the decreasing frequency of TCs, the number of typhoons (118 to 184 km/h) is projected to increase up to 119% (from 3.6 up to 7.9), or more than double, by 2030 and 2050 compared to historical (2010 to 2020) data. Additionally, super typhoons (185+ km/h) are projected to slightly increase by around 24% (from 3.3 up to 4.1) in the 2030 decade and experience a more significant increase of about 76% (from 3.3 up to 5.8) in the 2050 decade, both compared to historical records.
- By 2030 and 2050, tropical cyclones (TCs) are projected to experience significant increases in average maximum peak wind speed, reaching up to a 29% (from 113km/h to up to 146km/h) and 33% (from 113km/h to up to 150km/h) increase, respectively, compared to the historical average from 2010 to 2020.

As the Philippines is located in a region highly vulnerable to the impacts of TCs, it is crucial to understand the potential trajectory of these TCs for the Philippines. Projections regarding the future behavior of TCs in the Philippine Area of Responsibility (PAR) are derived from an ensemble of sophisticated spatial probabilistic models that incorporate statistical correlations between tropical cyclones and various climate drivers[173]. These models provide valuable insights into the potential changes in TC characteristics, such as intensity and frequency. However, it is important to acknowledge that there are inherent challenges in accurately predicting the behavior and spatial variation of TCs due to their high variability and complex interactions with the climate system. To address these challenges, an ensemble of models is employed, enabling more stable model results for the assessment of future TC behavior.

Decreasing frequency, heightened devastating intensity of TCs

Looking ahead to 2050, the projected decrease in TC frequency aligns closely with the 2030 figures for both PAR and landfalling TCs. The average number of TCs in PAR, previously recorded at 19.9 per year, is projected to decline up to -13% to 18.3 (SSP5-8.5) or 17.3 (SSP2-4.5) annually (Boston Consulting Group, 2023). Similarly, the number of landfalling TCs is projected to decrease up to -52% from 7.3 in 2010 to 2020 to 4.0 (SSP5-8.5) or 3.5 (SSP2-4.5) by 2050 (see Figure 3.3.4.1).

These findings are in line with Climate Model Simulations done by PAGASA and UK Met Office projecting that under the high emission scenario (RCP8.5), three of five model simulations suggest that decrease in TC frequency is significant.[174]



[173] Climate drivers including mean sea level pressure, relative humidity (near surface), sea surface temperature, and tropopause temperature

[174] DOST-PAGASA, 2018

The projected decrease in the frequency of tropical cyclones, coupled with an increase in their intensity, can be attributed to a complex interplay of factors driven by climate change. While rising sea surface temperatures provide more energy for storm development and intensification, certain changes in atmospheric circulations within the tropics may act as a counterbalance. The warming of sea surface temperatures is known to fuel storms, making them more powerful. However, the altered atmospheric conditions may create a less favorable environment for the initial formation of storms.[175] Notably, this intricate relation between several factors underscores the dynamic nature of climate change's impact on TCs and must continue to be closely monitored.

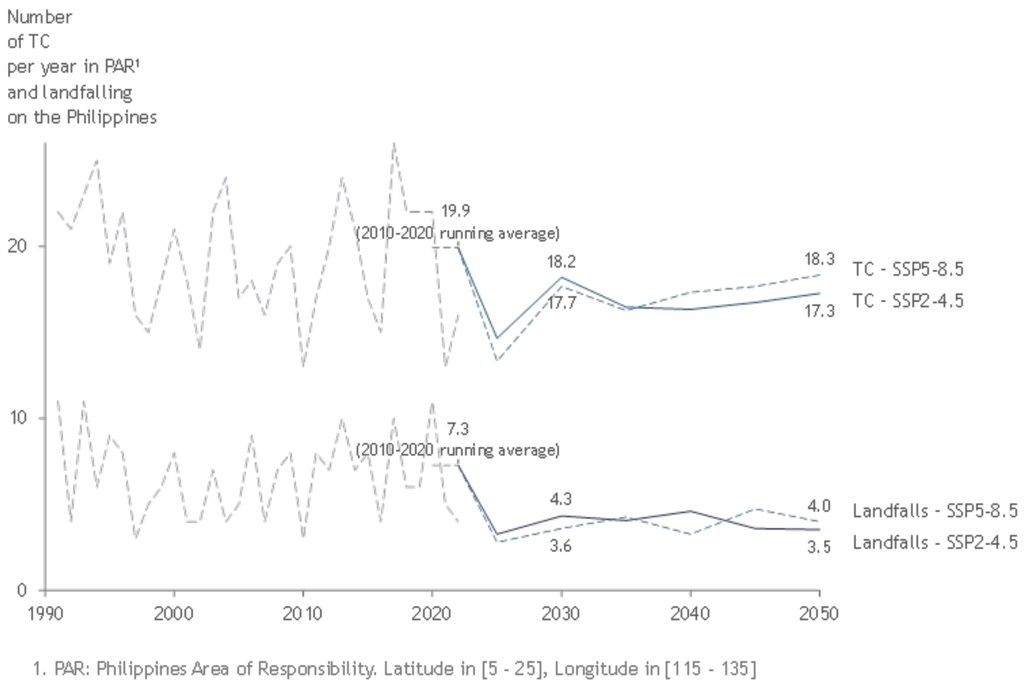


Figure 3.3.4.1: Number of TCs in the Philippine Area of Responsibility and landfalling on the Philippines under SSP2-4.5 and SSP5-8.5 scenarios until period of 2050[176, 177]

However, despite the decrease in frequency, there is a noteworthy increase in TC intensity. Projections indicate a twofold increase in the occurrence of typhoons (118-184 km/h) in PAR compared to the previous decade (Boston Consulting Group, 2023). The average of 3.6 typhoons from 2010 to 2020 is projected to increase 119% to reach 7.5 (SSP5-8.5) to 7.9 (SSP2-4.5) per year between 2030 and 2040. The number of super typhoons (≥185 km/h) is projected to slightly increase 24% from the previous average of 3.3 per year to about 4.0 (SSP5-8.5) to 4.1 (SSP2-4.5) per year (see Figure 3.3.4.2) (Boston Consulting Group, 2023).

By 2050-2060, there is an upward trend in super typhoons in PAR compared to the 2030-2040 projections. The range of typhoons per year in 2050 is generally lower than the 2030 figures, ranging from 6.7-7.3 typhoons per year.vProjections anticipate a 76% increase, reaching 5.2 (SSP2-4.5) to 5.8 (SSP5-8.5) super typhoons per year, surpassing the current level of 3.3 per year (see Figure 3.3.4.2). These projections highlight the potential escalation in TC intensity, particularly in the more severe categories, as the years progress.

This substantial increase in the occurrence of stronger tropical cyclones poses significant risks, as they have the potential to unleash stronger associated winds, heavier precipitation, and intensified storm surges, leading to more severe impacts on the affected areas.

[175] Kiest, 2023

[176] Boston Consulting Group. (2023). Data Model on Landslides [Data model]. Retrieved from Global Landslide Hazard map – precipitation trigger from the World Bank, NASA Global Landslide Catalogue, NASA Global Susceptibility Map, NOAA CPC Precipitation Data, and WorldPop population databases.

[177] Methodology provided in appendix.

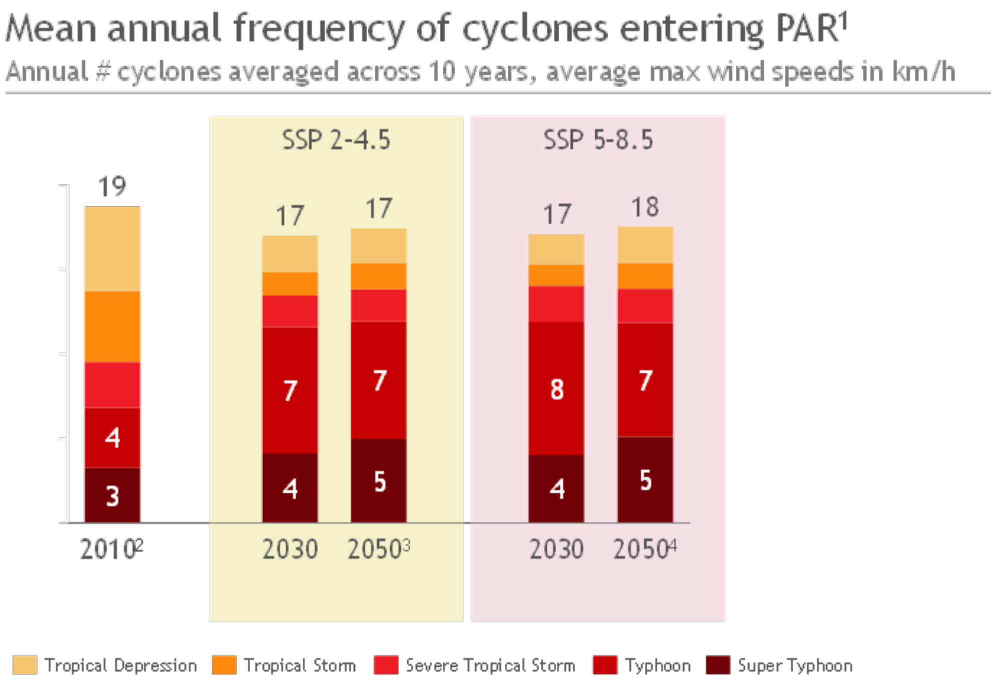


Figure 3.3.4.2: Number of TCs per category in the Philippines under SSP2-4.5 and SSP5-8.5 scenarios in 2030 and 2050 in comparison to 2010-2020 baseline[178, 179]

2030 and 2050 in comparison to 2010-2020 baseline

Philippine Area of Responsibility (not landfall)

2010 decade refers to period between 2010-2020

2030 decade refers to period between 2030-2040

2050 decade refers to period between 2050-2060

Note: PAGASA classification used – In terms of maximum sustained winds near the center: Tropical Depression: <62km/h, Tropical storm: >62km/h & < 88km/h, Severe Tropical Storm: >88km/h & < 117 km/h; Typhoon: > 118 km/h & < 184 km/h; Super Typhoons: > 185 km/h

TCs projected to surge in peak wind intensity

Projections indicate a notable increase in the average maximum peak wind speed of TCs compared to the 2010 to 2020 average, suggesting potential changes in TC intensity. From 2010 to 2020, the average maximum wind speed of TCs stood at around 113 km/h per year. However, by 2030, projections suggest a potential rise of up to 29%, with average maximum wind speeds reaching 142 km/h (SSP2-4.5) and up to 146 km/h (SSP5-8.5). The strongest TCs in a given year are also projected to see an increase of up to 13%, with average speeds of 225 km/h from 2010-2020 projected to reach 241 km/h (SSP5-8.5) and up to 254 km/h (SSP2-4.5) (see Figure 3.3.4.3).

By 2050, the projected increase in average peak wind speed of TCs is projected to escalate further compared to the 2030 figures. Forecasts estimate an increase of up to 33% compared to the 2010-2020 average of 113 km/h, with average maximum wind speeds ranging from 146 km/h (SSP2-4.5) to 150 km/h (SSP5-8.5). Moreover, the maximum wind speed of the strongest TCs in a given year is projected to rise by 15% by 2050, reaching approximately 258 km/h (SSP2-4.5) to 259 km/h (SSP5-8.5). These figures surpass the 2030 average projections of 241 to 254 km/h and the previous average of 225 km/h from 2010-2020 (see Figure 3.3.4.3).

[178] Boston Consulting Group. (2023). Data Model on Landslides [Data model]. Retrieved from Global Landslide Hazard map – precipitation trigger from the World Bank, NASA Global Landslide Catalogue, NASA Global Susceptibility Map, NOAA CPC Precipitation Data, and WorldPop population databases.

[179] Methodology provided in appendix.

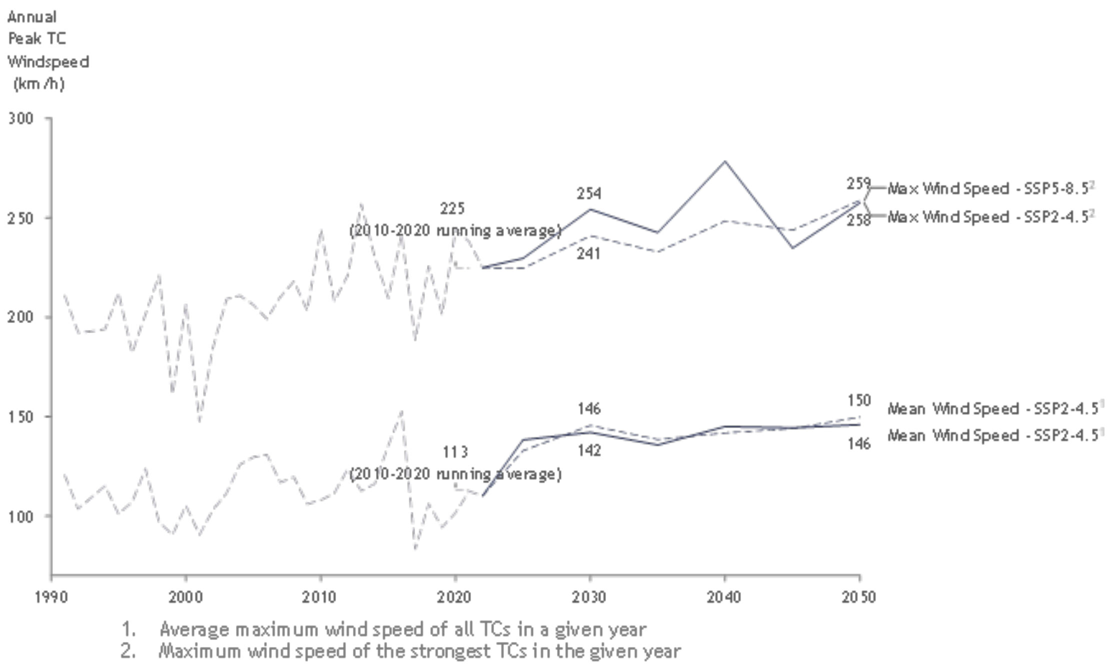


Figure 3.3.4.3: Annual peak TC windspeed (km/h) using cyclone track simulation for Philippine Area of Responsibility across SSP2-4.5 and SSP5-8.5 scenarios until period of 2050[180, 181]

These findings align with climate model simulations concerning anticipated shifts in tropical cyclones, as conducted by PAGASA and the UK Met Office. These simulations indicate that among the five models, four concur on an expected increase in tropical cyclone intensity, with two of these projections signifying a noteworthy intensification.

Potential socio-economic impact

Key takeaways

About six million Filipinos will face more than one TC occurrence with maximum winds exceeding 118 km/h, typhoon and/or super typhoon, translating to PHP83 billion and PHP78 billion in the 2030 and 2050 decades respectively.

Table 3.3.4.1: Social and economic impact of Tropical cyclone occurrence > 118 km/h (Typhoons and/or Super Typhoons)[182]

Socioeconomic Impact Tropical Cyclone	**2030 Decade** (2030-2040 Annualized Average)		**2050 Decade** (2050-2060 Annualized Average)	
	SSP2-4.5	**SSP5-8.5**	**SSP2-4.5**	**SSP5-8.5**
Social impact: Population exposed	1.7 million to 5.9 million	822 thousand to 5.3 million	1 million to 6 million	607 thousand to 6 million
Economic Impact: Infrastructure damage (PHP)	56 billion	83 billion	73 billion	78 billion

[182] Boston Consulting Group. (2023). Data Model on Tropical Cyclones [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) and International Best Track Archive for Climate Stewardship (IBTrACS) databases.

Note: Figures provided are approximations; Population exposed defined as population located in the track of Typhoons and/or Super Typhoons in a radius of 25 to 100 km2; Typhoon and Super Typhoon Occurrence: Estimated annual frequency of a Typhoon or Super Typhoon making landfall; 2030 decade: 2030 to 2040; 2050 decade: 2050 to 2060; 2010 to 2020 used as a baseline as data for socio-economic impact is only available from 2010 to 2020; 1 in 10 year return period; PAGASA classification used – In terms of maximum sustained winds near the center: Tropical Depression: <62km/h,

Tropical storm: >62km/h & < 88km/h, Severe Tropical Storm: >88km/h & < 117 km/h; Typhoon: > 118 km/h & < 184 km/h; Super Typhoons: > 185 km/h

Up to six million Filipinos exposed, with economic losses of PHP83 and 78 billion due to Typhoon and/or Super Typhoon occurrence in 2030 and 2050[183]

Analysis (see Table 3.3.4.1) reveals that, within a 25 km radius from the center of a Typhoon or Super Typhoon, up to 1.7 million Filipinos (SSP2-4.5) are projected to experience the direct impacts , potentially subjecting these people to displacement due to Typhoon or Super Typhoon destruction (Boston Consulting Group, 2023). Under the broader scenario of a 100 km radius from the center of a Typhoon or Super Typhoon, to increase to almost six million people impacted.

In both scenarios, around one million to six million people (SSP2-4.5) potentially encounter at least one Typhoon or Super Typhoon during the 2050 decade. It is worth mentioning that while the SSP5-8.5 scenario exhibits higher intensity, the overall occurrence of tropical cyclones is not projected to show a significant difference or even decline slightly compared to SSP2-4.5. As a result, there will be a limited change in the number of affected individuals and areas in this regard.

Regarding economic impact, specifically infrastructure damage resulting from the occurrence of typhoons or super typhoons with speeds exceeding 118 km/h, projections indicate potential damages of up to PHP83 billion by 2030 and PHP78 billion by 2050.

Most impacted regions

Key takeaways

- Regions in Luzon are projected to be most vulnerable to Typhoon or Super Typhoon occurrence and higher wind intensities compared to other regions.
- Top affected regions in terms of Typhoon or Super Typhoon occurrence by the 2030 decade under SSP5-8.5 scenario include regions II (Cagayan Valley), Region IV-B (MIMAROPA), and IV-A (CALABARZON).
  - Socioeconomic impact of extreme sea events highest in Luzon regions: IV-A, III, and NCR
  - Top regions in terms of population impacted within 100 km radius from the center of a typhoon or super typhoon include Luzon regions IV-A (CALABARZON), III (Central Luzon), and NCR, making up 47% (2.5 million of 5.3 million) of total population impacted within 100 km radius from the center of a Typhoon or Super Typhoon and 73% (603k of 822k) of total population impacted within 25 km radius from the center of a Typhoon or Super Typhoon by 2030 under SSP5-8.5 scenario.
  - These same regions are projected to bear the highest infrastructure damage due to Typhoon and/or Super Typhoon occurrences, accounting for up to PHP47 billion out of the projected PHP83 billion (57%) in infrastructure damage by 2030 under SSP5-8.5.

[183] Methodology provided in appendix.

[184] Boston Consulting Group. (2023). Data Model on Tropical Cyclones [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) and International Best Track Archive for Climate Stewardship (IBTrACS) databases.

Regions in Luzon projected to be most impacted by Typhoon or Super Typhoon occurrence and increased wind intensity

Regions in Luzon are predicted to be relatively more exposed to Typhoon and/or Super Typhoon occurrence by 2030 and 2050 (see Figure 3.3.4.4). By 2030 to 2040 decade and under the SSP5-8.5 scenario, regions II (Cagayan Valley), IV-B (MIMAROPA), and IV-A are identified as the most vulnerable regions in terms of the overall occurrence of TC occurrence >118km/h, or Typhoons and/or Super Typhoons.

In this scenario, Region II faces a potential of 89% for the occurrence of Typhoon or Super Typhoons in a year, which translates to an average of one Typhoon or Super Typhoon every 1.1 years. Region IV-B exhibits potential of 58% for the occurrence of Typhoon or Super Typhoons in a year, with an average frequency of one Typhoon or Super Typhoon every 1.7 years. Region IV-A faces a high potential of TC occurrence of 47%, translating to one Typhoon or Super Typhoon every 2.1 years.

Albeit similar frequency levels compared to the 2020 country profile, it must be recognized that the intensity of these tropical cyclones is projected to escalate over time. By 2030 and 2050, TCs are projected to intensify across the nation, with a more pronounced impact in the Luzon regions (see Figure 3.3.4.5). These regions require special attention and preparedness measures to mitigate the impacts of these potentially devastating weather events.

Regions IV-A (Calabarzon), III (Central Luzon), and NCR (National Capital Region) in Luzon will have the largest absolute socioeconomic impact

Furthermore, in terms of the absolute number of the population impacted, with population impacted defined as the population within a 25 km to 100 km radius of the center of the cyclone, the data shows that Regions IV-A (Calabarzon), III (Central Luzon), and NCR (National Capital Region) make up 47% (2.5 million of 5.3 million) of the total population impacted within a 100 km radius from the center of a Typhoon or Super Typhoon and 73% (603k of 822k) of the total population impacted within a 25 km radius from the center of a Typhoon or Super Typhoon by 2030 under SSP5-8.5 scenario (see Table 3.3.4.2).

These same regions are projected to bear the highest infrastructure damage due to Typhoon and/or Super Typhoon occurrences, accounting for up to PHP47 billion out of the projected PHP83 billion (57%) in infrastructure damage by 2030 under SSP5-8.5

[183] Methodology provided in appendix.

[184] Boston Consulting Group. (2023). Data Model on Tropical Cyclones [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) and International Best Track Archive for Climate Stewardship (IBTrACS) databases.

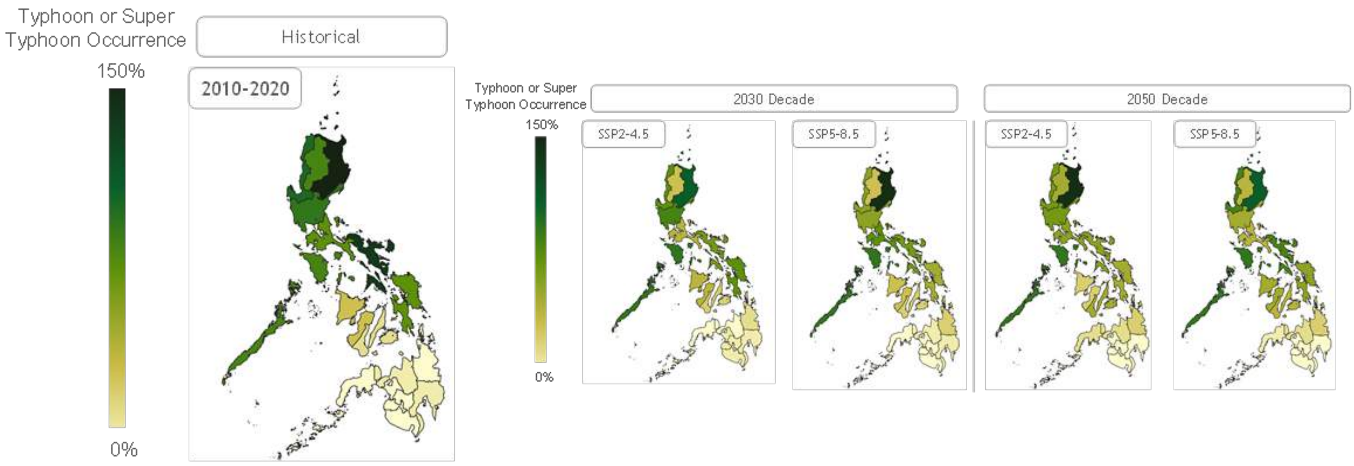


Figure 3.3.4.4: Typhoon and Super Typhoon occurrence potential by 2030 and 2050 decade[185]

Note: Typhoon and Super Typhoon Occurrence: Estimated annual frequency of a Typhoon or Super Typhoon making landfall; 2030 decade: 2030-2040; 2050 decade: 2050-2060; 2010-2020 used as a baseline as data for socio-economic impact is only available from 2010-2020; PAGASA classification used – In terms of maximum sustained winds near the center: Tropical Depression: <62km/h, Tropical storm: >62km/h & < 88km/h, Severe Tropical Storm: >88km/h & < 117 km/h; Typhoon: > 118 km/h & < 184 km/h; Super Typhoons: > 185 km/h

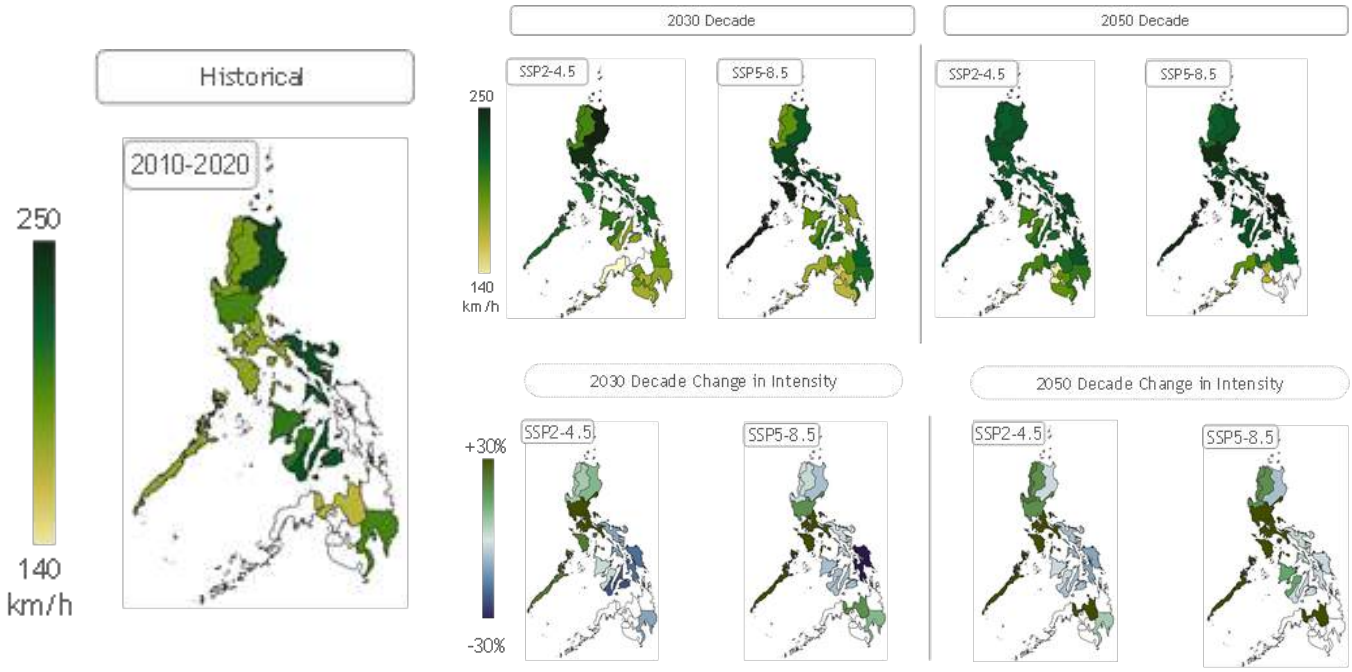


Figure 3.3.4.5: Upper panel – Maximum wind intensity of Typhoons and Super Typhoons; Lower panel – change in maximum wind intensity of Typhoon or Super Typhoons versus 2010-2020 baseline[186]

Note: 2030 decade: 2030-2040; 2050 decade: 2050-2060; 2010-2020 used as a baseline as data for socio-economic impact is only available from 2010-2020; PAGASA classification used – In terms of maximum sustained winds near the center: Tropical Depression: <62km/h, Tropical storm: >62km/h & < 88km/h, Severe Tropical Storm: >88km/h & < 117 km/h; Typhoon: > 118 km/h & < 184 km/h; Super Typhoons: > 185 km/h

[185, 186] Boston Consulting Group. (2023). Data Model on Tropical Cyclones [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) and International Best Track Archive for Climate Stewardship (IBTrACS) databases.

Table 3.3.4.2: Typhoon and/or Super Typhoon occurrence in a 10-year return period, maximum wind speed, population impacted by Typhoon or Super Typhoon occurrence in a 100 km and 25 km radius from the center of the cyclone, area impacted, and percent of total area impacted by Typhoon or Super Typhoon occurrence in a 100 km and 25 km radius from the center of the cyclone, and economic impact (PHP) under SSP5-8.5 scenario by 2030 to 2040 decade[187]

REGION	Typhon and/or Super Typhoon Occurrence	Max wind speed (km/h)	Pop. Impacted (k people) Within 100km Radius	% of Total Pop. (2020 figures)	Pop. Impacted (k people) within 25km Radius	% of Total Pop. (2020 figures)	Area Impacted ('000 sq km) 25km to 100km Range	% of Total Area Impacted	Economic Impact (PHP Bn)
Region II	89%	220	241	7%	20	1%	1-22	4%-77%	2
Region IV-B	58%	248	166	5%	26	1%	2 -15	6%-55%	3
Region IV-A	47%	232	1,048	7%	411	3%	3 -14	17%-85%	27
Region V	44%	218	410	7%	29	0%	1 -13	5%-75%	6
Region I	40%	180	341	7%	60	1%	1 -10	8%-76%	5
Region III	36%	224	772	6%	58	0%	3 -17	16%-78%	11
Region VIII	31%	172	282	6%	11	0%	1 -15	3%-71%	2
Region VI	24%	184	503	6%	-	0%	0-12	0%-59%	8
CAR	22%	183	110	6%	52	3%	-	-	2
Region XIII	18%	214	156	6%	15	1%	0-9	1%-46%	2
Region VII	16%	204	493	6%	3	0%	1 -5	7%-33%	4
Region XI	7%	205	-	0%	-	0%	0-7	1%-38%	0
Region X	7%	182	106	2%	4	0%	0-4	0%-22%	1
Region XII	4%	154	-	0%	-	0%	0-1	0%-4%	0
Region IX	4%	161	-	0%	-	0%	-	-	0
National Capital Region	4%	220	714	6%	135	1%	0-1	4%-86%	9
Bangsamoro Autonomous Region in Muslim Mindanao	2%	139	-	0%	-	0%	0-1	0%-7%	1

Top metrics under each category

Note: Table sorted based on Typhoon or Super Typhoon occurrence column; Figures highlighted indicate top figures under respective metrics; Typhoon or Super Typhoon Occurrence: Estimated annual frequency of a Typhoon or Super Typhoon making landfall; 2030 decade: 2030-2040; 2050 decade: 2050-2060; 2010-2020 used as a baseline as data for socio-economic impact is only available from 2010-2020; Population and area impacted defined as population and area located in the track of Typhoons and Super Typhoons' in a radius of 25 to 100km from the center of the cyclone; PAGASA classification used – In terms of maximum sustained winds near the center: Tropical Depression: <62km/h, Tropical storm: >62km/h & < 88km/h, Severe Tropical Storm: >88km/h & < 117 km/h; Typhoon: > 118 km/h & < 184 km/h; Super Typhoons: > 185 km/h

Note: A larger version of the figure is available in Appendix 6

[187] Boston Consulting Group. (2023). Data Model on Tropical Cyclones [Data model]. Retrieved from CMIP6 (Coupled Model Intercomparison Project Phase 6) and International Best Track Archive for Climate Stewardship (IBTrACS) databases.

3.3.5 Provincial categorization based on climate exposure

Future global trends

The previous sections in this subchapter delved into each CID and the social, economic, and physical impacts they may bring to the Philippines. **In this section of the National Adaptation Plan (NAP), the information from previous subsections is used to categorize provinces based on the exposure they are projected to face in the coming decades**. The considered dimensions span across the physical, social, and economic domains, and are analyzed both for individual CIDs as well as at an overall, multi-CID level.

As a nation with finite resources and exceedingly diverse levels of vulnerability across different provinces, this categorization helps support optimized decision making and distribution of resources, concentrating support where it is most urgently needed. While analyses in previous sections were done at a regional level, categorizations were further distilled into provinces given the presence of governing bodies at the provincial level–mapping of provinces to their respective regions can be seen in Appendix 1.

Provinces are split into five distinct categories, depending on percentile value of their exposure compared across other Philippine provinces, defined in Figure 3.3.5.1. Figure 3.3.5.2 showcases a risk categorization splitting provinces into quintiles[188] based on exposure arising from climate-driven social, economic, and physical impacts across all CIDs[189] in the decade of 2030, SSP5-8.5. CID-specific categorizations and detailed information on methodology can be found in Appendix 1.

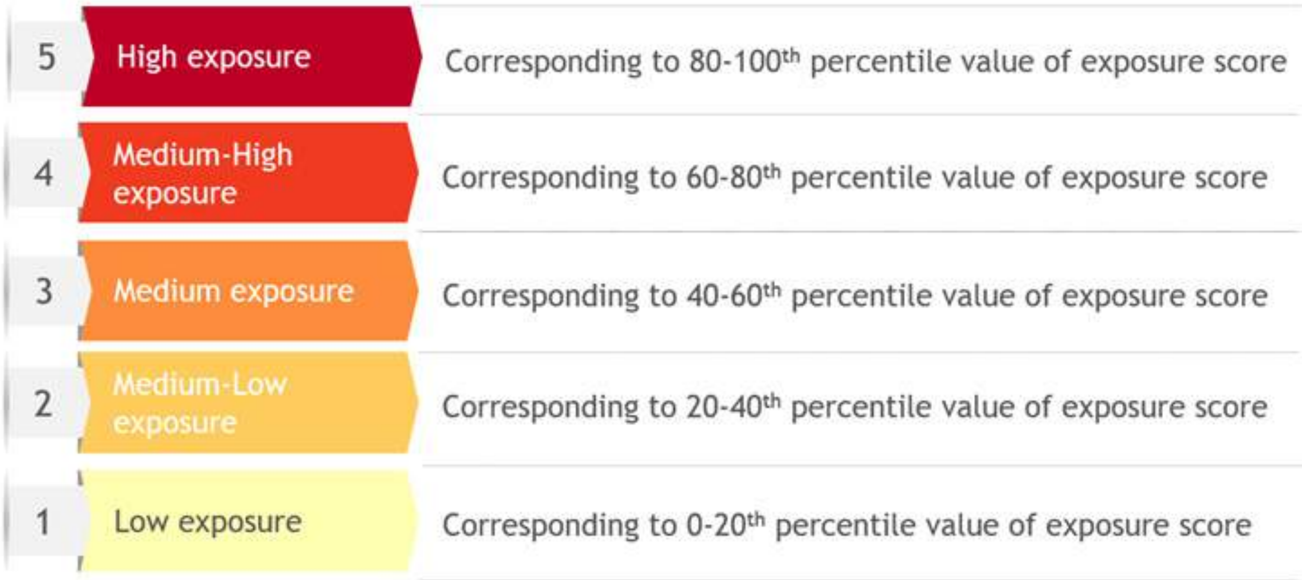


Figure 3.3.5.1 Definition of each risk category

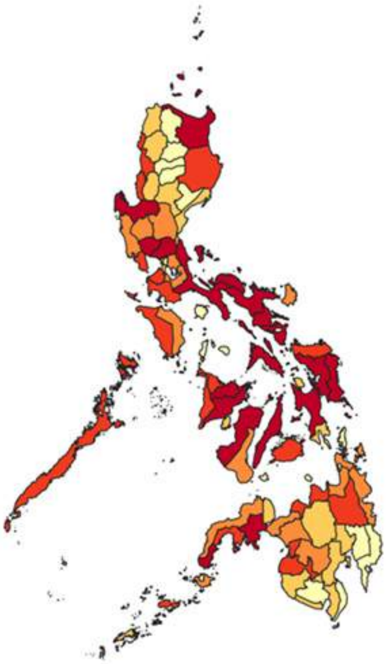
[188] Provinces within each quintile are listed in alphabetical order.

[189] Dimensions were weighted to ensure equal significance of physical, social, and economic impacts.

Sea level rise, Extreme Sea Levels, pluvial and fluvial flooding: Social - absolute population exposed and % of provincial population exposed, absolute and % of provincial impoverished population exposed; Economic - Damage cost as an absolute number and as a % of regional GDP; Physical: Absolute area exposed and % of total provincial area exposed.

Extreme Heat: Social - absolute # agricultural & construction workers in region and as % of total region workforce.

Extreme Wind: Social - absolute population exposed and % of provincial population exposed, absolute and % of provincial impoverished population exposed; Economic - Damage cost as an absolute number and as a % of regional GDP.



High Exposure	Medium-High Exposure	Medium Exposure	Medium-Low Exposure	Low Exposure
Province	Province	Province	Province	Province
Albay	Agusan del Sur	Agusan del Norte	Abra	Apayao
Bulacan	Aklan	Basilan	Aurora	Batanes
Cagayan	Antique	Catanduanes	Benguet	Camiguin
Camarines Norte	Bataan	Cotabato	Biliran	City of Isabela
Camarines Sur	Batangas	Cotabato City	Bukidnon	Davao de Oro
Capiz	Bohol	Laguna	Davao del Norte	Davao Occidental
Cebu	Cavite	Lanao del Norte	Davao del Sur	Davao Oriental
Eastern Samar	Ilocos Sur	Lanao del Sur	Guimaras	Dinagat Islands
Iloilo	Isabela	Negros Oriental	Ilocos Norte	Ifugao
Leyte	La Union	Nueva Ecija	Misamis Occidental	Kalinga
Masbate	Maguindanao	Oriental Mindoro	NCR, City of Manila, First District	Marinduque
Negros Occidental	Misamis Oriental	Rizal	NCR, Fourth District	Mountain Province
Pampanga	Northern Samar	Surigao del Norte	NCR, Third District	NCR, Second District
Pangasinan	Occidental Mindoro	Surigao del Sur	Nueva Vizcaya	Quirino
Quezon	Palawan	Tarlac	Sarangani	Romblon
Samar	Sulu	Zambales	Southern Leyte	Siquijor
Sorsogon	Zamboanga Sibugay	Zamboanga del Norte	Sultan Kudarat	South Cotabato
Zamboanga del Sur			Tawi-Tawi	

Figure 3.3.5.2 Projected provincial risk categorization between 2030-2040, SP5-8.5

Note: Provinces are arranged alphabetically within each category

The provincial categorization highlighted in Figure 3.3.5.2, when combined with factors such as vulnerability and adaptive capacity serves as an insightful reference point to support decision-making on adaptation action at a localized level. It is important to note that many of the components that make up this categorization will need to be downscaled at a more granular level in the future. Moving forward, downscaled, localized studies within high-risk localities must be performed to supplement this analysis. Combined, these studies can enable a well-informed selection of adaptation strategies, which can be chosen from the portfolios identified in the following chapter on Adaptation Priorities.

Social vulnerability and underlying impact-drivers

The concept of vulnerability encompasses a broad spectrum of interpretations within existing literature. While commonly viewed as a precondition, some scholars interpret it as an outcome. Vulnerability encompasses three distinct aspects: it indicates a result rather than a cause; it signifies an unfavorable outcome; and it operates as a comparative term, distinguishing among socio-economic groups or regions rather than serving as an absolute gauge of deprivation (Downing, 1991). The Intergovernmental Panel on Climate Change (IPCC) provides a definition rooted in exposure, susceptibility, and adaptive capacity: “Vulnerability delineates the degree to which a system is prone to, or unable to effectively manage detrimental impacts stemming from climate change, encompassing variations in climate patterns and extremes. This factor hinges not solely on a system’s sensitivity but also on its capacity to adapt.” (IPCC, 2007).

In its Synthesis Report of the Sixth Assessment Cycle, the IPCC further stated:

Approximately 3.3 to 3.6 billion people live in contexts that are highly vulnerable to climate change. Human and ecosystem vulnerability are interdependent. Regions and people with considerable development constraints have high vulnerability to climatic hazards.

Increasing weather and climate extreme events have exposed millions of people to acute food insecurity and reduced water security, with the largest adverse impacts observed in many locations and/or communities in Africa, Asia, Central and South America, LDCs, Small Islands and the Arctic, and globally for Indigenous peoples, small-scale food producers and low-income households. Between 2010 and 2020, human mortality from floods, droughts and storms was 15 times higher in highly vulnerable regions, compared to regions with very low vulnerability.[190]

In the context of comprehensive climate risk assessment, vulnerability includes environmental, physical, technical, social, cultural, economic, institutional, and policy-related factors that contribute to susceptibility and/or lack of capacity to prepare, prevent, cope, or adapt.[191] The study "Approaches to the Vulnerability to Climate Change"[192] posited that vulnerability to climate change encompasses changes in individual and collective vulnerability over time associated with the changing incidence of extreme events. Policies relevant to the reduction of social vulnerability to climate variability also support the capacity of vulnerable groups to maintain resources and to invest in maintaining these resources in the long run. Building social capital and trust networks, especially with state institutions, becomes essential due to extreme events and disasters.[193]

The factors that characterize vulnerability include socio-economic status (e.g., income, political power, and prestige), gender, race and ethnicity, age, rural/urban location, residential property, renters, family structure, education, social dependence, and special needs populations, among others.[195] In Metro Manila, low-income households in informal settlements do not have adequate access to potable water, electricity, health services, and sewage and sanitation facilities suffer significant impacts from tropical cyclones, floods, and tidal/storm surges.[196] In remote coastal communities, factors that influence social vulnerability include are household size, members with disability, and travel time to town center.[197]

Mortality rates from tropical cyclones are influenced more by population exposure and socio-economic conditions rather than the hazard itself.[198] In the Super Typhoon Haiyan-affected areas in Leyte, exposure to flood and storm surge, vulnerability of livelihoods, low level of information and awareness, and lack of disaster preparedness contributed to social vulnerability.[199] Communities living in areas prone to tropical cyclones and floods are found to be highly vulnerable to chronic poverty, showing a positive correlation between poverty and the frequency of tropical cyclones or disasters.[200]

[190] A.2.2, https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf

[191] UNDRR (2022) "Technical Guidance on Comprehensive Risk Assessment and Planning in the Context of Climate Change", United Nations Office for Disaster Risk Reduction.

[192] Adger, W. Neil. Center for Social and Economic Research on the Global Environment, University of East Anglia and University College London. 1995//ISSN 0967-8875.

[193] Porio, E. and See, J. 2017. Social Well-Being in the Philippines: Indicators and Patterns. The Senshu Social Well-being Review 4, 95-116.

[194] See, J. and Porio, E. 2015. Assessing Social Vulnerability to Flooding in Metro Manila Using Principal Component Analysis. Philippine Sociological Review 63, 53-80.

[195] Cutter, S.L., Boruff, B.J. & Shirley, W.L., 2003. Social Vulnerability to Environmental Hazards. Social Science Quarterly, 84(2), 242–261.

[196] Porio, E. 2011. Vulnerability, Adaptation, and Resilience to Floods and Climate Change-Related Risks among Marginal, Riverine Communities in Metro Manila. Asian Journal of Social Science 39, 425–445.

[197] Delfino, A.N., Dizon, J.T., Quimbo, M.A.T. and Depositario, D.P.T. 2019. Social Vulnerability and Adaptive Capacity to Climate Change Impacts of Women-headed Households in the Philippines: A Comparative Analysis. Journal of Environmental Science and Management 22 (2), 36-54.

[198] Toda, L., Orduna, J.R., Lasco, R., and Santos, C.T. 2016. Assessing Social Vulnerability to Climate-Related Hazards Among Haiyan-affected Areas in Leyte, Philippines. Climate, Disaster and Development Journal 1, 39-53.

[199] Yonson, R., Noy, I. and Gaillard, J.C. 2018. The Measurement of Disaster Risk: An Example from Tropical Cyclones in the Philippines. Review of Development Economics 22 (2), 736–765.

