National Climate Change Action Plan

RESULTS-BASED MONITORING & EVALUATION SYSTEM

ACRONYMS

AMIA	Mainstreaming Climate Change Adaptation and Mitigation Initiatives in Agriculture
AR5	Fifth Assessment Report
ATI	Agricultural Training Institute
BAS	Bureau of Agricultural Statistics
BAU	business-as-usual
BOD	biochemical oxygen demand
BSWM	Bureau of Soils and Water Management
CC	climate change
CCA	climate change adaptation
CCC	Climate Change Commission
CCET	climate change expenditure tagging
CCO	Climate Change Office
CHED	Commission on Higher Education
CNG	compressed natural gas
CPEIR	Climate Public Expenditures and Institutional Review
CCSWP	Climate Change Systems-wide Programs
CSIS	Climate Smart Industries and Services
DA	Department of Agriculture
DAR	Department of Agrarian Reform
DBM	Department of Budget and Management
DEPED	Department of Education
DENR	Department of Environment and Natural Resources
DILG	Department of the Interior and Local Government
DJF	December, January, February
DOE	Department of Energy
DOH	Department of Health
DOST	Department of Science and Technology
DOTC	Department of Transportation and Communication
DPWH	Department of Public Works and Highways
DRR	disaster risk reduction
EES	Ecological and Environmental Stability
EMB	Environmental Management Bureau
ENRA	environment and natural resources assessment
ENSO	El Niño Southern Oscillation
EPIMB	Electric Power Industry Management Bureau
EPPB	Energy Policy and Planning Bureau
EST	environmentally sustainable transport

FAO	Food and Agriculture Organization
FIT	feed-in-tariff
FS	Food Security
FSTP	Fueling Sustainable Transport Program
GDP	Gross Domestic Product
GHG	greenhouse gases
GVA	Gross Value Added
HUC	highly urbanized cities
HS	Human Security
IEC	information, education, communication
IPCC	Intergovernmental Panel on Climate Change
IRRI	International Rice Research Institute
IS	information system
IWRM	Integrated Water Resources Management
JJA	June, July, August
JCM	Join Memorandum Circular
KBA	key biodiversity areas
KCD	knowledge and capacity development
KM	knowledge management
LGU	local government unit
LWUA	Local Water Utilities Administration
MAM	March, April, May
M&E	monitoring and evaluation
MFO	major final outputs
MWSS	Metropolitan Waterworks and Sewerage System
NAPC	National Anti-Poverty Commission
NCCAP	National Climate Change Action Plan
NCR	National Capital Region
NEDA	National Economic and Development Authority
NFSCC	National Framework Strategy on Climate Change
NGA	national government agencies
NGO	non-government organizations
NIPAS	National Integrated Protected Areas System
NREP	National Renewable Energy Program
NRPS	National REDD Plus Strategy
NSCB	National Statistical Coordination Board
NSSMP	National Sewerage and Septage Management Program

NWRB	National Water Resources Board
OIMB	Oil Industry Management Bureau
PA	protected areas
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PAP	program, activities and projects
PDP	Philippine Development Plan
PEP	Philippine Energy Plan
PRECIS	Providing Regional Climates for Impact Studies
R&D	Research and Development
RE	renewable energy
REDD	Reducing Emissions from Deforestation and Forest Degradation
REMB	Renewable Energy Management Bureau
RPS	Renewable Portfolio Standards
RBMES	Results-Based Monitoring and Evaluation System
SAFDZ	Strategic Agriculture and Fisheries Development Zone
SALINTUBIG	Sagana at Ligtas na Tubig sa Lahat
SE	Sustainable Energy
SON	September, October, November
SUC	State Colleges and Universities
TESDA	Technical Education and Skills Development Authority
TC	Tropical Cyclone
ToC	Theory of Change
TS	Tropical Storm
TY	Typhoon
VA	vulnerability assessment
WPI	water poverty index
WS	Water Sufficiency
WTA	water withdrawal to availability

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INTRODUCTION

Background

The Philippines is an island republic in the Western Pacific Ocean. It is located in Southeast Asia and is composed of 7,107 islands with a land area of 300, 000 sq.km. and 32,400 km. of discontinuous coastline. The Philippine archipelago has one of the largest coastlines in the world and is considered as a haven for various reef and reef associated flora and fauna. Most of the people living in coastal areas are highly dependent on coastal fishing as a source of living. Moreover, the country is located just north of the equator which gives it a moderate tropical climate suited for the cultivation of crops such as coconut and pineapple, making agriculture the backbone of the country's economy.

The Philippine agriculture sector along with the terrestrial and aquatic ecosystems is the most affected by climate change. The changing climate affects the sea surface and areas. The warming of waters has damped the coastal areas which eventually affect the water resources, thus resulting to loss of food and mortality. Thus, manifestation of climate change will totally threaten the food security.

In response to the global phenomena of climate change, the Philippine Government enacted the Climate Change Act of 2009 (Republic Act 9729) that provides the policy framework in addressing the growing threats of climate change to community life and environment through the National Framework Strategy on Climate Change (NFSCC). This framework has been translated into a National Climate Change Action Plan (NCCAP) 2011-2028 with strategic priorities along the following thematic outcomes: food security, water sufficiency, ecosystem, environmental stability, human security, climate-smart industries and services, sustainable energy and capacity development. The NCCAP outlines the current situation of the country and its agenda for adaptation and mitigation to completely address the challenges of climate change.

To identify and monitor results that can be attributed to NCCAP interventions, a nation-wide Results-Based Monitoring and Evaluation System (RBMES) is put in place, building on previous and current government initiatives to incorporate climate risks into development planning processes. The RBMES is not only guided by the NFSCC and the NCCAP but also considers the Philippine Development Plan 2011-2016 as one of the country's main planning instruments incorporating climate change adaptation and disaster risk reduction (CCA-DRR) concerns. Existing national and local systems for M&E (e.g., Philippine Integrated Diseases Surveillance and Response of the National Epidemiology Center – Department of Health; Community-based Monitoring Systems of local government units) are also be optimized for the operationalization of the NCCAP RBMES.