[200] Balisacan, A., and N. Fuwa. 2001. Growth, Inequality and Poverty Reduction in the Philippines, UPSE Discussion Paper, 1–9 and Balisacan, A., and E. Pernia. 2002. What Else Besides Growth Matters for Poverty Reduction? ERD Policy Brief No. 5. February 2002

Through social vulnerability analysis, the relationships between climate impacts, adaptation strategies, and socio-economic impacts can be defined, qualified, and quantified. This analysis is undertaken at macro, meso, and micro levels looking into the vertical and horizontal linkages and interactions of social variables.[201] Through a composite social vulnerability index in the Philippines, for example, a trend of decreasing social vulnerability from south to north is observed within the municipalities of the southern and western coastal regions of MIMAROPA, Zamboanga Peninsula, BARMM and SOCCSKSARGEN exhibiting the highest levels of social vulnerability.[202, 203] The structure of social vulnerability among urban populations is found to be evolving, and becoming complex involving multiple stakeholders based on social vulnerability analyses conducted in Metro Manila, Iloilo City, and Naga City.[204]

The data modeling exercises in the above sub-chapters feature four (4) Climatic Impact Drivers (CID)— (1) increased temperature and drought, (2) extreme precipitation, (3) sea level rise and extreme sea levels, and (4) extreme winds and tropical cyclones—which were prioritized to understand the impacts of climate change in the Philippines and upon which adaptation options were derived across the targeted sector outcomes.

This process reflects the value of more granular information and datasets to highlight the aspect of social protection among the purposes of the NAP.

Each CID was analyzed in terms of its impacts, taking into account that projections indicate hazards to significantly intensify for the country under 2030 (short-term) and 2050 (long-term) horizons, and under the Shared Socioeconomic Pathway (SSP) 2-4.5 and SSP5-8.5 scenarios.

To illustrate the regard for the social dimension of the NAP, the data analytics highlight the following:

a. Incorporation of estimates of economic impacts by the CIDs; and

b. Computation of ranking of regions based on CID vulnerability.

The social indicators are then applied to ensure that the solutions are inclusive and appropriate as they aim to increase adaptive capacity, and at the same time, to leverage investment opportunities.

The application of Cost-Benefit Analysis, Social Accounting Matrix, and the use of scorecards is necessary to capture local (in terms of location) and social (in terms of human and community dimensions) vulnerability and are conducted to support targeted and deliberate determination of solutions based on scientific assessments of gaps and needs for adaptation and sustainable development.

[201] Porio, E. and See, J. 2023. Manila: Aspiring to be an Inclusive, Resilient, and Sustainable City amidst Climate and Disaster Risks. In R. Hu (ed) Routledge Handbook of Asian Cities.

[202] Lloyd, S., Gray, J., Healey, S., and Opdyke, A. 2022. Social Vulnerability to Natural Hazards in the Philippines. International Journal of Disaster Risk Reduction 79, 103103.

[203] Ignacio, J.A. 2014. Measuring social vulnerability to climate change-induced hazards in the Philippines. PhD Dissertation. Département de Géographie, Université de Namur.

[203] Porio, E. et al. 2021. WP 1.2.3 Social Vulnerability Analysis using PCA. Final Synthesis Report (2018-2021): Coastal Cities at Risk in the Philippines (CCARPH) Investing in Climate and Disaster Resilience Project. IDRC Project No. 108688, CRM: 002425.

The various interventions advanced by the UNDRR in its "**disaster risk reduction tools and methods for climate change adaptation**" support an effective framework for consolidating knowledge and experiences on disaster management and climate action to build adaptive capacity by communities. Seven approaches, applicable to particular regions, cover the following areas of intervention:

a. Political commitment and institutional aspects

b. Risk identification and early warning

c. Knowledge management and education

d. Risk management applications

e. Preparedness and response

The foregoing methodological approaches are considered to be helpful in ushering in a future-thinking approach to managing climate risks, and, ultimately, establish a cohesive, convergent, and results-oriented adaptation planning and implementation. This is consistent with the NCRMF, which upholds an anticipatory, probabilistic, and holistic risk assessment, planning, and management approach in support of sustainable development.

[205] https://www.undrr.org/publication/disaster-risk-reduction-tools-and-methods-climate-change-adaptation

Tubbataha Reef, Puerto Princesa City

04 Adaptation Priorities

4. Adaptation Priorities

4.1 Introduction to Priority Sectors for Adaptation and Resilience

This chapter outlines the adaptation priorities for eight (8) sector outcomes that underpin the Philippines' economic and social development under the SF outlined in Chapter 1. As underscored in the previous chapters, the frequency and intensity of multiple climatic-impact drivers (CID), the significant uncertainties sustained in projected risks due to climate change, and various challenges in implementing adaptation solutions all call for a systematic approach to defining and prioritizing strategies to increase resiliency.

To effectively build resilience to minimize climate-related loss and damage, and increase adaptive capacity towards the transformation of resilient and sustainable socio-economic development, eight key sector outcomes have been selected as pillars for adaptation actions for societal well-being and stability, and economic resilience. These include **Agriculture and Fisheries and Food Security; Water Resources; Health; Ecosystems and Biodiversity; Cultural Heritage, Population Displacement and Migration; Land Use and Human Settlements; Livelihoods and Industries; and Energy, Transport and Communications.**

The table below provides an overview of the importance of the sector and the need for adaptation and resilience considering the impacts of climate change:

Sector	Importance of sector and the need for adaptation and resilience[206]
Agriculture and Fisheries and Food Security	The production of crops, livestock, aquaculture, and fishery systems in the Philippines is critical to food security, as 75% of food consumed in the country is produced locally[207]. In addition, one out of ten households in the Philippines continue to be food insecure. Additionally, agriculture and fisheries are significant sectors of the economy as it contributes 8.9% of the nation's Gross Domestic Product (GDP) in 2022[208]. The agriculture sector constitutes a quarter of the nation's workforce, with 30% of this segment living in poverty[209], leading to their heightened vulnerability against climate change.

206 Sources for key statistics and information per sector can be found in the respective sectoral sub-chapters in Chapter 4.2
207 Philippine Statistics Authority. (2022). Food Balance Sheets of the Philippines, 2019-2021
208 Philippine Statistics Authority (2023). National Accounts of the Philippines (as of April 2023)
209 Philippine Statistics Authority. (2021). 2021 Full Year Official Poverty Statistics Among The Basic Sector in the Philippines

Water Resources	Water resources are essential for human survival and economic activity, such as agricultural irrigation, fishery production, hydropower generation, and industrial production. A rapidly growing population without appropriate planning and investment into water systems has led to national water stress levels twice the global average—12.4 million (12%) Filipinos lack basic access to drinking water (2015)[210], while 26 million Filipinos do not have access to basic sanitation. In 2022, the DOH estimated that out of the 25.5 million households, 2.87 million (11.26%) have no access to basic water supply, 4.17 million (16.36%) with no basic sanitation facilities[211].This situation may be further exacerbated by climate change, leading to cascading impacts on other sectors, such as health, where contaminated water sources are a significant source of waterborne diseases in the Philippines.
Health	More than 110 million Filipinos rely on the healthcare system to effectively anticipate, respond, and recover from climate-related disasters and climate-induced diseases. Climate change drivers have been seen to increase the incidence of vector-borne diseases like dengue and malaria. With only 56% of public health facilities sufficiently stocked with selected essential medicines and less than 25% of cities and municipalities having health worker density above recommended levels, the sector has limited capacity to respond effectively to sudden and increased healthcare demands, disproportionately impacting low-income populations who cannot afford private healthcare.
Ecosystems and Biodiversity	The Philippines' ecosystem makes it one of the 17 mega-biodiverse countries in the world. It also provides livelihood and value across key industries, such as aquaculture, agriculture, fisheries, and tourism, and protects surrounding communities from climate hazards. In particular, the Philippines' coral reefs (~70k PHP/ha annually), forests (~200k PHP/ha annually), and mangroves (~200k PHP/ha annually) have been estimated to generate billions of Philippine pesos in ecosystem services annually. These ecosystems have been heavily exploited over the past decade due to human-made developments and climatic-impact drivers, putting the ecosystems and the communities who depend on them for livelihood and protection at risk.
Cultural Heritage, Population Displacement and Migration	Extreme climate events and risks will continue to affect migration patterns in the country: more than 15 million estimated Filipinos were displaced by 245 climate disaster events from 2020 to 2022. Especially vulnerable to displacement and migration caused by sudden-onset climate events such as tropical cyclones, and slow onset climate risks (e.g., rising sea levels and associated adverse impacts) are 14 to 17 million indigenous people (IP) that inhabit the Philippines, belonging to 110 different ethnolinguistic groups, with 73% of all IPs belonging to the 40% poorest of the population.

[210] National Economic and Development Authority. (2022). Philippine Water Supply and Sanitation Master Plan (PWSSMP). Pasig City, Philippines

[211] Department of Health (2023). Field Health Services Information System 2022 Annual Report.

Land Use and Human Settlements	With 60% of Philippine cities located along the coast, the country's coastal areas and low-lying regions are especially susceptible to climate hazards, where an estimated 5.4 million Filipinos live. Rapid urbanization has led to unplanned land use and increasing informal settlements in hazard-prone areas; an estimated 2.45 million impoverished Filipinos live in informal settlements and have limited ability and resources to withstand and recover from climate disasters.
Livelihoods and Industries	Resilience in key industries in the Philippines must be built to protect the country's economic and social stability amidst increasing climate hazards and risks, especially since industries and their energy supplies are also significant contributors to greenhouse gas emissions. Key industries that contribute heavily to the Philippines' GDP must be protected, particularly Manufacturing (17.2%), Tourism (6.2%), and Professional Services (6.1%)[212], thus safeguarding the livelihood of over 12 million Filipinos who rely on these industries.
Energy, Transport, and Communications	Infrastructure such as energy, transport, and communications make up critical systems that empower and interconnect industries, businesses, and households, facilitating economic activities and growth while providing communities with access to essential services. Rapid economic and population growth combined with poorly implemented programs have led to overloaded infrastructure systems, resulting in the Philippines having 1/3 the average Kilowatt hour (kWh) per capita, as well as having among the highest people-to-telecom-tower ratio at over 6000. The infrastructure systems are also among the most vulnerable to climate change, putting the various communities and organizations that depend on these services at risk. Future climate change may also change the demand required for these infrastructure services and it is critical to balance adaptation efforts with mitigation efforts given that current energy and transport systems are significant emitters of greenhouse gases.

While adaptation priorities in this NAP are outlined per sector, the NAP also recognizes the inextricable links between various sectors and emphasizes the need for an integrated approach to climate adaptation. The diagram below presents a non-exhaustive illustration of select interlinkages across various sectors.

[212] Agriculture is also a key contributor to Philippines' GDP (9%); adaptation priorities for this sector is captured under Agriculture and Fisheries and Food Security.

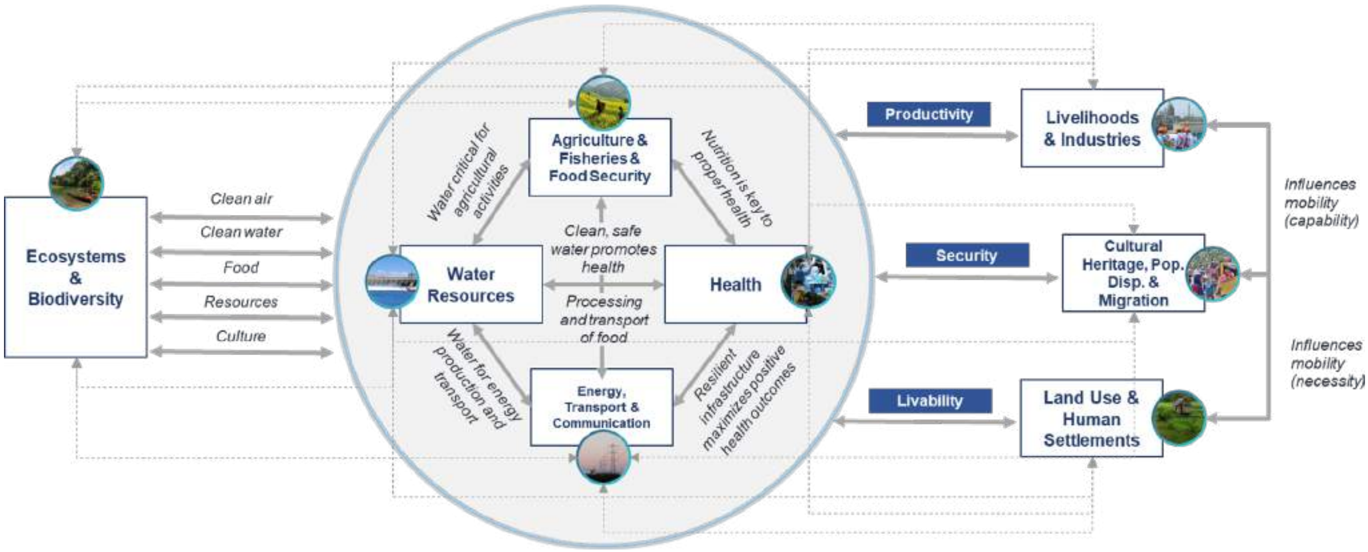


Figure 4.1.1. Sample illustration on select interdependencies across key sectors.

Ecosystems and biodiversity serve as the life support system, providing a range of services that directly and indirectly support human well-being and survival. These services are tied to clean air and water, food production, climate regulation, and cultural and recreational values. Recognizing the critical importance of ecosystems is paramount, as their resilience directly impacts the longevity of access to basic needs. Protecting and restoring these ecosystems not only safeguards biodiversity but also enhances resilience to climate impacts, ensuring the sustainability of essential services for all Filipinos.

Essential human needs across sectors are deeply intertwined, forming a complex web of dependencies. Disruptions in these areas can trigger cascading impacts on other pivotal domains. For instance, a severe drought affecting water resources can have devastating consequences on agriculture and fisheries, and food security, as well as on energy and health outcomes due to water scarcity and increased temperatures. Disruptions in energy, transport, and communication system can disrupt the access to health infrastructure through flooded roads, or interrupt health services due to power outages. The same can be said about impacts on agriculture and food security, and livelihood and industries. Disruptions in critical infrastructure can impact processing and transportation of products, thereby affecting accessibility, availability, and prices.

Strengthening resilience in these 'essential' services not only benefits each sector individually but also cascades to strengthen security for cultural heritage, population displacement and migration, sustain productivity in Livelihoods and Industries, and ensure livability in Land Use and Human Settlements. For example, a more resilient agricultural sector can enhance food security, reducing the need for population displacement and migration due to resource scarcity. Similarly, investments in sustainable land use and human settlements can mitigate the impacts of extreme weather events and support communities' adaptability. The NAP emphasizes the value of these interconnected benefits, promoting a synergistic approach that maximizes the co-benefits across sectors to build a more resilient and adaptive Philippines.

Beyond sectors above, other factors may also influence the effectiveness of the Philippines' climate response. For example, the nexus between population dynamics and the adaptive capacity of communities is a critical consideration when implementing the NAP. A growing population can amplify vulnerabilities or contribute to resilience, depending on the availability of resources, infrastructure, and socio-economic conditions. Rapid population growth can strain limited resources and infrastructure, making it challenging for communities to adapt to climate impacts effectively. On the other hand, a stable and well-managed population can enhance a community's adaptive capabilities, demonstrating the ability to absorb shocks and recover from climate-related events, and work on transformational sustainable resilience pathway for the long term.

In summary, disruptions in any one sector or factor can create a vicious cycle of vulnerability and exacerbate the challenges of climate change. Protecting and enhancing ecosystems, understanding the interdependencies among essential human needs, and strengthening resilience across sectors are all central tenets of the plan. Thus, the NAP recognizes the necessity of integrated, cross-sectoral approaches to address these interdependencies and promote holistic resilience.

4.1.1 Sectoral Categorization Based on Climate Risks

A broad estimation of the impacts across the CIDs to each sector was conducted. In line with the methodology for high-level socioeconomic model, the projected cost of inaction indicates the costs associated with infrastructure damage, productivity loss, and relocation of populations in relation to each sector. Recognizing these aspects holds significant implications for determining the optimal timing and approach that the Philippines should adopt in addressing adaptation measures for each of these sectors.

Economic implications of inaction in the face of climate change impacts are unambiguous.

The cost of inaction in the 2030 decade is estimated to be PHP645 billion per year across these eight sectors[213]. Failing to proactively address the challenges posed by climate change places not only the well-being of Filipinos at risk but also poses a substantial economic burden for the nation.

Four of the eight sectors, including Land Use and Human Settlements, Energy, Transport, and Communications, Livelihood and Industries, and Agriculture and Fisheries, have economic costs of inaction sizeable enough to spur action. For these sectors, the case for taking adaptive measures is clear: there is a compelling need to accelerate efforts to mitigate the cost of inaction. Doing so is crucial to ensuring the continuous functioning of critical infrastructure, protecting communities, and sustaining livelihoods in the face of an increasingly unpredictable climate.

However, it is equally crucial to consider the needs of women, youth and those with special needs, and **the other indirect social costs of inaction, such as health impacts, loss of ecosystem services, conflict and security risks, and psychological and social stress.** While these costs are not comprehensively quantified within socioeconomic models, a comprehensive assessment might reveal that these indirect consequences can be equally, if not more, detrimental to the Philippines.

Sectors such as Water Resources, Cultural Heritage, Ecosystems and Biodiversity, and Agriculture and Fisheries and Food Security provide essential human needs. Social costs attributed to systemic impacts in case disruptions happen in these sectors can vary widely. For these sectors, the approach to adaptation action may differ. There is a need for next-level impact assessments to trace pathways by which initial climate change impacts can trigger secondary and tertiary consequences.

[213] Estimated through climate analytics models using scenario SSP 5-8.5 across five climatic impact-drivers and attributed to selected sectors; overall economic cost of inaction including impacts beyond eight sectors are outlined in Chapter 3; detailed methodology for the climate analytics model found on Appendix 2

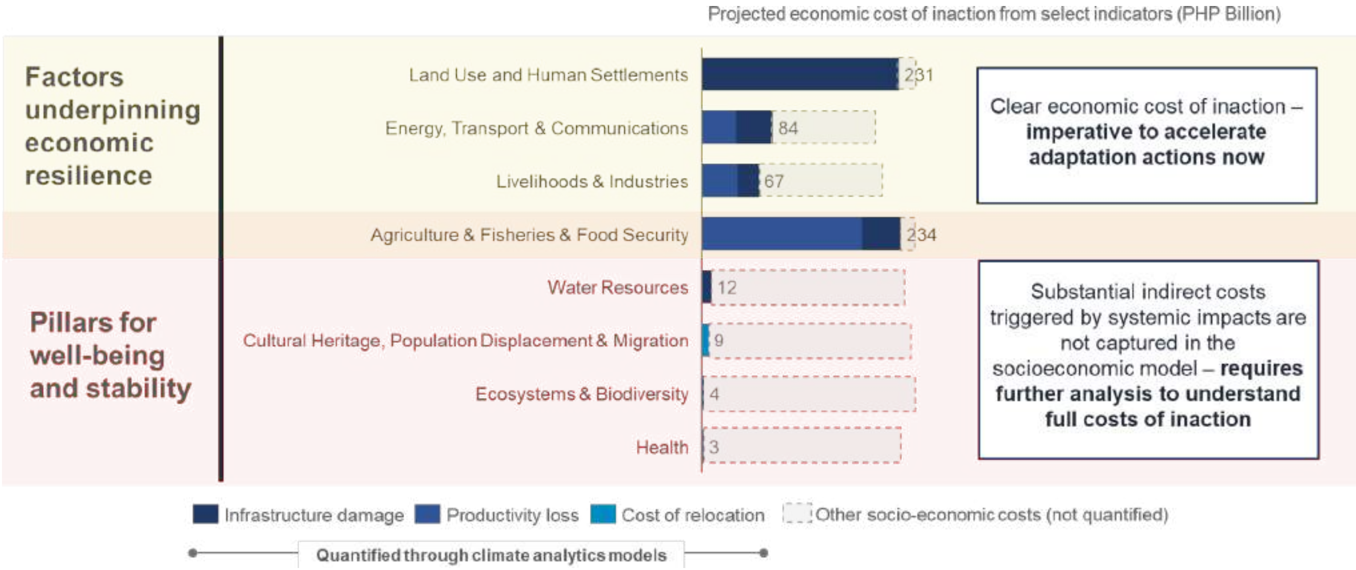


Figure 4.1.2. Implications of adaptation and resilience actions based on projected socio-economic cost of inaction across sectors

4.1.2 Qualitative Assessment of Existing Strategies

A review of existing mechanisms, including replicable or scalable case studies, can concretely model the way for cost-effective and transformative adaptation solutions that are founded on the best available science and recognize the value of traditional knowledge and tested practices on the ground.

One way to grasp a rather broad context of adaptation action is through an assessment of the first iteration of the **NCCAP Monitoring and evaluation (M&E) Report for the period 2011-2016**[214]. The development pathways under each thematic priority in the NCCAP[215] were evaluated based on the following parameters:

1. Governance readiness to adapt (e.g. Enabling policies and key plans and flagship programs, institutional capacity, capacity development, and knowledge management).
2. Adaptation action implementation (e.g. Programs and projects, social protection, financing)
3. Mitigation co-benefits
4. Contributions to enhancing adaptive capacity, reducing vulnerability and sustained development

The NCCAP M&E 2011-2016 provides valuable points to adopt certain paradigm shifts in terms of the context and methodological considerations of adaptation actions, which are explored to be incorporated in this NAP. This includes the following:

a. Science serves as the basis for framing long-term adaptation planning, utilizing modeled scenarios based on proper baselines and specific time horizons.
b. Funding mobilization should consider inputs from private sector stakeholders and should capture innovative approaches to climate finance while leveraging public sector investment. This should consider the People's Survival Fund (PSF), other climate and disaster funding mechanisms, and development assistance facilities for holistic governance of climate adaptation measures. The practice of Climate Change Expenditure Tagging (CCET) across a significant number of national government agencies and in some local government units, which provides further analysis of the correlation of agency budgets with projected risks in programs and activities.

[214] Climate Change Commission. (2019). The Philippine National Climate Change Action Plan Monitoring and Evaluation Report 2011-2016. Manila, Philippines.

[215] The following are the NCCAP Seven thematic priorities: Food Security, Water Sufficiency, Ecosystems and Environmental Stability, Human Security, Climate-Smart Industries and Services, Sustainable Energy, and Knowledge and Capacity Development)

c. Co-benefits should be an integral component of the assessment, as adaptation is the anchor strategy of the Philippines under the National Framework Strategy on Climate Change, and mitigation, while functioning as "adaptation," should concretely provide pathways for emissions reduction and avoidance.
d. The delivery of the means of implementation under the Paris Agreement should be tracked and evaluated, and should be aligned with the needs-based, evidence-supported adaptation priorities.
e. A reliable data tracking system on the physical, financial, and social impact progress of climate action should be established. A general inventory of policy levers and global opportunities for scaling up climate action should be conducted to optimize the emerging space for innovation and transformation. Given these insights, a reconfigured M&E structure and process could be formulated to align with the core dimensions and considerations of the NAP as a reenergized platform to pursue climate change adaptation over the long term, consistent with the best available science, including local and indigenous knowledge, and best available technologies.

The updated Philippine Development Plan (PDP) 2023-2028 provides a dedicated chapter on climate change. Chapter 15, entitled Accelerate Climate Action and Strengthen Disaster Resilience, focuses on the challenges faced in climate action and disaster risk reduction and outlines the outcomes and strategies to be pursued to address these challenges during the period, namely: (a) climate and disaster risk resilience of communities and institutions increased, (b) ecosystem resilience enhanced, and (c) low carbon economy transition enabled. The PDP also identified cross cutting strategies to improve governance and intersectionality of climate change and natural hazard resilience.

As part of the assessment and challenges, the chapter recognizes that numerous policies have been adopted to ramp up climate action and strengthen disaster resilience. Apart from citing critical adaptation roadmaps on water security, natural capital accounting, flood risk master plans, green financing and bonds, and early warning systems, it reiterated the importance of mainstreaming climate action at the local and community levels.

This underscores the importance of local-specific climate adaptation solutions based on unique CIDs. Investments, therefore, need to be attuned to infrastructure support, social protection, and financing strategies to implement fit-for-purpose solutions that address social vulnerability of communities.

Inadequate government budget allocation provides impetus to rethink climate financing regimes to catalyze public and private support for climate action. This includes grants, subsidies, and incentives for particular investment areas seen to enhance the capacity of human resources and unlock the potential for innovation.

Analyzing the strategies in harmony with the other critical roadmaps of government such as the Cabinet Cluster on Climate Change Adaptation, Mitigation and Disaster Risk Reduction (CCAM-DRR) Performance and Projects Roadmap (2018-2022), Public Investment Program 2023-2028, National Security Policy 2023-2028, Resilient and Green Human Settlements Framework, National Innovation Agenda and Strategy Document 2023-2032, and Harmonized National Research and Development Agenda 2022-2028 to promote a transdisciplinary approach towards inclusive, socially informed, and science-based climate actions and decisions over the long term.

4.1.3 Approach to Determining Adaptation Priorities

Sector-specific adaptation themes are crafted for each sector, underpinned by a set of priority adaptation outcomes, a consequent set of adaptation strategies, and a high-level determination of key implementation levers. These strategies are anchored on an understanding of the sector's progress and challenges in the Philippines, as well as an overview of the qualitative and quantitative climate change impacts on the sector based on current and future projected climate risks. Taking into consideration an understanding of the past, present and future of these sectors, priority outcomes are determined to serve as the guiding objectives to ensure sectors are resilient to climate change.

Adaptation strategies for each priority outcomes were then determined and prioritized with sectoral experts and various stakeholders to shape a full view of the Philippines' adaptation priorities. Prioritization criteria were used to determine priority sectoral strategies, including alignment with existing mandates, breadth of coverage across hazards and/or outcomes, scalability, track record and maturity, and urgency. These indicative key strategies outlined in the NAP are exhaustive list of strategies for the sector. Further downscaling and contextualization may reveal additional strategies that further support identified priority outcomes.

Quantitative indicators to measure success tied to these outcomes per sector will be determined as part of the implementation process. As indicators are determined, it will be critical to get the concurrence of implementing agencies in alignment with their own plans and strategies.

Lastly, to ensure that the Philippines can turn theory into action, the NAP outlines high-level actors and implementation timelines for each strategy.

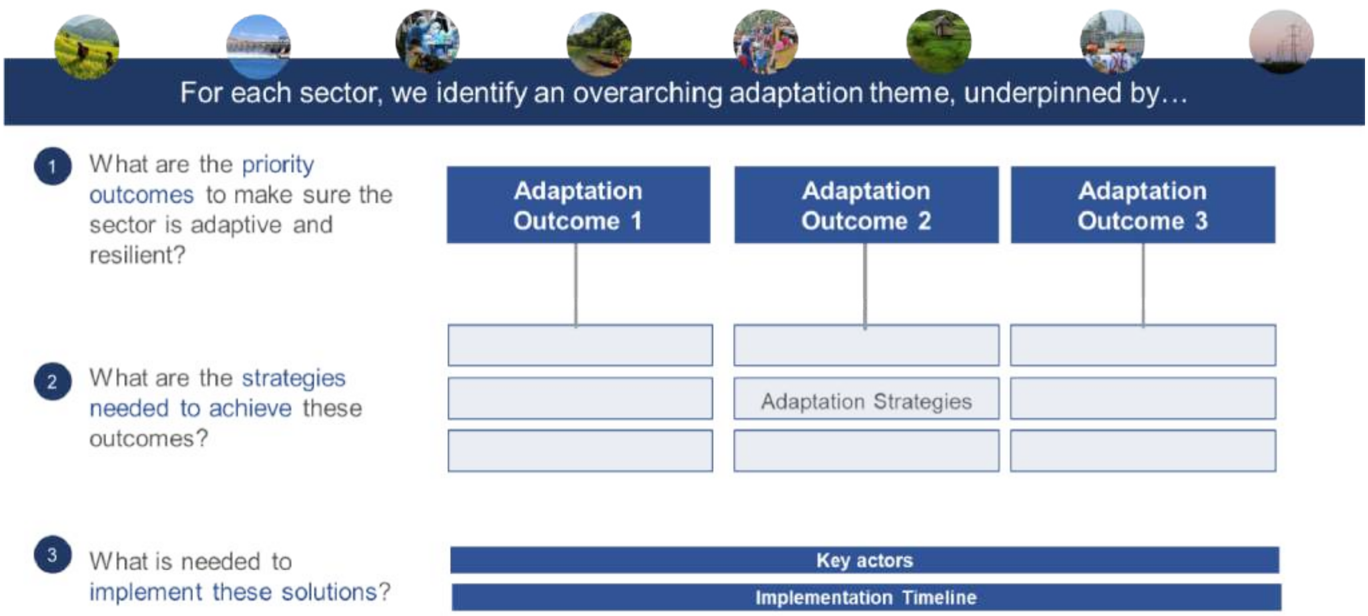


Figure 4.1.3. Approach to determining adaptation priorities across sectors

The determination of adaptation outcomes and strategies for the Philippines rests on two fundamental approaches.

First, the approach **emphasizes the vital role of representative voices within each sector, with the intent to uncover insights from those who possess an intimate understanding of the prevailing gaps and challenges in building climate resilience.** The NAP development undertook an inclusive, multi-stakeholder approach to ensure voices are presented onto priority adaptation outcomes and consequent strategies. This included dedicated sector-focused ideation sessions, workshops, and expert consultations with in-country sectoral experts to validate key gaps and critical strategies required to accelerate adaptation efforts in each sector. Members of national government, local government, civil society representatives, academe, private sector, and development partners were provided various avenues to engage on these priorities.

Second, the approach **commits to building on the foundations and progress established by various stakeholders, both governmental and non-governmental, in relation to climate resilience.** The NAP aims to complement ongoing initiatives, mechanisms, programs, and policies, with the ultimate intent of driving towards a more robust and collective endeavor. While the NAP outlines strategies to amplify ongoing initiatives, an evaluation of these initiatives, mechanisms, programs, and policies must be made in parallel, in consideration of its contributions to transformative adaptation.

Moving forward, a few key considerations must be integrated as the NAP is applied to the local setting.

1. **Adaptation outcomes and strategies provide guidance on the shared goals of the Philippines in relation to climate adaptation and resilience.** However, adaptation strategies are crafted at a national level and are intended to be tailored to the specific contexts of regions and localities, aligning with localized projected climate impacts. The intent is for regional and local stakeholders to view adaptation strategies in this document as guidance for contextualization. They are empowered to choose and customize actions that align with the unique circumstances and climate conditions of their respective localities, provided standardized criteria on where customization decisions can be made.
2. **The NAP recognizes the critical importance of integrating sectoral adaptation strategies as a cornerstone of effective climate resilience planning.** Climate change impacts are multifaceted and often cut across various sectors such as agriculture, water resources, infrastructure, and health. The country now needs a holistic, systems-thinking lens that recognizes the complex interplay of climate impacts, socioeconomic factors, health systems, and environmental systems, integrating an approach that harmonizes policies and interventions that address these systems collectively.

Isolated sectoral approaches may lead to unintended consequences and potential maladaptation, where efforts in one sector inadvertently undermine progress in another. Therefore, the NAP emphasizes the need to downscale adaptation planning to more localized levels, ensuring that communities and regions are equipped to address the specific challenges they face.

To address the risk of maladaptation, a crucial step in this downscaling process involves bringing together sector-specific adaptation strategies into a comprehensive systems model. This systems approach enables an understanding of how various adaptation measures interact with one another. By mapping out these interactions, local authorities can identify potential feedback loops that can either amplify or mitigate the effects of climate change. For example, strategies aimed at enhancing agricultural resilience might have ripple effects on water resources, ecosystem health, and food security. Understanding these connections allows for more informed decision-making and the optimization of adaptation efforts.

Lastly, beyond considerations of maladaptation, localized adaptation implementation also needs to consider adaptation limits. In some instances, implementation challenges are “soft” in nature, meaning that effective adaptation measures do exist. Implementation of these measures is hindered by economic, political, and social barriers, such as a lack of technical support and/or sufficient funding. However, implementors also need to be critical of instances where climate impacts are already so severe that no existing adaptation strategies can completely prevent further loss and damage. Efforts to introduce adaptation strategies may continue to lead to loss and damage instead of leading to increased resilience.

Emphasizing the recognition of the spectrum between soft and hard limits to adaptation is not only essential for enhancing the nation’s resilience to climate change but also for harnessing co-benefits with climate mitigation efforts.

4.2 Sectoral Priority Outcomes and Adaptation Solutions

This sub-chapter outlines the envisioned adaptation theme, outcomes, and strategies tailored to each sector. These adaptation strategies were determined based on a comprehensive understanding of each sector, encompassing current progress and prevailing challenges in building resilience, and equipped with a deep understanding of the projected climate risks attributed to the sector. The following diagram highlights the adaptation themes and common strategies across sectors.

Figure 4.2.1. Sector-specific adaptation themes and common adaptation strategies

Five common strategies are observed across sectors:

1. **Strengthen infrastructure resilience.** There is a need to reinforce the resilience of critical infrastructure in various sectors to withstand adverse impacts and disruptions caused by climate change. From water infrastructure to production facilities to power plants to roads and seaports, resiliency against climate hazards must be built to minimize disruption of services.

2. **Safeguard livelihoods with social protection and regulations.** With the unpredictability and magnitude of projected climate events, livelihoods, especially those of vulnerable populations, may be put at risk. This key strategy focuses on actions and mechanisms that safeguard the livelihoods of populations from the impacts of climate change through social safety nets and climate-responsive regulations.

3. **Empower local governments and communities to take adaptation action.** Policy frameworks provide the ambition, vision, and direction that the Philippines can work as one country. However, adaptation and resilience must happen at the local and community levels. This key strategy articulates the importance of enabling local governments and communities to implement adaptation solutions by mainstreaming an understanding of adaptation and resilience by providing access to climate data and tools and increasing their capacity to act.
4. **Mainstream integrated adaptation governance.** Enacting adaptation solutions will require a multi-stakeholder and multi-disciplinary approach. It will require facilitating common discussions among experts from multiple sectors and groups with various agendas, particularly those representing the most vulnerable sectors, not limited to, women and children, persons with disabilities (PWD), indigenous peoples, and senior citizens. This strategy articulates the importance of fostering a coordinated collaboration among stakeholders, policymakers, and institutions across horizontal and vertical chains of command.
5. **Scale nature-based solutions.** Given the richness of natural assets in the Philippines, this strategy articulates the importance of prioritizing the use of nature-based solutions, where possible, to drive climate resilience and protect vulnerable populations. Today, the popular solution to build adaptation and resilience is to invest in grey infrastructure, such as sea walls that often have detrimental offsets to populations in the area (i.e., maladaptation). This is especially important given the co-benefits with climate mitigation.

   Nature-based solutions is a critical approach to ensure a whole-of-ecosystem mechanism to address adaptation interventions across sector outcomes, anchored on the best available science and indigenous and local knowledge, among others. The appropriate investment directions should establish high regard for risk assessments covering safeguards for social impacts, but also to the carrying capacity of an ecosystem to said interventions, in light of sustainable development.

It is noted that systems of interest across sectors would generally support the analytics for sustainable consumption and production to uplift transformation of the economy as intended in the NAP, the commitments such as the 30x30 under the High Ambition Coalition for Nature and People, among other related international commitments, should be addressed and observed for holistic actions under the NAP. The people-planet-prosperity nexus should be a core governance principle for fit-for-purpose interventions of adaptation needs and opportunities on one hand, and overall climate action (e.g., with mitigation co-benefits), on the other.

The detailed climate impacts and adaptation strategies for each sector can be found in the following sub-sections in this chapter including:

- Overview of the sector
- Climate change impacts to the sector
- Priority adaptation outcomes for the sector
- Priority adaptation strategies for the sector

4.2.1 Approach to Determining Adaptation Priorities

Overview of Agriculture and Fisheries and Food Security in the Philippines

Crops, livestock, fish farms, and fisheries in the Philippines serve as a cornerstone of the country's economy and ensure food security for the population. Economically, the sector contributes 8.9% of the nation's GDP (2022)[216], which translates to PhP1.7 billion. While the Philippines is involved in a wide array of agricultural practices, its production is predominantly focused on the cultivation of crops (51.9%), rearing of livestock (10.3%), poultry (10.5%), and fishery-related activities (12.1%) as of the second quarter of 2023. Agricultural land makes up more than 40% of the nation's land area, underscoring the significance of this sector.

From a social perspective, this is a critical source of Filipinos' food supply and livelihood. The four (4) staple foods in the average Filipino diet are cereals (40.2%), vegetables (15.5%), fish (11.2%), and meat (10.8%)[217]—of this, 75% of food consumed was produced domestically in 2021[218], with all the local produce of certain key crops, such as rice, being consumed within the country. Agriculture also serves as the source of income for a substantial portion of the population, with almost a quarter of Filipinos being employed in the agricultural sector.

The agriculture and fisheries and food security sector faces key challenges across resource bases, labor, capital, productivity, and policy among other factors that have led to its relatively slow growth compared to other major economic sectors in the Philippines, as well as prevailing food insecurity across the nation. The average Philippine farm was just 1.29 hectares in 2012[219], severely limiting productivity gains from economies of scale. This was partly driven by the growing rural Filipino demographic, but also policies such as the Comprehensive Agrarian Reform Program, which broke up larger farmlands, reducing the average farm size by a third[220], in turn decreasing national agricultural productivity by 17%. Resource bases have also been poorly managed, with farmers facing issues in accessing enough water, while 70% of Philippine grounds are overfished, impacting fisherfolks' productivity. This decrease in agricultural productivity, among other contributing factors, has led to moderate to severe food insecurity observed across three out of every 10 Filipino households[221].

216 Philippine Statistics Authority (2023). National Accounts of the Philippines (as of April 2023)
217 Department of Science and Technology - Food and Nutrition Research Institute (DOST-FNRI). 2022. Philippine Nutrition Facts and Figures: 2018-2019 Expanded National Nutrition Survey (ENNS): Food Consumption Survey. FNRI Bldg., DOST Compound, Gen. Santos Avenue, Bicutan, Taguig City, Metro Manila, Philippines.
218 Philippine Statistics Authority. (2022). Food Balance Sheets of the Philippines, 2019-2021.
219 Briones, R.M., (2021). Philippine agriculture: Current state, challenges, and ways forward. Philippine Institute for Development Studies
220 Adamopoulos, T. and D. Restuccia. 2020. Land reform and productivity: A quantitative analysis with micro data. American Economic Journal: Macroeconomics 2020 12(3):1–39.
221 Department of Science and Technology - Food and Nutrition Research Institute (DOST-FNRI). 2022. Philippine Nutrition Facts and Figures: 2018-2019 Expanded National Nutrition Survey (ENNS): Food Consumption Survey. FNRI Bldg., DOST Compound, Gen. Santos Avenue, Bicutan, Taguig City, Metro Manila, Philippines.

Adding to the issues, farmers and fisherfolk face challenges in gaining access to the market. This is seen physically, with the need for more storage facilities and transportation infrastructure to facilitate the delivery of goods to consumers. However, it also manifests in other ways—most farmers and fisherfolk are smallholders, and the cascading of best practices, reasonable prices, and othwer aspects of selling their goods must be strengthened, to minimize their market cost and raise their income. These issues have pushed farmers and fisherfolk into extreme poverty. According to the PSA 2021 Poverty Statistics Among the Basic Sector[222], farmers and fisherfolks residing in rural areas have the highest poverty incidence rates with 30% and 30.6%, respectively. Both sectors also received the highest poverty incidence for 2015 and 2018.

Climate Change Impacts on Agriculture and Fisheries and Food Security

Agriculture and Fisheries, and Food Security is historically one of the most vulnerable sectors to climate change. Despite technological advancements in recent decades, the productivity of farms and fisheries is still heavily dependent on weather and climate. The projected increases in temperatures, changes in rainfall patterns, increases in severity and frequency of extreme weather and climate events and their associated impacts on water availability, and pest and disease outbreaks will substantially affect agricultural production. This has been observed globally with climate change causing USD280 billion (4%) in losses of crop and livestock production from 2008 to 2018[223].

These impacts are exacerbated in the Philippines, which experiences one of the highest disaster risk levels in the world. For example, over 7.4 million hectares of Philippine agricultural area were affected by typhoons, floods, and droughts from 2000 to 2010, leading to over PHP100 billion in damages.[224]

In fisheries, it was found that 94% Filipino fisherfolk within the Davao Gulf had experienced decreases in their catch[225], a phenomenon observed to be driven by climate change. Additionally, global models project a decline of 9% to 24% in potential marine fisheries across the Philippines by 2050. Exacerbating these issues is the high poverty incidence rate and the proximity to the coastline in the case of fisherfolk, compounding the vulnerabilities faced by Filipinos who depend on agriculture, aquaculture, and fisheries as their source of livelihood—poor access to resources amongst impoverished communities have been shown to lead to conflicts within and across communities, with incidences of looting, ransacking, and bloodshed having been recorded in the past.[226]

Worsening climate trends will severely impact the agriculture and fisheries and food security sector if no action is taken. For example, typhoons with higher peak wind speeds will damage farmland and fishery infrastructure, while degrading produce. Increasing temperatures are also expected to lead to reduced crop yield, degraded livestock health, and decreasing potential fish catch. The table below highlights the adverse impact of other CIDs in this sector.

[222]Philippine Statistics Authority. (2021). 2021 Full Year Official Poverty Statistics Among The Basic Sector in the Philippines

[223]FAO (2021), The Impact of Disasters and Crises on Agriculture and Food Security 2021, FAO, Rome, http://www.fao.org/3/cb3673en/cb3673en.pdf.

[224] Briones, R.M., Israel, D.C. (2012). Impacts of Natural Disasters on Agriculture, Food Security, and Natural Resources and Environment in the Philippines. PIDS Discussion Paper Series

[225] Macusi ED, Camaso KL, Barboza A and Macusi ES (2021) Perceived Vulnerability and Climate Change Impacts on Small-Scale Fisheries in Davao Gulf, Philippines. Front. Mar. Sci. 8:597385. doi: 10.3389/fmars.2021.597385

[226] Montaño, T. & Gonzales, A. (2018). Human Insecurity and Conflict: Effect of Coastal Communities' Vulnerability to Climate Change. International Journal of Environmental Science and Development. 9. 187-191. 10.18178/ijesd.2018.9.7.1098.

Table 4.2.1.1. Impacts of climate hazards on Agriculture and Fisheries and Food Security

Climate Impact-Driver	Impacts to agriculture and fisheries and food security sector
Increased temperature and drought	**Heat stress affects availability of crops, livestock, and fish** Increased temperature reduces the yield of rice and other crops, driven by heat stress, shortened growing periods, and other factors. Livestock also experiences heat stress, degrading health and productivity. Farmed fish, fisheries, and seaweed yield are projected to decrease, with longer fish culture periods and increased fish mortality contributing to this. **Increased incidence of pests and diseases** Increased temperature has been observed to increase the incidence of pests and diseases. **Water stress across crops and livestock** Drought leads to water stress across crops and livestock potentially leading to reduced yield, productivity, and quality. Droughts have also led to farmers not planting, leading to disrupted cropping schedules. **Soil degradation** Lack of soil moisture leads to reduced nutrient content, hindering nutrient absorption and thus reducing crop yield and health. **Decreased productivity amongst farmers and fisherfolk** Increased temperature may lead to heat-related illnesses, reduced productivity, and mental health impacts for farmers and fisherfolk. **Reduced fish stocks** Rising sea water temperature can lead to coral bleaching, decreased biodiversity, and disruption in the food chain. This translates to reduced catches of reef fish, which can impact available fish supply and associated economic activities
Sea level rise and extreme sea levels	**Saltwater intrusion in farmland** Sea level rise may lead to salinity intrusion into farmland and fishponds, resulting to substantial water shortages for irrigation in countries with extensive coastline and river deltas. As an archipelago with similar geographical features, the Philippines is at risk of finding itself in a similar situation. **Inundated farmland** Rising sea levels also threaten to inundate farmlands, leading to loss of crop productivity and livelihoods of farmers impacted. **Storm surges damaging fishing infrastructure** Storm surges may cause damage across fishing infrastructure situated along the coast, such as piers, docks, boats, and equipment. **Reduced fish stock** Rising sea levels may lead to the loss of mangroves, reducing spawning and nursery grounds for many fishes, which can impact fish supply and associated economic activities.

Extreme precipitation	**Flood damaging soil, crop, and fish health** Extreme precipitation leads to floods, which have a myriad of impacts on agriculture. Topsoil can be eroded, reducing soil fertility, and thus crop yields and crops can be physically impacted, leading to dislodging, bruising, etc. Post-harvest inability to dry wet crops leads to post-harvest losses. This causes increases in the cost of farming, which may lead to forest degradation as compensation for reduced farmland productivity. For aquaculture, flooding damages infrastructure and may lead to income loss from escaped stocks or the invasion of unwanted species in aquaculture farms. Prolonged rainfall also leads to hypoxia (depletion of dissolved oxygen), resulting in fish kills. **Waterlogging** Excessive rainfall causes waterlogging, poor aeration and hindered nutrient absorption. Prolonged moisture may also lead to diseases and fungal infections impacting crop yield. Waterlogging in surrounding forest ecosystems may also lead to habitat degradation, causing the spread of pests and vectors of diseases.
Wind patterns and tropical cyclones	**Crop, land, and infrastructure damage** Wind patterns and tropical cyclones risk uprooting and destroying crops, hence reducing yield. Additionally, infrastructure such as roads and storage facilities can be damaged, impacting the agricultural supply chain and the Philippines' food security. **Soil erosion of farmland** Wind patterns and tropical cyclones lead to soil erosion, removing essential nutrients and fertilizer for crop growth and health —this leads to reduced crop yields and harvests. **Reduced fishing days** Cyclones prevent fishers from going to sea to fish, resulting in lessened productive days and decreased income, further increasing their vulnerability.

Amidst the various climatic impact-drivers, pluvial flooding and extreme sea levels are expected to impact farms and fishponds the most, respectively. Across the decade of 2030-2040, 7.5% of agricultural land is projected to be exposed to pluvial floods, with this exposure potentially increasing further to 8.5% in the years between 2050-60. Pluvial floods are projected to be particularly significant in regions II, IV-A, V, VI, and VIII, where over a third of the exposed farmland will be located.

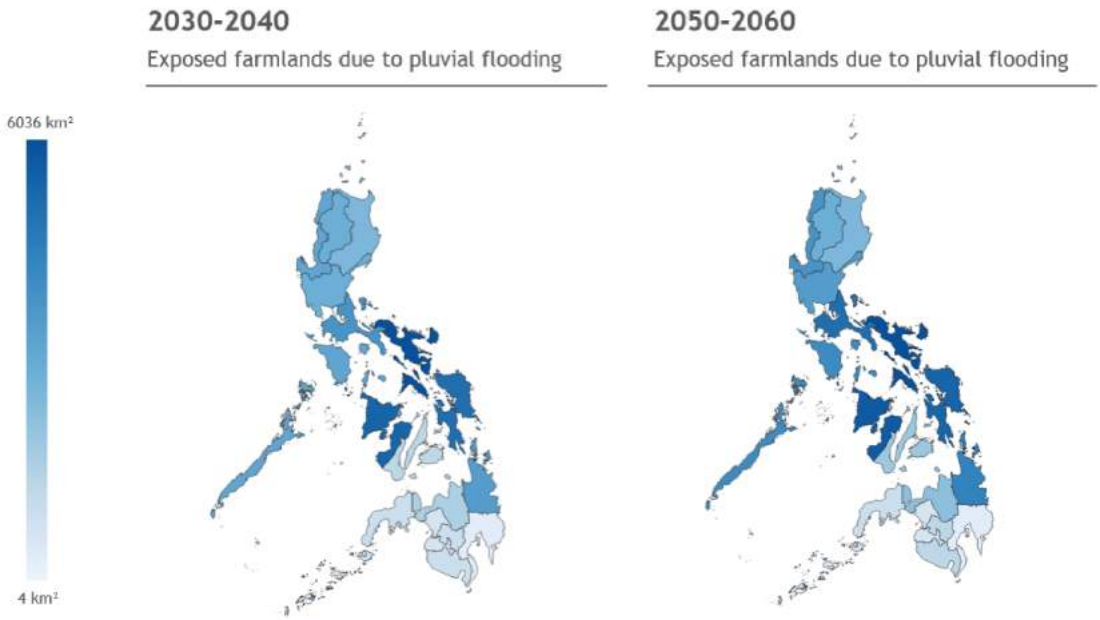


Figure 4.2.1.1 Exposed farmland due to pluvial flooding from 2030-40, 2050-60, SSP5-8.5

Due to their proximity to the coast, fishponds are projected to face the highest exposure to extreme sea levels—between 2030 to 2040, 15% of fishponds are expected to be exposed to extreme sea levels, with 80% of the exposure occurring within Regions I, III, and IV-A, V, and VI.

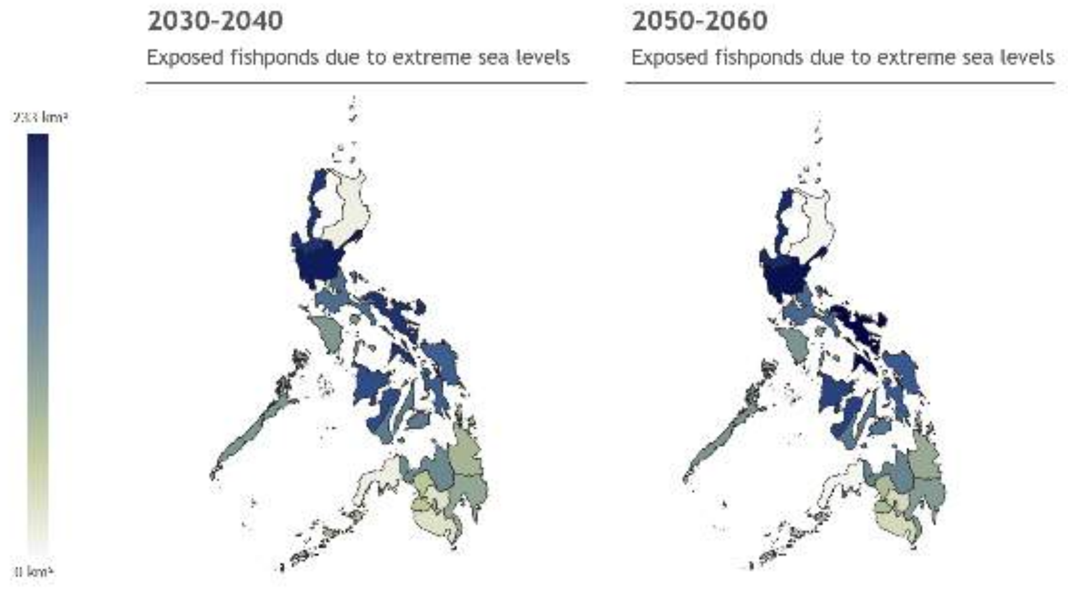


Figure 4.2.1.2 Exposed fishponds due to extreme sea levels from 2030-40, 2050-60, SSP 5-8.5

Furthermore, when considering rice and corn yields, two crucial crops for both production and consumption in the Philippines, there is a projected decline in yield of 6% for rice and 19% for corn by 2030. Provinces with the largest decrease in rice production are Camarines Sur, Nueva Ecija, and Masbate. For corn, Isabela, Camarines Sur, and Cotabato make up the three provinces with the highest drop in production.

A notable point is that across these indicators, Region IV-A, V, and the province of Camarines Sur standout as highly impacted localities on the absolute scale. The impacts of various CIDs on this sector are highlighted in the table below.

Table X. Climate Analytics Model Projections on Agriculture and Fisheries and Food Security indicators[227]

Climate Impact-Driver	Impacts to agriculture and fisheries and food security sector	
	2030 Decade Impact	2050 Decade Impact
Sea level rise	70 km2 (3%) fishponds inundated	85 km2 (3.5%) fishponds inundated
Cyclones	6.5K km2 (5%) farmland exposed 135 km2 (5.5%) fishpond exposed	7.5K km2 (6%) farmland exposed 145 km2 (6%) fishpond exposed
Pluvial flooding	10K km2 (7.5%) farmland exposed 70 km2 (3%) fishpond exposed	11K km2 (8.5%) farmland exposed 85 km2 (3.5%) fishpond exposed
Extreme sea levels	360 km2 (15%) fishpond exposed	370 km2 (15%) fishpond exposed
Fluvial flooding	25 km2 (~1%) fishpond exposed	38 km2 (1.5%) fishpond exposed
Crop productivity	Corn yield of 2.48 tonnes/ha (-19% compared to 2020 yield) Rice yield of 3.63 tonnes/ha (-6% compared to 2020 yield)	Corn yield of 2.54 tonnes/ha (-18% compared to 2020 levels) Rice yield of 3.67 tonnes/ha (-5% compared to 2020 yield)

Priority Adaptation Outcomes for Agriculture and Fisheries and Food Security

Grounded on national policies and existing programs related to this secto[r228,] the adaptation theme for Agriculture and Fisheries and Food Security is **Securing Food Supply: Nurture Nature, Sustain Livelihoods.**

Three priority outcomes underpin this strategy:

1. **Productive and resilient agriculture and fisheries achieved.** This outcome focuses on the employment of best practices and technology to achieve optimal productivity of crops, livestock, and poultry farms, fishponds, and fisheries in anticipation of the effects of climate change and evolving consumption profiles, emphasizing food self-sufficiency. To achieve this outcome, more resilient farming practices must be adopted, supported by improved infrastructure and training programs.

2. **Natural resources critical for agriculture, aquaculture, and fisheries are conserved.** This outcome focuses on the development and implementation of a comprehensive set of monitoring, evaluation, and management programs and procedures to ensure the long-term (6+ years) viability of natural resources needed to sustain farms, fishponds, and fisheries. For this outcome, agricultural and aquacultural practices that enable the conservation of natural resources and leverage organic methodologies must be encouraged across all levels, from farms to local government units to national agencies.

[227] Pluvial, fluvial, and extreme sea level-driven floods are modelled on a 10-year return period, represented by floods heights with a 10% chance of occurring in a year

[228] Refer to Appendix 3 – Agriculture and Fisheries and Food Security to see list of policies and programs referenced as part of the NAP process

3. **Farmers and fisherfolk's food and income are secured amidst climate change.** This outcome focuses on implementing adaptive strategies to safeguard workers and operations (e.g., supply chains) from the impacts of climate-related hazards. To achieve this outcome, support mechanisms for farmers and fisherfolk must be put in place across the value chain, from credit and financing to market linkages.

Prioritizing adaptation strategies that empower farmers and fisherfolk to improve their productivity, while at the same time preserving the natural resources they depend upon for the continuity of production, is key to ensuring the maintenance of domestic food production that most Filipinos depend upon. Well-enforced zoning and land protection policies, financial support systems and training programs, and accessible, localized climate data are all critical components to improve the security across agriculture, aquaculture, and fisheries in the Philippines.

Priority Adaptation Strategies for Agriculture and Fisheries and Food Security

Outcome 1: Productive and resilient agriculture and fisheries achieved.

Implementing Lead agency:	Supporting agencies:
DA	DENR, DOST, DILG, PSA, DTI, TESDA, DOST

Indicative Key Strategies	Brief Description	Implementation Priority	Capital-Intensiveness
Diversify and substitute crops, livestock, aquaculture	Diversification/rotation of crops, livestock, or aquaculture tested to ensure local adaptability, to de-risk specie-specific impact arising from climate change, building upon DA Climate Resilient Agriculture Office (CRAO) programs such as the Adaptation and Mitigation Initiative in Agriculture (AMIA) program.	Immediate (0-3 years)	Low

Expand cold storage chains and facilities	Efficient storage infrastructure that reduces post-harvest losses and extends the shelf life of perishable produce in case of climate change disrupting supply routes, potentially supported by partnerships with organizations such as the Cold Chain Association of the Philippines (CCAP).	Immediate (0-3 years)	High
Improve and ensure gender-responsive aquaculture infrastructure	Improvements in hatcheries, grow-out ponds, and other culture systems that are more inclusive and resilient to extreme weather events, such as aqua shading technology.	Immediate (0-3 years)	High
Improve feed varieties	Improvements in livestock and aquaculture feed varieties that are more cost-effective and sustainable.	Immediate (0-3 years)	Medium
Drive adoption of urban farming	Cultivating crops and raising livestock in urban areas for local food production, supporting the enactment of the Urban Agriculture Law.	Immediate (0-3 years)	Low
Develop and hold technical training programs for farmers and fisherfolk	Training programs to ensure farmers and fisherfolk can implement the identified solutions, through channels such as Climate-Resiliency Field Schools (CFS).	Immediate (0-3 years)	Medium
Continue researching and establishing crossbred/ genetically improved species	After testing to ensure their adaptability, providing farmers with access to genetically enhanced, climate-adaptive, and high-yielding crop, livestock, and aquaculture varieties, capitalizing on strains identified by Corn Germplasm Utilization through Advanced Research and Development, PhilRice, and private biotech firms	Long-term (6+ years)	High

Outcome 2: Natural resources critical for agriculture, aquaculture, and fisheries conserved

Implementing Lead agency:
DA

Supporting agencies:
DENR, DOST, DILG, DHSUD,
Higher Academic Institutions

Indicative Key Strategies	Brief Description	Implementation Priority	Capital-Intensiveness
Improve soil health management programs	Improvement of soil testing and application of corresponding soil amelioration measures to respond against diminished soil health from climate change, building upon DA-BSWM's National Soil Health Program (NSHP)	Immediate (0-3 years)	Medium
Improve and expand integrated pest management programs	Implementation of pest control strategies amidst potential infestations that may arise due to climate change that minimize pesticide use and incorporate natural predators and biological controls, expanding and improving on programs such as Pest Risk Identification and Management Efficiency (PRIME) and the Program for Bantay-Peste Brigade and Management (PBBM)	Immediate (0-3 years)	High
Promote adoption of efficient irrigation techniques	Promotion of drip irrigation, alternate wetting and drying (AWD), and other efficient irrigation methods that reduce water wastage, building on initiatives such as Water Efficient and Risk Mitigation Technologies (WateRice), Water Balance-Assisted Irrigation Decision Support System (WAISS), aligned with the National Irrigation Masterplan 2020-2030	Immediate (0-3 years)	Medium
Improve dissemination of precision agriculture and aquaculture	Utilization of technology and data analysis to optimize farming practices, minimizing waste and resource use while maximizing crop yield and sustainability, leveraging facilities such as the Precision and Digital Agriculture Center	Immediate (0-3 years)	High

Encourage sustainable farming and fisheries management	Sustainable management and conservation of agricultural and fishery resources that preserves health of terrestrial and marine ecosystems at the same time	Immediate (0-3 years)	High
Conduct sustainable and gender-responsive agriculture, aquaculture, and fisheries R&D	Research on sustainable farming practices, such as soil conservation, water-efficient irrigation, climate-resilient crop varieties, circular farming and aquaculture, and integrated mangrove aquaculture systems, both new and building on existing programs such as PhilRice - Community-Based Participatory Action Research on Climate (CPAR), as well as farmer-led research	Long-term (6+ years)	High

Outcome 3: Farmers' and fisherfolk's livelihoods secured amidst climate change

Implementing Lead agency:
DA

Supporting agencies:
DENR, DOST, DILG, DHSUD, Higher Academic Institutions

Indicative Key Strategies	Brief Description	Implementation Priority	Capital-Intensiveness
Expand and support farmer and fisherfolk cooperatives and networks with encouragement to women's representation and participation	Operationalization of adaptation-focused programs for the protection of labor rights and facilitation of knowledge sharing, collective decision-making, and access to resources, including but not limited to agrarian credit programs, technologies, and markets expanding on initiatives such as Climate-Resiliency Field Schools (CFS)	Immediate (0-3 years)	Medium

Develop localized and inclusive early warning systems & info dissemination	Developing localized and inclusive early warning systems and communication channels that consider regional climate patterns, crop- and fish-specific risks such as "ISDApp: The App for the Fishing Community" co-developed by Globe, iNON IT Solutions, NFRDI and BFAR, and larger scale programs such as Smarter Approaches to Reinvigorate Agriculture as an Industry (SARAI).	Immediate (0-3 years)	Low
Improve climate insurance and ensure its inclusiveness	Insurance against extreme weather events is made affordable through methods such as government subsidization to allow farmers and fishers to maintain business continuity despite such events, e.g., Philippine Crop Insurance Corporation, as well as new financing models such as private financing.	Immediate (0-3 years)	High
Train small holder farmers and fisherfolk; promote agricultural best practices	Promotion of climate resilient agriculture practices, training on sustainable water and soil management, reinforcing programs such as S&T Community-based Program for Inclusive Development (STC4ID) or Climate-Resiliency Field Schools (CFS), while also disseminating best practices for occupational safety and maintenance of health amidst climate change for farmers and fisherfolk.	Immediate (0-3 years)	Medium
Conduct climate risk vulnerability assessments (CRVA)	Conduct risk, vulnerability, and suitability assessment of crop and fishery commodities and communities to climate change for planning and monitoring purposes at various levels and scales using developed tools, e.g., CRVA, eVSA, and FishVool.	Immediate (0-3 years)	Medium

Establish and facilitate market linkages for small holder farmers and fisherfolk	Facilitate access to downstream market actors for smallholder farmers and fisherfolk through mechanisms such as contract farming and farm and fish markets, enabling more value capture and leading to strengthened resiliency amongst smallholder farmers and fisherfolk.	Immediate (0-3 years)	High
Improve the provision of smallholder credit and financing programs	Provide accessible, affordable and equitable financial support to empower smallholder farmers and fisherfolk to adopt adaptive and resilient practices and technologies, building on programs such as the Agricultural Credit Support Project, Agrarian Production Credit Program, or the Sikat Saka Program, as well as various agricultural financing programs provided by the Agricultural Credit Policy Council (ACPC) such as the Kapital Access for Young Agripreneurs (KAYA) Loan Program; Agri-Negosyo (ANYO) Loan Program; and Expanded SURE Aid and Recovery Project (SURE COVID-19) for Micro, Small and Medium Enterprises (MSMEs)	Immediate (0-3 years)	High

4.2.2 Water resources

Overview of Water Resources in the Philippines

The security of Water Resources is a top priority for the Philippines, evident from its inclusion in the Philippine Development Plan (2023-2028) and the National Climate Change Action Plan (2011-2028). The sector is deeply intertwined with industries, health, agriculture, and ecosystems. From an economic standpoint, water is a key input that fuels economic growth across the agriculture and industry sectors. These two sectors make up over 90% of the country's water consumption profile. Water is a necessary resource for drinking, sanitation, and hygiene practices. As such, access to safe and clean water is considered fundamental for human health and well-being, and well-planned water infrastructure is a key enabler to achieving this.

The Philippines faces a myriad of challenges that hinder the provision of safe and affordable water across its localities. While a study done in 2001 found that the Philippines had 1,907m^3 of water available per capita per year, the rapid population growth that the nation has undergone will have pushed that number down to an annual amount of 1,333m^3 per capita, well below the threshold for water stress of 1,700m3 per capita (see Figure 4.2.2.1).

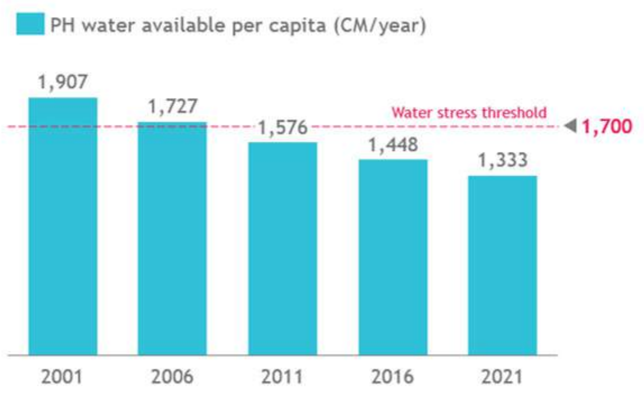


Figure 4.2.2.1. Water availability per capita, 2001-2021

These challenges manifest themselves institutionally as well. There are over 30 water-related agencies without clear boundaries of ownership, leading to weak institutional execution. Additionally, there is a lack of data and monitoring programs for water resources to provide agencies and organizations with the proper information to guide decisions[229]. Finally, inadequate inventory, planning, management, and financing of the Philippines' water infrastructure network, hinders its expansion, rehabilitation, and maintenance.

All these challenges are to be addressed by the establishment of the Water Resources Management Office (WRMO) of the Department of Environment and Natural Resources in April 2023[230]. The Office aims to ensure efficient water management at all levels and maximize utilization of the nation's water resources.

Climate Change Impacts on Water Resources

The current state of Philippine water supply and quality, and its water infrastructure network, make the nation's water resources particularly vulnerable to climate change. The Philippines faces varied rainfall patterns across geographies and seasons—according to the Philippine Water Supply and Sanitation Master Plan, NCR, CALABARZON, and Region VII face absolute water scarcity.

This variation in water security can be remedied with a well-developed infrastructure network of water storage, distribution, sanitation, and consumption systems, lacking in the current Philippine water system. For example, as of 2015[231], over 12% of Filipinos relied on water sources classified as unsafe, such as undeveloped wells, lakes, or rivers, while over a quarter of the population did not have access to safely managed sanitation.

Additionally, aging, and outdated infrastructure, such as most of irrigation systems in the Philippines, are particularly vulnerable to climate impacts. Open irrigation ditches or canals, which are most used today, are susceptible to leakage while open canals are at risk of reduced capacities stemming from sedimentation—the Philippine Development Plan (2023-2028) estimates that proper water management in farms could lead to 25% reduction in consumption, which equals to approximately 22% of the total water consumption profile in the Philippines.

More extreme climate conditions and events are projected to exacerbate the highlighted issues amongst Philippine water resources. Drier dry seasons are likely to worsen the conditions across localities already experiencing symptoms of water stress. On the other hand, wetter wet seasons and more intense cyclones damage may damage water infrastructure—for example, in 2009, Typhoon Ketsana's impact on water infrastructure led to a 92% decrease in water supply capacity. The table below highlights the negatives of other CIDs on Water Resources.

[229] National Economic Development Authority. (2023). Philippine Development Plan (2023-2028)
[230] Pursuant to Executive Oder No. 22 s. 2023
[231] National Economic and Development Authority. (2021). Philippine Water Supply and Sanitation Master Plan

Table 4.2.2.1. Impacts of climate hazards on Water Resources

Climate Impact-Driver	Impacts on the water resources sector
Increased temperature and Drought	**Algal blooms impacting water quality** Higher temperatures enhance nutrient cycling and availability in water bodies, providing favorable conditions for algal growth. Warmer temperatures accelerate algal metabolism, leading to increased growth rates and proliferation of certain algal species, decreased water clarity from oxygen depletion and toxin production, and proliferation of pathogenic bacteria, potentially impacting the freshwater aquaculture and water distribution industry. **Decreased water supply** Increased temperature can lead to the drying up of water sources in the Philippines, resulting from changes in precipitation patterns, evaporation rates, and soil moisture levels. Rising temperatures contribute to higher evaporation rates, causing water bodies, such as rivers, lakes, and reservoirs, to lose water more rapidly. The reduced water availability can have adverse effects on various sectors. Additionally, prolonged droughts can deplete groundwater reserves, further exacerbating water scarcity. Higher temperatures associated with drought intensify evaporation rates, leading to additional water loss. **Increased concentration of water pollutants** Reduced water flow during drought can result in the accumulation of pollutants, such as sediments, nutrients, and contaminants. Drought conditions can lead to increased water salinity and changes in pH levels, impacting water quality parameters, and potentially impacting a wide range of industries such as freshwater aquaculture, agriculture, tourism, and water distribution players.
Sea level rise and extreme sea levels	**Saltwater intrusion** Rising sea levels push saltwater inland, contaminating freshwater sources such as rivers, estuaries, and groundwater. Contaminated freshwater becomes unsuitable for drinking, irrigation, and other essential uses, leading to a scarcity of safe water supply. **Damaged water infrastructure** Sea level rise renders coastal water infrastructure, such as pumping stations, treatment plants, and distribution networks, more vulnerable to storm surges and coastal erosion. Increased exposure to saltwater can accelerate infrastructure deterioration and increase the risk of failures.

Extreme precipitation	**Contamination of the water supply due to flooding** Heavy rainfall can cause excessive surface runoff or overflowing of water bodies, resulting in the inundation of water sources and water treatment facilities. This can lead to the contamination of water supplies with pollutants, sediments, and pathogens. Floodwater can also pick up chemicals, waste, and debris, further contributing to water contamination, potentially impacting various industries, such as freshwater aquaculture, agriculture, tourism, and water distribution players. **Damaged water infrastructure** Water infrastructure, such as pipelines, pumping stations, wastewater treatment facilities, and water storage facilities, can sustain damage during extreme precipitation events. Flood and rain-induced landslides resulting from extreme precipitation have the potential to physically destroy infrastructure, interfere with water distribution systems, and cause service interruptions.
Wind patterns and tropical cyclones	**Damaged water infrastructure** Wind patterns and tropical cyclones can cause physical damage to water infrastructure, including pipelines, pumping stations, treatment plants, and storage facilities. This damage disrupts the water supply and distribution systems, resulting in service interruptions. **Contaminated water supply** Cyclones and strong winds contribute to water source contamination. Heavy rainfall associated with typhoons causes runoff, carrying pollutants into rivers, lakes, and reservoirs. Contaminants include sediment, chemicals, and pathogens, rendering water unsafe for consumption, potentially impacting various industries, such as freshwater aquaculture, agriculture, tourism, and water distribution players.

More intense drought or lack of rainfall potentially reduces water supply in certain localities.[232] Precipitation models in Chapter 3.3 projected a reduction in total precipitation across northeastern Luzon and south Mindanao. This scarcity is particularly pronounced in regions such as Region VII, which is expected to receive over 400 mm less rainfall per year in the decade of 2030 compared to 1991 to 2020.

Already facing a combination of an absolute scarcity level of water availability per capita (397 m3/capita/year) and more than a third of its population without access to a safe water source[233], the implication here is the need for more resilient water infrastructure to be built here to ensure its communities' secure, safe, and sustainable access to water resources.

[232] Quantitative climate impacts outlined in this chapter are projected based on climate models developed as part of the National Adaptation Plan process. Detailed methodology for climate models per sector can be viewed on Appendix 2 and Appendix 3 – Water Resources

[233] National Economic and Development Authority. (2021). Philippine Water Supply and Sanitation Master Plan

Additionally, pluvial flooding and cyclones are expected to damage water infrastructure across the nation. Across the decade of 2030 to 2040, almost 10% of water infrastructure, composed of water tanks and towers, dams, and treatment plants, is projected to be exposed to pluvial floods and cyclones.

The direct damages caused by these climate hazards is expected to stand at over PHP11 billion annually from 2030 to 2040, with more than half of the damage generated within Regions III and IV-A. These exposures are projected to remain relatively constant in the decade of 2050-60, largely driven by increased pluvial flooding and decreased cyclone frequency.

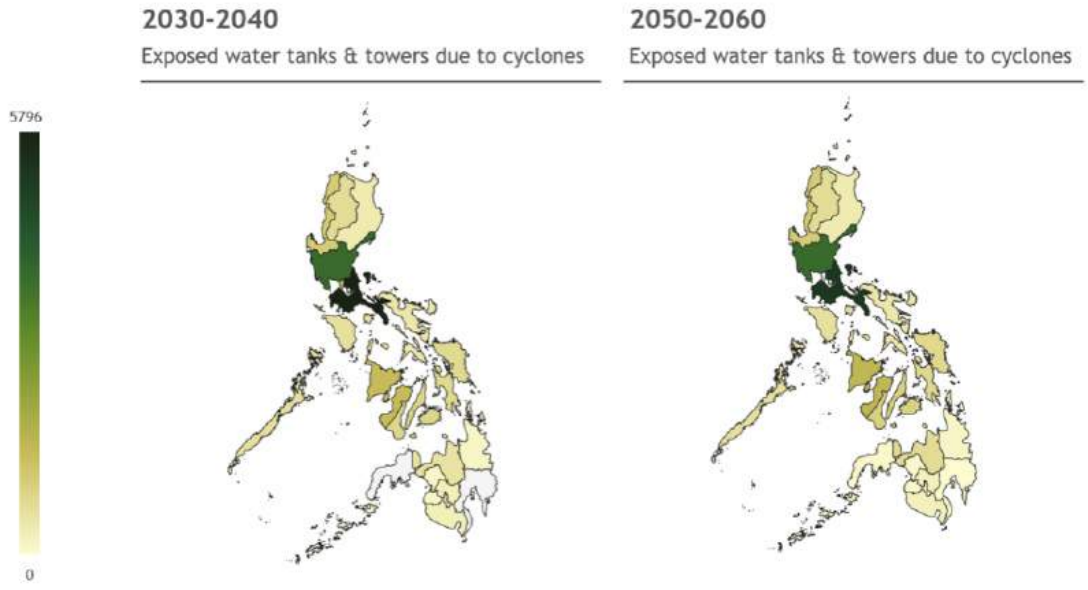


Figure 4.2.2.2 Water tanks and towers exposed to cyclones, 2030-40, 2050-60, SSP 5-8.5

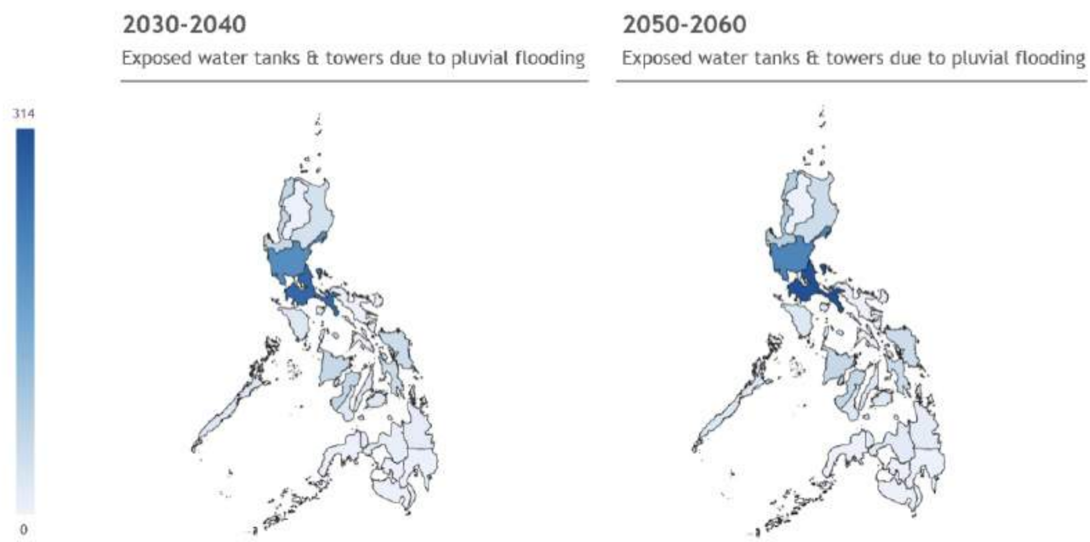


Figure 4.2.2.3 Water tanks and towers exposed to pluvial flooding, 2030-40, 2050-60, SSP 5-8.5

Priority Adaptation Outcomes for Water Resources

Grounded on national policies and existing programs related to this sector[234], the adaptation theme for Water Resources is **Safeguard Water Security: Secure and Sanitary Water for All.**

Three priority outcomes underpin this strategy:

1. **Water and sanitation infrastructure are inclusive and resilient.** This outcome focuses on building resiliency within new and existing water infrastructure aligned with comprehensive, updated structural standards and integrated planning. To attain this outcome, a proper inventory of existing infrastructure will be required, supported by a robust governance and implementation process to drive the implementation of strategies.
2. **Water supply, water quality, and water-related services are protected from shifts in weather patterns.** This outcome focuses on augmenting existing water supply with additional conventional and alternative sources where climate change is projected to affect the water balance, while managing demand and quality standards. Due consideration will be given to future trends in the distribution, frequency, and intensity of hydrometeorological events compared to historical trends. For this outcome, the private sector should be involved, where possible, and the mobilization of financing to continue programs aspiring to provide safe and sustainable water to communities should be implemented, incorporating learnings from initial rollouts.
3. **Watersheds and surrounding ecosystems are protected and properly managed.** This outcome focuses on the efforts on active planning and management of Philippine watersheds and surrounding ecosystems to ensure their capacity to serve as a reliable water source. To achieve this, an understanding of the current state of watersheds must be attained, followed by well-enforced policies and programs related to land use planning and forest, agriculture, and urban development to ensure the longevity of these water sources. Additionally, it is essential to engage representatives from different sectors in a structured and inclusive manner when consulting on these policies and programs.

Prioritizing adaptation strategies that ensure resilient water infrastructure, which enables the provision of safe, affordable, and secure water will help ensure individuals' health and sanitation amidst climate change, while providing key industries with the water needed to operate sustainably. A governance structure with clear roles and ownership, operating in line with an updated Water Code is needed to oversee initiatives such as inventory and profiling programs to set a baseline when making decisions on future programs to implement, as well as to mobilize sufficient funding to execute, whether from the government, private, or multilateral sources.

[234] Refer to Appendix 3 – Water Resources to see list of policies and programs referenced as part of the NAP process

Priority Adaptation Outcomes for Water Resources

Outcome 1: Water and sanitation infrastructure are inclusive and resilient.

Implementing Lead agency:
DENR

Supporting agencies:
DPWH, DOST, DND, DILG
DENR-NWRB, DAR, NCIP, DA

Indicative Key Strategies	Brief Description	Implementation Priority	Capital-Intensiveness
Implement Early Warning Systems for water infrastructure	Implementing tool to predict potential issues such as water shortages/ contamination/ infrastructure damage due to climate change prior to major consequences—build upon existing programs such as PAGASA advisory to LGUs & NGAs on water allocation and safety on a river basin/watershed level.	Immediate (0-3 years)	Low
Reassess water infrastructure building codes	Reviewing and updating water infrastructure building codes based on forecasted local climate hazard impact and ensure its gender-responsiveness.	Medium-term (3-6 years)	Medium
Improve resiliency of existing water infrastructure	Retrofitting and upgrading to achieve piped, treated, utility-managed surface water systems with interventions such as filters ensure protection of water infrastructure—geographical expansion of practices such as MMDA's operation and maintenance of various flood control structures, facilities, equipment, dams, and waterways, DPWH's Rehabilitation of Septage & Sewerage systems program.	Medium-term (3-6 years)	High
Implement zoning and land use and other regulatory policies such as dam releases to reduce risk to water infrastructure and surrounding communities	Implementing zoning regulations and land use planning measures that consider climate risks along with conservation of biodiversity, soil, water, and other ecosystem services.	Medium-term (3-6 years)	High

Outcome 2: Water supply, water quality, and water-related services are protected from shifts in weather patterns.

Implementing Lead agency:
DENR

Supporting agencies:
DPWH, DILG, DOH, DOST-PAGASA, MWSS, DENR-NWRB

Indicative Key Strategies	Brief Description	Implementation Priority	Capital-Intensiveness
Conduct a comprehensive climate risk assessment for water, sanitation, and hygiene (WASH) based on key hazards, exposures, and vulnerabilities affecting the sector.	Carry out a multi-stakeholder climate risk assessment, prioritizing climate risks to climate-resilient WASH services, resulting in an Action Plan for climate-resilient WASH services, and considering the outcomes related to key strategies referred to in the NAP. Note that this assessment is a requirement to access the Green Climate Fund (GCF), as endorsed in the GCF Water Project Design Guidelines.	Immediate (0-3 years)	Low
Ramp up rainwater harvesting programs	Ramp up utilization programs of rainwater as an alternative water source to ensure continued access to water supply amidst climate change and ensure gender-sensitive facilities, such as DPWH's installation of Rainwater harvesting system (RWHS).	Immediate (0-3 years)	High
Expand wastewater treatment facilities	Expand on the improvement of water quality and reusing of wastewater as an alternative water source to ensure continued access to water supply amidst climate change.	Immediate (0-3 years)	High

Install and expand strategic water supply mechanisms for remote areas	Install water storage tanks, water impounding facilities, small farm reservoirs, and cisterns in strategic locations where conventional water supply is unavailable, such as mountainous/upland areas, to ensure continued access to water supply amidst climate change, building upon programs such as the Sagana at Ligtas na Tubig para sa Lahat (SALINTUBIG) program, or supporting transition of water providers to grid-tied systems.	Immediate (0-3 years)	High
Augment public water supply and quality infrastructure	Mobilize investments to expand water storage facilities (e.g., dams, reservoirs, water tanks, water towers) as well as treatment and distribution systems (e.g., sewers, treatment plants) to ensure continued access to water supply amidst climate change for the public.	Immediate (0-3 years)	High
Review, develop, and update water pollution control regulations	Develop and update existing regulations that require industries, agriculture, aquaculture, and other potential polluters and non-point sources of pollution to adopt pollution control measures such as limits on pollutant discharges, wastewater treatment requirements, environmental users fee system, etc.	Immediate (0-3 years)	High
Review and update water quality standards and guidelines	Review and update regulatory frameworks that define the acceptable levels of various pollutants and contaminants in water bodies, in anticipation of future climate trends and their impact on the physical and chemical properties of our water bodies, building on initiatives such as Water Quality Management Areas (WQMA), should facilitate the adoption of innovative strategies for adaptation and mitigation in the implementation of clean water regulations.	Immediate (0-3 years)	Medium

Run training programs on water management and conservation techniques	Training/education sessions ranging from water management programs for farmers, industrial and energy players to conservation programs for households to build resiliency amongst water consumers.	Immediate (0-3 years)	Medium
Establish water markets and tariffs control regulations	Implementation of market-based mechanisms and pricing structures to promote efficient water use and incentivize conservation, such as consequences for unregulated groundwater extraction, informed by information from programs such as NWRB's Water Resources Supply and Demand Assessment.	Medium-term (3-6 years)	Medium

Outcome 3: Watersheds and surrounding ecosystems are protected and properly managed.

Implementing Lead agency:
DENR

Supporting agencies:
DILG, NCIP, DA, DOST, National Power Corporation

Indicative Key Strategies	Brief Description	Implementation Priority	Capital-Intensiveness
Enhance integrated watershed management	Development of integrated management plans for all watersheds and used as the integrated framework for comprehensive land use planning and development of sectoral development plans of LGUs to ensure watershed resiliency amidst climate change.	Immediate (0-3 years)	Medium
Establish riparian buffers	Vegetated buffer zones along water bodies that protect water quality from contamination stemming from climate change.	Immediate (0-3 years)	High

Perform profiling of critical water source	Identifying and assessing all watersheds and river basins for proper monitoring and evaluation, and management, across both surface water such as NWRB's Comprehensive Water Resource Assessments (CWRA) for Major River Basins (MRB), and DENR-MGB's Groundwater Resource and Vulnerability Assessment, and nuclear analytical techniques and stable isotopes profiling of the DOST PNRI.	Immediate (0-3 years)	High
Regulate development activity impacting watersheds	Implementing rules and regulations to manage development in areas that might impact watersheds to ensure the preservation of their adaptive potential.	Medium-term (3-6 years)	Medium
Regulate inappropriate developments in floodplains	Restrict inappropriate development in flood-prone areas, ensuring floodplains are properly utilized, and their resiliency is maximized.	Medium-term (3-6 years)	Medium

4.2.3 Health

Overview of Health in the Philippines

Health is fundamental to the transformation goals of AmBisyon Natin 2040 and underpins the Philippines' socioeconomic agenda. The country envisions Filipinos across the country to enjoy longer and healthier lives and be provided undisrupted access and financial protection to quality health services. From an economic perspective, resilience in the health sector acts as a form of economic insurance, helping to mitigate the economic impacts of health crises exacerbated by climate change. Proactive measures to climate-proof health systems minimize the disruption of emergency healthcare interventions in times of extreme weather events.

From a social standpoint, investments in health are investments in the protection of our most vulnerable and marginalized populations. Ensuring that populations have access to consistent and quality healthcare services promotes social equity and reduces disparities in health outcomes. Moreover, a resilient health sector displays a strong ability to address social determinants of health, such as economic stability, education, and social and community context.

Despite major health sector reforms and plans in the past decade, this sector continues to face challenges relating to healthcare resource capacity, financial protection, and equitable access to healthcare services. The fragmented nature of the Philippine health sector is hampering coordinated planning across private and public health systems.

Within public health, there continue to be high variations across local government units in terms of health priority, with a disproportionate amount of resources invested in treatment, rather than prevention. In addition, there are sustained and growing gaps in the absolute number and the inequitable distribution of health infrastructure and healthcare resources across the Philippines, typically with insufficient provision in areas with the greatest need for health care. As a result, the longstanding inequality embedded in the Philippines' health system makes it more challenging to plan for the long-term against climate change impacts.

Climate Change Impacts on Health

Key vulnerabilities emerge in relation to the Philippines' ability to achieve targeted health outcomes considering climate change impacts. First, the Philippine health system face resource limitations, especially across medical personnel and essential supplies. For example, in 2020, only 56% of public health facilities was sufficiently stocked with selected essential medicines[235], and less than 25% of cities and municipalities have health human resource density above the 41 physicians, nurses, and midwives per 10,000 population recommended by the World Health Organization[236].

These constraints hinder the sector's ability to respond effectively to sudden and increased healthcare demands resulting from climate-related risks. This challenge became evident during the onset of the COVID-19 pandemic in 2020, as abrupt surges in healthcare needs critically strained the Philippine health system's resources. Drawing key learnings from the pandemic experience, the health sector has initiated efforts to enhance its responsiveness to unforeseen scenarios. There is an opportunity to proactively prepare for health resilience, specifically focusing on the implications of climate change on health.

Second, primary healthcare facilities in the Philippines are not built to withstand extreme climate events such TCs, floods, and rain-induced landslides. These barangay health centers serve as frontline health facilities for the population (e.g., 18 available per every 100,000 population in BARMM[237]), especially in low GDP regions such as BARMM that have limited access to large healthcare facilities (e.g., 0.95 hospitals per every 100,000 population vs. NCR's 1.1 hospitals per every 100,000 populations). These primary care facilities are jeopardized during unforeseen climate events weakening an already weak primary care system, with limited sector-wide strategies to protect against such risks.

Lastly, there remains inadequate social health insurance support that ensures the affordability of healthcare for all Filipinos. Household out-of-pocket expenditures remain at 50%[238], even after 40 years of Philippine Health Insurance Corporation (PhilHealth). As climate impacts increase, a more robust healthcare financing system will be necessitated to ensure Filipinos have affordable access to healthcare.