The Climate Change Commission (CCC) is set to lead the M&E which is aimed to learn what has been done and how – by focusing on efficiency, effectiveness and impact.

Content of the Report

This main report provides a documentation of the conceptual underpinning that guided the establishment of the RBMES for the NCCAP and is divided according to the following:

Chapter 1: Context of Climate Change Actions in the Philippines

Chapter 2: NCCAP Implementation Framework

Chapter 3: NCCAP Adaptation Hypothesis and Theories of Change

Chapter 4: Results-Based M&E Framework for NCCAP

Chapter 5: NCCAP RBMES Implementation Plan

Chapter 1 reviews the climate and non-climate factors that affect and is affected by the planned interventions under the NCCAP. Impacts of climate change have been arranged as a chain of interrelated events that affect the overall resiliency of the natural ecosystems and dependent communities. This allowed addressing the risks and opportunities presented by climate change as a moving target marked with spatial and temporal uncertainty and variability.

The second chapter lays down the NCCAP implementation framework which the RBMES is intended to measure and evaluate in terms of efficiency, effectiveness and impact. The framework looked at the implementation of the NCCAP according to elements, phasing and priorities, implementation strategies/schemes, and options for financing. This enabled the identification of the contributions of NCCAP interventions to climate change adaptation and mitigation.

Adaptation hypotheses or testable statements for each NCCAP major intervention outcome are elaborated in Chapter 3. The hypotheses link the outcomes of the NCCAP priorities (e.g. food security) to the relevant risks and vulnerabilities the intervention intends to address. Illustrative examples of how and why the outcome is expected to contribute to adaptation are given per thematic priority. Adaptation theory of change that essentially reviews the primary activities, outputs and outcomes of the NCCAP priorities and presents it in a sequential narrative is also included in this chapter. It is used as reference for checking progress while monitoring and to evaluate completed interventions per and across thematic priority.

The fourth chapter presents key lessons learned from a review of experiences, both international and local, in M&E of development interventions and climate change actions, as an introduction to the adopted NCCAP RBMES framework. The first part, an appropriate segue to the second's, provides valuable lessons for establishing an M&E for climate change actions which draws from the analytics of climate change impacts elucidated amply in the previous chapters. The RBMES framework adopts a phased approach initially dovetailing the thematic structure of the Action Plan, moving on to flagship programs and then to targeted monitoring of vulnerable areas.

The last chapter, Chapter 5, operationalizes the implementation framework and presents a plan that, while adopting a phased approach, also takes into consideration the current institutional landscape and political realities faced by the Climate Change Commission. These realities are: the ex-post facto nature of NCCAP (having been conceptualized after the Philippine Development Plan and thus accommodative to the larger PDP and its sectoral targets); the coordinative (instead of oversight) function of the Commission; and the need for evidence-based conclusions or results attribution. Consideration of these realities is reflected in the Plan's programs, milestones and tasks.

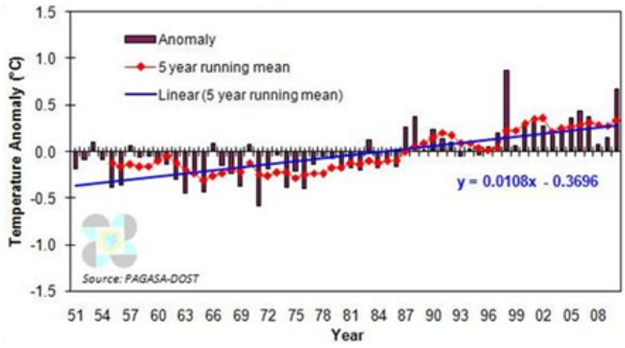
CONTEXT OF CLIMATE CHANGE ACTIONS IN THE PHILIPPINES

The Philippines, being an archipelagic country composed of small islands, is highly vulnerable to the impacts of climate change. Climate data for the past 60 years already show trends of rising temperatures, changes in rainfall pattern and increasing incidence of extreme events like drought, intense rainfall, tropical cyclones and flooding that cause considerable damage to livelihood, properties – and in many cases, loss of lives.

Current Climate and Observed Trends

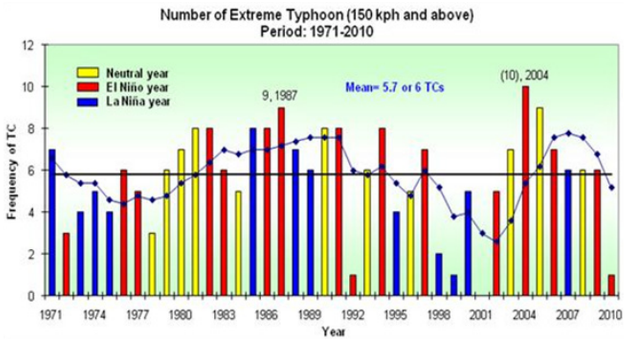
Observed mean temperature anomalies (or departures from the 1971-2000 normal values) during the period 1951 to 2010 indicate an increase of 0.648^{0}C or an average of 0.0108^{0}C per year-increase (see Figure 1). Maximum and minimum temperatures are seen to have increased by 0.36 ^{0}C and 1.0 ^{0}C, respectively, during the last 60 years (PAGASA, 2011).

Figure 1. Observed annual mean temperature anomalies (1951-2010) in the Philippines based on 1971-2000 normal values. *Source: PAGASA, 2011.*



An average of 20 tropical cyclones form and/or cross the Philippine Area of Responsibility (PAR) per year. Analysis of trends shows a high variability over the decades but there is no indication of increase in the frequency. However, there is a very slight increase in the number of tropical cyclones with maximum sustained winds of greater than 150kph and above (typhoon category) being exhibited during El Niño event (see Figure 2). A slight increase in tropical cyclone passage in the Visayas during the 1971 to 2000 as compared with the 1951 to 1980 and 1960-1990 periods is shown in the the 30-year running means analysis of tropical cyclone passage over the three main islands (Luzon, Visayas and Mindanao).