Climate change has both direct and indirect impacts on human health. Directly, exposure to extreme weather events may increase incidences of vector-borne diseases, waterborne diseases, and heat-related illnesses. The proliferation of dust particles and pollutants due to air pollution and the emergence of allergens may also worsen health issues for populations with comorbidities. Indirectly, the nutrition of populations may be compromised due to losses in agricultural land and changes in crop production and fish catch, leading to starvation and malnutrition. Exposure to extreme events can also trigger stress and anxiety in the affected population; leading to depression and suicide.

[235] Philippine Statistics Authority. (n.d.). OpenStat: Sustainable Development Goals (Goal 3. Ensure healthy lives and promote wellbeing for all at all ages, 3.b.3.p1 Percentage of public health facilities properly stocked with selected essential medicines) [Dataset]. https://openstat.psa.gov.ph/PXWeb/pxweb/en/DB/DB__3I__G03/0233I3D3B31.px/table/tableViewLayout1/?rxid=8ea3c28a-e5f9-4fee-888e-dfebffd616e8

[236] Panay News. (2023, August 13). Maldistribution of healthcare workers. Philippine Institute for Development Studies. Retrieved August 11, 2023, from https://www.pids.gov.ph/details/news/in-the-news/maldistribution-of-healthcare-workers

[237] Department of Health. (n.d.). Department of Health National Health Facility Registry (V3.0) [Dataset]. https://nhfr.doh.gov.ph/

[238] Ulep, Valerie Gilbert T. dela Cruz, Nina Ashley O., (2016). Analysis of Out-of-Pocket Expenditures in the Philippines

Climate change compounds the threats posed to the stability of health systems, thus, potentially disrupting access to health services for all Filipinos. The health system already faces constraints that impact its ability to provide equitable healthcare—interrupted service delivery, insufficient capacity of the health workforce, non-interoperable health information systems, limited financing, and disconnected health governance. Climate-induced migration may also increase demand for healthcare services and strain health systems in select areas where unforeseen migration occurs. Insufficient preparation to ensure the resilience of health systems will hinder the ability to minimize mortality amidst climate impacts.

The table below highlights the negative effects of climatic impact-drivers on this sector.

Table 4.2.3.1. Impacts of climatic impact-drivers on Health

Climate Impact-Driver	Impacts to health
Sea level rise and extreme sea levels	**Water-related diseases from salinity intrusion and contamination** As seawater intrudes into freshwater sources, salinization occurs, compromising the drinking water quality. This impacts the health of communities reliant on freshwater supplies. Contaminated or polluted water also increases the risk of water-related diseases, including cholera. **Damaged health infrastructure** Extreme weather events, exacerbated by sea level rise, can damage healthcare facilities and disrupt access to medical services, putting people at risk and causing delays in the delivery of health services, thus exacerbating health issues. **Loss of human lives and mental disorders** Rising sea levels lead to coastal erosion and the submergence of low-lying areas, resulting in immediate loss of shelter and livelihoods and potential displacement of communities. This displacement can cause psychological distress, trauma, and loss of sense of place and cultural identity.

Extreme precipitation	**Risk for physical injuries and exposure to water-related illness, e.g., cholera and leptospirosis** Extreme rainfall leads to heavy flooding, leading to injuries, drowning, and waterborne diseases. Contaminated floodwater increases the risk of gastrointestinal illnesses, skin infections, and leptospirosis. **Contamination of the water supply** Pollutants from submerged waste dumps may also contaminate water supplies. **Expansion of breeding grounds for vector-borne diseases** Wet and humid conditions are ideal mosquito breeding conditions increasing the likelihood of spreading vector-borne diseases e.g., dengue and malaria. **Poor Sanitation promotes the potential spread of polio virus** The polio virus enters through the mouth, and the infected individual then sheds the virus to the environment where it could rapidly spread to communities, particularly those with poor sanitation.
Wind patterns and tropical cyclones	**Injuries and fatalities** Cyclones and extreme winds can cause physical injuries (e.g., cuts, bruises, fractures), and fatalities due to the collapse of structures, flying debris, and/or drowning. People with chronic diseases are at risk for death during severe typhoons due to interrupted access to medical facilities. **Exacerbated mental health impacts** Experiencing the destruction of homes, loss of loved ones, or sudden displacement from communities due to tropical cyclones can lead to post-traumatic stress disorder (PTSD) and worsen existing anxiety disorders.
Increased temperature and droughts	**Expansion of breeding grounds for vector-borne diseases** Increased temperatures may also result in changes in breeding patterns of mosquitoes, increasing the likelihood of spearing vector-borne diseases. **Increased incidences of heat stroke and cardiovascular stress** Extreme heat may potentially worsen conditions like hypertension and increase the risk of heart attacks and other cardiovascular diseases. **Compromised food supply and nutrition** Extreme heat can lead to drought conditions, which can affect agricultural crops production and compromise health of livestock, which in turn can have significant impacts on available food supply and nutrition.

Among the various climatic-impact drivers, pluvial flooding[239] is a key climate risk that threatens health infrastructure and networks[240]. Pluvial flooding can damage roads, bridges, and other transportation infrastructure, making it difficult for healthcare providers, patients, and medical supplies to access healthcare facilities. As a result, populations will experience delays in receiving urgent medical care. By 2030, a projected 8% of critical healthcare infrastructure, including hospitals, medical centers, and pharmacies[241], will be exposed to pluvial floods, with an estimated 24% of facilities in CAR exposed. Annualized damage of critical healthcare infrastructure nationally could reach PHP610 million in damages per year just from pluvial floods. Accounting for impacts of other climatic-impact drivers beyond pluvial floods, an additional PHP495 million yearly damages may be incurred on healthcare infrastructure. In the following decade, healthcare infrastructure in other regions may also be exposed. By 2050, a projected 10% of critical healthcare infrastructure will be exposed to pluvial floods. In CAR, Region IV-B, and Region IV-A, more than 20% of facilities[242] are projected to be exposed to pluvial flooding.

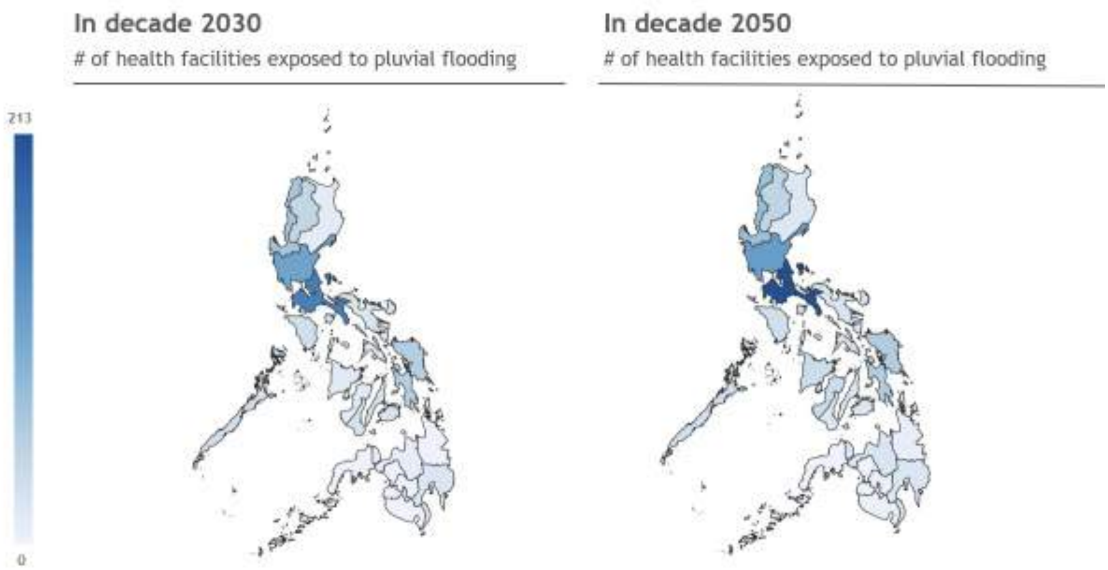


Figure 4.2.3.1. Number of health facilities exposed to pluvial floods in decade 2030 and decade 2050[243]

Extreme sea levels are also projected to damage critical health infrastructure significantly. While less health infrastructure is exposed to extreme sea levels (7%), the potential damage cost incurred is larger at an estimated PHP490 million in damages per year due to the height of flooding.

Extreme precipitation due to tropical storms coupled with contaminated and polluted water is also expected to increase incidence of climate-related diseases in the next few decades.

[239] Pluvial, fluvial and extreme sea level-driven floods are modelled on a 10-year return period, represented by flood heights with a 10% chance of occurring in a year

[240] Quantitative climate impacts outlined in this chapter are projected based on climate models developed as part of the National Adaptation Plan process. Detailed methodology for climate models per sector can be viewed on Appendix 2 and Appendix 3 - Health

[241] Data does not exhaustively include all health centers e.g. frontline facilities such as barangay health centers and rural health centers

[242] Same as above

[243] "In decade 2030" refers to 1 in 10 yr return period events in 2030-2040 and "In decade 2050" refers to 1 in 10 year return periods events in 2040-2060

Leptospirosis and dengue fever are among the most critical climate-related diseases facing the Philippines, provided the high volume of dengue cases and the high death rate from leptospirosis. A correlation analysis of environmental determinants was thus used to estimate change in incidences of leptospirosis and dengue.

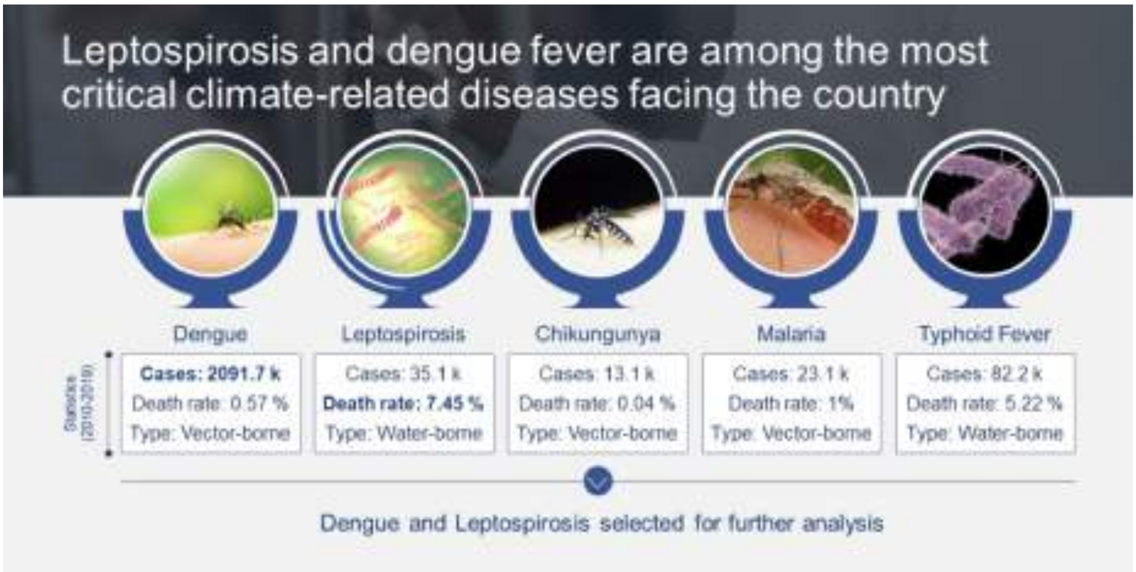


Figure 4.2.3.2. Various vector-borne and water-borne climate-related diseases present in the Philippines. [244]

Contaminated or polluted water brought about by poor drainage systems after heavy rainfall may contribute to increases in leptospirosis incidence in the 2030 decade, projected to grow by 58% versus historical incidences. Geographically, Region VI (0.12‰), NCR (0.10‰), and Region III (0.09‰) are expected to have the highest incidence[245] rate relative to population. This is in line with historical trends, as well as the large population size and high population density living in informal settlements. However, it is also critical to protect Region X and Region XVIII, given projections estimate a 2-3x increase in annual cases of leptospirosis in the 2030 decade despite a low historical base.

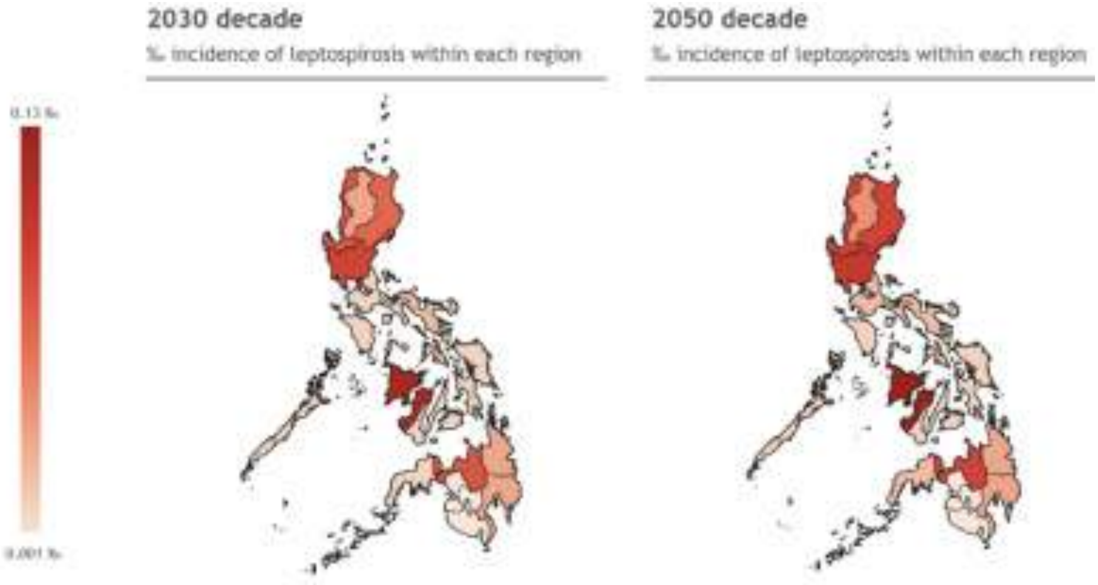


Figure 4.2.3.3. ‰ Leptospirosis incidences for 2030 decade and 2050 decade

[244] Compendium of Philippine Environment Statistics, 2010-2019.pdf (un.org)
[245] 2010 to 2019 historical annual cases

In the 2050 decade, annual leptospirosis cases are projected to be 4% greater than in the 2030 decade. However, similar regional trends are projected, with largest annual projected incidences in Region VI (0.13‰), NCR (0.10‰), and Region III (0.09‰).

Table 4.2.3.2. Philippine regions grouped by projected growth rates of leptospirosis cases for 2030 decade against historical annual leptospirosis cases (2010-2019)

	GROUP 1 Growth rate > National Growth Rate (58%)	GROUP 2 Growth rate < National Growth Rate
High historical base of annual leptospirosis cases (>206 cases/year)	Region X Region VIII Region XIII	NCR Region I
Low historical base of annual leptospirosis cases (<206 cases/year)	Region VI Region III	Region IV-A Region XI Region V Region VII CAR Region IV-B Region XII BARMM Region II Region IX

On the other hand, warmer temperatures and altered precipitation patterns can expand the geographic range of dengue-carrying mosquitoes. Climate change can also lead to shifts in the timing and duration of seasons, affecting mosquito populations and dengue transmission patterns. While dengue incidences are projected to stabilize at a national level (8% decrease in total annual cases versus historical), dengue incidences in some regions are expected to grow in the 2030 decade. For example, projected incidence rates for dengue in CAR (4.71%) and Region XIII (3.42%) will be higher than the national average, when historically regions that had a low historical base of dengue incidences. Consequently, it will be critical to accelerate dengue prevention and control efforts in the select regions where annual incidences are still expected to grow, including BARMM (171% increase) and Region V (131% increase), potentially overwhelming health systems available.

However, it is also critical to protect Region VI and Region III given projections estimate 2 to 3x increase in annual cases of leptospirosis in the 2030 decade, despite its low historical base.[246] Region X, Region VIII and Region XIII are also key regions to monitor for leptospirosis incidences against a large population base, provided expectations of high growth rate, greater than the overall projected national growth rate of 58%.[247]

[246] 2010-2019 Leptospirosis cases taken from: Compendium of Philippine Environment Statistics, 2010-2019.pdf (un.org)
[247] Projected incidences for 2030 and 2050 decade from BCG Data Model, with methodology detailed in Appendix 3.3.3 Methodology for sectoral climate analytics

Table 4.2.3.3. Philippine regions grouped by projected growth rates of dengue cases for 2030 decade against historical annual dengue cases (2016-2018)

	GROUP 1 Growth rate > National growth rate (-8%)	GROUP 2 Growth rate < National growth rate (-8%)
High historical base of annual dengue cases (>14k cases/year)	Region IV-A NCR	Region III Region VII Region X Region VI
Low historical base of dengue leptospirosis cases (<14k cases/year)	Region XI Region V Region XIII CAR Region IV-B BARMM	Region XII Region I Region IX Region VIII Region II

For example, projected incidence rates for dengue in CAR (4.71%) and Region XIII (3.42%) will be higher than national average, when historically these had been regions that had a low historical base of dengue incidences. Consequently, it will be critical to accelerate dengue prevention and control efforts in select regions where annual incidences are still expected to grow, including BARMM (171% increase) and Region V (131% increase), potentially overwhelming health systems available.[248] Similar insights on regional archetypes for Dengue cases can be found on Table 4.2.3.3, where Group 1 regions may be key areas to monitor based on projected growth rate of cases being higher than the projected national rate of -8%.[249]

When considering priority adaptation solutions for the sector, actions must be taken to protect the most vulnerable populations: elderly, rural, women, children, indigenous communities, marginalized low-income communities, and various subgroups of persons with disabilities, who may have limited access to healthcare facilities. Action must be taken to ensure the resiliency of health services in extending services to remote rural and indigenous communities, raising awareness about disease prevention and preparedness, and providing support to older adults living in isolation or in remote areas. In addition, a rights-based approach must be taken when viewing the needs and circumstances of persons with disabilities.

[248] 2016-2018 Dengue cases taken from: HDX – Philippine Dengue Cases and Deaths, DOH-Epi Dengue Data 2016-2021.csv (data set link: https://data.humdata.org/dataset/philippine-dengue-cases-and-deaths?
[249] Projected incidences for 2030 and 2050 decade from BCG Data Model, with methodology detailed in Appendix 3.3.3 Methodology for sectoral climate analytics

Priority Adaptation Outcomes for Health

Built on the vision of activating a holistic approach to improve health outcomes, reduce health inequalities, and achieve universal healthcare and supported by current programs and policies[250] that help address social determinants of health, the adaptation theme for **Health is Climate-Adaptive Healthcare for All: Protecting Health & Well-Being of Filipinos.**

Three priority outcomes underpin this strategy:

1. **Minimized patient mortality from climate-sensitive diseases through reinforced primary care and reinforced community health workers.** This outcome focuses on reinforcing the accessibility, availability, and affordability of primary health care for all, and enables health workers to diagnose, treat, and manage climate-related health challenges effectively. For this, dedicated policy and funding support must be activated to build up a cadre of health workers who can respond anytime and anywhere. Unlocking and upskilling health workers will allow for responsive healthcare delivery, even at the most microscale level of healthcare.
2. **Seamless access to climate-responsive health services underpinned by resilient health networks.** This outcome focuses on ensuring equitable access to healthcare for all Filipinos through enhanced preparedness across public and private health networks for climate-related health risks. This will require the Philippines to rethink funding and incentivization schemes to ensure the financial protection of all Filipinos in relation to health and reinforcing health networks, particularly frontline facilities that serve the most vulnerable populations, to be resilient against the impacts of climate change.

3. **Interoperable information system to monitor and evaluate health vulnerability and capacity developed.** This outcome focuses on empowering health authorities and practitioners at all levels to make data-driven decisions on health adaptation priorities. To enable this, it is critical to expedite efforts to utilize existing data from different agencies, sectors, and communities and work towards a comprehensive integration of health and climate data.
4. **Resilient, interconnected, and community-driven health governance at all levels.** This outcome focuses on establishing effective collaboration mechanisms among various health agencies, sectors, and community stakeholders to foster an integrated approach to healthcare planning and DRR-CCA actions. This requires bridging gaps between national policy makers and local health implementors, bringing together climate experts and health experts, and activating community involvement in maximizing health outcomes.

[250] Refer to Appendix 3 – Health to see list of policies and programs referenced as part of the NAP process

Priority Adaptation Strategies for Health

Outcome 1: Minimized patient mortality from climate-sensitive diseases through reinforced primary care and community health workers

Implementing Lead agencies:
DOH, DILG (LGUs, Local Government Academy)

Supporting agencies:
CHED, TESDA, DSWD, DOST, DPWH, SUCs

Indicative Key Strategies	Brief Description	Implementation Priority	Capital-Intensiveness
Conduct needs assessment of healthcare workers for climate and disaster risk	Determine training needs and gaps of health care workers and develop tailored adaptation measures, ensuring the continued provision of essential medical services.	Immediate (0-3 years)	Medium
Unlock funding for increasing health worker capacity up to the barangay level	Initiate policy development to allocate specific funds for adaptation projects and provide financial incentives or recognition programs to build up health worker capacity and invest in their welfare.	Medium-term (3-6 years)	High
Increase coverage of community-based programs for prevention and control of climate-sensitive diseases and risks, including vaccine-preventable diseases with particular attention to poliomyelitis (e.g., leptospirosis, dengue, pollution)	Scale up community-based programs that focus on education on health risks of indoor and outdoor pollution, vector control measures, early detection, and treatment to effectively prevent and manage climate-sensitive diseases and risks (e.g., promoting the use of cleaner cooking stoves, plant-based diets, urban green spaces, etc.). , including environmental sanitation programs and the conduct of supplemental vaccination campaigns and activities.	Medium-term (3-6 years)	Medium
Upskill health workers through the development and incorporation of CCA-DRR modules in the curriculum of all health professionals	Design comprehensive and context-specific training modules that integrate climate change adaptation and disaster risk reduction principles to enhance the preparedness and response capabilities of health workers (e.g., impacts on mental health, climate-sensitive diseases, etc.).	Medium-term (3-6 years)	Medium

Outcome 2: Seamless access to climate-responsive health services underpinned by resilient health networks.

Implementing Lead agencies:
DOH, PhilHealth

Supporting agencies:
DILG (LGUs, Local Government Academy), DOTR, DOE, DSWD, DOST, DENR, DPWH, NNC, SUCs

Indicative Key Strategies	Brief Description	Implementation Priority	Capital-Intensiveness
Conduct climate and disaster risk and vulnerability assessment of healthcare networks and related infrastructure	Conduct data collection and analysis, identify critical assets, assess vulnerabilities, and develop tailored adaptation measures, ensuring the continued provision of essential medical services.	Immediate (0-3 years)	High
Establish PhilHealth schemes and provisions to contextualize climate-change related outcomes	Conduct research and analysis to understand the potential impacts of climate change on public health and identify coverage where PhilHealth schemes and provisions need to be adapted to address climate-related outcomes.	Immediate (0-3 years)	Low
Strengthen WASH protocols and prioritize access to health services in post-disaster and makeshift areas	Scale concrete measures to strengthen water, sanitation, and hygiene and ensure access to health services, given that diseases can be transmitted easily in post-disaster communities and evacuation centers.	Immediate (0-3 years)	Medium
Unlock funding, monitoring and national incentivization schemes for climate-proofing health facilities networks and supporting infrastructure	Initiate policy development to allocate specific funds for adaptation projects and offer financial incentives or recognition programs to healthcare institutions (public and private).	Medium-term (3-6 years)	High
Improve and increase equitable access to healthcare, especially in climate-vulnerable, geographically isolated, and disadvantaged areas	Establish strong and responsive primary care, including capabilities on emergency response plans, establishing additional power systems to ensure service delivery, and outreach health programs for underserved communities and bedridden / incapacitated / elderly people who are confined at home.	Long-term (6+ years)	High

Outcome 3: Interoperable information system to monitor and evaluate health vulnerability and capacity developed

Implementing Lead agencies:
DOH, DICT, DOST

Supporting agencies:
DILG, PAGASA, DENR, PHIVOLCS, NAMRIA

Indicative Key Strategies	Brief Description	Implementation Priority	Capital-Intensiveness
Accelerate standardization of data collection, especially on climate-sensitive health conditions and diseases	Accelerate progress on DOH's PIDSR[251] and FSHIS[252] programs to standardized protocols for data collection on climate-related health vulnerability and capacity, ensuring that data from various health facilities and agencies can be integrated into a cohesive information system.	Immediate (0-3 years)	High
Integration of health information systems with climate data at national and local levels	Integrate health information systems with other information systems, such as meteorological/climate/environmental/agricultural/pollution etc., to elucidate climate-health linkages and to inform forecasting, anticipatory planning, and decision-making.	Immediate (0-3 years)	Medium
Invest in technology and data infrastructure for early warning and anticipatory planning for health	Invest in upgrading technological infrastructure, such as electronic health records and cloud-based systems, to facilitate data sharing and real-time monitoring of health vulnerability and capacity.	Medium-term (3-6 years)	High
Build capacity and capability to utilize information systems and make informed decisions that protect population health from climate risks	Conduct training programs for health workers and personnel on how to effectively use information systems for monitoring and evaluating health vulnerability.	Long-term (6+ years)	High

[251] Philippine Integrated Disease Surveillance and Response
[252] Philippines Field Health Services Information System

Outcome 4: Resilient, interconnected, and community-driven health governance at all levels

Implementing Lead agency:
DOH

Supporting agencies:
DILG, DPWH, DENR, DOST-PCHRD, DSWD, OCD, DICT, NDRRMC, NNC

Indicative Key Strategies	Brief Description	Implementation Priority	Capital-Intensiveness
Identify trusted climate change champions who can drive health adaptation priorities at national and local levels	Create platforms or networks that bring together potential climate change champions, health professionals, policymakers, and civil society organizations and stakeholder groups to advocate for health adaptation priorities at both national and local levels.	Immediate (0-3 years)	Low
Develop and fund a transdisciplinary and people-centered climate and health research agenda	Create and strengthen research centers dedicated to climate and health, deepening transdisciplinary research on impacts of climate change and disasters on health, links and mechanisms of disease causations, and adaptation options and measures; critical to ensure research is properly translated into policy.	Immediate (0-3 years)	Medium
Establish formal community-engagement mechanisms to foster knowledge sharing, and collaborative decision-making	Establish community-engagement platforms to ensure that climate-resilience strategies are contextually relevant, effectively implemented, and sustainable over time.	Immediate (0-3 years)	Medium
Strengthen the health sector and DOH structures to ensure responsiveness to climate risks to health systems, , developing plans and strategies to minimize the health sector's contribution to climate change and reduce global greenhouse emissions and carbon footprint.	Delineate roles and responsibilities for DRR-CCA issues and establish coordination, communication, and collaboration mechanisms.	Medium-term (3-6 years)	Medium
Deepen inter-agency and cross-sector collaboration to assess and act on health vulnerabilities	Mainstream DRR-CCA issues into health plans at different levels of the health systems, incorporating health lens into climate plans and actions of other sectors.	Medium-term (3-6 years)	High

4.2.4 Ecosystems & Biodiversity

Overview of Ecosystems and Biodiversity in the Philippines

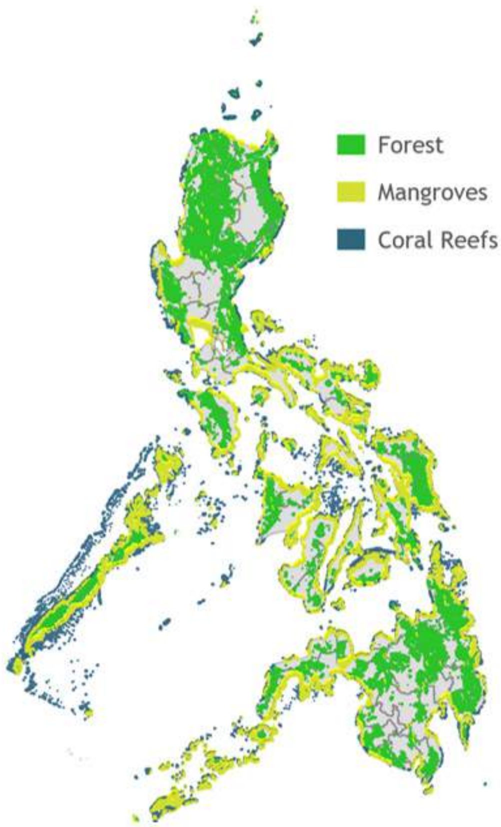


Figure 4.2.4.1 Overview of Philippine Forests, Mangroves, and Coral Reefs[253]

The Philippines is one of the most biodiverse countries in the world, spanning both terrestrial and marine domains—the protection and rehabilitation of its ecosystems is a critical initiative for the Philippines from both an economic and social standpoint, underscored by its inclusion and emphasis in the Philippine Development Plan for 2023-2028.

Economically, ecosystems provide myriad direct and indirect economic services, supporting a significant portion of Philippine industries and communities. For example, the Philippines marine reef system is estimated to contribute >USD1.35B to the national economy annually.[254] Smallholder fisherfolk comprise 45% of the population living in coastal areas and depend on reefs for livelihood. Mangroves in Tawi-Tawi are estimated to provide from 3,216 to 4,733 USD/hectare annually[255], while the Philippine reef ecosystem services were estimated to amount to USD4 billion, or 140k USD/km2 annually.[256] Ecosystems also provide value in the form of protection against climate hazards—for example, as of 2018, Philippine mangroves were found to prevent flooding damages of over USD1.7 billion per year.[257]

This value applies socially as well, as ecosystems provide valuable protection to neighboring communities—the same Philippine mangroves were found to prevent flooding exposure for 613,000 Filipinos per year[258], with 23% of this group residing below the poverty threshold[259]. The combined social and economic ecosystem services provided to Filipinos are undeniably invaluable but have yet to be fully accounted for.

Finally, in terms of biodiversity, with 7,641 islands and its geographic location at the apex of the Coral Triangle, the Philippines stands as one of the 17 mega-biodiverse countries in the world and is ranked third in terms of marine biodiversity across its many coral reef, mangrove, seagrass, and wetland ecosystems, while also housing a wide range of terrestrial ecosystems.

[253] DENR (for Mangroves and Forests) and Coral Reef Watch (for Coral Reefs)

[254] Department of Environment and Natural Resources – Biodiversity Management Bureau. (2016). Philippine Biodiversity Strategy and Action Plan 2015-2018

[255] Roldan, R.B. (2022). ECONOMIC VALUATION OF MANGROVES IN TAWI-TAWI ISLANDS, SOUTHERN PHILIPPINES: A MARKET PRICE AND CONTINGENT VALUATION APPROACH

[256] Tamayo, N., Anticamara, J., Acosta-Michlik, L. (2018). National Estimates of Values of Philippine Reefs' Ecosystem Services.

[257] Beck, M.W. et. Al. (2018). Valuing the protection services of mangroves at national scale: The Philippines

[258] Losada, I.J., M. Beck, P. Menéndez, A. Espejo, S. Torres, P. Díaz-Simal, F. Fernández, S. Abad, N. Ripoll, J. García, S. Narayan, D. Trespalacios. 2017. Valuation of the Coastal Protection Services of Mangroves in the Philippines. World Bank, Washington, DC.

[259] ibid

Poor management and exploitation plague Philippine ecosystems. Over the past decades, Philippine ecosystems have undergone rapid degradation due to large-scale deforestation and grassland conversion, urbanization, mining, and dam construction, leading to freshwater alteration, river and lake pollution from domestic and industrial sources, as well as the general decline of mangrove and coral reef habitats. Forested and logged areas are converted to agriculture, overfishing depletes fishery resources, and destructive practices like poisoning and dynamite fishing severely damage the valuable coral reefs. This widespread environmental deterioration has impacted numerous endemic species, as highlighted by the IUCN, which reports that 21% of the country's vertebrates and over half of its known plant species are already threatened.

Overview of Ecosystems and Biodiversity in the Philippines

Ecosystems across the world are particularly vulnerable to climate change, and the Philippines is no exception. Degradation of ecosystems caused by humans is expected to be compounded by climate change—for example, coral bleaching from El Niño in 1997 to 1998 decreased live coral cover in the Philippines by up to 49%—reefs in El Nido were particularly hard hit, going from 60 to 70% coral cover to 5 to 10%, according to the National Climate Change Action Plan. A three-year massive global coral bleaching event was likewise documented from 2014 to 2017, the longest ever recorded, alongside successive record-breaking hot years.[260]

Impacts like these have cascading effects on the same communities and biodiversity that these ecosystems protect —for example, researchers from Charles Darwin University in Australia and the National University of Singapore found that a 10% increase in deforestation results in a 4 to 28% increase in flood frequency.[261]

In terms of biodiversity, the Philippines ranks among the top ten countries with the largest number of species threatened with extinction. Certain species are very sensitive to climate change-related impacts and the corresponding habitat loss caused by increased temperature, erratic rainfall distribution, and more intense TCs which significantly reduce their respective populations.

Worsening climate trends will have severe impacts on Philippine ecosystems, biodiversity, and overall ecological stability if not addressed promptly. While varied communities and biodiversity depend on the ecosystem in question, the increasing intensity of extreme weather events could lead to the deterioration of habitats and disruption of ecological balance, further endangering various species. Chronic events such as rising temperatures and sea levels are also anticipated to contribute to habitat degradation, compromised species health, and a decline in biodiversity. The table below outlines the adverse effects of different climate drivers on these vital ecosystems and the rich tapestry of life they support.

[260] Eakin, C.M., Sweatman, HPA, Brainard, R E. (2019). The 2014–2017 global-scale coral bleaching event: insights and impacts. Coral Reefs.

[261] BRADSHAW, C.J., SODHI, N.,PEH, K. and BROOK, B. (2007). Global evidence that deforestation amplifies flood risk and severity in the developing world. Global Change Biology (2007) 13, 1—17

Table 4.2.4.1. Impacts of climate hazards on Ecosystems & Biodiversity

Climate Impact-Driver	Impacts on ecosystems and biodiversity
Increased temperature and Drought	**Water scarcity for flora and fauna** Increased temperature and drought may reduce water availability, leading to the reduction of species population that depend on specific aquatic habitats, the redistribution of others, or the stunting of growth of terrestrial and mangrove forest trees and potentially forest die-offs, while also increasing the risk of forest fires and raising probability of saltwater intrusion. **Coral bleaching** Raised sea temperatures can lead to coral bleaching and the resulting degradation of reef ecosystems
Sea level rise and extreme sea levels	**Coastal and marine habitat submersion** Increasing sea levels, and storm surges amplified by extreme tropical cyclones, can pose significant risks to mangrove forests, leading to the loss of their protective functions[262] and crucial habitats for fish and other wildlife. Increased saltwater intrusion also affects mangrove growth and survival. Higher sea levels may also lead to limited access for corals to photosynthesize, stunting their growth or even leading to mortality. **Saltwater intrusion** Sea levels increase saltwater intrusion into river systems, affecting freshwater availability, water quality, and the distribution of freshwater species. It disrupts the natural flow regimes of rivers. Storm surges and coastal flooding associated with extreme sea levels inundate lowland forests, leading to soil erosion, loss of biodiversity, and changes in species composition. In wetland and marsh areas, this changes vegetation composition and potential loss of habitat for wetland-dependent species.

[262] Blankespoor, B., Dasgupta, S. & Lange, GM. (2016). Mangroves as a protection from storm surges in a changing climate. Ambio 46, 478–491 (2017). https://doi.org/10.1007/s13280-016-0838-x

Extreme precipitation	**Flooding leading to forest damage** Intense rainfall increases the risk of flooding and weakens earth composition in forested areas, triggering landslides leading to soil erosion, habitat destruction, and changes in vegetation structure. **Tree Mortality and Species Composition** Prolonged and excessive rainfall saturates the soil, leading to waterlogging and reduced oxygen availability for tree roots. This results in tree mortality and alterations in species composition. Intense rainfall events also cause temporary inundation and changes in water chemistry within wetland and marsh areas, influencing vegetation composition and affecting wetland-dependent species. **Salinity fluctuations** Intense rainfall can lead to freshwater influx into estuaries, altering salinity levels and affecting mangrove forests. Changes in water chemistry can impact mangrove species composition and disrupt nursery habitats for marine species.
Wind patterns and tropical cyclones	**Structural damage** Strong winds during cyclones uproot trees and cause widespread damage in forested areas, leading to habitat destruction, altered forest structure, and loss of biodiversity. Intense winds also result in riverbank erosion, increased sedimentation, and altered flow dynamics, affecting the structure and function of riverine ecosystems. Likewise, this damages wetland and marsh ecosystems, leading to changes in vegetation composition, habitat loss, and potential impacts on marine and wetland-dependent species.

Distinct ecosystems are each particularly vulnerable to a specific climatic impact-driver—sea level rise inundating mangroves, increased air temperatures bleaching coral reefs, and extreme precipitation causing inland flooding forested areas.[263]

Sea level rise has been known to cause stress to mangrove trees, driving the retreat or disappearance of mangrove forests in submerged areas. By the 2030 decade, 32% of mangroves in the nation are projected to be exposed to sea level rise flooding of 1 m, further increasing to 48% in the decade between 2050 and 2060—70% of this impact may materialize along the coasts of regions IV-A, IV-B, V, VIII, and XIII.

In particular, the mangroves of the provinces of Palawan and Quezon are expected to face the most exposure, each at approximately 90 km^2. This impact on mangrove forests combined with the expected vulnerability of regions IV-A, V, and VIII highlighted in Chapter 3.3 due to more frequent and intensified extreme sea levels may lead to compounded impacts that local government units should be prepared for.

[263] Quantitative climate impacts outlined in this chapter are projected based on climate models developed as part of the National Adaptation Plan process. Detailed methodology for climate models per sector can be viewed on Appendix 2 and Appendix 3 – Ecosystems and Biodiversity

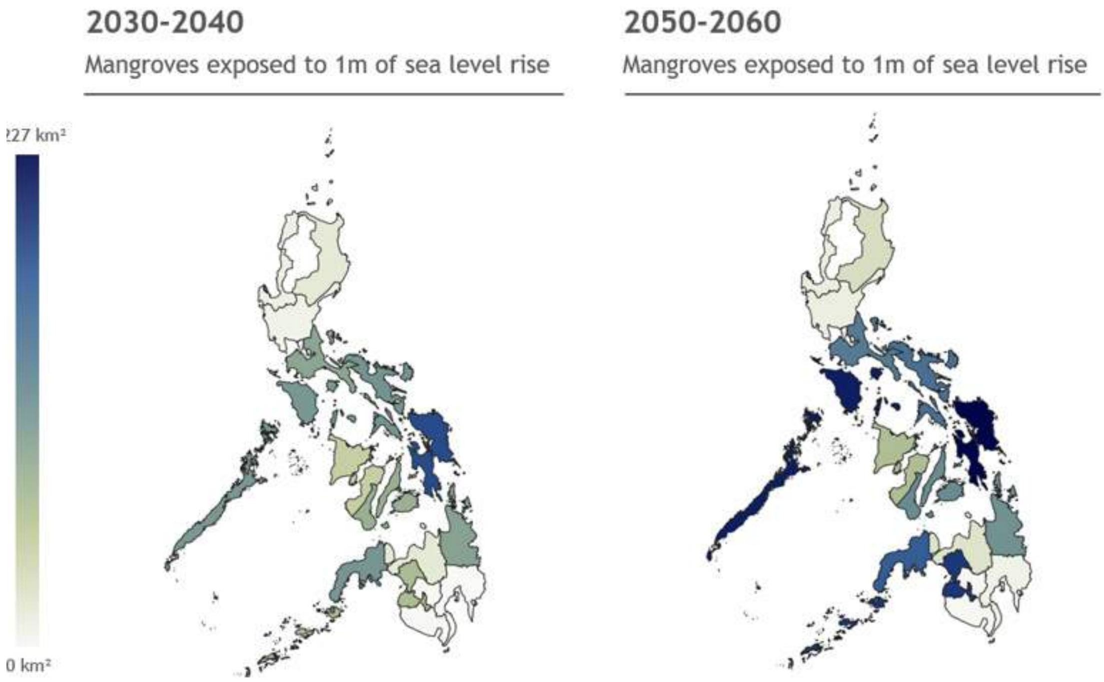


Figure 4.2.4.2 Mangroves exposed to 1 m of sea level rise between 2030-40, 2050-60, SSP5-8.5

Rising temperatures is by far the most threatening climatic impact-driver for coral reefs – Between 2030 and 2040, 19% of coral reefs across the Philippines may be exposed to a rise in air temperature of 1 degree Celsius or more. Of this exposure, close to half of the exposed coral reefs are projected to fall within Region IV-B and Palawan in particular, despite it making up only a fifth of the total reef area of the Philippines. Of note, the coral reefs of Palawan house the Tubbataha Reef, a UNESCO-declared World Heritage Site wherein 75% of the world's known corals can be found.

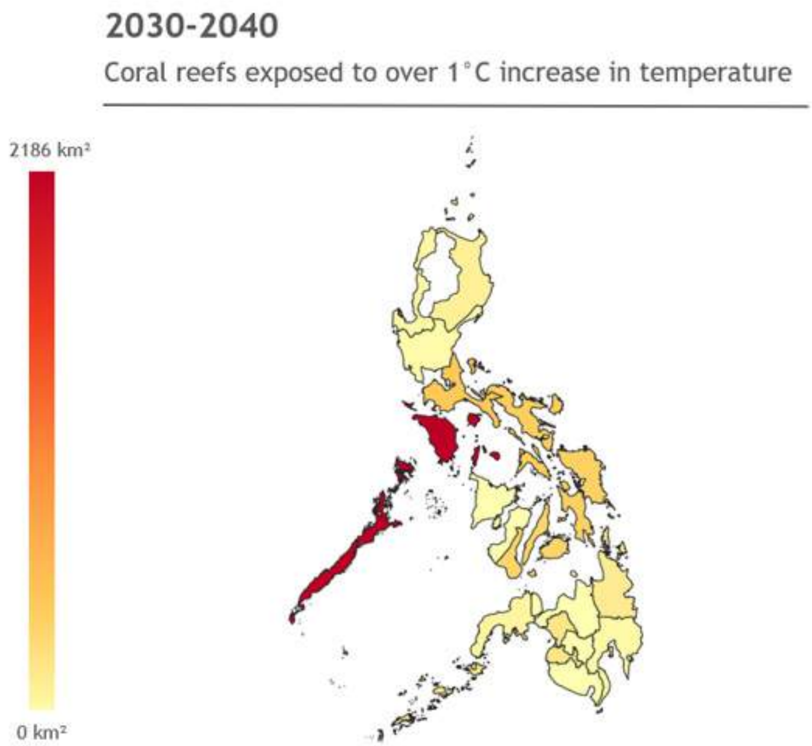


Figure 4.2.4.2 Mangroves exposed to 1 m of sea level rise between 2030-40, 2050-60, SSP5-8.5

While they protect communities from the impacts of flooding, forests themselves are vulnerable to the impacts caused by extreme precipitation. Between 2030 to 2040, over a third of Philippine forests are projected to be exposed to either pluvial or fluvial floods exceeding 1m in depth, further increasing to ~47% in the decade of 2050. Over 65% of this exposure is expected to be observed in CAR and Regions II, III, IV-B, and XI, with CAR in particular composing more than a fifth of the exposed forests. In terms of provinces, Palawan, Abra, and Benguet are expected to see the most forest exposed to such floods. Given the importance of forests in minimizing damage caused by floods and landslides in nearby communities, it is important to highlight further vulnerability of CAR, Regions II, III, IV-B, and XI, already identified as among the most at risk due to pluvial and fluvial flooding, and Benguet being the most susceptible province towards landslides in Chapter 3.3 when selecting and localizing strategies to be implemented.