Figure 2. Trend analysis of tropical cyclones with maximum sustaoined winds of 150 kph and above (typhoon category) during the 1971-2010 period. *Source: PAGASA, 2011.*



There are statistically significant increasing number of hot days but decreasing number of cool nights as shown by the analysis of extreme daily maximum and minimum temperatures (hot-days index and cold-nights index, respectively) done by PAGASA (2011). Although there have been changes in extreme rain events in certain areas in the Philippines, the trends of increases or decreases in extreme daily rainfall and its frequency are not statistically significant.

Climate Projections

PAGASA (2011) developed climate change scenarios for the Philippines using the PRECIS (Providing Regional Climates for Impact Studies) regional climate model developed at the UK Met Office Hadley Centre for Climate Prediction and Research. The climate simulations centered on two time slices (2020 and 2050) using high-, medium-, and low-range emission scenarios. Projections at the provincial level and comparison values with the high- and low- range scenarios in 2020 and 2050 is provided in the technical annexes of the "Climate Change in the Philippines" report of PAGASA (2011). The following summarizes the projections on seasonal temperature increase and rainfall change, and total frequency of extreme events at the national level based on the mid-range scenario outputs:

Seasonal Temperature Change – Warmer seasons warmest during summer months

All areas of the Philippines will get warmer, more so in the relatively warmer summer months. Mean temperatures in all areas in the Philippines are expected to rise by 0.9 ^{0}C to 1.1 ^{0}C in 2020 and by 1.8 ^{0}C to 2.2 ^{0}C in 2050. Likewise, all seasonal mean temperatures will also have increases in these time slices; and these increases during the four seasons are quite consistent in all parts of the country. Largest temperature increase is projected during the dry (MAM) season.

Seasonal Rainfall Change – Wetter wet season and drier dry season

Generally, there is reduction in rainfall in most parts of the country during the dry (MAM) season. However, rainfall increase is likely during the southwest monsoon (JJA) season until the transition (SON) season in most areas of Luzon and Visayas, and also, during the northeast monsoon (DJF) season, particularly, in provinces/areas characterized as Type II climate in 2020 and 2050. There is however, generally decreasing trend in rainfall in Mindanao, especially by 2050. The projections also clearly indicate the likely increase in performance of the southwest and northeast monsoons in provinces exposed to these climate controls.

Extreme temperature events – Hotter days and nights

Hot temperatures will continue to become more frequent in the future. The number of days with maximum temperature exceeding 35 0C (following value used by other countries in the Asia Pacific region in extreme events analysis) is increasing in 2020 and 2050.

Extreme Rainfall Events – More frequent heavy rainfall, increasing dry days

Heavy daily rainfall will continue to become more frequent, extreme rainfall (daily rainfall exceeding 300 mm) is projected to increase in Luzon and Visayas only, but number of dry days (rainfall less than 2.5mm) is expected to increase in all parts of the country in 2020 and 2050.

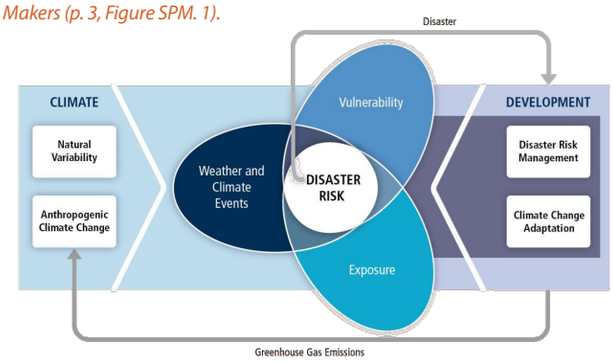
Climate Change Impacts

The IPCC Fifth Assessment Report (2014) defined impacts as:
"…effects on natural and human systems primarily of extreme weather and climate events and of climate change. It generally refers to effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services, and infrastructure due to the interaction of climate changes or hazardous climate events occurring within a specific time period and the vulnerability of an exposed society or system. Impacts are also referred to as consequences and outcomes. The impacts of climate change on geophysical systems, including floods, droughts, and sea level rise, are a subset of impacts called physical impacts" (p. 5).

The impacts of climate change are chains of inter-related events that affect the overall resiliency of the natural ecosystems and the people depending on their environmental services. For instance, typhoons and floods destroyed crops and infrastructures (dams, roads, power) which are the foundations for attaining food security (supply, distribution, and consumption), water sufficiency and energy security. Policies to address the sequences output monitoring of priorities may complement each other the preferred measures that may benefit one at the expense of the other (IPCC, 2007).

The Working Group II of the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2014) looks at the risk of climate-related impacts as resulting from the interaction of climate-related hazards with the vulnerability and exposure of human and natural systems where hazards, exposure and vulnerability are driven by changes in both the climate system and socio-economic processes. The core concepts are illustrated in the Figure 3.

Figure 3. Illustration of the core concepts of the WGII AR5. Risk of climate-related impacts results from the interaction of climate-related hazards (including hazardous events and trends) with the vulnerability and exposure pf human and natural systems. Change in both the climate system (left) and socio-economic processes including adaptation and mitigation (right) are diverse hazards, exposure and vulnerability. Source: IPCC, 2014, Summary for Policy Makers (p. 3, Figure SPM. 1).



This conceptual framework focuses on risks of climate change impacts, resulting from the interaction of vulnerability, exposure, and hazard. It guided the development of the NCCAP RBMES by identifying key and critical indicators for the elements of risks (i.e., vulnerability, exposure, hazard) per thematic priority. The climate change impact in the Philippines is non-linear and in fact undergoes a series of permutations of risks and vulnerabilities as the rise in temperature combines spatial and temporal variations in rainfall and extreme climate-related events in reducing the resiliency of the natural ecosystems and effectiveness of existing knowledge and measures to constantly changing climate.

It must be noted that orders of climate change impacts are simplified sequential changes in climate and weather events reflecting the modified patterns, durations and intensity of rainfall in different Philippine climate types in the country (see Figure 4). PAGASA (2011) has stated that climate change shall render "dry areas to become even drier and wet areas, wetter." Applying this statement to the prevailing climate types in the country, the dry areas will become drier and can have the temperatures too high for many field crops and crop areas in river-dependent irrigated areas will reduce significantly in dry season. Multi-purpose hydropower dams will face serious problems in allocation and prioritization of water for energy, irrigation and domestic users during the six months of high temperature and lack of typhoon rains to fill the dam to desired levels that are enough to run the turbine for electricity, water for domestic use and irrigation. Example would be experiences in the case of Angat Dam, the major water facility that supply power and irrigation for Bulacan and Pampanga provinces and which supplies 97 percent of Metro-Manila's domestic water. During the wet season, the impact will be positive to rainfed field crops and irrigated lands which will have full water coverage. However, flooding can be a serious challenge to rice farmers. Spatial and temporal flooding and landslides will increase to life-threatening levels, and cause serious disruption in transport and movement of workers and products from agriculture and industries. Most serious impacts will be felt in small island provinces and municipalities affected by prolonged rainfalls and tropical cyclones.

The water balance studies of the Department of Agriculture (DA-BSWM, 2005) shows the spatial distribution of the flood prone irrigated rice areas (see Figure 5). The major rice producing areas that are identified as high risk to flooding include, but not limited to, Pangasinan, Isabela, Pampanga, Iloilo, Mindoro Island, Camarines Sur and Davao Oriental. Figure 6 shows the spatial distribution of drought prone/water deficit rainfed rice and corn areas (DA-BSWM, 2005). The major corn producers that are most likely will suffer from water deficiency includes, but not limited to, Cagayan Valley, Davao del Sur and South Cotabato. It is interesting to note that areas in Climate Type 1 are prone to flooding are almost same area prone to drought or moisture stress.

Figure 4. Climate map of the Philippines. Classification of climate used the Corona's four climate types (Types I to IV), based on monthly rainfall received during the year. Type I climate exhibits a distinct dry and a wet season; wet from June to November and dry, the rest of the year. Type II climate is when there is no dry period at all throughout the year, with a pronounced wet season from November to February. On the other hand, Type III climate is when there is a short dry season, usually from February to April, and Type IV climate is when the rainfall is almost evenly distributed during the whole year. Source: PAGASA, 2011 (p. 25).

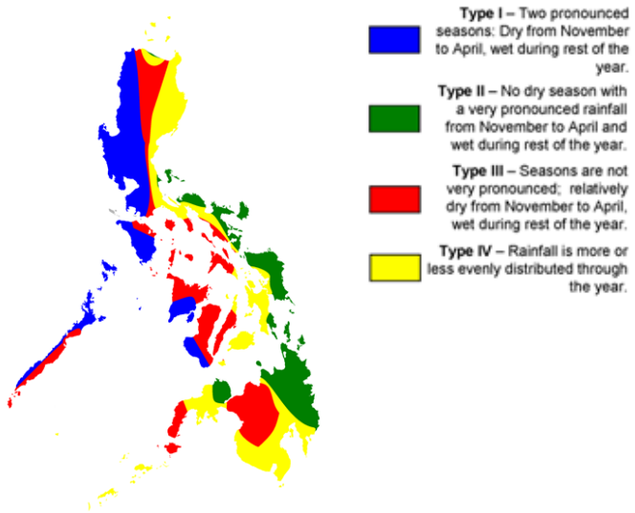


Figure 5. Flood prone, wet season irrigated rice areas. Source: DA-BSWM (n.d.).

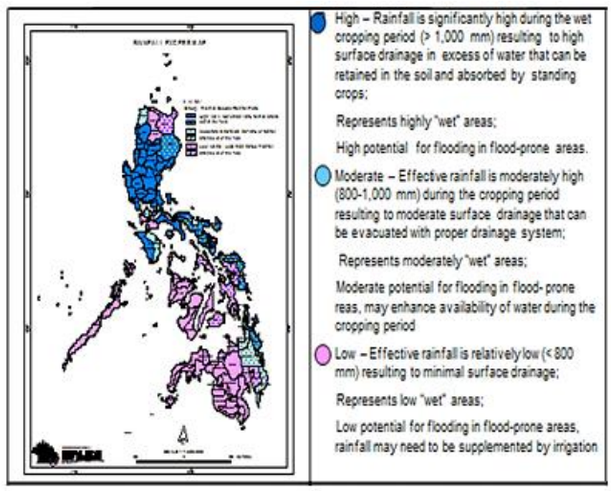
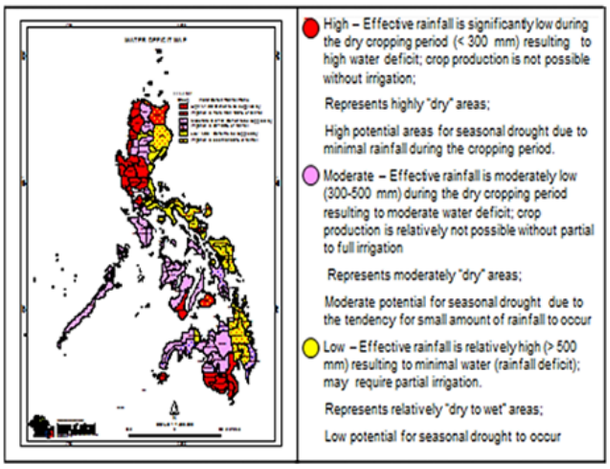


Figure 6. Drought prone rainfed rice and corn areas. Source: DA-BSWM (n.d.).



Rise in Temperature

The 1st order of impact refers to the effects of the rise in temperature and its contribution to changes in resilience and functions of the ecosystem to development and environmental productivity. The effects of an increase in global temperature include rise in sea levels and a change in the amount and pattern of precipitation. The rise in global mean temperature since the mid-20th century has been documented (IPCC, 2007). It has progressively expanded and increased its temporal and spatial value and coverage. In the Philippines, temperature increases have been observed and mean temperature anomalies during the period 1951 to 2010 indicate an increase of 0.65 ^{0}C or an average of 0.0108 ^{0}C per year increase with maximum and minimum temperature increases of 0.36 ^{0}C and 1.0 ^{0}C, respectively (PAGASA, 2011). The duration of exposures of local natural resources (flora and fauna) and stakeholders has already shown clear responses to the temperature changes.