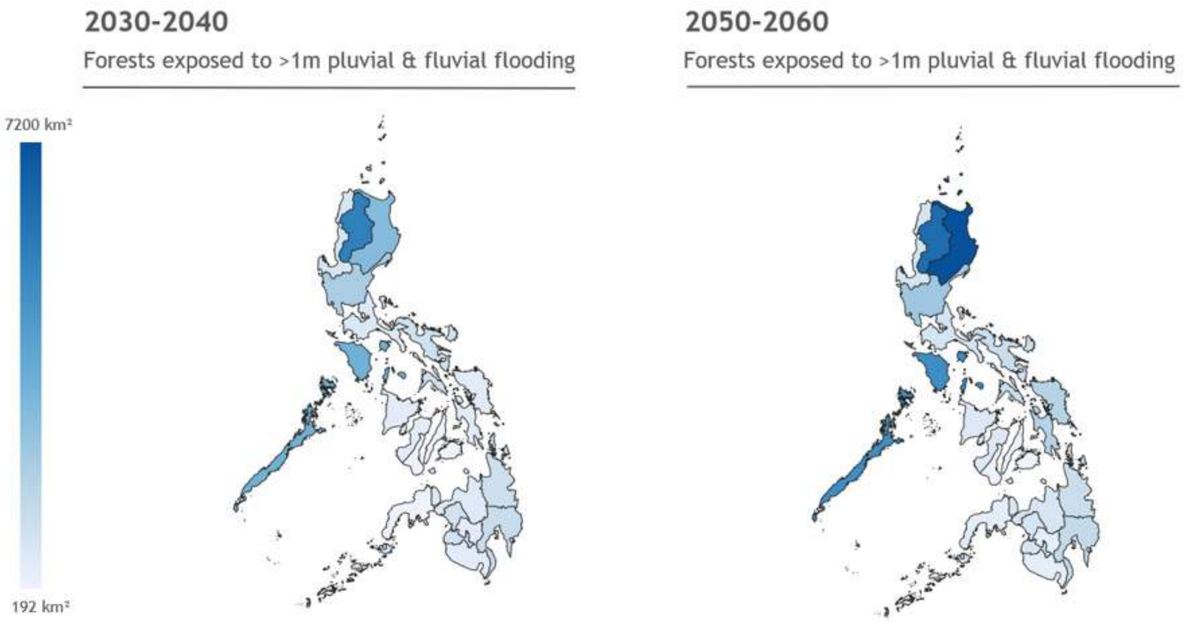


Figure 4.2.4.4 Forests exposed to 1m of pluvial or fluvial flooding between 2030-40, 2050-60, SSP5-8.5

Priority Adaptation Outcomes for Ecosystems & Biodiversity

Grounded on national policies and existing programs related to this sector[264], the adaptation theme for **Ecosystems & Biodiversity is Safeguard and Nurture Biodiversity: Restore and Sustain Natural Assets.**

Three priority outcomes underpin this strategy:

1. **Ecosystems accounts developed and regularly updated to monitor and enhance regulating services for adaptation.** This outcome focuses on the valuation of ecosystem services and developing and maintaining ecosystem accounts to optimize understanding of the regulatory services of ecosystems and inform policy development and investment plans for adaptation. To achieve this, accounting and monitoring programs that have been rolled out must be strictly and regularly enforced by local government units.

[264] Refer to Appendix 3 – Ecosystems & Biodiversity to see list of policies and programs referenced as part of the NAP process

2. **Protected and rehabilitated biodiversity across habitats and ecosystems.** This outcome focuses on the protection and rehabilitation of critical habitats and ecosystems, maintaining their interconnectedness for biodiversity and ecosystem service output amidst climate hazards, following well-received approaches such as the Ridge-to-Reef Approach, while capitalizing upon Ecosystem-based Adaptation (EbA) or Nature-based Solutions. To achieve this outcome, efforts must go beyond protecting remaining ecosystems and their surrounding areas to active rehabilitation and restoration. Academe and the public are key actors in supporting the programs that work towards this outcome.
3. **Enabled and empowered communities to lead ecological management.** This outcome focuses on equipping and supporting local communities to enable their active involvement in the planning, decision-making, and implementation of the management and conservation of ecosystems. To achieve this, the involvement and capacitation of local communities and government units, indigenous people, and the private sector is critical.

Prioritizing adaptation strategies that ensure resilient and well-monitored ecosystems will not only bolster the nation's capability to withstand climate change, but also provide a long-lasting source of value derived from ecosystem services for generations to come. Strategies must involve comprehensive, and regular accounting and monitoring programs to guide decision-making regarding ecosystems and well-enforced protection, management, and rehabilitation programs to ensure decisions are implemented as intended.

Priority Adaptation Strategies for Ecosystems & Biodiversity

Outcome 1: Ecosystems accounts developed and regularly updated to monitor and enhance regulating services for adaptation

Implementing Lead agency: DENR

Supporting agencies: DOST, NEDA, PSA, DILG, DHSUD

Indicative Key Strategies	Brief Description	Implementation Priority	Capital-Intensiveness
Expand and improve upon ecosystem zoning and mapping	Spatial planning that designates areas for different uses and conservation priorities/actions, such as DENR's Natural Resources Assessment, while updating documents such as DHSUD's Zoning Guidebook/Development Controls	Immediate (0-3 years)	High

Implement vulnerability assessment and monitoring programs	Detection of climate change indicators in certain ecosystems, enabling enactment of other interventions.	Immediate (0-3 years)	Medium
Implement existing programs to perform natural capital accounting and valuation of ecosystem services	Quantifying and valuing natural capital and ecosystem services to assess their economic value through a standardized approach, informing decision-making and management to ensure the resiliency of ecosystems to climate change, building upon the Roadmap to Institutionalize Natural Capital Accounting in the Philippines.	Long-term (6+ years)	High
Perform long-term ecosystem research to enhance the assessment of the consequences of management policy decisions	Long-term (6+ years) research on and monitoring of changes in ecosystems due to changes in land use, climate change, and other environmental factors.	Long-term (6+ years)	High

Outcome 2: Protected and rehabilitated biodiversity across habitats and ecosystems

Implementing Lead agency:
DENR

Supporting agencies:
DILG, DAR, DA, SUCs, DepEd, CHED, NCIP

Indicative Key Strategies	Brief Description	Implementation Priority	Capital-Intensiveness
Identify, assess, and monitor vulnerable habitats on a regular basis	Identification of high-priority habitats, followed by an assessment to enable timely protection from further degrading natural and anthropomorphic activities combined with proactive rehabilitation to minimize further loss amidst climate change.	Immediate (0-3 years)	Medium

Enhance implementation of existing laws, regulations, and guidelines	Ensuring enhanced enforcement of laws, protection, and interconnectivity of ecosystems to maximize their resiliency to climate change following principles such as the Ridge-to-Reef approach, while regulation of activities permitted (e.g., no trawling, farming, etc.) within prioritized ecosystems, with policies such as RA 7586 or National Integrated Protected Area System Act (NIPAS) and RA 11038 or Expanded National Integrated Protected Area System (ENIPAS) Act.	Medium-term (3-6 years)	Medium
Rehabilitate and restore coastal and marine ecosystems	Managed realignment of coastlines; re-establishing and protecting coastal habitats, including mangroves, saltmarshes, coral reefs, sea grass beds, and other such ecosystems with high adaptation potential	Medium-term (3-6 years)	High
Establish coastal setback zones/ boundaries	Survey/mapping and delineation of tidal datum lines to build resiliency of coastal ecosystems through the Wetland Conservation Program, and Coastal and Marine Ecosystems Management Program (CMEMP).	Medium-term (3-6 years)	High
Restore degraded forests and deforested areas	Facilitate forest restoration to ensure their resiliency amidst climate change through DENR's forestry programs such as the National Greening Program and Community Based Forest Management using diverse strategies including reforestation, agroforestation, assisted natural regeneration, and tree plantation development.	Long-term (6+ years)	High
Strengthen the monitoring and management of threatened and rare species	Monitoring and identification of most suitable measures to take (managed relocation, captive breeding, supplementation, etc.) to avoid further loss amidst climate change, building upon the Threatened Species Conservation and Management Program, and the Protection and Conservation of Wildlife Program.	Long-term (6+ years)	Medium

Outcome 3: Enabled and empowered communities to lead ecological management

Implementing Lead agency:
DENR

Supporting agencies:
DILG, DAR, DA, SUCs, DepEd, CHED, NCIP

Indicative Key Strategies	Brief Description	Implementation Priority	Capital-Intensiveness
Run public education/ awareness programs on the importance of ecosystems	Publicizing the role of ecosystems in supporting human society, reducing anthropogenic pressures for development, and minimizing further loss amidst climate change.	Immediate (0-3 years)	Medium
Establish collaborative research partnerships	Partnerships between local communities, researchers, and environmental organizations to provide access to scientific expertise, enabling ecological assessment, and better-informed decisions at a local level to improve the resiliency of ecosystems.	Immediate (0-3 years)	High
Enact legislation to support community-based ecological management	Policies and programs established at an LGU level, integrated with supporting programs such as Payment for Ecosystem Service (PES) programs, ecotourism development, and Biodiversity-friendly enterprises (BDFE) to legitimize local communities' ownership and encourage sustainable use across ecosystems.	Immediate (0-3 years)	Medium
Enact legislation to enhance uses of land, ecosystems and watersheds	Enacting the National Land Use Act and Sustainable Forest Management Act will facilitate the integrated and coordinated use of land, ecosystems and watersheds for socioeconomic purposes and environmental protection to help ensure resiliency across ecosystems and the communities that depend on them.	Immediate (0-3 years)	Low

Establish Payment for Ecosystem Services (PES) programs	Financial incentives to landowners and communities for implementing practices that enhance ecosystem services, such as reforestation, wetland restoration, or sustainable land management—integrate PES into nature-dependent industries such as tourism.	Medium-term (3-6 years)	High
Implement eco-certification programs	Certifications and labels for businesses that meet certain criteria, such as sustainable resource use, habitat protection, or pollution reduction, help encourage the improvement of ecosystem resilience.	Medium-term (3-6 years)	Medium

4.2.5 Cultural Heritage, Population Displacement, and Migration

Overview of Cultural Heritage, Population Displacement, and Migration in the Philippines

Addressing climate-induced human mobility with a lens of cultural heritage preservation is critical in planning adaptation measures for the Philippines. As a result of climate-related environmental stressors, many Filipino communities now face challenges in human mobility. Increasingly, mobility is seen as an adaptation strategy to manage the impacts of climate change.

From an economic perspective, effective integration of displaced individuals and migrants into the local workforce can lead to improved human capital in relocated areas. In addition, proper measures to address integration into localities can utilize the skills and talents of migrants, leading to increased economic productivity and growth.

More importantly, from a social standpoint, proper reintegration of populations ensures that communities can maintain their unique traditions, languages, and ways of life. With the Philippines' rich and diverse identity, fostering a sense of belonging, social cohesion, and continuity across generations is a critical element of climate adaptation.

The country has a responsibility to ensure the dignity and well-being of individuals and communities who have left their homes due to climate-related events. Upholding human rights and providing aid reflects the Philippines' values and commitment to basic principles of fairness and justice, especially since society's most vulnerable populations are most impacted by these events.

Today, discussions on climate emergencies in relation to communities focus on recovery from rapid onset events like typhoons, storm surges, and floods. However, there is a need to consider the whole spectrum of human mobility considering climate change—migrants, returning migrants, temporary evacuation, permanent evacuation, and voluntary and involuntary mobility. Proper reintegration of displaced populations and support for populations needing to migrate due to slow onset events (e.g., chronic physical impacts of climate change) need to be central to climate adaptation priorities. Individuals lose their livelihoods and income sources when they move, and reintegrating them into the workforce can be challenging, especially if their skills do not match local job market demands. Reintegration efforts may face difficulties in ensuring that populations have access to essential services, especially since overcrowding in host communities can strain existing infrastructure and resources.

Lastly, cultural differences and misconceptions often lead to exclusion and marginalization. The Philippines needs to strengthen its proactive planning approach to human mobility and shift away from reactive disaster management and response. There is an opportunity to enhance capacities and design durable solutions to address migration, displacement, and planned relocation.

Climate Change Impacts on Cultural Heritage, Population Displacement, and Migration

Two key considerations center the discussions on climate change impacts on human mobility in the Philippines. First, the increasing frequency and magnitude of climatic impact-drivers will continue to affect migration patterns in the country. Over 15 million Filipinos were estimated to be voluntarily and involuntarily displaced by 245 reported climate disaster events from 2020 to 2022.[265] Displaced populations, including those who have migrated due to slow onset environmental pressures, face the dual challenge of finding new settlements, while contending with unfamiliar surroundings and limited resources. The disruption caused by climate change exacerbates the vulnerability of these populations, compounding their struggle for adequate housing, livelihoods, security, and access to essential services.

Second, the Philippines also home to large indigenous communities spread out across the archipelago. An estimated 14 to 17 million indigenous people belong to 110 different ethnolinguistic groups[266]. These indigenous groups inhabit remote or ecologically sensitive land that are increasingly susceptible to adverse climate events, further exacerbated by environmentally destructive projects.[267] Displacement from their cultural lands significantly impacts their way of life, as land is integral to their cultural identity, livelihoods, spiritual practices, social structures, and traditional knowledge systems. In addition, these communities are more economically vulnerable, with 73% of all IPs belonging to the 40% poorest of the population.[268]

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[265] Internal Displacement Monitoring Centre. (2022). Country Profile: Philippines - Displacement Data [Dataset]. In Disaster Data. https://www.internal-displacement.org/countries/philippines

[266] Legal Rights and Natural Resources Center. (2022). State of Indigenous Peoples Address 2022 Report. Legal Rights and Natural Resources Center - Friends of the Earth Philippines. Retrieved August 14, 2023, from https://www.lrcksk.org/post/sipa-2022-report-launched-half-of-ancestral-domains-found-under-environmental-threat

[267] Previous studies have found that almost half of all Certificate of Ancestral Domain Titles (CADTs) are embroiled in environmentally destructive projects

[268] International Organization for Migration - Philippines. (2021). Framing the Human Narrative of Migration in the Context of Climate Change. In International Organization for Migration

To enact this, adaptation efforts should respect and integrate indigenous traditions, languages, and knowledge systems. Many indigenous groups have deep cultural and spiritual connections to their ancestral lands. As such, ensuring their ownership and control over these lands is a matter of justice and a strategy for sustainable adaptation.

Indigenous communities also possess invaluable traditional ecological knowledge about resource management, passed through generations. This wisdom, which often involves sustainable practices and harmonious coexistence with the environment, should be acknowledged and incorporated into adaptation plans.

Lastly, engaging indigenous leaders and community members in decision-making processes is crucial to ensuring effective and well-received adaptation measures. They should be provided with the resources, training, and support needed to take an active role in designing and implementing their own adaptation strategies.

Climate change poses a significant threat to the well-being of migrants and indigenous peoples. The negative impacts of climate change largely exacerbate current risk conditions for displaced populations, particularly for existing vulnerable populations. The table below highlights some of these negative effects.

Table 4.2.5.1. Impacts of climatic impact-drivers on Cultural Heritage, Population Displacement, and Migration

<table>
<tr><th>Climate Impact-Driver</th><th>Impact on cultural heritage, population displacement and migration</th></tr>
<tr><td>Increased temperature and Drought</td><td rowspan="3">Expected increase of climate refugees
Slow-onset climate events (e.g., rising sea levels) will persistently drive populations away from their settlements, amplifying the need for managed retreat and mobility as an adaptation strategy.
Increased mobility due to extreme heat
Increased temperature can affect the productivity of agricultural land. These circumstances may result in farmers seeking other sources of livelihood in other areas.
Disruption of livelihoods
Loss of sw livelihoods, overcrowded settlements with limited infrastructure and resources can trap displaced populations in a cycle of vulnerability.
Disruption of learning continuity for children
Children who are displaced due to climate change may end up in areas with limited access to quality education facilities and resources, which may affect early learning.
Loss of access to services
Displaced populations often have difficulty in accessing necessities, such as shelter, infrastructure, and social services, exacerbating their vulnerabilities and hindering recovery and resettlement efforts.</td></tr>
<tr><td>Extreme precipitation</td></tr>
<tr><td>Wind patterns and tropical cyclones</td></tr>
</table>

Climate Impact-Driver	Impact on cultural heritage, population displacement and migration
Increased temperature and Drought Extreme precipitation Wind patterns and tropical cyclones	**Potential loss of culture and traditions** Climate-induced displacement can sever ties between populations and their cultural heritage rooted in specific geographic locations including traditional practices, language, rituals, and ways of life. **Increased conflict and instability**[269] Climate-related impacts can exacerbate existing social and political tensions and contribute to instability in vulnerable regions (e.g. BARMM), often through indirect pathways. Populations displaced by a combination of both conflict and the consequences of climate change are extremely unlikely to be able to return home. **Links with trafficking in persons and smuggling of migrants**[270] While climate risks do not in themselves cause trafficking in persons and smuggling of migrants, these can create personal, situational, and contextual conditions that affect migrants, especially women.

Among the various CIDs, wind patterns and tropical cyclones, and pluvial flooding[271] are projected to affect the largest magnitude of populations[272]. In the 2030 decade, an estimated 5.3 million people per year will be exposed to at least one Category 4 or Category 5 cyclone, of which 20% are impoverished populations who have limited resources to resist, adapt, or recover from voluntary or involuntary migration. In the 2050 decade, an estimated six million people per year will be exposed to cyclones, most affected of which include Region V, CAR, and Region II, in terms of percent of population exposed in the region. In terms of absolute number of populations exposed, highly populated regions, including NCR, Region IV-A, and Region III are most impacted in both the 2030 and the 2050 decades.

On the other hand, 4.8 million Filipinos per year are projected to be exposed to pluvial floods. CAR, Region IV-A, Region V, and Region X have ratios of populations most exposed to pluvial floods relative to its regional population. Notably, the largest indigenous groups are mainly concentrated in CAR (33% of IPs). While exposure to climate events does not directly lead to climate-induced migration, recurring exposure to these climate risks increases the occurrence of potential migration.

[269] United Nations Framework Convention on Climate Change (UNFCCC). (2022). Conflict and Climate. UNFCCC. Retrieved September 14, 2023, from https://unfccc.int/blog/conflict-and-climate

[270] United Nations Office on Drugs and Crime (UNODC). (2022). Policy Brief Climate, Crime and Exploitation: The gendered links between climate risk, trafficking in persons and smuggling of migrations. Retrieved September 14, 2023, from https://www.unodc.org/documents/human-trafficking/GLO-ACTII/UNODC_Climate-TIP-SOM_Policy_Paper.pdf.

[271] Pluvial, fluvial and extreme sea level-driven floods are modelled on a 10-year return period, represented by flood heights with a 10% chance of occurring in a year.

[272] Quantitative climate impacts outlined in this chapter are projected based on climate models developed as part of the National Adaptation Plan process. Detailed methodology for climate models per sector can be viewed on Appendix 2 and Appendix 3 – Cultural Heritage, Population Displacement and Migration

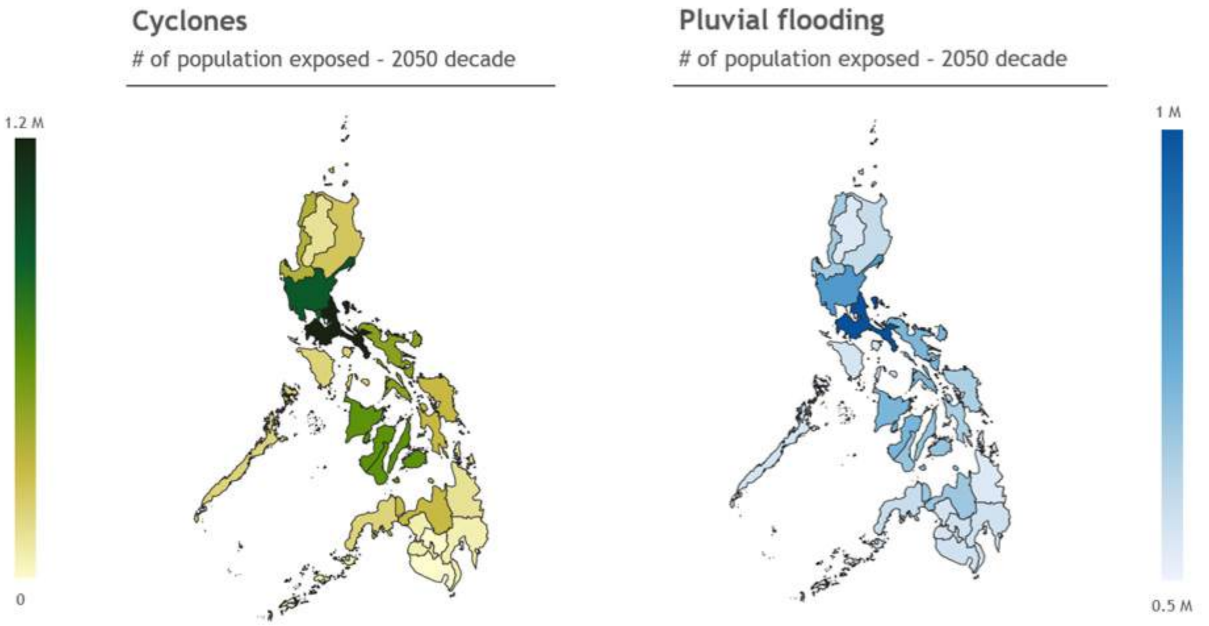


Figure 4.2.5.1. % of populations exposed to cyclones in 2050 decade and % of populations exposed to pluvial flooding in 2050 decade

Migration due to slow onset climate events such as sea level rise is also a key climate risk that will impact this sector. In the 2030 decade, an estimated 150,000 Filipinos may be exposed to sea level rise annually. In the 2050 decade, this increases to an estimated 425,000 Filipinos per year, of which 50% of the populations exposed are from Region III and Region V. Over 150,000 elderly and children are also projected to be exposed to sea level rise, accounting for populations who will have limited ability and/or resources to fend for themselves.

As these populations are exposed to sea level rise and its permanent effects, this may necessitate voluntary or involuntary migration away from their areas of settlement. Various mobility strategies will need to be employed to manage human mobility in light of climate change, considering populations' desire to migrate and their capability to do so.

Notably, among vulnerable population segments, Filipinos below the poverty threshold are projected to be disproportionately exposed to sea level rise, particularly in provinces in Southern Mindanao. Impoverished populations often have fewer social networks and connections that can influence their capability to migrate. This results in either involuntary immobility, where populations may then continue to be exposed to harmful hazards, or forced mobility, where reintegration efforts may be constrained by their limited financial resources. Inclusive policies, social safety nets, education and skill development programs, and community engagement initiatives are crucial to ensure successful reintegration and reduce the socio-economic disparities that the poor face.

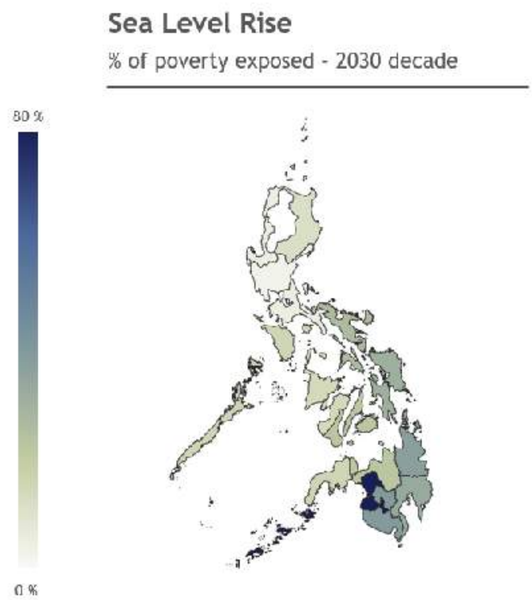


Figure 4.2.5.2. % of impoverished exposed among exposed populations in 2030 decade

Priority Adaptation Outcomes for Cultural Heritage, Population Displacement, and Migration

With expectations of increased climate-induced human mobility[273], the adaptation theme for Cultural Heritage, Population Displacement, and Migration is **Safeguarding Communities & Culture: Durable Solutions for Climate-Induced Mobility.**

Three priority outcomes underpin this strategy:

1. **Provision of adaptive physical, social, economic, and gender-responsive support to populations displaced by sudden climate events.** This outcome focuses on ensuring displaced populations regardless of if voluntary or involuntary, have access to mechanisms that protect their physical, social, and economic welfare. This includes access to temporary shelter and/or safe sustainable permanent housing options, basic services, and temporary/long-term employment opportunities. Displaced populations must deem relocation areas that are conducive for living.
2. **Robust preparatory and reintegration support for populations impacted by slow onset climate events.** This outcome focuses on providing psychosocial and sufficient preparatory aid to communities affected by gradual onset climate events. Ensuring mental well-being and readiness to cope with long-term environmental changes is critical, especially for populations who migrate involuntarily from their areas of settlement. Focus needs to be given to vulnerable segments such as children, women, persons with disabilities, and the elderly to ensure support for reintegration into new communities.
3. **Preservation, protection, and rehabilitation of cultural heritage amidst climate risks.** This outcome focuses on deploying proactive measures to preserve and protect cultural heritage to safeguard important aspects of Filipino history and identity. This includes the protection of not only the physical cultural heritage sites, but also considers the unique circumstances of indigenous peoples and their ties to their ancestral land.

Priority Adaptation Strategies for Cultural Heritage, Population Displacement and Migration

Outcome 1: Provision of adaptive physical, social, and economic support to populations displaced by sudden climate events

Implementing Lead agency:
NDRMMC, DSWD, DHSUD, DENR

Supporting agencies:
OCD, DILG, NHA, DTI, Commission on Population & Development, PCW, National Council on Disability Affairs, National Commission of Senior Citizens

Indicative Key Strategies	Brief Description	Implementation Priority	Capital-Intensiveness
Provide adequate social facilities and programs in resettlement areas	Organize gender-responsive community events and programs aimed towards inclusion and protection of displaced individuals within their new communities, as well as the creation of social facilities in resettlement areas (e.g., day care centers, recreational spaces, etc.).	Immediate (0-3 years)	High

[273] Refer to Appendix 3 – Cultural Heritage, Population Displacement and Migration to see list of policies and programs referenced as part of the NAP process

Strengthen recovery coordination between the public sector, community volunteers, CSOs/NGOs, and the private sector.	Strengthen NDRRMC and other multi-stakeholder task forces that facilitate regular communication, information sharing, and joint planning among the public sector, CSOs/ NGOs, and the private sector to identify resource gaps and streamline recovery strategies.	Immediate (0-3 years)	Medium
Develop incentive mechanisms to encourage climate-resilient shelter design and construction.	Upgrade new and available shelters using locally available, sustainable materials and techniques, elevated in flood-prone areas, integrated with renewable energy sources and rainwater harvesting systems.	Immediate (0-3 years)	High
Provide temporary subsidies for necessity support.	Widen distribution and reach of food stamps, rations, emergency food distribution, education, and healthcare subsidies.	Immediate (0-3 years)	High
Capacitate regional offices to roll out Post-Disaster Shelter Recovery Policy Framework to LGUs.	Implement action plans along dimensions of the policy framework, including institutional arrangements, shelter recovery practices, shelter recovery planning, shelter recovery financing, and shelter recovery implementation, with direct focus on the most vulnerable segments—women, elderly, youth, and persons with disabilities.	Immediate (0-3 years)	High
Introduce a variety of local sources of livelihood in the locality.	Coordinate with nearby communities to identify open economic opportunities for resettled communities to tap into.	Medium-term (3-6 years)	High
Build resilient social enterprises through public-private partnerships.	Create programs that will enable displaced communities to set up or contribute social enterprises (e.g., green solutions/products) through public-private partnerships.	Medium-term (3-6 years)	Medium

Broaden access to local financing and lending facilities.	Ensure that displaced communities have access to financing and lending facilities to support their relocation.	Medium-term (3-6 years)	Medium
Scale partnerships with NGOs and train local healthcare providers, licensed social workers, and emergency responders.	Establish joint programs to deliver services and programs to address the psychological and social needs of individuals and communities who have been forcibly displaced or relocated.	Medium-term (3-6 years)	High

Outcome 2: Robust preparatory and reintegration support for populations impacted by slow onset climate events

Implementing Lead agency:
NDRMMC, DSWD, DHSUD, DOLE

Supporting agencies:
OCD, DILG, NHA, Commission on Population & Development, DENR

Indicative Key Strategies	Brief Description	Implementation Priority	Capital-Intensiveness
Define national policy framework on climate-induced migration to ensure social protection.	Determine national policy and framework to assess, support, and reintegrate climate refugees and other migrants affected by climate change, with a focus on activating social preparation methods for return or resettlement into new areas.	Immediate (0-3 years)	High
Scale targeted community education programs to increase awareness on climate risks.	Establish comprehensive early warning systems to monitor and predict slow onset climate events and combine with targeted community education programs to increase awareness about the potential impacts.	Immediate (0-3 years)	Medium
Strengthen capacities on safe evacuation and disaster response	Enhance skills and readiness of individuals and communities to effectively carry out safe evacuation procedures and respond to disasters.	Immediate (0-3 years)	Medium
Facilitate mechanisms for community-based adaptation planning	Facilitate participatory adaptation planning at the community level by collaborating with locals to identify specific vulnerabilities and design context-specific strategies.	Medium-term (3-6 years)	Medium

Outcome 3: Preservation, protection, and rehabilitation of cultural heritage amidst climate risks

Implementing Lead agency:
NCIP, NCAA,
National Historical Commission of the Philippines

Supporting agencies:
DoH, DepEd, DSWD, DILG, DHSUD, DENR, DFA-UNACOM

Indicative Key Strategies	Brief Description	Implementation Priority	Capital-Intensiveness
Assess vulnerability of cultural heritage sites to climate risks.	Conduct thorough assessments of cultural heritage sites, including detailed vulnerability maps, to pinpoint high-risk areas and prioritize preservation efforts.	Immediate (0-3 years)	Medium
Integrate indigenous knowledge into climate risk assessments.	Collaborate with indigenous communities to integrate traditional ecological knowledge, such as local climate patterns, adaptive practices, and sustainable resource management, into climate risk assessments.	Immediate (0-3 years)	Medium
Develop and deploy culture-specific disaster preparedness.	Develop disaster preparedness programs, especially for indigenous communities impacted by climate change, that incorporate cultural values, practices, and community roles.	Medium-term (3-6 years)	Medium
Activate community-led monitoring and protection.	Empower indigenous communities to actively monitor and protect their heritage sites and ancestral land.	Medium-term (3-6 years)	Medium
Develop culturally sensitive capacity-building programs to ensure job security of traditional workers.	Create capacity-building programs tailored to the cultural context of traditional workers for new green jobs, aiming to secure their employment and livelihoods while protecting informal traditional livelihoods, where possible.	Long-term (6+ years)	High

4.2.6 Land Use and Human Settlements

Overview of Land Use and Human Settlements in the Philippines

Land use and human settlements play a vital role in the development and sustainability of the Philippines.[274] From an economic perspective, the sector has far-reaching impacts on national prosperity and economic growth. Proper land use planning and settlement development reduces transportation costs and increases productivity, while sustainable land use practices can enhance agricultural productivity and support rural livelihoods. Moreover, well-planned human settlements can improve housing affordability, increase property values, and stimulate tourism, thus increasing revenue streams for local economies and the country.

From a social standpoint, effective land use and well-planned human settlements contribute to improved quality of life for Filipinos. Properly designed urban and rural spaces can enhance community cohesion, provide access to essential services, and promote a sense of belonging. Decent infrastructure promotes social inclusion by providing housing for low-income families and marginalized communities. Additionally, thoughtfully managed land use can help preserve cultural heritage and protect natural ecosystems.

Today, this sector faces a myriad of challenges relating to capacity, land use, access to shelter and services, connectivity, equity and justice, and informality. For example, land use planning operates in a complex environment of mandates between various government agencies. Furthermore, land use planning functions are carried out at different levels of the Philippine administrative hierarchy, and there are challenges to capacitating land use planning at local government levels.

In parallel, human settlements[275] are overburdened by rapid urbanization, with urban populations growing by 12% from 2015 to 2020[276]. Rapid urbanization has contributed to increasing informal settlements in hazard-prone areas, increasing by 5.4%, with an estimated 1.3 million informal settlers in Metro Manila alone[277] living in informal housing. Further, the pandemic has highlighted and compounded existing inefficiencies, inequities, and injustices in our settlement systems and placed setbacks in a challenging path to sustainability.

Climate Change Impacts on Land Use and Human Settlements

There are two unique reasons why the Philippines' land use and human settlements are indisputably vulnerable to climate change. First, given the Philippines' archipelagic geography, 60% of Philippine cities are along the coast. As climate events become more frequent and increase in intensity, those living in the country's coastal areas and low-lying regions, home to an estimated 5.4 million people, are especially susceptible to these hazards.[278]

Second, rapid urbanization has contributed to divergences to planned land use and increased informal settlements in hazard-prone areas. An estimated 2.45 million impoverished Filipinos live in informal settlements, with ~40% concentrated within NCR[279]. This means that future climate events disproportionately impact vulnerable populations, who have limited ability to withstand and recover from climate disasters.

[274] Aligned with the Philippine Development Plan 2023-2028 and Resilient and Green Human Settlements Framework

[275] In line with the Resilient and Green Human Settlements Framework, human settlements are viewed as a system comprised of physical, natural, and social elements

[276] Philippine Statistics Authority. (2022). Urban Population of the Philippines (2020 Census of Population and Housing). Retrieved August 10, 2023, from https://psa.gov.ph/content/urban-population-philippines-2020-census-population-and-housing.

[277] UNESCO, UNDP, IOM, & UN-Habitat. (n.d.). Policy Briefs on Internal Migration in Southeast Asia: Overview of Internal Migration in Philippines. In bangkok.unesco.org.

[278] Climate Central. (n.d.). Coastal Risk Screening Tool [Software]. https://coastal.climatecentral.org

[279] Navarro, A. M., Reyes, C. M., & Francisco, K. A. (2021). UN Common Country Assessment Update for the Philippines. https://pidswebs.pids.gov.ph/.

Escalating climate change directly jeopardizes land and human settlements. For example, extreme sea levels such as storm surges are becoming more severe due to climate change, resulting in the inundation and flooding of coastal cities, settlements, and infrastructure. Floods damage infrastructure, disrupt transportation networks, and affect land use patterns. Beyond sea level rise and extreme sea levels, the table below highlights the negative effects of other CIDs on this sector.

Table 4.2.6.1 Impacts of climatic impact-drivers on Land Use and Human Settlements

Climate Impact-Driver	Impact on cultural heritage, population displacement and migration
Sea level rise and extreme sea levels	**Inundation of land and human settlements** Extreme sea levels caused by storm surges and typhoons are becoming more severe due to climate change, resulting in the inundation and flooding of coastal cities, settlements, and infrastructure. **Infrastructure damage** Flooding from sea level rise damages critical infrastructure, including roads, bridges, and buildings. Apart from residential infrastructure, coastal facilities like ports and airports are susceptible to the effects of rising sea levels and severe maritime events.
Extreme precipitation	**Damaged human settlements and non-connectivity due to flooding and landslides** Intense rainfall events loosen earth structure and increase the risk of landslides and soil erosion, especially in mountainous and hilly regions. This threatens both land (agricultural land) and infrastructure.
Wind patterns and tropical cyclones	**Damaged human settlements** Cyclones and extreme winds often lead to mass displacement as homes and communities are destroyed. The affected population is forced to relocate, putting pressure on available resources and infrastructure in safer areas. Additionally, displaced populations often face compromised health due to limited access to clean water, sanitation, and medical services while also experiencing heightened mental health challenges stemming from trauma, loss, and the stress of displacement. **Infrastructure damage** Cyclones and extreme winds can cause substantial damage to infrastructure, including buildings, roads, bridges, and power lines.

Among the various CIDs, sea level rise is among the key climate risks that threaten land use and human settlements.[280] As sea levels rise, existing infrastructure, properties, and ecosystems become permanently inundated, disrupting urban development, and necessitating costly adaptations. By 2040, a projected 160 km^2 of land will be permanently inundated by sea level rise, with more than 30% of land in the National Capital Region at risk. Region III will see the most landcover exposed at 45 km^2. It may disproportionately impact coastal areas in Luzon, such as Bulacan and Pampanga, where there is land subsidence due to groundwater activity. This translates to an estimated 85,000 residential homes inundated by rising sea levels, many of which unaccounted for are informal settlements and coastal communities. Annualized damage of residential infrastructure could potentially reach PHP7 billion in damages per year due to sea level rise.

Rising sea levels may also permanently inundate significant land areas in other regions. By 2060, a projected total of 380 km^2 of land across the country will be impacted, more than double compared to two decades before. Regions III, IX, VI, and VIII will each see an increase of more than 20 km^2 of land permanently inundated by rising sea levels versus 2040.

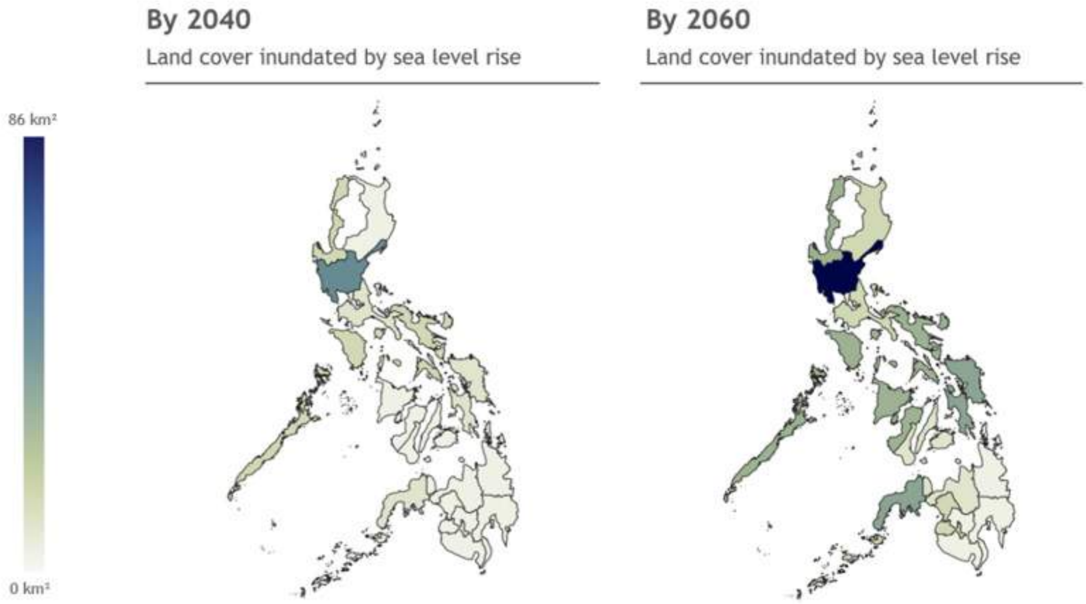


Figure 4.2.6.1 Projected inundated land cover (km^2) due to sea level rise by 2040 and by 2060

Wind patterns and tropical cyclones and pluvial flooding are also among the climatic impact-drivers that may threaten land use and human settlements. More than 80% of land (180,000 km^2) is projected to be exposed to at least one Category 4 or Category 5 tropical cyclone in both the 2030 decade and 2050 decade, particularly in the north and east where there is more cyclone activity. Among most cyclone-prone regions, more than 90% of closed forests in Region II and Region VII are projected to be exposed. In Region V, more than 90% of grassland is also projected to be exposed to cyclones.

[280] Quantitative climate impacts outlined in this chapter are projected based on climate models developed as part of the National Adaptation Plan process. Detailed methodology for climate models per sector can be viewed on Appendix 2 – Land Use and Human Settlements

[281] Pluvial, fluvial and extreme sea level-driven floods are modelled on a 10-year return period, represented by flood heights with a 10% chance of occurring in a year

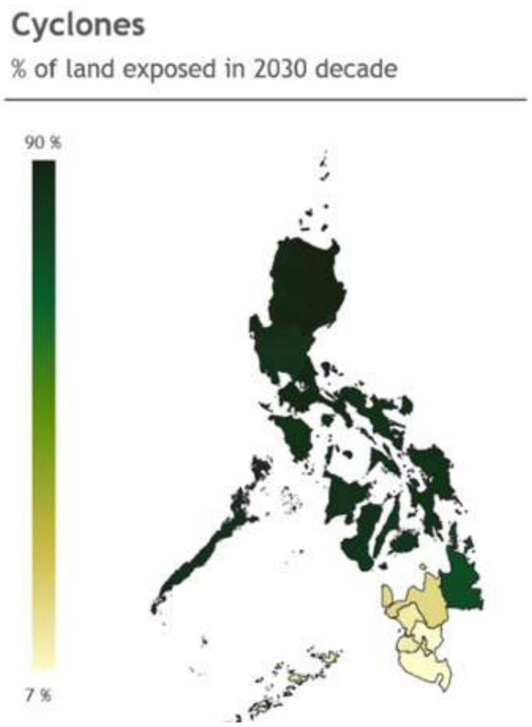
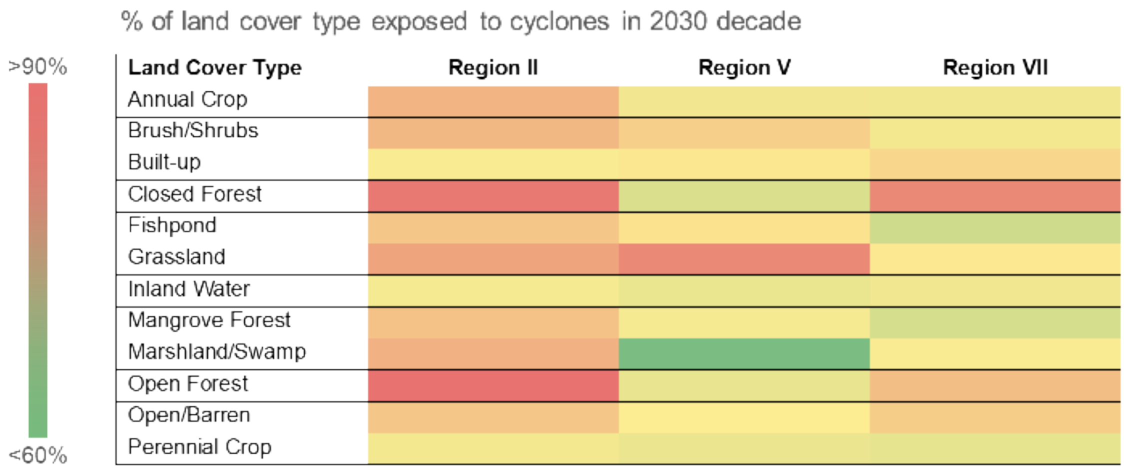


Figure 4.2.6.2 % of land cover exposed to wind patterns and tropical cyclones in 2030 decade (left)

Figure 4.2.6.3 Heatmap of land cover types exposed to wind patterns and tropical cyclones in 2030 decade for select cyclone-prone regions (below)



Additionally, more than 55% of land is projected to be exposed to pluvial flooding in the 2030 decade, impacting about 170,000 km^2 of land. Particularly exposed regions are projected to include CAR (74%), Region II (67%), Region IV-A (66%), and Region V (66%). Areas in Luzon may also experience the most pluvial flooding due to inadequate drainage systems to meet the projected precipitation. An estimated 11 million residential homes will be exposed to pluvial flooding in this decade, particularly in CAR, where 70% of residential assets are projected to be exposed.