Rise in temperature is the major indicator of climate change which created observable "ecosystem footprints" or bio-signals that are used by local communities as part of their autonomous adaptation and "oral risk communication" to reduce recurrent impacts of climate change to their livelihood and food sources. Bio-signals are observable response to stimulus and processes of climate change. This includes shifting of flowering of fruit trees, migration of insects and birds, algal bloom in water bodies. Trees are found to contain some of the nature's most accurate evidences relating historical temperature regime. Their growth layers, appearing in rings in the cross section of tree trunk, record of evidences of drought, floods, insect attacks and changes in length of water stress during their growing periods. Researchers on tress and changing climate (Williams, et. al. 2013) noted that tree rings tell us much more than the age of individual trees. They provide a year-by-year record of changing climate that can be extended back over centuries, reaching back beyond the beginning of the historical climatic record.

Rise in temperature is a year round warming episode which accelerates the process of desertification, a form of land degradation that led to irreversible loss of soil productivity. At some point in the rise in temperature, the length of growing periods of the high elevation forestlands (Highland, national total of 2-3 million hectares) become favorable to the cultivation of many high value crops and livestock of agriculture. While this may augment the food self-sufficiency program, the uncontrolled intrusion of agriculture can become serious threat to many biodiversity. Farm crops and local livestock can be source of pests and diseases and some invasive weeds can pose difficult problem in the unmanned forest areas. The International Rice Research Institute (IRRI) has concluded that for every one degree rise in night time temperature would result in ten percent reduction in rice yields. Global warming and attendant weather changes affect the electric power sector, including electricity generation, transmission and distribution systems and end users for power.

Water availability also impacts food commodity prices, as was shown in summer 2008 when a drought-induced collapse of rice production in Australia helped trigger a sharp increase in global rice prices, impacting food security in import-dependent countries in the Middle East and Caribbean. Increased temperature and dry weather due to climate change will raise water requirements for livestock whose numbers are growing as global demand for meat increases. Meat is a very water-intensive food with a large carbon footprint. As water problems become more severe, the impacts of agriculture generally will draw even more attention.

Higher water temperature due to climate change may increase the concentration and variety of water-borne pathogens. As a result, food supplies may face greater risk of contamination and recall, disrupting the supply of ingredients for food manufacturers and

negatively affecting consumer confidence in food products. Studies showed a decrease in the number of illnesses with increasing temperature until reaching a threshold of 19.2 °C, beyond which the number of morbidity cases increases with temperature. The continuous rise in temperature is likewise found to have diverse impacts on human health, particularly the expansion of vector-borne diseases like dengue fever. High temperature and carbon dioxide were found to cause the reduction of iron and zinc in rice which will affect nutrition and health of vulnerable families, particularly children.

Temporal Variation of Rainfall

The effects of the year round temporal variation of rainfall contribute to the modification of impacts of rising temperature to various NCCAP priority themes and major reduction of ecosystem stability and environmental services. The on-set of rainfall signals the development of series of spatial and temporal convergence of changing orders of impacts (e.g. disasters, flood, landslides, diseases, health and sanitation) to one and number of undefined benefits to the other adjacent areas. The convergence of rainfall variation and the extreme events magnification led to the series of permutations and magnification of negative and positive impacts of climate change. These confluence of non-linear impacts of combined rising temperature and rainfall variations are moving targets and pose a great challenge to the monitoring of expected outcomes and unintended co-benefits from the alignment of policy and technology interventions to reduce the perils of "immeasurable surprises" from permutation of impacts of climate change.

Declining rainfall may extend the duration of dry season in Climate Type 1 and 3 and would impact on the extent of cultivation of rain fed and irrigated crops as water for irrigation become scarce. Water supply for domestic and municipal consumption as well as hydropower will also be affected. Increase in rainfall is anticipated to exacerbate flooding, rain-induced landslides and soil erosion and favor increase in cultivation of rain fed crops thus help in the attainment of food security and self - sufficiency in areas not served with irrigation.

Extreme Weather Events

Impacts related to extreme weather events are mostly treated as surprises since the patterns of occurrence and coverage include areas where people are least prepared to cope with their impacts. Local communities observed that the contemporary "super typhoons" have never been seen or have no any equivalent experiences from events before. This is the case for Typhoon Pablo (Bopha) in 2012 that surprised high value export crop producers in Mindanao, portion of the Philippines often referred to as "typhoon-free."

Drought and El Niño seriously aggravate the spatial and temporal impacts from climate-change driven increase in temperature. The combination of drought, El Niño and rising temperature predisposes sloping lands from massive run-off and landslides during prolonged rainy months and tropical cyclones. One special effect of these convergences of heat generating climate episodes is accelerated desertification and formation of deep surface soil cracks which accelerate the saturation of subsoil with rainwater which may pave the way for massive mass movement or landslides. Changes in water availability and quality are also expected to put pressure on societies and the environment, directly linked to climate change issues and concerns of inter-connected NCCAP priorities of Food Security, Water Sufficiency, Sustainable Energy, Ecological and Environmental Stability and Human Security. Climate related food and water scarcity has the highest impact on isolated poor communities in small island LGUs and in off-grid areas of water and power distribution.

Prolonged monsoon rainfall results to extended waterlogging in low-lying areas, massive run-off, predisposed sloping lands to massive landslides, and widespread heavily silt-laden flooding that create havoc and massive damages to livelihood, properties, including loss of lives. Prolonged rainfall is generally related to spread of pollutants in water bodies and expansion of climate related diseases particularly affecting the health of marginalized communities in low lying, poorly-drained areas. However, prolonged monsoonal rains create opportunities as well for growing short seasonal food crops, increase in areas of cultivation, and increase in yield per unit area which may contribute to improvement of food production.

Extreme rainfall events from "super typhoons" combine impacts of intense rainfall and strong winds with new sets of ecological signatures the most outstanding of which is the increased in diameter coverage of high winds that magnify the extent of damages to properties and infrastructures, loss of human lives and increase in the time and budgetary resources for restoration of socio-economic activities.