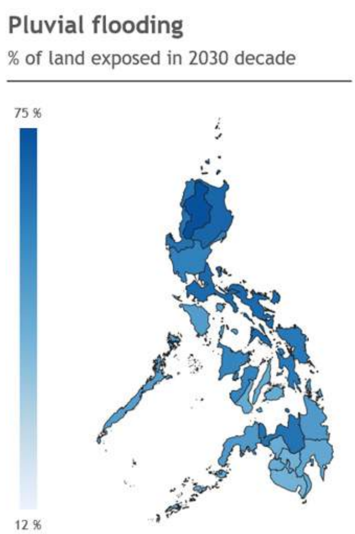


Figure 4.2.6.4 % of land cover exposed to pluvial flooding in 2030 decade

Extreme sea levels are also among the most damaging to human settlements. While fewer residential homes are vulnerable to extreme sea levels compared to other climatic impact-drivers, the magnitude of damage caused by flooding is notably higher. In 2030, PHP67 billion of annualized damage to residential assets is projected due to extreme sea levels.

Exposure of land and human settlements to these climatic impact-drivers may risk widespread destruction, infrastructure damage, and displacement of communities. Looking at residential assets, an estimated PHP225 billion in annual damage is projected from exposure to various climate risks. Consequently, the unpredictability of these occurrences presents heightened difficulties for local government land use planners in adhering to pre-existing plans, as they can undermine land suitability for a specific purpose.

When considering priority adaptation solutions for the sector, actions must be taken to protect the most vulnerable populations—low-income communities residing along coastlines, informal settlements, persons with disabilities and indigenous peoples. Action must be taken to include economically disadvantaged populations residing in areas prone to flooding, cyclones, and other climate-related hazards due to limited housing options and inadequate infrastructure. Additionally, indigenous communities have strong cultural ties to specific land areas, making it critical to engage them in conversations to build long-term resilience. Critical actions must address equity concerns by prioritizing these communities in resilience strategies.

Priority Adaptation Outcomes for Land Use and Human Settlements

Grounded on national policy anchors and existing programs related to this sector[282], the adaptation theme for **Land Use and Human Settlements is Data-Driven Land Use & Settlements: Conventionalizing Robust, Evidence-Based Planning.**

Three (3) priority outcomes underpin this sector:

1. **Data-driven, climate-focused land use, and urban planning.** This outcome focuses on activating collaborative and interconnected risk-based planning and monitoring of land use across vertical and horizontal administrative areas. To enable this, the build-up of climate data at local levels is critical. Enabling access to dependable data will empower local land use and urban planning professionals. They will be able to proactively plan to enhance the resilience of existing settlements with effective solutions, while clearly understanding the most affected areas and events.
2. **Adaptive capacities of communities improved, and resilient, inclusive, decent, and affordable human settlements achieved.** This outcome focuses on empowering and safeguarding vulnerable and disadvantaged populations by increasing the participation of local leaders, women, youth, and other marginalized sectors to participate in resiliency-building programs. However, for these sectors to be involved in these interventions, it is necessary for national and local actors to provide communities with revitalized housing programs and access to basic services for their own resilience.
3. **Transformative and gender-responsive multi-level climate governance activated.** This outcome focuses on ensuring sufficient capacity and capability for climate action at all levels. Beyond capacitating the adaptation agenda, this outcome aims towards activating a coordinated, participatory, gender-responsive, and inclusive governance of climate priorities in relation to land use and settlement planning. This means providing avenues for voices of disadvantaged populations to partake in shaping and implementing adaptation solutions.

[282] Refer to Appendix 3 – Land Use and Human Settlements to see list of policies and programs referenced as part of the NAP process

Priority Adaptation Strategies for Land Use and Human Settlements

Outcome 1: Data-driven, climate-focused land use and urban planning

Implementing Lead agency:
DHSUD, DOST

Supporting agencies:
DILG, NEDA, DENR, NAMRIA, CCC

Indicative Key Strategies	Brief Description	Implementation Priority	Capital-Intensiveness
Ensure access to comprehensible, open, and shared climate information	Develop an accessible, interoperable, and centralized database of climate information for settlement planning, starting with providing policy support to capacitate LGUs, academe, and other contributors to share and access climate data (e.g., GHG emissions, biodiversity assessments and geohazard assessments).	Immediate (0-3 years)	High
Enhance capacity development efforts and funding for LGUs to develop local climate assessments (e.g., Climate and disaster risk assessment)	Deepen understanding and technical capacity of LGUs to be able to develop their CDRAs through necessary tools and platforms (digital, non-digital) and simplified guides to tie to national climate action plans.	Immediate (0-3 years)	High
Enhance capacity support to LGUs to mainstream CDRA into local Comprehensive Land Use Plans (CLUPs)	Simplify guides and increase engagement with LGUs to determine implications of CDRA to local land use plans (e.g., priority decision areas based on risk evaluation, policy interventions / options with emphasis on Risk Management options, analysis of land supply and suitability-based climate change, and possible impacts on the severity and frequency of natural hazards).	Medium-term (3-6 years)	High

Mainstream nature-based solutions and resilience-focused urban planning and design	Mainstream nature-based solutions and resilience-focused urban planning and design	Medium-term (3-6 years)	Medium
Accelerate implementation of current policies in relation to land use and urban planning and climate risks (e.g., National Spatial Strategies, National Climate Risk Management Framework)	Implement programs under the NSS and NCRMF for improved population and urban planning, including the establishment of a database system for all human settlement assets and capital, bridging gaps in climate risk information, tools, and methodologies, and accelerating climate risk evaluation at local levels.	Long-term (6+ years)	Medium

Outcome 2: Increased adaptive capacities of communities towards resilience and achieved resilient, inclusive, decent, and affordable human settlements

Implementing Lead agency:
DHSUD, DILG

Supporting agencies:
DOF, DENR, DOST, DOH, DPWH, DOTR, CCC

Indicative Key Strategies	Brief Description	Implementation Priority	Capital-Intensiveness
Review and revise existing guidelines (e.g., Green Building Code, Batas Pambansa 220, PD 957) to improve standards and incorporate green and resilient technologies	Incentivize green and circular economy principles in housing programs and housing value chains at all levels (national, local, homeowner associates) while updating the relevant guidelines to incorporate gender-responsive and climate and disaster-resilient strategies.	Immediate (0-3 years)	Medium
Ensure inclusivity and strengthen reliability of early warning systems and resilience of infrastructure in relation to hazardous climate events	Ensure systems and infrastructure (i.e., communications) are resilience-proofed to withstand climate hazards, especially for communities living in geographically isolated areas.	Medium-term (3-6 years)	High

Strengthen the capacity of stakeholders to understand, decide, and act on warning messages and forecasts	Adopt a needs-based approach in providing capacity training and development for community participation in relation to hazardous climate events.	Medium-term (3-6 years)	Medium
Knowledge building on sustainable community and housing design and community-based disaster preparedness	Conduct training and capacity building activities to build knowledge on green and sustainable housing design and community-based protection, particularly around CCA-DRR, (e.g., biomimicry in urban design).	Medium-term (3-6 years)	Medium

Outcome 3: Activated transformative and gender-responsive multi-level climate governance

Implementing Lead agency:
DHSUD, DILG, DOF

Supporting agencies:
NEDA, DICT, Philippine Space Agency, DOST, DPWH, DOTR, CCC, CHED, Higher Academic Institutions

Indicative Key Strategies	Brief Description	Implementation Priority	Capital-Intensiveness
Strengthen inter-LGU collaboration and inclusive participatory planning	Facilitate best practice sharing among LGUs, particularly utilizing LGUs that have already successfully implemented climate programs as resources for other LGUs.	Immediate (0-3 years)	Medium
Establish formal coordination platforms between local universities and state colleges for climate action	Establish linkages with local universities and state colleges that can provide access to localized data and research and/or provide capability support to land use and urban planning.	Immediate (0-3 years)	High
Establish formal PPP mechanisms and platforms	Encourage PPPs and cross-sector collaboration in the creation, review, and update of local land use plans and urban settlement planning.	Medium-term (3-6 years)	Medium
Increase access to PSF and other climate finance	Increase access to local and international climate finance, in particular, investments for social preparation and capacity building for stakeholder groups.	Medium-term (3-6 years)	Medium

4.2.7 Livelihoods and Industries

Overview of Livelihoods and Industries in the Philippines

Livelihoods and Industries is a key pillar to the sustainable economic and social development of the Philippines. In the context of the NAP, livelihoods and industries refers to key economic sectors and the employment associated with these key sectors. The Philippines envisions a revitalized industries sector, with focus on expanding the domestic market and supplier base, moving up the value chain, and enhancing linkages across sectors. For services, the Philippines envisions a shift from its current low productivity level to become a modern, productive, and resilient global leader providing higher value-adding and differentiated services[283]. From an economic perspective, industries and services provide a significant portion of employment opportunities for Filipinos. Provided that a large portion of the population relies on informal and low- to medium-skilled work, strengthening resilience in this sector can lead to sustainable employment opportunities and income generation, especially in less developed areas in the country.

From a social perspective, diversified industries can contribute to community resilience and social stability. More importantly, in line with the Philippines' focus to improve accessibility of micro, small, and medium enterprises (MSMEs) to a dynamic science, technology, and innovation ecosystem, supporting local entrepreneurs fosters a culture of innovation and encourages social mobility.

Today, industries and services continue to recover from COVID-19 slowdowns[284]. In the first half of 2022, economic recovery has become more broad-based as many industry sub-sectors have surpassed pre-pandemic performance. As a result, employment has also rebounded given the sustained economic momentum. However, certain challenges continue to face this sector. For example, despite many businesses turning to digital tools over the pandemic, manufacturing businesses continue to have low technology utilization, due to high cost of technologies, lack of infrastructure, absence of skilled employees, and lack of management knowledge. These challenges will equally underlie future efforts for climate adaptation.

Within services, which includes tourism and professional services, the sector continues to be dominated by low-paying jobs concentrated in low-skills domestic services. Constraints to increasing productivity include lack of access to reliable and advanced information and communications technology (ICT) infrastructure, lack of access to markets and capital, and mismatch in skills and lack of skilled talent for niche job roles. Ultimately, businesses will be challenged to consider climate resilience in their plans as resources will focus on recovery and immediate growth.

Climate Change Impacts on Livelihoods and Industries

Two key considerations are focal to the discussions on climate change impacts on Livelihoods and Industries. First, resilience in key industries in the Philippines must be built to protect the country's economic and social stability amidst increasing climate hazards. Focus must be placed on climate adaptation priorities, to protect key industries that contribute heavily to our GDP[285], particularly, Manufacturing (17.2%), Tourism (6.2%) and Professional Services (6.1%)[286]. In this regard, we protect livelihoods of over 12 million Filipinos[287] who rely on these industries.

[283] Refer to Appendix 3 – Land Use and Human Settlements to see list of policies and programs referenced as part of the NAP process

[284] National Economic and Development Authority. (2023). Philippine Development Plan 2023-2028. In National Economic and Development Authority. Retrieved August 14, 2023, from https://pdp.neda.gov.ph/philippine-development-plan-2023-2028/

[285] Agriculture is also a key industry contributing 9% of Philippine GDP, and is covered as a separate priority sector under the National Adaptation Plan

[286] Labor Force Survey. (2023). [Dataset]. Philippine Statistics Authority. https://psa.gov.ph/statistics/labor-force-survey

[287] 2021 MSME Statistics. (2021). [Dataset] Department of Trade and Industry. https://www.dti.gov.ph/resources/msme-statistics/

Second, more than 95% of establishments in the Philippines are MSMEs[288]. MSMEs often operate with limited financial and technical resources compared to larger corporations, and as such have fewer capacities to invest in climate-resilient infrastructure, technology, and adaptation measures. In addition, many MSMEs rely heavily on informal labor with limited access to social protection, making them more susceptible to income losses during climate-related disruptions. Therefore, it will be critical for adaptation priorities to equip MSMEs with the proper resources and regulatory support to be able to plan for climate resilience.

Climate change has wide-ranging impacts on key industries, in turn impacting livelihoods of Filipinos. For example, in the manufacturing sector, critical industry infrastructure can be inundated or damaged by extreme weather events, leading to disruptions in production and supply chains. As a result, economic losses and decreased manufacturing output will occur.

The tourism sector, which is a major source of employment, is vulnerable to sea-level rise and changing weather patterns, impacting coastal communities that rely heavily on tourism-related activities for their livelihoods. Increased temperatures can also impact tourism workers, who are disproportionately exposed to outdoor environments.

In the professional services sector, waterlogged areas from extreme rainfall and tropical storms can cause temporary closures, impacting temporary or permanent loss of livelihoods for service workers.

The table below highlights some of these negative impacts:

Table 4.2.7.1. Impacts of climatic impact-drivers on Livelihoods & Industries

Climate Impact-Driver	Impact on cultural heritage, population displacement and migration
Sea level rise and extreme sea levels	**Inundated industry enablers and infrastructure** Manufacturing facilities located in coastal areas are at risk of damage from storm surges, flooding, and coastal erosion. Disruptions in production and supply chains can result in economic losses and decreased manufacturing output. Climate hazards damage infrastructure that services, such as hospitality, retail, and transportation, are reliant upon. For example, sea level rise contributes to the erosion of coastlines and loss of beaches, which are significant attractions for tourists. This reduces the appeal and competitiveness of coastal destinations, impacting tourism revenue. **Loss of livelihood** As a result of these events, Filipinos relying on these industry activities may lose their homes, access to livelihoods, and cultural ties to their land. Vulnerable communities are particularly at risk due to lesser social mobility and limited ability to recover.

[288] 2021 MSME Statistics. (2021). [Dataset] Department of Trade and Industry. https://www.dti.gov.ph/resources/msme-statistics/

Increased temperature and droughts	**Reduced productivity across industries** For manufacturing, higher temperatures increase the demand for cooling[289], resulting in increased energy consumption and operational costs for manufacturing facilities. Research suggests that, on average, a one degree increase in ambient temperature can result in a 0.5 to 8.5% increase in electricity demand[290]. Within services, particularly tourism, higher temperatures can lead to heat-related health issues, impacting the well-being of workers and affecting productivity.
Extreme precipitation Wind patterns and tropical cyclones	**Damaged industry enablers and infrastructure, reduced incomes** Heavy rains and flooding can disrupt transportation routes, causing delays and interruptions in the delivery of raw materials and finished goods, disrupting supply chain, and affecting manufacturing operations. Waterlogged areas from extreme rainfall and tropical storms can result in temporary closures or reduced customer traffic for businesses in the service sector. Restaurants, hotels, and retail establishments in flood-prone areas experience reduced customers and disruptions in operations.

Increased temperatures and droughts are projected to impact labor productivity in these key sectors[291,292]. PHP36 billion in productivity losses is projected for the manufacturing industry while an additional PHP2 billion in productivity losses is projected for professional services resulting from extreme heat in the 2030 decade. Within manufacturing, labor productivity in Region IV-A, Region III, and NCR will be most impacted. This correlation is aligned provided majority of manufacturing activities are concentrated within these regions. Meanwhile, within professional services, labor productivity in NCR and Region VII will be most impacted.

[289] Cooling through creation of green spaces or other nature-based solutions as opposed to airconditioning

[290] World Bank Group & Asian Development Bank. (2021). Climate Risk Country Profile - Philippines. In World Bank. Retrieved August 14, 2023, from https://climateknowledgeportal.worldbank.org/.

[291] Labor productivity losses for tourism has not been quantified as workers are subsumed across various industries (e.g., wholesale & retail trade, agriculture, forestry and fishery, real estate activities, etc.). It is worth noting that many workers in the tourism industry, especially in nature tourism, are exposed to extreme heat due to the outdoor nature of work.

[292] Quantitative climate impacts outlined in this chapter are projected based on climate models developed as part of the National Adaptation Plan process. Detailed methodology for climate models per sector can be viewed on Appendix 2 and Appendix 3—Livelihood and Industries

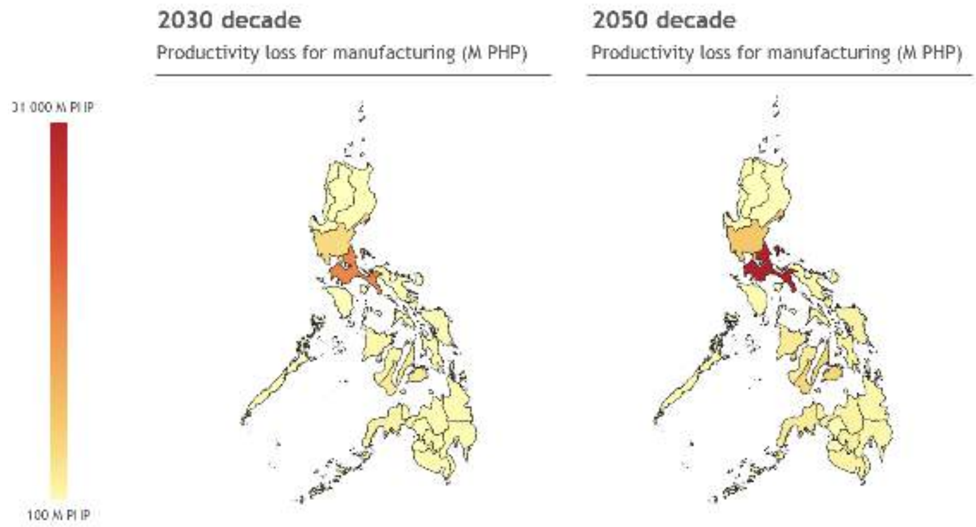


Figure 4.2.7.1 Value of labor productivity loss per region in the 2030 decade and 2050 decade for Manufacturing

In the 2050 decade, productivity losses for manufacturing and professional services can reach, in one region alone, as high as PHP31 billion (e.g. Region IV-A) and PHP2.5 billion (e.g. NCR), respectively. Like in the 2030 decade, industry hubs are projected to be most impacted.

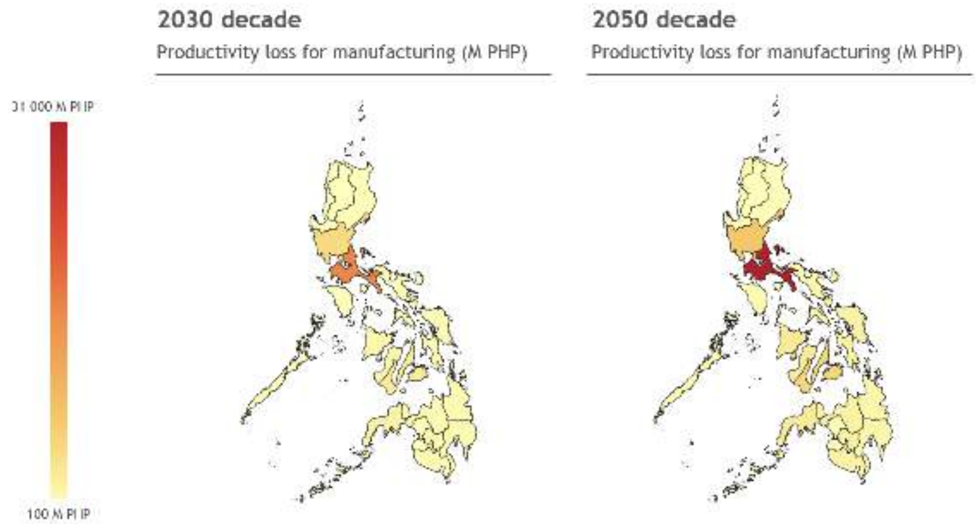


Figure 4.2.7.2 Value of labor productivity loss per region in the 2030 decade and 2050 decade for Professional Services

Among the various CIDs, exposure to wind patterns and tropical cyclones is among the key climate risks that threaten critical infrastructure across key industries[293]. Overall, 5% of key industry infrastructure is projected to be exposed to at least one Category 4 or Category 5 cyclone in the decade of 2030.

Within the national context, the total exposure of industry infrastructure is attributed significantly to exposure of infrastructure in Region IV-A (25%), Region III (18%), and the National Capital Region (13%), owing to the concentration of industry hubs in these areas. Annualized damage of infrastructure could potentially reach PHP22 billion in damages per year due to cyclones and extreme winds.

[293] Socioeconomic impact modelling considers select points of interest for key industries: Manufacturing: Warehouses and factories; Tourism: Hotels, restaurants, tourism spots and religion spots; Professional services: Banks, commercial buildings, and offices

Of the projected damages per year, PHP16 billion is attributed to damages to professional services infrastructure, while PHP4.5 billion is attributed to damages to manufacturing infrastructure. Although most manufacturing and professional services infrastructure is constructed to endure powerful winds and heavy rainfall, prolonged exposure to such occurrences can gradually erode their resilience. Furthermore, it is imperative to consider the facilities owned by micro, small, and medium enterprises (MSMEs) within these industries. These enterprises often face greater challenges in terms of repairing and recuperating from such damages.

In addition, exposure of manufacturing infrastructure (6%) and professional services infrastructure (5%) to cyclones and extreme winds can result in significant and wide-ranging impacts on both operational efficiency and economic stability. Beyond physical damage, production and supply chain disruptions, equipment loss, and workforce disruption also threaten the stability of this sector.

Adaptation plans must also exercise vigilance concerning tourism infrastructure (5%), as it often exhibits a heightened degree of fragility compared to other infrastructure. Many tourist destinations are characterized by their ecological and natural attributes, rendering them inherently susceptible and prone to vulnerabilities. Figure 4.2.7.3 shows a region by region view of the extent of cyclone exposure for industry-related infrastructure, in number of infrastructure exposed.

Figure 4.2.7.3 Exposed points of interest across various industries in the 2030 decade

Beyond damage to industry infrastructure and consequent disruptions in operations, it is imperative to consider the impact to livelihoods and well-being of Filipino workers. The continuity of industries is intrinsically linked to the stability of employment opportunities, income streams, and social support systems that sustain the workforce. The ripple effects of disrupted operations can extend to families, communities, and the broader economy, underlining the significance of safeguarding not only industrial assets but also the economic security and dignity of the labor force.

Priority Adaptation Outcomes for Livelihoods and Industries

In line with the Philippines' long-term vision to revitalize industry and reinvigorate services[294], the adaptation theme for **Livelihoods & Industries is Embrace Resilience: Fortifying Industry for Economic Prosperity.**

Three priority outcomes underpin this strategy:

1. **Key industry infrastructure and production facilities protected.** This outcome focuses on implementing comprehensive risk assessments to identify potential vulnerabilities across critical industry-related infrastructure. Protection of these key infrastructures ensures the continuity and resilience of essential industries that underpin the Philippine economy.
2. **Due diligence to occupational safety and hazard regulations and social protections enhanced for workers in the formal and informal economy.** This outcome focuses on enacting adaptive strategies to safeguard workers' well-being and livelihoods from the impacts of climate-related hazards. Reviewing worker practices and regulations should especially focus on MSME workers who may not have the resources to resist and adapt to climate-related risks. Where there are co-benefits between mitigation and adaptation, consideration of opportunities for green jobs is also a focus area.
3. **Continuity of industry operations and productivity sustained amidst climate risks.** This outcome focuses on ensuring business continuity and safeguarding operations (e.g., supply chains) from the impacts of climate-related hazards, especially for MSMEs. Second-level effects of climate hazards are expected, including susceptibility of supply chains to climate-related disruptions, which in turn may lead to revenue losses and reduced production outputs.

Priority Adaptation Strategies for Livelihoods and Industries

Outcome 1: Key industry infrastructure and production facilities protected

Implementing Lead agency: DTI, DoT

Supporting agencies: DPWH, NEDA, DILG, DENR

Indicative Key Strategies	Brief Description	Implementation Priority	Capital-Intensiveness
Standardize assessment of climate risks across key industry infrastructure.	Provide industry players with a suite of tools (e.g., clear guidelines and requirements, access to climate impact data, etc.) to partake in climate risk assessments to identify potential climate risks on end-to-end value chain; capacity building needed to support MSMEs.	Immediate (0-3 years)	Medium

[294] Refer to Appendix 3 – Livelihoods and Industries to see list of policies and programs referenced as part of the NAP process

Broaden roll-out of incentivization programs to reinforce critical infrastructure at risk.	Widen reach of incentive mechanisms that encourage private sector to include climate de-risking as part of their business priorities; ensure provision of support mechanisms for MSMEs.	Immediate (0-3 years)	High
Mainstream use of climate-resilient design and nature-based solutions, where possible, among industry players.	Reinforce infrastructure with climate-resilient design, including nature-based solutions in compliance with environmental laws to mitigate the impacts of climate hazards and ensure continuity of operations.	Medium-term (3-6 years)	High
Activate and widen access to funding sources for public and private sector to invest in green infrastructure.	Enhance access to climate finance mechanisms, such as climate funds, grants, loans, and sustainable finance, to support climate adaptation initiatives across industries.	Medium-term (3-6 years)	High

Outcome 2: Due diligence in occupational safety and hazard regulations and worker social protections enhanced for climate-resilience of workers in the formal and informal economy.

Implementing Lead agency:
DOLE, DTI

Supporting agencies:
TESDA, NEDA, DepEd, CHED

Indicative Key Strategies	Brief Description	Implementation Priority	Capital-Intensiveness
Develop sector-specific guidelines for treatment and handling of workers in relation to climate change.	Foster partnerships between government bodies, industry associations, and private enterprises to review regulations to protect workers from climate-related risks, such as worker safety during extreme weather events, and develop industry-specific guidelines for the protection of workers.	Immediate (0-3 years)	Medium
Incorporate climate resiliency topics into organizational learning programs and academic curriculums.	Integrate climate resilience topics into organizational learning programs and trade / vocational curriculums to educate workers on protection against climate hazards in the workplace.	Medium-term (3-6 years)	Medium

Enhance capacity building and training of climate-resilient skills (e.g., programs under National Green Jobs Human Resources Development Plan).	Provide training and capacity-building programs to enhance the knowledge and skills of workers on climate-resilient practices, including reskilling workers from industries phased out due to climate change.	Medium-term (3-6 years)	High
Ensure funding and capacity to activate social protection for impacted workers (e.g., DOLE DILEEP).	Implement programs to provide support and assistance to individuals who may experience job loss or economic disruptions due to climate-related impacts or the transition to a climate-resilient economy.	Medium-term (3-6 years)	High

Outcome 3: Industry operations and productivity continity amidst climate risks is sustained.

Implementing Lead agency: DTI

Supporting agencies: DOLE, NEDA

Indicative Key Strategies	Brief Description	Implementation Priority	Capital-Intensiveness
Scale awareness programs to educate industries on best-practice adaptation strategies.	Educate industries on best-fit adaptation strategies (e.g., specific to industry context) to deepen understanding of climate change impacts.	Immediate (0-3 years)	Medium
Require adaptation planning among private sector businesses, including continuity planning and disaster response plans.	Mandate adaptation plan development to assess and address climate risks, supported by clear guidelines and access to climate data for decision-making.	Immediate (0-3 years)	Medium
Create avenues to allow for value chain integration and market linkages for small scale producers.	Create nationwide programs to support diversification and redundancy in supply chains to minimize the risk of disruptions caused by climate-related events, particularly through involving MSMEs.	Medium term (3-6 years)	High
Create incentives for private investment in nature-based solutions.	Create formal incentive platforms supported by strengthened policies and simplified mechanisms for private sector access, to encourage adoption of nature-based adaptation solutions.	Medium term (3-6 years)	High

4.2.8 Energy, Transport, and Communications

Overview of Energy, Transport, and Communications Infrastructure Systems in the Philippines

Critical services such as Energy, Transport, and Communications systems, which make up the remaining key physical infrastructure[295] in IPCC AR6, are vital components to enabling socioeconomic development, highlighted by their inclusion within the Philippine Development Plan (2023-2028). These infrastructures are drivers of economic growth—ensuring the efficient, uninterrupted operation across industries, while enabling the production, distribution, and consumption of goods and services.

Energy systems propel residential, commercial, industrial, transport, agricultural, and forestry sectors to provide channels for the movement of goods and human resources, and communications systems enable transfer of information and services, which in turn facilitates trade and investment activities. Socially, access to a reliable source of energy uplifts the quality of life of communities by providing access to a wide array of services for well-being, such as lighting, cooking, and cooling. Accessible transport infrastructure enhances connectivity across the country, connecting rural areas to urban centers and improving access to basic services, such as education, healthcare, and markets. Communication unlocks many of the same services as transportation, and goes beyond, enabling virtual access to key systems and services.

This sector presently faces a myriad of challenges that impedes secure and reliable access to across the Philippines. The rapid growth of the Philippine population alongside the expansion of demand per capita for services related to Energy, Transport, and Communications infrastructure systems has contributed to issues with capacity across all three infrastructure systems.

Within energy, this can be seen through the fact that 5% percent of Filipino households still live without electricity[296], pointing towards a network lacking in breadth. Compounding this is the expectation for national electricity consumption in 2040 to nearly quadruple from 2019 numbers according to AmBisyon Natin 2040, while the Malampaya gas reserve, which supplies almost a third of electricity in Luzon, is facing impending depletion[297]. Within transport, the mobility of many Filipinos is hindered by the inadequacy of transportation facilities—inefficient, inconvenient transit systems, and poor last mile connectivity discourage private motorists from utilizing public mass transportation, while many of the Philippines' rail systems are operating in a state of overcapacity today, according to ADB[298]. Communications systems are no exception to this—currently the nation has 164 towers per one million people, one of the lowest ratios in the region. An additional 60,000 towers on top of the current 27,000 are expected to be required by 2031 for unserved and underserved communities[299].

Challenges exist on the institutional plane as well, with outdated policies and program implementation challenges hindering the improvement of the sector's situation. The lack of available data also hinders execution—for example, there is limited transport-related data, largely driven by a lack of regular survey and data collection initiatives, that has caused difficulty in the implementation of the National Transport Policy[300].

[295] Other key physical infrastructure – water & sanitation, waste, built form, are covered in other sectors in this NAP & NCCAP
[296] Department of Energy. (2022). 2021 Philippine Energy Situationer
[297] National Economic and Development Authority. (2016). AmBisyon Natin 2040
[298] ADB. (2021). Accessibility Analysis of the South Commuter Railway Project of the Philippines
[299] ADB (2022). ADB, Tiger Infrastructure Sign $40 Million Loan to Support Rural Connectivity in Southern Philippines
[300] National Economic and Development Authority. (2022). Philippine Development Plan 2023-2028

Climate Change Impacts on Energy, Transport, and Communication Infrastructure Systems

Climate change will further exacerbate vulnerabilities within the Energy, Transport, and Communications sector, as it impacts both the infrastructure of these services and influence the demand profile for services across these systems.

Energy, Transport, and Communications infrastructure are inherently vulnerable to climate hazards, but poor construction and placement in vulnerable areas exacerbates this further. According to the ND-GAIN index[301], the Philippines is among the top tercile of countries in terms of infrastructure vulnerability to climate change, and for transportation, the WEF ranked the Philippines' road, seaport, airport, and railroad infrastructure quality amongst the bottom quintile globally[302]. The results of this vulnerability have been witnessed time and time again historically, such as during Typhoon Odette in 2021, where in over a third of seaports were put out of operations and access to communication services was hampered across multiple municipalities for six weeks, disrupting supply chains, logistics, while hampering disaster relief and recovery operations[303].

Rising temperature, coupled with the growing population and digitalization is expected to influence demand across Energy, Transport, and Communications services—additionally, increased temperature will likely lead to less efficient hardware systems. This is particularly true for Energy systems, evidenced by past incidences such as the 2019 heatwave, which caused shortages due to reduced cooling capacity of the Calaca Coal-fired power plant[304], or the 2015 El Niño event, which reduced hydroelectric power output and necessitating the implementation of power rationing[305].

If left unattended, intensifying climate change will continue to negatively impact Energy, Transport, and Communications infrastructure. For example, extreme events such as storm surges, typhoons, and floods are projected to become more severe due to climate change, resulting in the inundation of infrastructure from sea level rise or damage from flooding or landslides, likely leading to disruptions in service provision. Increased temperature and drought are expected to influence the demand profile for services provided by these systems, while potentially reducing efficiency of infrastructure. Beyond these impacts, the table below outlines the adverse effects of different CIDs across the Energy, Transport, and Communications sector.

Table 4.2.7.1. Impacts of climatic impact-drivers on Livelihoods & Industries

Climate Impact-Driver	Impact on cultural heritage, population displacement and migration
Increased temperature and Drought	**Less efficient systems and vulnerable infrastructure** Higher temperatures lead to increased demand for cooling, both across consumers and for critical infrastructure themselves, such as in powerplants and data centers, which puts pressure on electricity supply. This results in higher energy consumption during heatwaves and can strain the power grid. Additionally, the increased demand for cooling from infrastructure itself, coupled with the availability of cooling water potentially decreasing, may reduce the efficiency and performance of power plants and data centers. This can result in reduced output or the need for operational adjustments.

[301] The University of Notre Dame Global Adaptation Initiative (2022). Notre Dame, United States. Available at: https://gain.nd.edu/our-work/country-index/

[302] World Economic Forum, Global Alliance for Trade Facilitation. (2016). The Global Enabling Trade Report 2016

[303] National Economic and Development Authority. (2016). AmBisyon Natin 2040

[304] National Economic and Development Authority. (2022). Philippine Development Plan 2023-2028

[305] Teves, C. (2019). El Niño can force Mindanao power rationing. Philippine News Agency

Increased temperature and Drought	**Damaged infrastructure and disrupted service** Increased temperature can cause transmission lines to expand, sag, or overload due to increased electrical resistance. These constraints can lead to power disruptions and impact the reliability of electricity supply. Increased temperature also poses significant risks to the transport infrastructure sector in the Philippines, particularly in terms of road surfaces, railway tracks, and airport operations. High temperatures can cause thermal expansion of pavement materials, resulting in pavement deformations and cracks. Moreover, extreme heat can affect railway tracks, causing buckling and disruptions in train services.
Sea level rise and extreme sea levels	**Damaged infrastructure and disrupted services** Rising sea levels raise the risk of coastal flooding, which can damage or inundate critical infrastructure such as fossil fuels facilities (e.g., oil refineries, oil depos/terminals, fuel stations including natural gas processing plants and coal mines), power plants, substations, and transmission and distribution lines within energy, coastal roads, bridges, and seaports within transportation, and towers, cables, and base equipment for communications. This damage could result in the disruption of services, especially if infrastructure impacted is a critical node within network. In addition, as sea levels rise, saline water can infiltrate freshwater sources and aquifers, threatening the water supply needed for thermal power plant operations. Saltwater intrusion can corrode equipment and compromise the efficiency of cooling systems, leading to operational challenges.
Extreme precipitation	**Damaged infrastructure and disrupted services** Extreme precipitation events pose a substantial risk across Energy, Transport, and Communications infrastructure systems in the Philippines, particularly through the occurrence of floods, landslides, and associated damages. These events can lead to road closures, bridge collapses, flooding of substations, ducts, cabinets, and cables, potentially leading to the disruption of services.
Wind patterns and tropical cyclones	**Damaged infrastructure and disrupted services** Wind patterns and tropical cyclones can cause extensive damage to across energy, transport, and communications infrastructure systems, including transmission lines, distribution networks, substations, and turbines within Energy; roads, bridges, ports, and airports for Transport; and aerial components of Communications network such as poles, exposed wires and cables, towers, and masts. Damage to these can lead to disruptions in services.

Priority Adaptation Outcomes for Energy, Transport, and Communications

Grounded on national policies and existing programs related to this sector[307], the adaptation theme for Energy, Transport, and Communication is **Protect Critical Infrastructure Systems: Secure and Sustain Access and Connectivity**

Three priority outcomes underpin this strategy:

1. **Outcome 1: Comprehensive planning and response mechanisms established across energy, transport, and communication infrastructure systems.** This outcome focuses on building structural and geographic resilience into infrastructure systems aligned with policies and planning procedures, while implementing monitoring and response mechanisms to minimize disruptions. To achieve this outcome, regular baselining and data collection exercises must be performed to inform policies, and sufficient government support must be provided for initiatives.
2. **Sufficient capacity of energy, transport, and communication infrastructure systems to provide goods and services to meet evolving demand induced by climate change.** This outcome focuses on addressing changing demands for critical infrastructure services caused by climate change through scaled up and diversified networks and systems. To attain this outcome, existing networks must be bolstered, and alternative systems should be explored to aid in de-risking communities' access to the services provided by these infrastructure systems.

Prioritizing adaptation strategies that ensure resilient, sufficient, and sustainable energy, transport, and communication infrastructure will not only ensure the security and sustainability of the services stemming these infrastructure systems, but also an improvement in the qualities of life across the country's population. Resiliency must be embedded across the whole planning, construction, and response processes of these infrastructure systems, while applying regional and hazard specific lenses to trends identified through climate analytics models to ensure the secure distribution and access across all subsectors.

[307] Refer to Appendix 3 – Energy, Transport, and Communications to see list of policies and programs referenced as part of the NAP process

Priority Adaptation Strategies for Energy, Transport, and Communications

Outcome 1: Comprehensive planning and response mechanisms established across energy, transport, and communication infrastructure systems.

Implementing Lead agencies:
DOE, DPWH, DOTr, DICT

Supporting agencies:
DOST, DENR, DILG, NCIP

Indicative Key Strategies	Brief Description	Implementation Priority	Capital-Intensiveness
Upgrade engineering design codes for critical infrastructure.	Updating engineering design codes and standards for critical infrastructure to account for climate change impacts	Immediate (0-3 years)	Medium
Regulate and enforce critical infrastructure standards based on land zoning and risk assessment.	Implementing and improving building codes and land use regulations such as the National Land Use Act and National Building Code, informed by thorough risk assessments, to ensure that vital infrastructure is strategically located and designed to withstand natural hazards	Immediate (0-3 years)	Medium
Incorporate climate risk into planning of roadways and transportation hubs	Strategic determination of efficient road routes and optimal locations for transportation hubs considering climate risks alongside regular factors	Immediate (0-3 years)	High
Integrate energy infrastructure planning and site selection.	Ensure new energy infrastructure situated in best suited areas based in shifting climate patterns, building upon the Philippine Energy Resiliency Policy, and the National Energy Contingency Plan	Immediate (0-3 years)	Medium
Climate-proof critical infrastructure	Implementing green and grey flood/ landslide protection measures, and wind-proofing elevated infrastructure transportation infrastructure, supporting initiatives such as the Asset Preservation Program of DPWH, or the Energy Resiliency Policy of DOE	Medium-term (3-6 years)	High

Outcome 2: Sufficient capacity of energy, transport, and communication infrastructure systems to provide goods and services to meet evolving demand induced by climate change.

Implementing Lead agencies: DOE, DPWH, DOTr, DICT

Supporting agencies: DOST, DENR, NCIP

Indicative Key Strategies		Brief Description	Implementation Priority	Capital-Intensiveness
Energy	Perform R&D to understand energy flow accounts.	Referencing natural capital accounts, energy flow accounts can provide indicators on energy efficiency in terms of the flows of energy inputs to the economy, flows of energy within the economy, and flows to the environment as residuals.	Immediate (0-3 years)	Medium
	Install infrastructure to ensure continuous energy supply to remote and vulnerable areas.	Energy storage systems, microgrid, natural gas generators strategically distributed across vulnerable areas and communities, supporting the Energy Resiliency Policy and the National Energy Contingency Plan	Immediate (0-3 years)	High
	Enforce policies to encourage alternative energy sources and energy efficiency.	Enforcing alternative energy sources for suppliers, and energy efficiency regulations for consumers, leveraging items such as the Energy Efficiency and Conservation Act, as well as the Feed-in Tariff System which incentivizes investors and developers to put up renewable energy projects	Immediate (0-3 years)	High
	Encourage and facilitate investment in smart grids.	Intelligent electrical grids allowing efficient energy distribution, real-time monitoring and response to climate-related disruptions	Medium-term (3-6 years)	High

Transport	Improve infrastructure to enhance inclusivity of alternative transport systems.	Implementing alternative transportation infrastructure improvement projects such as expanded and improved bike lane systems, pedestrian walkways, railway systems, building on policies such as the Philippine Bicycle Act	Immediate (0-3 years)	High
	Incentivize new technologies and design innovations within public and private transport	Encouraging intelligent transportation systems, electronic vehicles, etc., to avoid overdependence on a single source, by strengthening initiatives such as the Republic Act (RA) 11697 or the Electric Vehicle Industry Development Act which seeks to develop the Philippine electric vehicle (EV) industry via mechanisms such as tax incentives	Medium-term (3-6 years)	High
	Invest in mass transport and transit-oriented development.	Directing investments towards the improvement and expansion of mass transport networks and promoting transit-oriented development, expanding on existing programs such as KATUPARAN or the Kalsada Tungo sa Paliparan, Riles at Daungan Program	Medium-term (3-6 years)	High
Communications	Augment communication infrastructure to strengthen digital connectivity.	Expanding both conventional infrastructure (fixed broadband, fiber, mobile networks) as well as alternative sources of digital connectivity, such as broadband satellites to meet general demand while providing access to remote communities	Medium-term (3-6 years)	High

Bangui Wind Farm, Bangui, Ilocos Norte

05 NAP Implementation

5. NAP Implementation

The NAP implementation framework, as shown in Figure 5.1.1, is guided by international frameworks, guidelines, and adaptation platforms. These include the Cancun Adaptation Framework, UNFCCC guidelines, and NAP Global Network, and the Philippines' unique national circumstances, overall policy environment, and in-country process on adaptation planning, investment programming, implementation, and monitoring and evaluation.

The NAP implementation framework follows a dynamic cycle with three phases—planning, implementation, and monitoring evaluation, accountability, and learning—and is supported by key cross-cutting enablers, which have been adapted from the NAP Global Network and lessons learned from international NAPs and expert inputs.

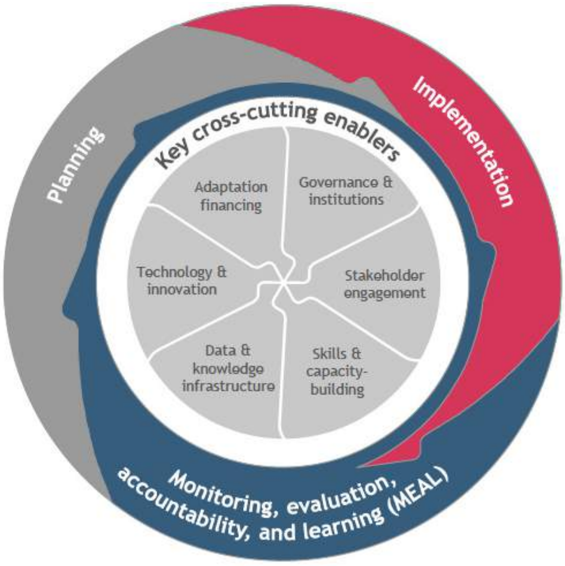


Figure 5.1.1. NAP implementation framework[308]


San Juanico Bridge

The NAP implementation framework follows five (5) key guiding principles:

1. It is based on international guidelines and local priorities in the strategic framework.
2. It embraces a whole-of-nation approach, fostering collaboration across government and non-government entities, including local communities and diverse demographic groups.
3. It integrates with existing plans, policies, strategies, and mechanisms to prevent redundancy and incorporates adaptation into ongoing initiatives.
4. It calls for regular evidence-based review, rooted in local context and informed by the latest scientific knowledge.
5. It prioritizes a fair transition and inclusivity.

This chapter of the NAP document assesses the current state of key enablers, proposes enhancements, and outlines next steps. It presents a roadmap for adaptation and enabling action plans, including lead agencies and timelines. Finally, it offers an overview of developing a comprehensive NAP MEAL strategy, drawing from national and global frameworks.

[308] Based mainly on NAP process map from the NAP global network and key lessons synthesized from UNFCCC guidelines, Cancun Adaptation Framework, and the Philippines' national circumstances

5.1 Key cross-cutting enablers

The NAP implementation framework is supported by six key cross-cutting enablers:

1. Governance and Institutions
2. Stakeholder Engagement
3. Skills and Capacity-Building
4. Data and Knowledge Infrastructure
5. Technology and Innovation
6. Adaptation financing

These key enablers are crucial for effective planning, implementation and monitoring, evaluation, accountability, and learning for the NAP. Each key enabler section covers the following topics:

1. **Definition and purpose** – A concise description and underscores the significance of each enabler within the context of the NAP.
2. **Key success factors** – The vision of the NAP for each enabler, drawing from international guidelines and good practices.
3. **Starting point** – Summary of the current state in the Philippines, encompassing vital issues and areas with potential for improvement for each enabler.
4. **Action plan** – Outline of actions proposed to operationalize the NAP. It is important to acknowledge that these action plans are subject to potential iterations over time as key learnings and innovations are captured.

5.1.1 Enabler 1: Governance and institutions

Definition and Purpose

> Governance and institutions refer to strategic measures and arrangements to enable government-level coordination and adaptation integration into development processes.

Governance and institutions have a key role in driving effective coordination, collaboration, and implementation of the NAP across various government entities and stakeholders. Additionally, improved governance will underpin the country's collective effort to ensure long-term climate and disaster resilience and accelerate efforts to achieve the Philippines' long-term vision as stated in Ambisyon Natin 2040.

A well-coordinated and streamlined multi-level governance can more effectively address the needs of stakeholders. Local government units, in particular, are well-positioned to address the specific issues and vulnerabilities of their respective constituents because of their knowledge and experience with the local communities.

At the highest levels of governance, clear and concise goals and processes ease the implementation of the NAP. At the lower levels of governance, context-specific and tailor-fit solutions enhance the effectiveness of the NAP in their respective areas.

Key success factors

To fully operationalize the NAP, there are four key success factors under the governance and institutions enabler.

1. Well-defined roles and responsibilities to strengthen sense of ownership, commitment, and advocacy to adaptation present across government entities, especially for leaders.
2. Shared clear vision and objectives among government entities.
3. Adaptation lens integrated across government roles, responsibilities, and operations.
4. Institutional arrangements marked by resilient horizontal and vertical coordination are firmly established, while local government units (LGUs) are seamlessly integrated, empowered, and actively engaged in every facet of the NAP process.

Starting point

The Philippine government has consistently undertaken proactive measures to tackle climate change impacts at the national, local, and sectoral levels, as seen in Figure 5.1.1.1. This reflects a dedicated, country-wide approach encompassing both mitigation and adaptation efforts.

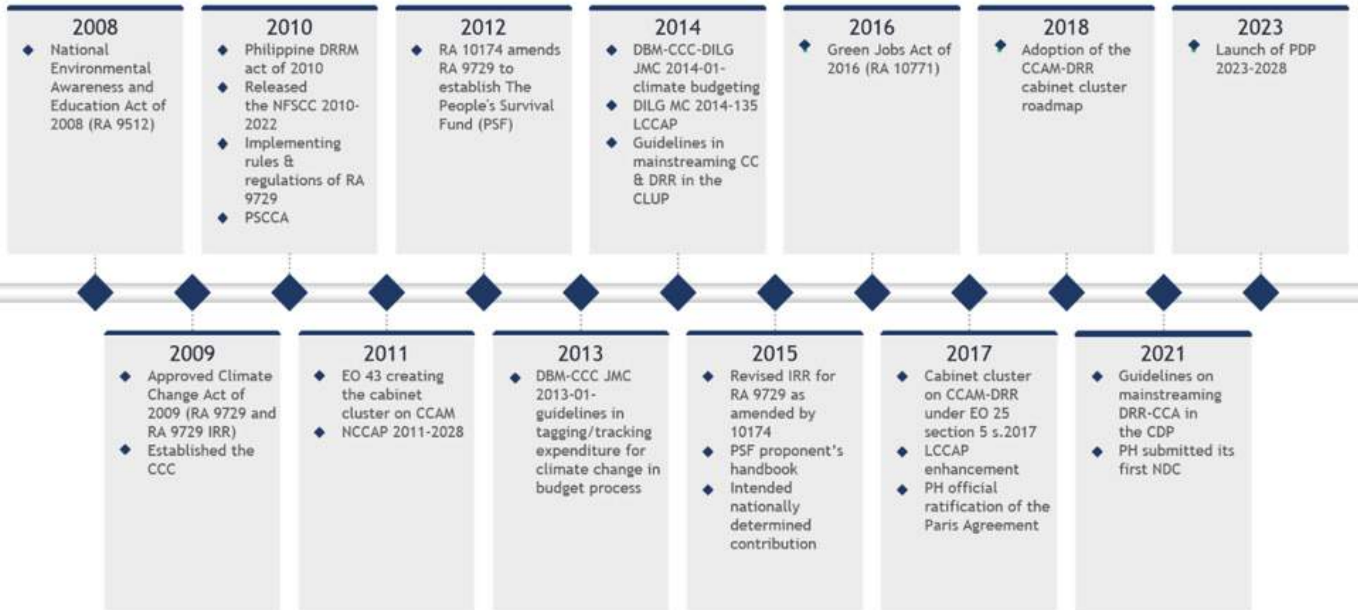


Figure 5.1.1.1 Public policies and programs on climate change adaptation[309]

[309] RA–Republic Act, DRRM–Disaster Risk Reduction and Management, NFSCC–National Framework Strategy on Climate Change, CCAM–Climate Change Adaptation and Mitigation, DBM–Department of Budget and Management, CCC–Climate Change Commission, JMC–Joint Memorandum Circular, PSF–Peoples' Survival Fund, DILG–Department of Interior and Local Government, MC–Memorandum Circular, LCCAP–Local Climate Change Action Plan, CC–Climate Change, DRR–Disaster Risk Reduction, CLUP–Comprehensive Land Use Plan, EO-Executive Order, DRR-CCA–Disaster Risk Reduction & Climate Change Adaptation, PDP–Philippine Development Plan, CDP–Comprehensive Development Plan, NDC– Nationally Determined Contributions.

Roles & responsibilities of government entities in climate change agenda today

Several government entities have a role to play in the NAP process (see table in Chapter 5 Appendix). The Climate Change Commission (CCC) takes the lead in coordinating, monitoring, and evaluating climate change-related activities. Executive departments and select national agencies are responsible for integrating adaptation within their respective disciplines. Local government units also play a crucial role by contributing localized knowledge and implementing adaptation actions. This interplay across and along government levels (i.e., horizontal, and vertical coordination) necessitates robust coordination mechanisms to be put in place to operationalize the NAP, foster cross-learning, and realize synergies.

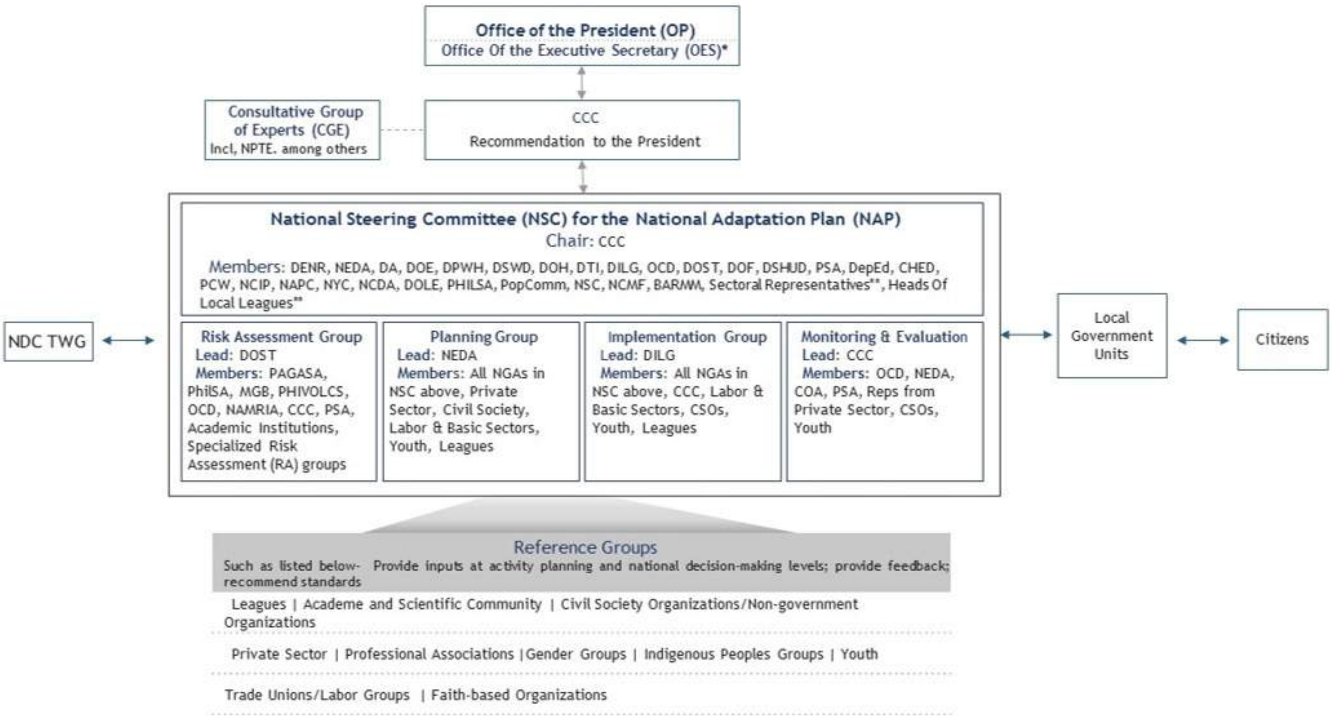

United Nations Framework Convention on Climate Change Conference

Relevant climate change-related policies, plans and strategy

Multiple climate change plans and strategies are currently in place (see table in Chapter 5 Appendix). However, the presence of overlapping policies, plans, and strategies necessitates an urgent assessment and streamlining process to avoid disputes and ensure efficient implementation of the NAP.

Current institutional arrangement of the NAP

To kickstart the NAP process, the Philippines has created the National Steering Committee for the National Adaptation Plan (NAP-NSC) under the leadership of the Climate Change Commission (CCC). However, to institutionalize the NAP process, the Philippines still needs to define an optimal governance structure. Figure 5.1.1.2 illustrates the current institutional arrangements for the NAP in the Philippines.



* Pursuant to Executive Order no. 11, series of 2022
** Pursuant to RA 9729, as amended by RA 10174

Figure 5.1.1.2 Current institutional arrangements on the NAP

Action plan

To enable strong governance and institutions for adaptation in the long-term, the government of the Philippines is committed to the actions listed in Table 5.1.1.1.

Table 5.1.1.1 Governance and institutions list of actions

No.	Overview of actions	Timeline[310]
GI 1	**Define national level governing structure and coordinating mechanism for NAP implementation that is integrated and aligned with existing adaptation mechanisms:** Clearly define overall permanent governance mechanism to facilitate the NAP after NAP-NSC by: 1. Assigning a high-level entity to provide policy advice and decision-making. 2. Assigning a technical working group for projects, investments, and technical matters. 3. Assigning other key focal entities such as data office, finance focal point, sector-specific climate change adaptation focal points, representatives from vulnerable communities, etc. More clearly demarcate and detail roles and responsibilities of government units and institutions to avoid disputes and gaps (e.g., clear assignment of data and analytics roles and handoffs between CCC, DOST PAGASA, etc.) Establish coordination mechanisms to harmonize entities, foster synergies, prevent duplication, and strengthen cross-sectoral convergence in alignment with the PDP 2023-2028 (e.g., establishing working sessions between DILG, DOST, and NEDA to translate plans into local implementation actions) Conduct thorough stocktaking of existing plans, policies, and strategies to align the NAP with ongoing efforts and decomplexify climate change efforts (e.g., establishing the linkages between the NAP and other frameworks and plans such as NFSCC and NCCAP)	Immediate (0-3 years)
GI 2	**Define horizontal (sectoral) and vertical (LGU) integration strategy:** Strongly embed sectoral entities and LGUs, leagues, and regional development councils in permanent institutional arrangement to strengthen cross-sectoral convergence and enable adaptation localization, cross-LGU collaboration, and alignment of LGU priorities with national and sectoral priorities	Immediate (0-3 years)
GI 3	**Mainstream climate change adaptation into other policies and plans:** Integrate adaptation and resilience considerations into national planning and enact policy reforms that encompass provisions aligned with climate change adaptation and resilience. This entails undertaking a comprehensive assessment and streamlining of existing plans, policies, and strategies.(e.g., Integrate resilience measures into existing Green Building Code)	Medium term (3-6 years)

[310] Immediate – needs to be done earliest as possible to lay the foundation for other activities; medium-term – important activities unlocked / can be done after establishing foundational activities

GI 5	**Create comprehensive risk management approach:** Develop and implement a comprehensive risk management approach to reduce intersecting vulnerabilities and address complexities in managing compounding and cascading risks posed by climate change across sectors as highlighted in the PDP 2023-2028.	Medium term (3-6 years)
GI 6	**Develop NAP governance and institutions assessment tools to enhance adaptation enforcement:** Develop appropriate assessment tools such as environmental valuation methodology to inform adaptation enforcement, decision-making, policy development, research and development, payment and incentive mechanisms, and other climate change-related endeavors. Additionally, establish a long-standing repository of climate-related goals and activities to ensure continuity amidst changing governance/leadership, including a method to hold units accountable despite leadership changes.	Medium term (3-6 years)

Conclusion

In conclusion, governance and institutions are pivotal in enabling the NAP process by establishing ownership, collaboration mechanisms, and linkages with existing plans, policies, and strategies. To drive this process, the Philippines has established the NAP-NSC to streamline and operationalize the NAP; however, this is an interim version and will be revised immediately. To push a more streamlined climate change agenda, the Philippines will identify the best governance mechanism that involves one high-level entity (e.g., CCAM-DRR or CCAB) and a streamlined technical working group for climate change. By enhancing governance and institutions, the Philippines aims to seamlessly integrate adaptation into its national blueprint, ensuring resilience and a sustainable future.

5.1.2 Enabler 2: Stakeholder engagement

Definition and Purpose

> Stakeholder engagement refers to socially inclusive efforts to engage key actors (local, national, and international communities) to operationalize the NAP process.

Stakeholder engagement plays a pivotal role in achieving climate equity among vulnerable groups, fostering collaboration, enabling cross-learning based on differing experiences and perspectives, and optimizing synergies among diverse autonomous groups in the Philippines, each with unique yet complementary strengths.

1. The private sector brings substantial industry experience, a network of national and international partners, and development financial institutions that could leverage adaptation finance and investments.
2. Civil society organization bring perspectives from the different groups in civil society. Their specialized knowledge in their respective fields and experience with grassroots efforts make their collaboration with the government invaluable in mobilizing collective efforts.
3. Academia and research institutions provide technical expertise, technical assistance, technological innovations, and knowledge on the best available science.
4. Local community organizations possess in-depth localized understanding and established relationships, working alongside community members who offer vital first-hand insights.
5. The international community brings in expertise, external opportunities, and a wealth of other key learnings.

6. Vulnerable groups, including women and girls, children, youth, indigenous peoples, local communities, differently abled, senior citizens, MSMEs, academia, civil society, and the private sector provide essential perspectives and solutions for equitable adaptation outcomes, recognizing the importance of multi-generational engagement, particularly with the youth, to foster awareness, advocacy, and understanding in climate change adaptation.
7. Gender-focused organizations and advocates that work specifically on gender-related aspects of adaptation.
8. Experts or practitioners from varying disciplinary studies enable the development of a novel and inter-disciplinary approach to tackling adaptation.

Key success factors

To fully unlock the value of stakeholder engagement, three key success factors must be met as shown in the table below. These key success factors reflect the end state targeted by the NAP.

1. Embraces inclusivity, collaboration, transparency, and participation across government and non-government entities, guided by a whole-of-the-nation and whole-of-the-planet approach while aligning with locally led adaptation.
2. Special attention is directed towards highly vulnerable groups to guarantee equitable adaptation outcomes and capture diverse and valuable adaptations, insights and solutions.
3. Established roles, responsibilities, and engagement mechanisms for non-government stakeholders, tailored communication based on stakeholder needs, and a focus on meaningful engagement to ensure high-quality participation and effective outcomes.

Starting point

The crafting and implementation of the National Adaptation Plan (NAP) necessitates the incorporation of the gender lens, recognizing the diverse experiences and vulnerabilities that different genders face in the context of climate change. This enables a crucial and valuable perspective in understanding the unique impacts of climate change on women, girls, and gender minorities, and for devising inclusive strategies that address their specific needs.

Both the PDP 2023-2028 and CCC Resolution No. 2019-002 highlight the need to ensure convergence of gender and climate change, and to strengthen gender-based approaches in the formulation and implementation of all climate change plans, programs and initiatives in the public sector.

When guided by a gender lens, stakeholder engagement within the framework of NAP development becomes more robust and meaningful. Through a multi-stakeholder approach among government agencies, gender-focused organizations and advocates with diverse voices and experiences, including those of women, indigenous communities, and marginalized groups, stakeholders can co-create adaptation strategies that are effective, sustainable, and responsive to varied needs and priorities, while advancing gender equality and social justice.

Currently, there is a need for enhanced coordination and stakeholder engagement in the implementation of existing plans, policies, and strategies in the Philippines.

The voluntary and non-incentivized nature of involvement may result in limited quality of participation of vulnerable groups and communities (e.g., existing policies such as RA 10174 only encourages rather than mandate or incentivize community participation), some of whom may lack sufficient awareness regarding available spaces and platforms for participation. To overcome these challenges, the government of the Philippines will identify key stakeholders, bridge engagement gaps, provide necessary tools and programs, raise awareness, incentivize participation, and establish clear engagement mechanisms throughout the entire NAP process.

Additionally, gender mainstreaming will be done through the existing Gender Equality and Women Empowerment Plan and the Gender and Development (GAD) agenda.

Most recently, the CCC has formed contact groups and networks through its ACCELERATE, ENACT, WE CAN, CONNECT, and ACT LOCAL programs, to further bolster stakeholder engagement (see table in Chapter 5 Appendix for summary of programs).

Action plan

To operationalize effective stakeholder engagements for adaptation, the government of the Philippines is committed to the actions listed in Table 5.1.2.1.

Table 5.1.2.1 Stakeholder engagement list of actions

No.	Overview of actions	Timeline[311]
SE 1	**Identify engagement gaps and opportunities to boost involvement of key stakeholder groups:** 1. Identify who are the key stakeholder groups, particularly different demographic groups needing engagement. 2. Identify pain points and needs of each stakeholder group. 3. Perform a thorough assessment of the current stakeholder roles, responsibilities, contributions, level of participation in adaptation activities, ongoing engagement mechanisms, and coordination mechanisms to pinpoint and rectify significant gaps in stakeholder involvement and collaboration.(e.g., identifying gaps and strategizing involvement of academia, private sector, differently-abled, senior citizens indigenous groups, youth and children, gender groups, vulnerable local communities, etc. in implementing and reviewing the NAP)	Immediate (0-3 years)
SE 2	**Develop inclusive and collaborative engagement strategy tailored for sectoral and local entities to build awareness of the NAP:** 1. Develop a simplified and abbreviated version of the NAP for sectoral and local entities. 2. Strategize to implement existing plans, establishing inclusive arrangements and coordination mechanisms that encompass outreach, input collection, co-development, and co-implementation of adaptation solutions alongside different stakeholders. 3. Test and deploy various communication techniques (e.g., culture-based communications, use of artistic methods to engage, in-person visits etc.) tailored to engage specific stakeholder groups.	Immediate (0-3 years)
SE 3	**Build multi-stakeholder engagement platforms:** Utilize the CIN as a foundation to construct multi-stakeholder platforms and channels that improve communication and transparency among stakeholders. This includes having an effective mechanism for engaging local communities and indigenous people and gathering their input. (e.g., scaling CONNECT, ACCELERATE, ENACT, & WE CAN programs)	Medium term (3-6 years)

[311] Immediate – needs to be done earliest as possible to lay the foundation for other activities; medium-term – important activities unlocked / can be done after establishing foundational activities

No.	Overview of actions	Timeline[311]
SE 4	**Develop long-term network strengthening strategy:** Develop a long-term plan to sustain and enrich engagements with and across each stakeholder group, enabling continuous involvement and cross-sharing. This includes strategic public-private partnerships with local and international players	Medium term (3-6 years)

Conclusion

In conclusion, diverse stakeholder engagement and representation are essential for a comprehensive whole-of-the-nation approach to the NAP in the Philippines. Vulnerable groups possess valuable knowledge and experience. While the government has initiated mechanisms, gaps remain in reaching remote, indigenous, and highly vulnerable communities. To address this, a detailed assessment of stakeholder engagement gaps will be conducted, followed by establishing initial interim arrangements. As the NAP progresses, these arrangements will be enhanced for seamless and regular participation, co-learning, and co-development among stakeholders.

5.1.3 Enabler 3: Skills and capacity building

Definition and Purpose

> Skills and capacity building refers to investments equipping entities with the necessary capabilities to operationalize the NAP effectively and efficiently.

Skills and capacity building plays a pivotal role in facilitating the NAP process. By providing essential knowledge, tools, and a network, it empowers key stakeholders to actively contribute toward achieving the nation's adaptation objectives. This includes imparting data management and analytics skills to local government units, conducting adaptation and climate change awareness programs for highly vulnerable communities, and bolstering technical capacities within Higher Education Institutions (HEIs).

Furthermore, this approach cultivates collaboration among stakeholders with diverse yet complementary skill sets. For example, HEIs, equipped with robust technical expertise, are guiding local government units and vulnerable communities in comprehending climate change science, and implementing effective adaptation strategies. Given that stakeholders vary in their capabilities and needs, a crucial aspect of this approach is to accurately identify key gaps and surpluses in capabilities and capacities across stakeholders. Building a strong partnership network is vital for facilitating the transfer of capabilities.

Key success factors

To fully enable key stakeholders to participate in the NAP process, five key success factors will be taken into consideration as shown in the table below.

1. Comprehensive evaluation and ongoing monitoring of capacity gaps among NAP key stakeholders in place.
2. Inclusive and comprehensive capacity-building programs that leverage technical assistance and strategies customized to each key stakeholder.
3. Sufficient human, institutional, financial, and organizational capacities available to facilitate capacity-building programs among NAP key stakeholders.
4. Key insights, best practices, best available science, new innovations, and localized discoveries captured and shared among NAP stakeholders.
5. Robust partnerships network in place to facilitate capabilities transfer.

Starting point

Taking the lead in developing adequate skills and capacity building mechanisms, the CCC has established some programs, tools, and guidelines to equip key stakeholders responsible for executing each step of the NAP.

Among these programs is the Communities for Resilience (CORE) program established in 2016. The CORE program aims to strengthen the planning and programming capacity of LGUs to kickstart their adaptation activities; strengthen the technical capacities of Higher Education Institutions (HEIs) to mentor and enhance the knowledge of LGUs, vulnerable groups, and indigenous people on the science, issues, vulnerabilities, and risks of climate change; and develop a pool of local technical experts with a strong know-how on nationally developed tools, guidelines, and strategies such as the development of Local Climate Change Action Plan (LCCAP), Climate and disaster risk assessment (CDRA), Climate Change Expenditure Tagging (CCET), and People's Survival Fund (PSF) project proposals.

Despite the existence of initiatives needed to upskill relevant stakeholders, these initiatives are mostly in the pilot stage, thus the Philippines will push for more innovative capacity building mechanisms and also focus on scaling proven and tested programs beyond the pilot scale.

Beyond these CCC programs, the entire government has taken action to upskill the younger population. Through RA 9512, the Department of Education (DepEd) integrated environment in the school curriculum while DOST ensures that students receive science-based quality information to inspire the development of environment-friendly solutions. Also, through RA 9512, DepEd together with the Technical Education and Skills Development Authority (TESDA), the Commission on Higher Education (CHED) and in coordination with the DENR will undertake capacity-building programs on environmental education nationwide.

Action plan

To enhance skills and capacity building for adaptation, the government of the Philippines is committed to the actions listed in table 5.1.3.1.

Table 5.1.3.1 Skills and capacity building list of actions

No.	Overview of actions	Timeline[312]
SCB 1	**Identify knowledge, skill, and capacity gaps in relation to climate change adaptation across national and local entities:** To clearly map and assess skills, capacity, and infrastructural gaps and strengths across key stakeholders in the NAP process. (e.g., gap in LGU skills on creating proposals to acquire adaptation funding, vulnerable groups lack awareness on adaptation measures, LGUs have limited technical capacity and infrastructure to utilize risk information)	Immediate (0-3 years)

[312] Immediate – needs to be done earliest as possible to lay the foundation for other activities; medium-term – important activities unlocked / can be done after establishing foundational activities

No.	Overview of actions	Timeline[312]
SCB 2	**Strengthen the technical and institutional capacity of agencies across specialized adaptation topics tailored to address key issues and needs:** Create and implement adaptation awareness and foundational training initiatives, utilizing diverse delivery methods tailored to distinct stakeholder groups, with a specific focus on vulnerable communities and pivotal decision-makers. Successful pilot programs will be scaled to reach a wider audience, taking advantage of the Philippines' abundant human resources. (e.g., data generation and collection, adaptation 101 tailored for inherent risks in coastal, landslide-prone, flood-prone, and remote communities) Develop technical assistance programs in collaboration with technical experts. Provide tools and build the capacity of key stakeholders, particularly government entities, to access, analyze, and interpret climate data, facilitating the formulation, implementation, and monitoring of relevant policies and programs as outlined in the PDP 2023-2028.	Immediate (0-3 years)
SCB 3	**Identify and promote adaptation champions:** Establish and promote government and non-government champions to lead and advocate for adaptation initiatives. (e.g., identify and define the local government office responsible to implement NAP initiatives)	Immediate (0-3 years)
SCB 4	**Integrate adaptation into the national education curricula:** The Philippines will build on NCCAP activity to integrate climate change in basic and higher education curricula, particularly focusing on the importance of climate change adaptation, resilience, loss and damage, and disaster risk reduction.	Medium term (3-6 years)
SCB 5	**Promote partnerships with academe to deliver capacity-building programs:** Harness the capabilities of other sectors to amplify the delivery of capacity-building programs, for example, by integrating skills and capacity-building initiatives with academic and training institutions to achieve broader reach and impact. (e.g., trained HEIs to teach vulnerable communities on the importance of adaptation)	Medium term (3-6 years)
SCB 6	**Create adaptation best practices playbook and collaborative learning platforms with varying communication methods to share key climate-related information:** Create an adaptation best practices playbook that includes indigenous knowledge, systems, and practices, and science-based approaches. (e.g., building on the long list of adaptation solutions per sector identified in this NAP) Establish a collaborative platform facilitating sustainable knowledge-sharing among diverse entities for mutual learning and growth. Create a communications strategy for the capacity-building programs, designed to effectively share essential climate science and adaptation knowledge among diverse stakeholder groups with varying communication preferences.	Medium term (3-6 years)

Conclusion

Skills and capacity building empower stakeholders to actively engage and collaborate in implementing the NAP. While the Philippine government has made initial efforts to enhance stakeholder capabilities, scaling these initiatives to a wider population is necessary to scale adaptation action. Going forward, the Philippines will focus on developing and expanding skills and capacity building mechanisms, while also identifying complementary skills and capacities among stakeholders to foster collaboration and co-development. To kick-start this process, a comprehensive mapping of skills and capacities across stakeholders will be conducted, followed by the development of a NAP curriculum that recognizes and leverages the complementary nature of stakeholder skills and capacities.

5.1.4 Enabler 4: Data and knowledge infrastructure

Definition and Purpose

> Data and knowledge (information) infrastructure refers to the generation, management, and use of climate change-related information to operationalize the NAP process.

Information plays a critical role in enabling the NAP process by providing a solid foundation grounded in science and evidence, thereby strengthening decision-making among key stakeholders. It facilitates a comprehensive understanding of exposure and vulnerability to climate hazards, enabling the prioritization of impactful and easily implementable programs through cost-benefit analyses and impact evaluation against baseline values. Historical data analysis and scenario generation support decision-makers in taking proactive measures despite the uncertainties of climate change. Furthermore, information serves as a catalyst for creating a compelling narrative that mobilizes critical NAP actors both locally and internationally, fostering a unified call to action.

Key success factors

To unlock the full potential of information, four key factors, as shown in table below, will be taken into consideration.

1. Climate change information is easily accessible and stored in a universal format, interoperable, and communicated in a tailored manner to meet stakeholder needs.
2. Usable analytical models for adaptation across entities, generating actionable insights and data-driven approaches from information.
3. Ownership of climate change information is well-defined, encompassing responsibilities throughout its lifecycle.
4. Mechanisms are in place to capture real-time learnings and new information through feedback channels.

Starting point

Currently, the Philippines possesses a wealth of climate-related data and knowledge. However, these resources are managed and stored independently by various sources. While the National Mapping and Resource Information Authority (NAMRIA) is mandated to centralize data sourcing, its application for climate change-related information gathering is still nascent. Challenges remain in gathering, cleaning, and processing information for end-users.

As to the DOST PAGASA, data collection and insight generation is done through sophisticated analytical models and tools like HazardHunter. Recently, DOST initiated PlanSmart, a comprehensive tool integrating existing platforms like HazardHunter and GeoRiskPH into a unified government entity platform. PlanSmart, specifically GeoRisk, acts as central data lake for climate-related data and information. The tool's goal is to present LGUs with projected climate hazards, enable the ability to add historical hazards and their impact over time, and formulate a standardized adaptation plan. However, certain prerequisites such as robust data architecture, ownership, security, user experience and interface design, incorporation of tools from other departments, and monitoring plan must be addressed to ensure platform comprehensiveness, quality, usability, and continuous usage.

As for the CCC, it created the National Integrated Climate Change Database Information and Exchange System (NICCDIES) to serve as the integrated information portal of the CCC. However, NICCDIES does not operate alone as other relevant government agencies facilitate information sharing. This presents an opportunity to streamline climate change-related information to a single repository as a main source of truth.

Key Actions

To strengthen data and knowledge infrastructure for adaptation, the government of the Philippines is committed to the actions listed in table 5.1.4.1.

Table 5.1.4.1 Data and knowledge infrastructure specific actions

No.	Overview of actions	Timeline[313]
DKI 1	**Establish well-defined and user-friendly protocols for the collection of climate information:** Harmonize, standardize, and simplify information generation and collection to maintain consistency. (e.g., building a central information collection platform where inputs from multiple entities are standardized) Establish clear ownership and tagging of different climate change information. (e.g., Agreements to leverage climate-related data owned by private sector acknowledging data privacy laws and other relevant considerations, designate responsibility to LGUs for encoding and uploading localized climate change-related information)	Immediate (0-3 years)
DKI 2	**Stock-take and encode existing climate data in data lake:** Conduct detailed stocktaking, encoding, and standardizing of available climate-related information through a centrally managed and accessible platform. (e.g., data from existing reports and databases to be encoded in an interoperable format then stored in a central cloud-based platform) Improve and scale climate information platform, creating a comprehensive and centralized climate information bank for data. (e.g., CCC and relevant agencies can build on NICCDIES or Plansmart as the central climate change information sharing platform) ***Similar to initiative AF 2 in Enabler 6 (Adaptation Financing)**	Immediate (0-3 years)
DKI 3	**Institutionalize a national adaptation data office:** Build or designate an accessible adaptation data office to centrally manage adaptation data and knowledge, building upon existing systems of data collection and information from local and indigenous communities. (e.g., developing adaptation data offices in the most vulnerable communities— "hotspots," or build on the PDP plan to establish local climate change data centers and natural hazard information centers, or build on the DOST's PlanSmart) ***Similar to initiative AF 4 in Enabler 6 (Adaptation Financing)**	Medium term (3-6 years)

[313] Immediate – needs to be done earliest as possible to lay the foundation for other activities; medium-term – important activities unlocked / can be done after establishing foundational activities

DKI 4	**Enhance data security across platforms:** Implement robust data security measures across various tools and platforms to safeguard sensitive information, fostering trust, and reliability in data management processes. Establish environments to enable the testing of new features, ensure data quality assurance, and maintain isolation when uploading data from various departments. Implement Identity and Access Management (IAM) systems, along with associated roles and responsibilities, to effectively record and authenticate user login information, maintain access history for audits, monitor user activities, and enforce access policies.	Medium term (3-6 years)
DKI 5	**Integrate feedback mechanisms:** Develop real-time and accurate feedback mechanisms in tools being developed. (e.g., integrate real-time feedback collection mechanism in NICCDIES platform)	Medium term (3-6 years)
DKI 6	**Develop national risk registry:** Build on the PDP 2023-2028 goal to develop a national risk registry that outlines and identifies location-specific hazards, exposure, and vulnerability, complementary to the development of localized climate models and projections and with a dedicated focus to progress beyond initial output-level data by providing richer insights for enhanced decision-making.	Medium term (3-6 years)

Conclusion

In conclusion, the Philippines has an abundant pool of climate change information; however, this information is fragmented, unharmonized, and difficult to access today. To streamline information management, processing, sharing, and updating, the Philippines will build on existing tools and platforms and will build adaptation data offices. Building this upfront will enable a data and evidence-driven NAP process nationally and locally.

5.1.5 Enabler 5: Technology and innovation

Definition and Purpose

> Technology and innovation refers to the development and/or transfer of solutions (both soft and hard solutions) enabling adaptation to the diverse impacts of climate change.

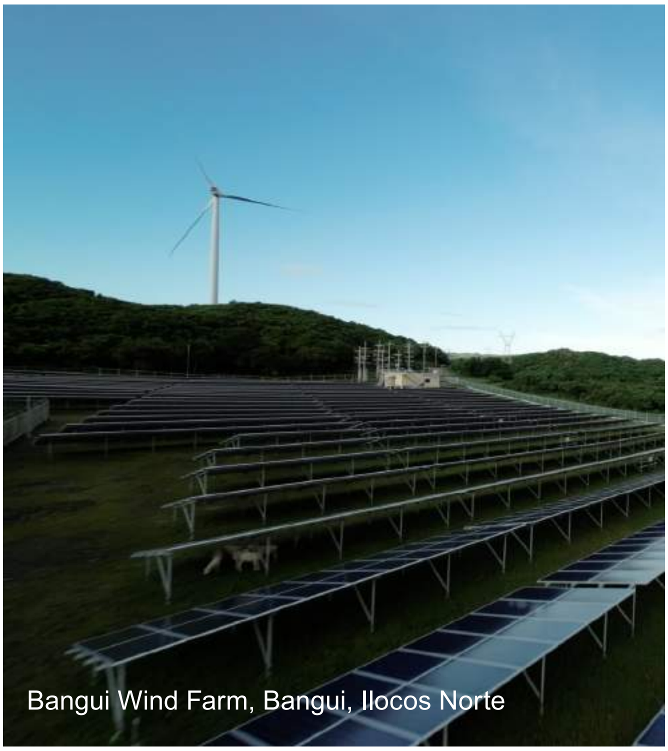
Advancing technology and innovation is crucial for economic growth, social progress, and addressing climate change impacts. This includes developing tools, policies, and solutions for adaptation. To be effective, adaptation tech and innovation must be tailored to the unique circumstances in various Philippine regions.

Key success factors

To enhance the NAP and bolster adaptation through innovation, five key success factors are considered, as shown in the table below. This aligns with the Philippines' goal to boost R&D and commercialization of new technologies, promoting research for improved adaptation tech.

1. Adequate funding and incentives established to support the exploration, nurturing, and expansion of novel adaptation technologies.
2. A perpetual cycle of learning and innovation, coupled with a culture of adaptation-focused technology and innovation, deeply ingrained in the national framework.

3. Open and collaborative mechanisms instituted to facilitate mutual learning and joint innovation endeavors.
4. Customized and accessible development of technology and innovation, catering specifically to the needs of the most marginalized.
5. Operationalizing both national and international technology and innovation transfer mechanisms while establishing avenues to capture, share, and scale best available science, indigenous knowledge, and local experiences.


Bangui Wind Farm, Bangui, Ilocos Norte

Starting point

Advancing research, development, technology, and innovation is a top priority for the Philippines, as outlined in the PDP 2023-2028. This plan aims to accelerate R&D and technology progression while strengthening innovative ecosystems. The Philippines also recognizes the importance of adaptation technologies within the NAP.

Research and development (R&D) in climate change adaptation (CCA) and disaster risk reduction (DRR) have been priorities in the Philippines' Harmonized National R&D Agenda (HNRDA) 2017-2022, guided by the DOST. Key research areas identified include advanced observation and monitoring systems, modeling for better forecasting, climate change adaptation tools, disaster risk management technologies, and policy development. RA 9512 mandates the DOST to offer science-based environmental education, inspiring eco-friendly innovations.

Recently, the Philippines also approved the National Innovation Agenda and Strategy Document (NIASD) 2023-2032, aiming to enhance innovation governance and foster a dynamic innovation ecosystem.

In addition to existing plans, the Philippines has initiated various programs to promote adaptation technology and innovation. The CCC launched programs like Klimathon to spur environmental solution development.

Expanding on these initiatives, the Philippines will work to boost adaptation R&D, technology, and innovation. This effort includes promoting local tech development and adopting international advancements for local applications.

Key Actions

To increase technology and innovation for adaptation, the government of the Philippines is committed to the actions listed in table 5.1.5.1.

Table 5.1.5.1 Technology and innovation list of actions

No.	Overview of actions	Timeline[314]
TI 1	**Reform policies to facilitate adaptation-related R&D/innovation and guardrails to protect vulnerable communities from undesired consequences of adaptation solutions:** Enhance policy frameworks to facilitate innovation and investment in adaptation, particularly in emerging domains (e.g., strengthening IP rights of adaptation-related R&D, offering incentives to encourage private sector investment in adaptation research and development) Establish proactive safeguards to ensure that adaptation solutions yield greater benefits than harm for vulnerable communities.	Immediate (0-3 years)
TI 2	**Promote adaptation-focused R&D in collaboration with non-state entities:** In collaboration with key non-state entities (e.g., academia, the private sector, civil society, NGOs, etc.) incentivize, promote, and advance the pursuit for adaptation-focused R&D to build technical expertise. (e.g., promoting and scaling reach of DOST's Engineering Research for Development & Technology to fund more adaptation studies) Transform adaptation R&D concepts into viable projects through private sector funding. (e.g., scale up the CCC Klimathon to accommodate more research institutes and include more representatives from the private sector, active participation in international adaptation-related accelerator programs)	Immediate (0-3 years)
TI 3	**Build inclusive climate technology and innovation partnerships:** Promote and support local and international technology and innovation partnerships to develop fit-for-purpose adaptation solutions and to acquire necessary funding. (e.g., participating in international scientific/technical conferences to learn from other researchers and foster international partnerships in developing new solutions; scaling the National Research and Development Conference to facilitate co-developments in the R&D sector) Promote an inclusive and participatory technology and information sharing and partnership mechanism to ground innovation with best available science and indigenous and local knowledge. Particularly, involve representatives from different demographic groups such as gender, age (youth and elderly), income levels, and indigenous peoples to unlock nuanced insights and solutions. Develop mechanisms and pathways to foster multi-stakeholder discussions and partnerships. (e.g., creation of platform connecting R&D sector to private sectors, climate-related innovators and investors, financial institutions, and international partners)	Medium term (3-6 years)

[314] Immediate – needs to be done earliest as possible to lay the foundation for other activities; medium-term – important activities unlocked / can be done after establishing foundational activities

TI 4	**Deploy information collection and sharing mechanisms:** Develop mechanisms to capture, share, and scale key insights, best available science, new innovations, indigenous knowledge, and local experiences, operationalizing both national and international technology and innovation transfer mechanisms	Medium term (3-6 years)
TI 8	**Deploy local grants to pursue adaptation ideas:** Create or scale existing local grants to incubate local adaptation ideas	Medium term (3-6 years)

Conclusion

In summary, the Philippines is intensifying efforts to develop adaptation solutions to address climate change impacts. There is growing enthusiasm to prioritize R&D, with small-scale initiatives in progress. The NAP will prioritize adaptation in R&D and support project transformation for private sector investment. It will also foster collaboration within the scientific community through active engagement in conferences and events.

5.1.6 Enabler 6: Adaptation financing

Definition and Purpose

> Adaptation financing involves deploying strategies to secure, allocate, access, and optimize the use of financial resources for addressing climate impacts.

Globally and particularly in highly climate-vulnerable nations like the Philippines, there is a growing need for adaptation financing. As a developing country disproportionately affected by climate change, the Philippines must utilize domestic public, international development, and private sector funds to implement adaptation solutions and sustain the NAP process.

The central focus of this enabler in the NAP is to address issues and opportunities in allocating, accessing, and utilizing each funding source. As the NAP proceeds, a national investment and financing plan will be created to quantify the funding gap and optimize allocation for priority adaptation solutions.

Key success factors

To unlock a holistic and sustainable adaptation financing strategy for the Philippines, six key success factors will be critical.

1. Utilizing a co-benefit approach: To enhance the mobilization of adaptation financing, policymakers can design priority programs and projects in a manner that not only addresses adaptation but also yields co-benefits in terms of advancing climate change mitigation, achieving the Sustainable Development Goals, disaster risk reduction, and more.
2. Mainstreaming adaptation in Public Finance Management and budgeting: Integrate climate adaptation considerations into budgeting and financial planning processes to ensure adequate and timely public funding is directed towards high-impact adaptation interventions.
3. Enabling private sector investments in adaptation: Facilitate private sector investments in adaptation projects by highlighting potential risks, returns, and benefits.
4. Leveraging innovative funding instruments: Explore a range of innovative funding instruments, especially those that help unlock private capital, by making semi-bankable projects viable
5. Actively engage public sector and local communities throughout the process: Involve government agencies (national, sectoral, and local), local communities, and vulnerable groups in the formulation of adaptation financing strategies and prioritization.
6. Establishing robust and strategic networks: Partner with multiple Multilateral Development Banks (MDBs) and Development Finance Institutions (DFIs) to access additional funding, global project insights, technical support, and innovative funding mechanisms.

Starting point

Figure 5.1.6.1 illustrates the adaptation funding resources in the Philippines. Relative thereto, three primary funding sources were identified to underpin the adaptation financing in the Philippines: (1) domestic public funding, (2) international development funding, and (3) private funding. Given the large funding gap for adaptation, the strategic targeting and utilization of each source or the combination of these sources is pivotal in ensuring sustainable funding for the nation's adaptation priorities.