Sea Level Rise

Increasing temperature contributes to rising sea level and will continue to rise as oceans warm and glaciers melt. Rising sea level means higher storm surges, even from relatively minor storms, which increases coastal flooding and subsequent storm damage along coasts. In addition, the associated heavy rains can extend hundreds of miles inland, further increasing the risk of flooding and inundation of low lying areas.

The section below is a summary of (highly aggregated) impacts in different climate types in the country (see Table 1). As a general rule, rise in temperature initiate the reduction of ecological stability and resilience to climate change impacts. These same areas will then be subjected to series and chains of climate change impacts and further undergo undefined magnitude of reduction in resilience as watershed resources are subjected to changing patterns of low and high rainfall and further magnified into various forms and proportions of climate-related risks.

Table 1. Summary of climate-related drivers of impacts and risks and opportunities for adaptation related to the thematic priorities of the NCCAP.

DRIVERS OF IMPACT	RISKS AND OPPORTUNITIES FOR ADAPTATION
Rise in Temperature	Alteration of Ecosystems Resilience to Climate Change Impacts Rise in temperature is most outstanding in Climate Type 1, which has distinct dry and wet months. In terms of areas, food production in small island LGUs and Mindanao is at risk since irrigation facilities are limited and most of them are river-dependent. Most high value crops (export-type banana plantations) however are owned by big corporations and have their own irrigation system. The immediate effect of rising temperature is the modification of the previously observed changes in ecological risks in various climate types. As a result, the knowledge and practices by local communities and that developed by science must be re-evaluated in terms of relevance and effectiveness and would require re-adjustments to new spatial and temporal changes in ecological risks to food, health and livelihood. The changing patterns of rainfall showed shifting in fruiting and harvesting which will mean possible exposures to new sets of diseases and pests and will affect changes in patterns and location of farm products and the need for review for improvement or new investments for market support and distribution of agriculture and fishery products. Some changes in land uses will contribute to the aggravation of non-compatible land uses and would, therefore, require new sets of policies and technologies and even new and appropriate long term investments. Most large irrigation facilities in the country, particularly in Climate Type 1, are drawing irrigation water from multi-purpose dams and they are located both in drought and typhoon-prone areas. Allocation and postponement of water share can become a common problem of these areas: 60 percent of irrigated rice producers are in these areas in Luzon. The river-dependent irrigation systems in the major rice producing areas in the Visayas (Iloilo, Climate Type

	3) and in Mindanao (Cotabato and Davao Provinces, generally Climate Type 4) are in a more precarious situation. These areas can have serious reduction in cultivation because discharge is limited and is aggravated by poor watershed cover. Aside from irrigation, it is expected that invasive weeds and pests and diseases will increase and would affect yields and income of poor farming communities. Prolonged exposures to high temperature will affect forest flora and fauna and may induce changes in forest biodiversity. Agriculture may intrude into the high elevation forest areas which will have growing periods very favorable to high value crops. This shift in mixtures of natural and domesticated plants and biodiversity would require very strong land use policy and measures to protect Key Biodiversity Areas from the incursion farming which will bring along invasive weeds, pests and diseases. The presence of high-value farming will be an added major environmental issue for managing river water quality and new sets of strategy for environmental health management in the lowland. Climate-related vectors of human diseases are expanding and therefore affect the positioning of health care facilities and deployment strategies for health personnel. Heat stroke along with dengue for instance, is now recognized as major health risks associated with rising temperatures. Adaptation through strengthening of local knowledge by research and development is crucial and would require immediate and common actions and budgetary support by all national and local institutions. Rise in temperature is a creeping, slow acting and constantly moving target which will make community-based adaptation crucial and strategic in developing measures for reducing climate change incremental impacts on various government interventions. The adaptation will have adjustments to rise in temperature as the fundamental base knowledge for all climate change adaptation measures specific to location.
Temporal Variation in Rainfall	Increasing uncertainty of rainfall, loss of effectiveness and application of local and institutional knowledge and practices
Reduction in rainfall	In Climate Type 1 the decline in rainfall amidst rising temperatures magnify the decline in cultivation areas and productivity of the crop, fishery and livestock subsectors. The spatial and temporal level of risks described above for rising temperature are similar in locations but may extend to other adjacent geographic areas in the watershed belonging to other climate types which may also suffer from declining rainfall. This Sub-Order may have lesser impacts in areas under Climate Type 2 (no well-defined dry months, but with well pronounced maximum rainfall during the later parts of year until the first few months of the following year). Forest and biodiversity will be seriously affected and risks to forest/grassland fire can increase particularly in Climate Type 1 provinces. The run-off type irrigation systems – mostly in the Visayas and Mindanao – can be at high risks due to severe reduction in irrigation water supplies and irrigation service areas due to the decline in rainfall amidst rising temperatures in Climate Types 2 and 4 areas. This will affect the distribution and transfer of food stocks from areas with surplus supplies to areas mentioned above.

	Flooding and landslides are nil to very minimal even in areas that are traditionally prone to flood and landslides during rainy months (normally in the second semester of every year). The temporal and climate - related human health observed in the 1st order shall be expanded and where health personnel and LGUs must be properly and regularly supplied with proper facilities, medicines and support to perform their expanded tasks. Off grid areas shall suffer from severe problem of access to safe and adequate water and electrical power for their households. The future power capacities, especially in areas that are host to tourism, commerce and industries, new subdivision areas have to be reviewed for new investment for small water impounding systems and mini-hydro to augment the present power sources.
Increase in Rainfall	Priority Theme on Water sufficiency will benefit most, followed by Food Security, Energy Security. The priority Theme on Human Security may have added problems of temporal and spatial expansion of climate-related health risks. Rice and corn cultivation, favor high temperature, and can expand in yield and cultivated areas in Climate Type 1 and 3. These positive impacts will be best appreciated in small island and upland farming communities where food crops can be grown twice to produce surplus for the market and thus support their household food security. However, flooding will be common in flood prone areas, particularly in Climate Types 2 and 4 where low lying areas will suffer from long periods of flooding and water stagnation and lower crop productivity. This will extend to the problem of distribution and access to market by the small unorganized farming communities. Likewise, Sub-Order 2b favors expanded fisheries production in low lying water accumulation areas. However, in the second semester of year, in all Climate Types, but more pronounced in Climate 2 and 4, where excessive rainfall are expected, landslides in sloping lands and flooding in low-lying informal/ resettlement areas can be a major cause of increased loss of properties, death and diseases. Success in reforestation with more seedling survival can be expected. Forest vegetation will improve to support their local wildlife and Indigenous peoples and likewise improve water generation services for power, sanitation and irrigation needs by downstream urban and rural communities.
Extreme Events	Magnification of Drought, Flooding and Health Risks
Drought	Drought and El Niño will exacerbate the impacts of rising temperature (1st Order of Impacts) on food, health, power, water supply and sanitation because of magnified water evaporation, evapotranspiration and losses of groundwater recharge. Prolonged drought and increasing incidence of El Niño will cause loss of pollinators and forest wildlings thus affecting supply of new generation of forest communities and breaking down of poorest forest flora and fauna. Along with these effects on flora and fauna, forest defoliation will be excessive and thus reduced their carbon-sequestration capacity. However, the forest litters accumulate on forest floors to become

	habitat of some insects which are food for some forest animals; forest litter likewise become stable sources and storage of soil organic matter and ultimately function as alternate soil-carbon sequestration.
Prolonged Monsoon Rain	Prolonged rainfall create favorable condition and recovery of ecosystem from the impact of low water supply and extreme heat. However, in sloping lands, landslide-related loss of lives and properties will be magnified because of the loss of organic matter (create surface sealing phenomenon) from combined episodes of reduction in rainfall and drought. Widespread flooding in high density areas will redistribute pollutants and may cause the spread of vector borne diseases. The risk will extend to agricultural crops, properties and infrastructures and even loss of lives, particularly for people living near waterways. Run-off accelerates the loss of accumulated forest litters which would result to loss of opportunity for soil carbon sequestration and, at the same time, result to loss of feeding grounds for wildlife feeding on insects and earthworms whose habitats are surface soil areas covered with forest litters. The high defoliating forest trees will start growing new leaves which will restore the C-sequestration function of the forest ecosystem. Massive redistribution of vector-borne diseases such as snail fever, leptospirosis and dengue are outstanding health risks. Food security will be improved by increasing yield and area of production for major food grains, including fisheries production, although flooding may also result in losses in both food and fisheries subsector.
Extreme Rainfall Events	Extreme rainfall events (e.g., super typhoons) will result in magnified threats to human and food security with its associated loss of lives and damage to lifeline and development infrastructures and the resulting serious disruption in economic activities. The sub-order may create significant changes in patterns of river systems through stream bank erosion which accelerate siltation, changing the volume and distribution of silt-laden flood waters. This contributes to changes in river pathways and sites of future flooding areas. This sub-order creates significant site- and condition-specific coping measures appropriate to each unique requirement of the Priority Themes with special considerations to the special changes related to climate types. Sub-order 3c is basically related to super typhoons which have been described in the earlier discussion as having strong winds covering an extra wide diameter (up to 940 miles, Table 2-1). The great challenge for the RBMES is monitoring losses as well as gains resulting from super typhoons.

In general, assuming all incremental actions and measures being equal, the provinces in Climate Type 1 are at the greatest risks in the country to the convergences of the orders of impacts. The management of incremental risks attributed to temporal and spatial convergence of all orders of impacts will remain moving target and one of the greatest NCCAP challenge in managing outputs and monitoring outcomes from the various risk interventions of the NCCAP priority themes. Priority theme on Knowledge and Capacity Development will always play pivotal role in the successful attainment of NCCAP ultimate outcomes. There is huge demand for innovative capacity building and knowledge management as a result in the changes of suitable areas of production, changing locations of food supply and the accompanying requirements for site-specific technologies and practices for food production, transport, packaging and marketing, flood control and irrigation design and water management and many areas of health infrastructures and management.

Climate Change Impacts and M&E Implications

The progressive monitoring of climate change impacts in different climate type areas in the country will require good network of strategic sentinel sites for monitoring losses as well as gains from the temporal and spatial changes in climate (see Table 2 as an example). For example, the identification of areas that gain from wide swath of rain from super typhoons will enable government agencies and local government in developing spatial strategy for climate smart investment towards sustainable development. Equally urgent is the identification of high risk areas that will require retro-fitting and climate proofing to address the challenges of a changing normal. The temporal and spatial confluences of rising temperature with changing patterns, duration and intensity of rainfall and extreme climate events reduced the relevance and effectiveness of some climate related defense infrastructures and as result lead to the increase the exposures of areas and communities to various risks attributed to climate change.

Climate change is a moving target which will require simple, robust data base and baselines and particularly monitoring indicators for timely processing and interpretation of new and changing environmental risks, including immediate detection of interventions that have positive co-benefit and potential maladaptation impacts. It is important to document responses to the changes in ecosystems and environmental services that have potential consequences of many traditional knowledge and practices losing their effectiveness and where its continued use to managed risks can result into more losses and serious maladaptation with unintended risk creation to other related activities. It is also imperative to acknowledge and assess the possible magnification of risks yet inadequately managed because current knowledge, practices and technology are no longer applicable against a changing normal.

Table 2. Gainers and losers in extreme events. Source: DA-BAS (compiled).