While the Philippines urgently requires substantial funding from both the private sector and international sources, the country must exercise caution to ensure that the terms of such agreements align with its national interests, especially the well-being of the most vulnerable communities.

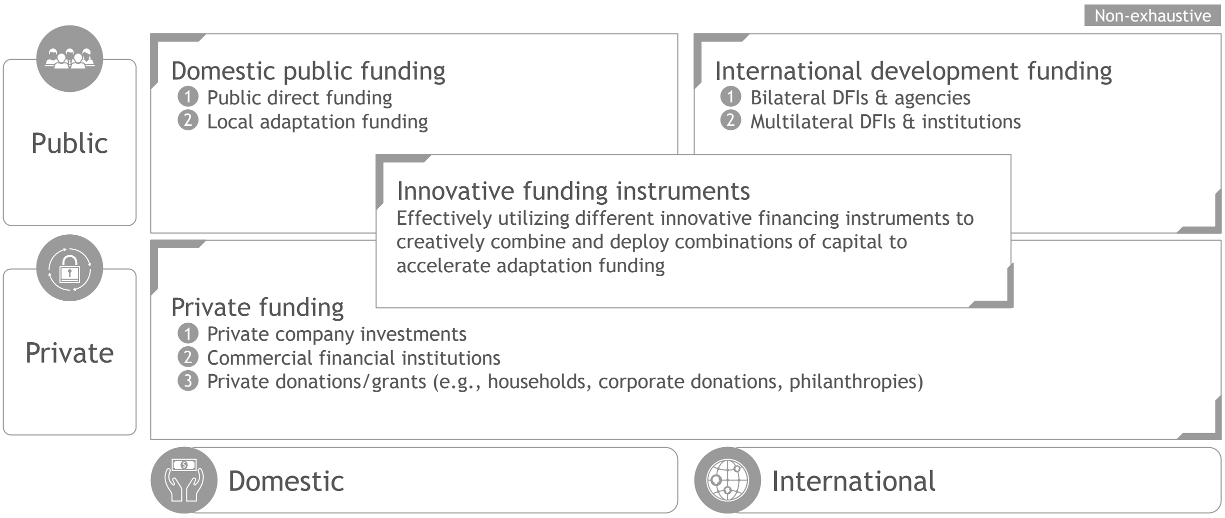


Figure 5.1.6.1 Adaptation funding sources in the Philippines

Domestic public funding

Domestic public funding refers to government funding allocated for adaptation. As a government-issued resource, domestic public funding not only sustains the NAP but also reflects the country's unwavering dedication to its adaptation commitments. It serves as a tangible demonstration of the Philippines' determination to protect its communities and ecosystems from the impacts of climate change.

Public direct funding

From 2016 to 2022, the Philippines allocated PHP1.59 trillion for climate initiatives, representing 5.8% of total national spending during this period. Notably, 94.5% of this budget was dedicated to adaptation, highlighting the nation's commitment to adaptation and resilience (A&R). In 2021, the Philippines allocated over PHP275 million to adaptation, which increased to PHP411 million in 2023, marking a 50% increase in two years.

Ramon Magsaysay Center, Malate, Manila

Despite increased public climate funding, significant adaptation financing challenges persist. In the 2022 climate budget proposal, nearly 90% of the budget was allocated to four departments: DPWH (64%), DOTR (14%), DA (8%), and DENR (4%). This highlights the need to expand the focus of current adaptation strategies. A closer look at the DPWH budget reveals that most funding is directed toward flood management, indicating the need for broader infrastructure coverage to address other climate risks, such as typhoon-induced extreme winds. Specific sectors, like agriculture and transportation, show strong innovation in budget allocations.

Peoples' Survival Fund (PSF)

Recognizing the importance of localized adaptation, the Climate Change Act of 2009 was amended, leading to the establishment of the Peoples' Survival Fund (PSF) in 2012. This national treasury fund complements annual appropriations for relevant government agencies, enhancing climate change adaptation programs at the local level. The PSF serves as a long-term finance facility for adaptation projects proposed by LGUs and local/community organizations, with a minimum annual allocation of PHP1 billion. This enables LGUs and accredited organizations to execute vital adaptation activities aligned with the National Framework Strategy on Climate Change (NFSCC).

However, the current approved PSF support is PHP889.6 million, with ongoing reviews of project proposals. Presently, the PSF is funding eleven projects located in Agusan del Norte, Bukidnon, Cebu, Eastern Samar, Isabela, Mountain Province, Quezon, Sarangani, Surigao del Sur, Surigao del Norte, and Tarlac, and six approved project development grants located in Northern Samar and Mountain Province as part of the General Appropriations Act (GAA). The utilization of the PSF by LGUs and local communities has faced challenges, including awareness of available financing facilities, integration of adaptation considerations, and disbursement.

Programs Convergence Budgeting – Risk Resiliency and Sustainability Program (PCB-RRSP)

The DBM initiated Program Convergence Budgeting to enhance strategic budgeting, interagency collaboration, and climate priorities.

Within the framework of PCB, the Climate Change Adaptation, Mitigation, and Disaster Risk Reduction (CCAM-DRR) cabinet cluster, under the leadership of the Department of Environment and Natural Resources (DENR), has developed the Risk Resiliency Program (RRP). This program serves as a mechanism to operationalize the cluster's roadmap for the years 2018 to 2022. It is strategically designed to enhance both the quantity and quality of climate-responsive investments in the initially identified 24 climate-vulnerable provinces and four major urban centers in the country. While support is being provided to the initially identified areas, the DENR also endeavors to expand the geographical scope of areas benefiting from the program.

A total of PHP291 billion worth of programs/activities/projects were tagged and funded under the Risk Resiliency Program Convergence Budget through the 2023 General Appropriations Act. Despite this, there is a need to strengthen the planning and prioritization of RRP PAPs using the best available science to help make development programming and financing more evidence-based and risk-based.

Manila Bay, Roxas Boulevard, Manila

International development funding

International development funding sources is defined as financial resources procured from public entities and global origins, earmarked specifically to bolster adaptation efforts. To meet the escalating adaptation demands of developing nations, particularly those most susceptible to climate change, developed countries have pledged an annual sum of USD100 billion to support both mitigation and adaptation endeavors in developing countries.

According to an Institute for Climate and Sustainable Cities (ICSC) study from 2013 to 2017, the Philippines received a total commitment of USD4.3 billion from international climate funding, mainly from Japan and the World Bank, contributing 49% and 25%, respectively. During this period, 56% of the funding supported emissions reduction, while 44% went to climate change adaptation.

In 2021, the Official Development Assistance (ODA) Portfolio Review Report highlighted approximately 37 projects related to climate adaptation and mitigation, with 30% incorporating adaptation components. The report emphasized the importance of rebalancing the loans-to-grants ratio due to the country's debt situation. The prior year's NEDA ODA report estimated that these projects would cost PHP128.8 billion, with the majority (96.7%) funded through loans and a smaller fraction covered by grants.

Despite access to bilateral and multilateral funding, a significant portion of available resources remains untapped. There is a vast pool of international development funding accessible, and international partners are eager to provide support.

Private funding

To address these concerns, the involvement of the private sector is critical. As the Global Commission on Adaptation puts it in its Flagship Report, "the public sector needs to shift its focus to include both generating finance and creating incentives to scale up private sector engagement in adaptation investments" (GCA, 2019). However, globally, corporations and institutional investors contributed a mere USD1 billion, which accounts for only 2% of the tracked adaptation finance in 2019 and 2020. This is in stark contrast to the significant 98% provided by public sources.

The private sector has good reason to focus on climate adaptation due to physical and transition risks. These risks make adaptation investments financially prudent and crucial for long-term stability. The Philippines recognizes the private sector's role in adaptation and has established lending instruments for climate projects. Examples include the Land Bank of the Philippines' Ecosystem Program and sub-loans via the Climate Special Adaptation Facility, as well as the Development Bank of the Philippines' Green Financing Program.

Furthermore, the Philippines has begun implementing regulatory measures to encourage increased private sector engagement. Among these measures are the issuance of circular no. 1085 by the BSP on April 19, 2020, outlining the Sustainable Finance Framework, Circular No. 1128 dated October 26, 2021, detailing the Environmental and Social Risk Management Framework, the Green Jobs Act, the CREATE act, and Circular No. 1149 issued on August 23, 2022, providing guidelines on integrating sustainability principles into investment activities of banks. The implementation of these enabling policies has resulted in the issuance of over PHP100 billion worth of sustainable bonds in 2020.

Despite the progress made, significant challenges persist for the private sector's active involvement in climate adaptation efforts. Private sector involvement in climate adaptation remains low in the Philippines. While financial institutions are increasingly issuing sustainability and green bonds, critical sectors (e.g., infrastructure) have yet to fully engage.

Key barriers for adaptation financing

Having explained the existing condition and difficulties related to different adaptation funding sources in the Philippines, five (5) pivotal barriers that hinders the progress of adaptation in financing are identified.

Narrative and information gaps

Awareness and understanding on available adaptation financing are key to accessing resources such as the People's Survival Fund (PSF).

Potential project proponents such as LGUs and local/ community organizations in the case of PSF, and private sector and other entities in the case of other funding mechanisms by financial institutions, need to be fully informed and oriented on the nature of the climate finance, and how these can be tapped to leverage existing resources.

The technical capacity to develop and submit project proposals for different funding windows is likewise crucial. Proponents need to be provided with sufficient and up-to-date technical assistance, and to be equipped with necessary skills in developing project proposals.

In accessing adaptation financing, it is crucial for project proposals to have clear and comprehensive climate rationale, which shall establish that the proposed initiatives are fit-for-purpose and responsive to site-specific risks and vulnerabilities.

It shall be noted further that there is urgency in tapping additional resources to support adaptation initiatives. In this regard, systems and procedures by those governing the funds, shall likewise be further streamlined and simplified.

Bankability of adaptation strategies and projects

The Philippines recognizes multiple and blended climate finance sources including grants, highly concessional loans, investments and subsidies, to scale up implementation of climate actions.

This means that apart from public funding sources, available resources from private sources shall be unlocked, and access shall be accelerated.

In this regard, the Philippines is working on unlocking private sources to supplement public funding for climate change adaptation through setting up policies and systems to provide incentives and enhancing the 'bankability' of project proposals making these more appealing to investors.

Project structure and procedural complexity

Project structure and its complexity affects ability to access financing and investments, involving multiple sectors, location-specific factors, and diverse stakeholder alignment. Alignment of perspectives is needed when coordinating with funders with distinct preferences in risk, return, and impact. This also necessitates detailed financial evaluation, extensive risk analysis, and rigorous due diligence, increasing project financing costs which affects the interest of both developers and financiers.

Procedural complexity likewise affects the provision of financing and investments for adaptation projects and strategies. Disbursement of financing such as those released in tranches impacts the ability of LGUs to efficiently implement projects as this may cause negative cash flow or financial strain.

Inadequate policies and regulations

Unclear policy signals can serve as a barrier. The absence of clear guidelines raises uncertainties for investors and financiers, who become uncertain about the regulations that oversee adaptation projects. This uncertainty contributes to an elevated perception of risks, potentially dissuading potential investors from investing in projects. Specifically, uncoordinated, and ambiguous cross-sectoral policies can impede private sector engagement in adaptation endeavors. For example, the water sector in the Philippines is grappling with insufficient private sector investment as existing tariff policies and the political pressure to maintain low water tariffs has discourage private investment. Furthermore, investing in adaptation, particularly in innovative areas, often demands changes to regulatory frameworks or permissions.

Lack of robust standards and budgeting

The absence of a shared 'language' for assessing adaptation risks is evident, with many global objectives, metrics, and methodologies in their infancy—unlike the more established frameworks in the realm of mitigation. In the absence of clear and consistent criteria, it becomes challenging to determine which projects align with climate adaptation goals. This lack of standardized assessment can result in confusion and ambiguity, leading to suboptimal project selection and resource allocation. Specifically, efficient utilization of funds emerges as a key concern within the Philippines as funding from international funders are often diverted from its intended focus to address other national priorities.

Moreover, without adopting an adaptation lens during budgeting, opportunities for targeted investments in climate-resilient projects might be overlooked. This omission can lead to underinvestment in critical sectors, leaving vulnerabilities unaddressed. Particularly, large projects in the Philippines lack a systematic screening process for assessing their vulnerability to either physical or transitional climate risks. The level of adherence to budget tagging requirements continues to be quite limited, as approximately only 10% of spending units report their climate-related expenditure. This is attributed to the fact that the integration of these expenditures into the budget management system has not yet been fully realized. [315]

Key Actions

Overall cross-cutting strategies

The Philippines needs to embark on a series of strategic action plans by addressing the crucial aspects of adaptation financing across the entire ecosystem. Table 5.1.6.1 below outlines the overarching cross-cutting list of actions.

Table 5.1.6.1. Overall cross-cutting list of actions

No.	Overview of actions	Timeline[316]
AF 1	**Develop national investment and financing plan:** Formulate a national investment and financing plan aimed at quantifying adaptation costs, addressing financial gaps, prioritizing interventions, and identifying strategies to unlock access to sustainable financing options for each recognized adaptation priority. Critical to consult with wide range of stakeholders, including local and vulnerable communities.	Immediate (0-3 years)

[315] World Bank (2022). Philippines, Country Climate and Development Report

[316] Immediate – needs to be done earliest as possible to lay the foundation for other activities; medium-term – important activities unlocked / can be done after establishing foundational activities

AF 2	**Create investor database for climate risks and events:** Provide access to historical climate data and develop predictive models to assist key stakeholders in efficiently funding critical adaptation priorities. Continuously monitor and compile data and trends to furnish investment-related insights for adaptation efforts. (e.g., leverage on existing DOST PlanSmart, a unified government entity platform. PlanSmart, specifically GeoRisk, acts as central data lake for climate-related data and information. The tool's goal is to present LGUs with projected climate hazards, enable the ability to add historical hazards and their impact over time, and formulate a standardized adaptation plan.)	Immediate (0-3 years)
AF 3	**Implement technical assistance programs aimed at enhancing awareness and technical proficiency in adaptation financing:** Educate relevant stakeholders on existing adaptation financing sources and provide support on how to strategically unlock potential financing opportunities. This can be done through strategically leveraging the expertise of local and international partnerships.	Immediate (0-3 years)
AF 4	**Institutionalize a national focal entity for adaptation finance:** Function as a unified entity that centralizes all adaptation-related finances and projects, offering comprehensive oversight of macro-level developments, create a robust pipeline of adaptation projects that are financially feasible and attractive and act as a coordination platform for matchmaking opportunities between key stakeholders.	Medium term (3-6 years)
AF 5	**Enhance national sustainable finance taxonomy:** Continue developing the Philippine Sustainable Finance Taxonomy Guidelines for more effective and accurate reporting as aligned to the PDP 2023-2028 strategy to mainstream sustainable finance.	Medium term (3-6 years)

Domestic public funds

As domestic public funding is the primary source for financing adaptation projects, the Philippines is committed to implementing a set of action plans outlined in Table 5.1.6.2.

Table 5.1.6.2. Domestic public funding sources list of actions

No.	Overview of actions	Timeline[317]
AF 3	**Implement technical assistance programs aimed at enhancing awareness and technical proficiency in adaptation financing:** To educate public sector actors on existing adaptation financing sources and provide support on how to strategically unlock potential financing opportunities. This can be done through strategically leveraging the expertise of local and international partnerships. (e.g., leveraging regional development councils or leagues to inform far-flung LGUs and organizations on available national financing facilities and corresponding requirements, raising awareness and capacitating implementing entities on DOST's PlanSmart to generate local vulnerability assessments and technical proposals)	Immediate (0-3 years)

[317] Immediate – needs to be done earliest as possible to lay the foundation for other activities; medium-term – important activities unlocked / can be done after establishing foundational activities

AF 6	**Integrate adaptation lens into public finance management:** Actively incorporate an adaptation lens into the operations and future undertakings at all levels of governments, as climate events are critical fiscal risk that needs to be integrated in fiscal planning. This includes (1) identifying and quantifying climate risks (i.e., take stock of public assets exposed to natural hazards, especially critical public services), (2) disclosing climate-related fiscal risks (i.e., as part of the overall fiscal risk statement) to guide policymakers, and (3) embedding climate risks in fiscal planning and make provisions in the budget (i.e., investing in resilience, fiscal buffers, budget flexibility) (IMF, 2022).	Immediate (0-3 years)
AF 7	**Enhance climate adaptation tagging from national budget:** Ensures dedicated funding for adaptation initiatives are tagged correctly to ensure a systematic way of tracking adaptation finance. (e.g., build on the PSFR plan to identify and implement the necessary enhancements for the Climate Change Expenditure Tagging)	Immediate (0-3 years)
AF 8	**Prioritize funding for social welfare and community adaptation:** To channel significant domestic public funding to social resilience of communities, ensure equitable resilience-building and prevent exacerbation of existing inequalities. (e.g., provide cash transfers, relocate vulnerable communities, integrate the Philippines' Population, Health, and Environment Approach)	Immediate (0-3 years)
AF 9	**Improve funding source disbursement rules:** Align national funding sources disbursement regulations according to implementing entity needs and contexts. (e.g., Increasing PSF's upfront funding amount to approved projects)	Medium term (3-6 years)
AF 10	**Mainstream existing Program Convergence Budgeting:** Expand government's program convergence budgeting approach across provinces, especially important given slow uptake (i.e., 14 out of 82 provinces covered by 2021)	Medium term (3-6 years)

International Climate Finance

The Philippines has cultivated strong partnerships with numerous international actors, and the interest from international development funding institutions to support the country remains high. This situation provides the Philippines with a significant avenue to complement its domestic public funding sources and expedite its adaptation efforts. The Philippines is committed to executing a series of action plans as outlined in table 5.1.6.3.

Table 5.1.6.3 International development funding sources list of actions

No.	Overview of actions	Timeline[318]
AF 3	**Provide technical assistance programs to build awareness and technical capabilities on adaptation financing:** To educate local stakeholders on existing adaptation financing sources from international development funders and provide support on how to strategically unlock potential financing opportunities. This can be done through strategically leveraging the expertise of local and international partnerships. (e.g., strengthening direct access by facilitating new accreditations to Climate Financial Intermediary Funds, facilitating inter-agency workshops discussing available international adaptation financing facilities and their corresponding requirements)	Immediate (0-3 years)

[318] Immediate – needs to be done earliest as possible to lay the foundation for other activities; medium-term – important activities unlocked / can be done after establishing foundational activities

AF 4	**Institutionalize a national focal entity for adaptation finance:** Function as a unified entity to (1) map of available international funding sources along with their associated key requirements and (2) monitor the utilization of acquired international development funding. Information should be made available across government and to project proponents.	Medium term (3-6 years)
AF 11	**Utilize existing platforms to expand partnership network:** Capitalize on established networks such as the ENACT contact group to establish and cultivate enduring partnerships with diverse international development funding providers.	Medium term (3-6 years)

Private funding

Private sector involvement in adaptation financing has remained minimal. It is imperative to engage the private sector to bridge the adaptation financing gap in the Philippines. Consequently, the Philippines is dedicated to the action plans outlined in Table 5.1.6.4 which are aimed at enhancing the participation of private sector players.

Table 5.1.6.4 Private funding sources list of actions

No.	Overview of actions	Timeline[319]
AF 2	**Create investor database for climate risks and events:** Provide access to historical climate data and develop predictive models to assist key stakeholders in efficiently funding critical adaptation priorities. Continuously monitor and compile data and trends to furnish investment-related insights for adaptation efforts. (e.g., leverage on existing DOST PlanSmart, a unified government entity platform. PlanSmart, specifically GeoRisk, acts as central data lake for climate-related data and information. The tool's goal is to present LGUs with projected climate hazards, enable the ability to add historical hazards and their impact over time, and formulate a standardized adaptation plan.	Immediate (0-3 years)
AF 3	**Provide technical assistance programs to build awareness and technical capabilities on adaptation financing:** To educate relevant stakeholders on existing adaptation financing sources and provide support on how to strategically unlock potential financing opportunities. This can be done through strategically leveraging the expertise of local and international partnerships. (e.g., communicate evaluation criteria to private sector on how to access funds, facilitating private sector forums to discuss the important role private sector plays in funding adaptation gap, raising awareness and capacitating implementing entities on DOST's PlanSmart to extract adaptation-related data and information that the private sector can use)	Immediate (0-3 years)
AF 4	**Institutionalize a national focal entity for adaptation finance:** Function as a unified entity that centralizes all adaptation-related finances and projects, offering comprehensive oversight of macro-level developments, create a robust pipeline of adaptation projects that are financially feasible and attractive and act as a coordination platform for matchmaking opportunities between key stakeholders. (e.g., leverage on National Resilience Council as a starting point)	Medium term (3-6 years)

[319] Immediate – needs to be done earliest as possible to lay the foundation for other activities; medium-term – important activities unlocked / can be done after establishing foundational activities

AF 12	**Integrate an adaptation lens into private sector operations:** Actively incorporate an adaptation lens into the operations and future undertakings for private sector players by climate stress testing investment portfolios to understand existing risks and impacts, develop measures to address risks identified and explore opportunities to invest in climate adaptation. (e.g., integrate adaptation-related disclosures from private sector in ESG reporting)	Immediate (0-3 years)
AF 13	**Integrate an adaptation lens in PPP funding:** Devise strategies to include private sector-driven adaptation solutions within Public-Private Partnership (PPP) funding mechanisms, ensuring wider sector coverage. (e.g., enhancing the PPP's requirements to consider cost of inaction; tapping international funding facilities to conduct public and private policy reforms)	Immediate (0-3 years)
AF 14	**Develop private sector engagement mechanisms:** Establish clear and effective mechanisms to engage the private sector, encouraging their active participation in climate adaptation initiatives. (e.g., developing regular and frequent private sector leaders' forum to provide key developments related to adaptation such as the National Resilience Council and the Philippine Disaster Resilience Foundation)	Immediate (0-3 years)
AF 15	**Co-develop financing models accelerating private investments:** Collaboratively develop creative financing models that expedite private sector involvement in various sectors, accelerating their contribution to adaptation efforts. (e.g., co-developing blended finance schemes to attract private sector investment in projects that would otherwise not attract investments)	Immediate (0-3 years)

Innovative financing instruments

There is a growing recognition amongst practitioners that countries must explore options outside the conventional reservoirs of funds—namely, grants and loans—toward innovative financing instruments that can unleash further investments. This includes accessing financial resources from a range of entities such as financial institutions, private investors, institutional investors, impact investors, foundations, and philanthropists. These tools have the potential to unlock more adaptation funding because of their ability to attract investors with different risk profiles and investment horizons.

At present, the Philippines has initiated the implementation of several innovative financing instruments, such as Catastrophe-Deferred Drawdown Option and CAT bonds. As many of these instruments are still nascent, the Philippines is dedicated to the action plan outlined in table 5.1.6.5. This aims to systematically codify the insights learned from the following innovative funding instruments to comprehensively understand the impacts of these instruments and determine their viability for the future. The existing innovative financing instruments, which are not limited to those listed, can be found in the Chapter 5 Appendix.

Table 5.1.6.4 Private funding sources list of actions

No.	Overview of actions	Timeline[320]
AF 16	**Codify the insights learned from the existing innovative financing instruments:** Monitoring and evaluation of existing financing instruments to comprehensively understand their impacts and determine their viability for the future.	Immediate (0-3 years)

[320] Immediate – needs to be done earliest as possible to lay the foundation for other activities; medium-term – important activities unlocked / can be done after establishing foundational activities

It is also important for the Philippines to continuously explore a range of other financing instruments to achieve these goals. Many of these instruments have demonstrated promising outcomes. Thus, the Philippines is committed to the action plan outlined in Table 5.1.6.6 by considering the following innovative funding instruments below in Table 5.1.6.7.

Table 5.1.6.6 Innovative Financing Instruments action plan

No.	Overview of actions	Timeline[321]
AF 17	**Accelerate use of innovative financing instruments:** Explore the viability of the different financing instruments and develop strategies to accelerate selected instruments.	Immediate (0-3 years)

Table 5.1.6.7 List of innovative funding instruments for consideration

Instrument type	Description[322]	Key advantage[323]	Key consideration
Pooled investment fund	Financial vehicles combining capital from different entities (e.g., public funding, international funding providers, private sector) and then deploy it to projects with specific development or sectoral objectives.	Brings layers of capital with differing return-impact considerations under one platform.	The project or initiative should yield a satisfactory return on investment for its investors.
Guarantee schemes / programs	Provided lenders to cover non-commercial risks. These catalyzes bringing additional private capital to the table who might otherwise not participate.	Catalysts for bringing additional capital that would not otherwise be available, resulting in a leverage ratio of up to 5x.	Typically appear on the balance sheets of guarantors for the complete sum, and consequently, they are not as favored by guarantors as other instruments (such as loans).
Debt-for-nature swaps	Debtor country allowed discounts on the debt owed to its creditor in exchange for investments towards conservation. This frees up fiscal resources for governments to improve resilience without triggering a fiscal crisis.	Frees up fiscal resources for governments to improve resilience without triggering a fiscal crisis.	Creditor governments need to establish legal assurance to ensure that debt-for-nature swaps lower the debt burden to the extent agreed.
Adaptation Benefits Mechanism	Reputable international organizations will be able to certify the benefits of specific adaptation activities (Certified Adaptation Benefits) to project developers and/ or governments.	Acts as extra security/collateral when seeking upfront loans or equity investments to attract initial investors.	Requires agreed-upon methodologies to capture the impact of adaptation activities.

[321] Immediate – needs to be done earliest as possible to lay the foundation for other activities; medium-term – important activities unlocked / can be done after establishing foundational activities

[322] IISD (2023)

[323] Ibid.

Conclusion

In sum, this section has explored the landscape of adaptation finance in the Philippines, along with the barriers faced in attracting adaptation financing. It then outlines a series of actions to tackle these challenges in a comprehensive way. The success of the NAP hinges on financing as an enabler—it has the power to determine whether we succeed or fail in protecting the Philippines against the impacts of climate change.

Bonifacio Global City, Taguig, Metro Manila

5.2 Implementation roadmap

The NAP roadmap outlines a high-level plan of activities to kickstart the NAP implementation. It focuses on the necessary next steps based on the understanding of priorities for the country based on the analysis in Chapter 3 on climate analytics, recommendations on adaptation priorities in Chapter 4, and enablers required to support implementation in Chapter 5, leading to specific initiatives and activities. The roadmap includes actions at both national and local levels, recognizing their interconnected roles.

The features of the NAP roadmap for initial implementation are summarized below:

- Overarching initiatives for the initial implementation (immediate, within three years) that are driven by specific actions that relate to chapters on climate analytics, adaptation priorities, and implementation, with each initiative contributing to the broader goal of effective adaptation.
- National and local level of implementation, with select initiatives needing cooperation between national (including sectoral) and local efforts.
- High-level potential strategic indicators that will track progress, accountability, and success.
- Defined lead and supporting agencies for key activities to ensure clear and synchronized implementation.
- Indicative timescales for key activities.

The NAP Roadmap: Initial implementation[324]

Level of implementation	Category	Activity	Potential indicators	Lead agencies	Supporting agencies	Time scale
National	**Initiative 1** **Clearly define roles, responsibilities, and institutional arrangements for the NAP to mainstream adaptation and resilience (A&R) in the national agenda**					
	Governance and Institutions	Design national level governing structure and coordinating mechanism for the NAP, integrated, and aligned with existing adaptation mechanisms (e.g. Philippine Development Plan, National Climate Change Action Plan, National Adaptation Plan)	• Approved and operational institutional framework for implementing the NAP • Clearly demarcated roles and responsibilities of government units and institutions • Designated decision-making body, technical working group, data office, finance focal entity, and focal climate change adaptation points in sectoral entities for the NAP implementation • Coordinating mechanisms seamlessly integrated with key country frameworks e.g., PDP 2023, NCCAP, NDC, etc.	CCC DENR	NAP NSC Members	Q1 to Q2 2024
		Define horizontal (sectoral) and vertical (LGU) integration strategy to embed LGUs in permanent institutional arrangement	• Approved and operational sectoral and LGU integration strategy for institutional arrangements	CCC DENR	DILG RDC	Q3 2024

[324] Immediate focus for first few years of the NAP implementation. Periodic progress assessments are essential during the NAP review phases to allow for necessary adjustments in the implementation plan, informed by valuable insights gained from practical experience.

Level of implementation	Category	Activity	Potential indicators	Lead agencies	Supporting agencies	Time scale
National	**Initiative 2** **Enhance stakeholder engagement and communication strategies to amplify NAP awareness and understanding**					
	Stakeholder engagement	Identify engagement gaps and opportunities to boost involvement of key stakeholder groups (e.g., private sector, academia, vulnerable groups, indigenous communities, civil society groups, youth and elderly, etc.)	• Key stakeholder groups and their pain points and needs identified and specified • Roles, responsibilities, and coordinating mechanisms of stakeholder groups detailed	CCC DENR	DILG CHED	Q4 2023
		Develop and deploy inclusive, collaborative, understanda-ble, and transparent stakeholder engagement strategy tailored for sectoral and local entities to build awareness for the NAP	• Simplified and abbreviated version of the NAP to summarize key insights relevant for sectoral and local entities created • Stakeholder engagement strategy developed and operational • Various and relevant communication techniques used to engage specific stakeholder groups	CCC DENR	DILG CHED PCO DepEd	Q1 to Q2 2024
	Initiative 3 **Downscale climate analytics and enhance adaptation data management and application**					
	Climate Analytics	Build new/ build on existing analytical models downscaled at a sectoral and local level, translating climate change data into actionable insights for sectors and LGUs	• Downscaled climate analytics for prioritized sectors and provinces (note: may first need to address concern on limited observation stations in the Philippines to fully downscale analytics)	DOST	CCC DENR DILG DHSUD PSA	Q4 2023 to Q1 2024

Level of implementation	Category	Activity	Potential indicators	Lead agencies	Supporting agencies	Time scale
National	Data and knowledge infrastructure	Stock-take and encode existing climate data in data lake	• Centralized climate information platform developed • Existing climate data collected and encoded into centralized database • Database and progress dashboard published and regularly updated	DENR	CCC PSA DICT DOST	Q4 2024
		Establish well-defined and user-friendly protocols for the collection of climate information	• User-friendly data collection and management protocols developed and shared	DOST	CCC DENR	Q2 to Q3 2024
	Initiative 4 **Translate adaptation strategies into a sectoral-level program/project portfolio, prioritizing based on social, economic, and ecosystem benefits for informed decision-making**					
	Adaptation priorities	Leverage climate analytics and insights on social, economic, and ecosystem returns to prioritize most exposed sectors and develop phased approach to engage sectors	• Prioritized sectors identified, and phased approach to engage sectors based on prioritization developed	CCC DENR	DA DOST DND-OCD NEDA PSA DILG DSWD	Q1 to Q2 2025
		Develop sectoral adaptation program/project portfolio, indicators, and implementation plan in line with current and future sectoral plans and priorities	• Number of adaptation programs/projects developed by key sectors	Sectoral agencies	CCC DENR NEDA DA DOE DOTr DOH DTI DOLE DHSUD	Q3 to Q4 2024

Level of implementation	Category	Activity	Potential indicators	Lead agencies	Supporting agencies	Time scale
National	**Initiative 5** **Develop a national adaptation investment strategy to mobilize resources needed for adaptation programs**					
	Adaptation Financing	Develop national investment and financing plan	• Approved and deployed national adaptation investment plan to assess bankability of sectoral adaptation programs/ projects • Contributions from domestic sources, private sector, development partners, and international funds	CCC DOF	NEDA DSWD SEC DBM BSP	Q4 2024 to Q2 2025
		Create investor database for climate risks and events	• Database developed and operational	CCC DOF		Q2 2025
		Provide technical assistance programs to build awareness and technical capabilities on adaptation financing	• Number of technical assistance programs • Awareness of relevant stakeholders	CCC DILG DOF		Q2 2025 to Q2 2026
National and Local	**Initiative 6** **Translate adaptation strategies into a provincial-level program/project portfolio, prioritizing based on social, economic, and ecosystem benefits for informed decision-making**					
	Adaptation priorities	Leverage climate analytics and insights on social, economic, and ecosystem returns to prioritize most exposed LGUs and develop phased approach in plan to cascade sectoral adaptation programs/projects	• Highly exposed local government units (LGUs) prioritized and phased approach to engage LGUs based on prioritization developed	Sectoral Agencies DENR CCC	DA DILG	Q1 to Q2 2025

Level of implementation	Category	Activity	Potential indicators	Lead agencies	Supporting agencies	Time scale
National and Local	Adaptation priorities	Cascade priority sectoral adaptation programs/projects to LGUs and equip with necessary capacity building initiatives for implementation	• Adaptation plans integrated with LCCAP • LGUs onboarded on sectoral adaptation programs/projects	Sectoral Agencies	DA DILG CCC DHSUD DENR NEDA DOE DOTr DOH DTI DOLE	Q3 2025 onwd
		Implement adaptation programs/ projects by LGUs, supported by proper monitoring & feedback mechanisms	• Number of programs/ projects implemented by LGUs	CCC, DILG for LCCA, LGUs	NAP-NSC	Q4 2025 onwd
		Conduct localized consultation engagements, prioritizing vulnerable communities, to tailor projects and address critical needs	• Number of consultations with vulnerable communities conducted	CCC DENR	PCW NCSC NYC NAPC NCDA	Q4 2025 onwd
	Initiative 7 **Enhance capability building, research, and innovation on the topic of climate change adaptation**					
	Skills and Capacity building	Identify knowledge, skill, and capacity gaps in relation to climate change adaptation across national and local entities	• Knowledge, skill, and capacity gaps identified on national and local level	CCC DENR DILG		Q2 2024
		Identify and promote government and non-government adaptation champions	• Adaptation champions from government and non-government entities identified	CCC DENR DILG	NAP-NSC	Q2 2024

Level of implementation	Category	Activity	Potential indicators	Lead agencies	Supporting agencies	Time scale
National and Local	Technology and innovation	Reform policies to facilitate adaptation-related R&D/innovation and guardrails to protect vulnerable communities from undesired consequences of adaptation solutions	• Policies reformed to facilitate adaptation R&D and innovation • Safeguards in place protect vulnerable communities from potential consequences of adaptation solutions	CCC DENR DOST	DOST	Q4 2024 onwd
		Promote adaptation-focused R&D in collaboration with non-state entities	• Collaboration and networking among the public and private sector, civil society, academia, NGOs, and other key stakeholders • Number of R&D concepts developed • Number of R&D concepts turned into viable projects	CCC DENR DOST		Q4 2024 onwd
	Initiative 8 **Develop effective MEAL system for climate change adaptation**					
	MEAL	Develop a framework and specific key indicators for adaptation monitoring, evaluation, assessment, and learning implementation that is aligned with existing adaptation mechanisms and will be used for knowledge sharing to key stakeholders and relayed to policymakers to iterate the NAP	• MEAL indicators in place for NAP implementation • Regular MEAL reports at the national, local, and project levels that are shared with key stakeholders • Iterations to NAP based on MEAL reports and insights	NEDA	CCC DENR NAP NSC Members	Q3 2024

Level of implementation	Category	Activity	Potential indicators	Lead agencies	Supporting agencies	Time scale
International	**Initiative 9** **Align the National Adaptation Plan with the Glasgow-Sharm El-Sheikh Work Programme on the Global Goal on Adaptation**					
	International negotiation	Identify linkage between the NAP and the GGA framework and ensure the alignment of the NAP with the global framework in the succeeding iterations.	• Number of consultation workshops with agencies and members of the Philippine delegation to international negotiations and relevant stakeholders • Iterations to the NAP based on the result of consultation workshops.	CCC DFA	Members of the Philippine Delegation to UNFCCC events and other relevant stakeholders	Q2 to Q3 2024

5.3 Monitoring, evaluation, accountability, and learning (MEAL)

The NAP Monitoring, Evaluation, Accountability, and Learning (MEAL) refers to the systematic processes and tools to measure, evaluate, and disseminate the effectiveness of adaptation actions within the NAP. The MEAL system is composed of four key components defined in this document as follows:

1. **Monitoring** – continuous, routinary, and systematic information collection and analysis to measure progress against key objectives.
2. **Evaluation** - systematic and objective assessment of on-going or completed projects, programs, policies, etc.
3. **Accountability** - systematic processes & tools to guarantee ownership such as tracking, reporting, and well-defined roles and responsibilities.
4. **Learning** - systematic collection and sharing of insights to enable continuous development.

5.3.1 Purpose

The NAP MEAL system strategically drives NAP action plan implementation in the Philippines. It ensures timely delivery through clear ownership and monitoring. Immediate indicators assess plan effectiveness, allowing early adjustments. Long-term impact indicators track adaptive capacity, resilience, and development progress. It captures key learnings and science-based insights for ongoing improvement.

Coastal Clean Up in Leyte

5.3.2 Action plan

The MEAL system action plan (see Figure 5.3.2.1) is guided by ten key principles emerging from best practices and key learnings from other NAPs.

1. **Fit-for-purpose:** Clarity of purpose is the foundation.
2. **Participatory:** Engaging stakeholders in continuous development.
3. **Strong government alignment:** Aligning with key agencies.
4. **Strong ownership:** Clearly defined roles and responsibilities.
5. **Socially inclusive:** Capturing progress for vulnerable groups.
6. **Built from existing:** Leveraging current frameworks to avoid duplication.
7. **Transparent:** Openly sharing results and findings.
8. **Comprehensive:** Showing adaptation progress with select indicators.
9. **Resource-efficient:** Maximizing measurement with minimal resources.
10. **Progressive:** Incorporating key learnings and scientific advancements.

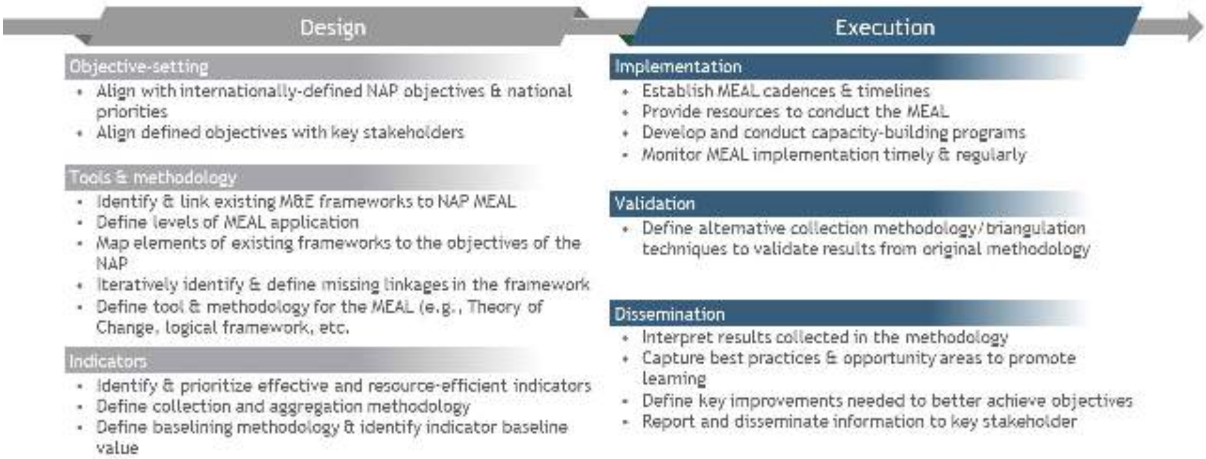


Figure 5.3.2.1 MEAL system action plan

Design phase

Objective-setting: The MEAL system design phase defines NAP objectives and scope. It ensures alignment with national priorities and international goals.

Tools and methodology: Key tools, methodologies, and frameworks for the MEAL will be defined in alignment with the set MEAL objectives.

To enrich the MEAL system, existing frameworks, including the NCCAP RBMES, sector-specific M&E frameworks, other existing action plans[325] and any other future action plans will be assessed. This evaluation will also consider globally recognized climate actions and frameworks like Stocktaking for National Adaptation Planning (SNAP) tool; Progress, Effectiveness, and Gaps (PEG), Pilot Program for Climate Resilience (PPCR) monitoring & reporting toolkit, and the vulnerability sourcebook. Additionally, hybrid frameworks like Tracking Adaptation and Measuring Development (TAMD) Making Adaptation Count will be explored. In addition, the MEAL strategy will align with international agreements such as the Global Goal on Adaptation.

[325] Examples: National Security Policy, Philippine Water Supply and Sanitation Master Plan, Philippine Action Plan for Sustainable Consumption and Production – PAP4SCP, Roadmap to institutionalize Natural Capital Accounting in the Philippines, National Renewable Energy Program 2020-2040, Philippine Energy Plan 2020-2040, and Philippine Development Plan 2023-2032

Leveraging existing frameworks, especially at the national level, will define MEAL levels and approaches. Once established, linkages among relevant frameworks will identify critical gaps and guide the selection of suitable tools. This may involve developing a national Theory of Change or strategic framework through extensive consultations and stakeholder engagement.

Indicators: To measure comprehensively, the Philippines will adapt (e.g., SDG indicators from NEDA) or develop indicators, considering key factors:

1. Aligning adaptation goals with chosen indicators
2. Optimizing indicators for cost-effective monitoring.
3. Ensuring comprehensive indicators to avoid misinterpretation.
4. Choosing indicators that are easily understood and accepted by NAP stakeholders.
5. Maintaining flexibility for evolving science and learning from adaptation actions.

Selected indicators will have defined measurement methods, such as manual tracking, proxy data use, interviews, analysis, aggregation, or a hybrid approach. Each indicator will have designated owners for regular updates. Baseline methods for these indicators will be established using secondary data, interviews, assessments, or a combination, forming the foundation for progress measurement in the NAP.

Execution phase

Implementation: The Philippines will calculate and allocate resources required for the NAP MEAL system. It will collaborate with government bodies and educational institutions for upskilling programs, establishing clear schedules and timelines for effective implementation. A national entity will monitor MEAL progress.

Validation: The responsible bodies are tasked to devise alternative information collection methodologies to validate or triangulate findings from initially outlined approaches. Experts will be engaged to aid in creating and implementing these triangulation methodologies.

Dissemination: The Philippines will create feedback and insights mechanisms to facilitate cross-body learning, ensuring local experiences and indigenous knowledge are shared and scaled. It will collaborate with higher education institutions to disseminate research findings for NAP strategies.

Port in Cebu City

5.3.3 NAP revisions and updates

The NAP is a dynamic document influenced by insights from the MEAL system. In the early years, frequent assessments will focus on building a strong national adaptation infrastructure. The intermediate assessment on the third year or earlier may be adjusted based on activity outcomes. This aligns with changes in local administration. From the second NAP version onward, updates occur every five years, aligning with national strategy document reviews, and national administrative changes. (see Table 5.3.3.1).

Table 5.3.3.1. NAP revisioning and updating cadences.

Activity	Responsible Entity	Frequency
NAP local and sectoral process review and monitoring	Respective LGUs and agencies with guidance of NEDA and CCC	Annually or as necessary
National process review, monitoring, and assessment	NAP focal entity guided by CCC & NEDA	Annually or as necessary
Mid-term detailed NAP progress assessment	NAP focal entity, CCC, and NEDA	Every 3 years or as necessary
NAP document updating	NAP focal entity, CCC, and NEDA	Every 5 years or as necessary