Tropical Cyclone and Date of Occurrence	Max. Wind speed (1-min sustained)	Affected Areas and Climate Type	Changes in Production				
			Before the Cyclone (MT)	During the Cyclone (MT)	% Gain or (Loss)	After the Cyclone (MT)	% Gain or (Loss)
Iliang (Oct. 7-18, 1998) and Loleng (Oct. 15-24, 1998)	285 km/h 250 km/h	Pangasinan (I) Cagayan (III) Isabela (III)	940 4,666 10,235	1,128 1,147 8,636	20.0 (69.9) (15.6)	704 9,808 10,951	(37.6) 592.2 26.8
Frank (June 18-23, 2008)	205 km/h	Iloilo (I) Cebu (III & IV) Negros Or. (I&III)	15,508 1,234 1,704	23,147 2,774 2,324	49.3 124.8 36.3	8,960 3,299 2,277	(61.3) 18.9 (2.0)
Pepeng (Sept. 30-Oct. 13, 2009)	250 km/h	Pangasinan (I) Cagayan (III) Isabela (III)	2,977 6,043 66,137	2,052 12,327 104,549	31.1) 104.0 58.1	1,980 11,743 141,441	(3.5) (4.7) 35.3

NCCAP ADAPTATION HYPOTHESES AND THEORIES OF CHANGE

The National Climate Change Action Plan, as the translation of the National Framework Strategy on Climate Change (2010), comprehensively addresses the challenges of climate change. It provides a policy environment that will encourage the participation of all sectors to optimize opportunities toward sustainable development. The NCCAP outlines the strategies for adaptation and mitigation for 2011 to 2028 for the seven strategic priorities on food security, water sufficiency, environmental and ecological stability, human security, climate-smart industries and services, sustainable energy and knowledge and capacity development (see Figure 7). The NCCAP recognizes that there are cross-cutting concerns for all the seven priorities such as gender and development, technology transfer, research and development, IEC and capacity building.

Each major intervention outcomes in the NCCAP are supported by adaptation hypothesis and theory of change that backstops the theoretical framework of the RBMES. Adaptation hypotheses are testable statements for each major intervention outcome. The hypotheses should link the outcomes of the NCCAP priorities (e.g. food security) to the relevant risks and vulnerabilities the intervention intends to address. It should elaborate how and why the outcome is expected to contribute to adaptation. This brief statement summarizes the rationale for the outcome by linking the outcome through key dimensions of the intervention strategy to the findings of the initial vulnerability or risk assessment. Once a clear hypothesis is drafted for each intervention outcome, the next step is to draft a consistent theory of change (ToC) that maps out and links core activities to adaptation outcomes and acts as a point of reference for checking progress while monitoring and to evaluate completed interventions (Spearman and McGray, 2011).

For the NCCAP RBMES, the primary activities, outputs and outcomes of each NCCAP priorities were reviewed as a sequential narrative to form a common narrative and agreement among diverse stakeholders about what to change and how they are going to go about creating that change. The ToC as an analytical tool helped articulate the assumptions that underlie the formulation of NCCAP outcomes and also to help layout the pathway for achieving immediate objectives and long-term goals.

In connection with NCCAP implementation, a theory of change is a systematic assessment of what needs to happen in order for the desired outcomes to occur. It explains how and why change happens as well as the potential role of CCC and partner agencies in contributing to the outcomes and impacts of NCCAP's seven priority themes. In this regard, the theory of change must be:

- Plausible - evidence suggest that the specified activities will lead to the desired outcomes;
- Doable - the initiative has adequate financial, technical, political, institutional and human resources to implement the strategy; and
- Testable - the pathways of change are specific and complete enough, with measurable indicators and specified pre-conditions, to track the progress in a credible and useful way.

Perhaps the most useful aspect of a theory of change is the discussion and exchange among stakeholders during the development process. The value of the process can be extended by recognizing that a theory of change is a constantly evolving working document that should be the focus of regular reflection and revision with all stakeholders.

NCCAP's ultimate goal is to build the adaptive capacity of women and men in their communities, increase the resilience of vulnerable sectors and natural ecosystems to climate change, and optimize opportunities toward gender-responsive and rights-based sustainable development. Through careful and thorough review of NCCAP vis-à-vis the voluminous recent scientific literature on climate change, the overall adaptation hypothesis for NCCAP could be stated as follows:

As climate change impacts arise from the increase in temperature with associated increase in sea level, temporal and spatial variation in rainfall and devastation from frequent extreme weather events, it affects all sectors, communities and ecosystem (with more severe effects on poor families and less developed communities or areas) wherein climate change adaptation or resiliency depends on knowledge, preparedness, ability or skills and resources or means to cope and resolve.

The **knowledge** referred to is the understanding by individuals and community of the phenomenon of climate change and how different from traditional beliefs and prior experiences, the importance of which is the underscored by the cross-cutting priority theme of knowledge and capacity development. **Preparedness** means the proactive initiatives to climate proof infrastructure, buildings and settlements; and education of the populace. **Ability or skills** arise from conscious efforts to train the people to better respond to or cope with the different impacts of climate change; and means or resources refers to the wealth of individuals or capability of communities to withstand or to recover from adverse effects of extreme weather event. And resolve refers to the mindset or attitude of individuals or ethos of society to survive and move on despite calamities and disasters wrought by Mother Nature. Thus, the desired outcomes are the combined results or synergistic effects of various actions under the different NCCAP priority themes.

Interventions for effective coping or adaptation are expensive, and must aim for other benefits to be justifiable. NCCAP will utilize existing government budgets and new sources of financing from the private sector and international community by aligning programs along the national framework strategies and actions for climate change. Mainstream programs of sectoral agencies can contribute to CCAs or achievement of resiliency with minor adjustments and incremental costs. It will also take advantage of the huge human resources in government by mobilizing and building their capacities. Proactive CC actions can be potent economic stimuli with lasting benefits to society.

Based on the NCCAP adaptation hypothesis, an integrated results model (see Figure 7) which demonstrates causally interdependent intermediate outcomes of the seven priority themes was constructed. This somehow represents the "integrated theory of change" for the entire NCCAP at the outcome level. It is based on the premise that the success of one strategic priority theme will lead to the success of other strategic priority themes that will contribute to the attainment of the ultimate outcomes. The interrelated output areas and indicators for each of the seven strategic priorities have their own pathways to effectively achieve their respective immediate and intermediate outcomes which, in turn, contribute to the attainment of the ultimate outcomes. NCCAP's ultimate goal is to *"build the adaptive capacity of women and men in their communities, increase the resilience of vulnerable sectors and natural ecosystems to climate change, and optimize mitigation opportunities towards gender-responsive and rights-based sustainable development."*

Figure 7. NCCAP integrated results model.

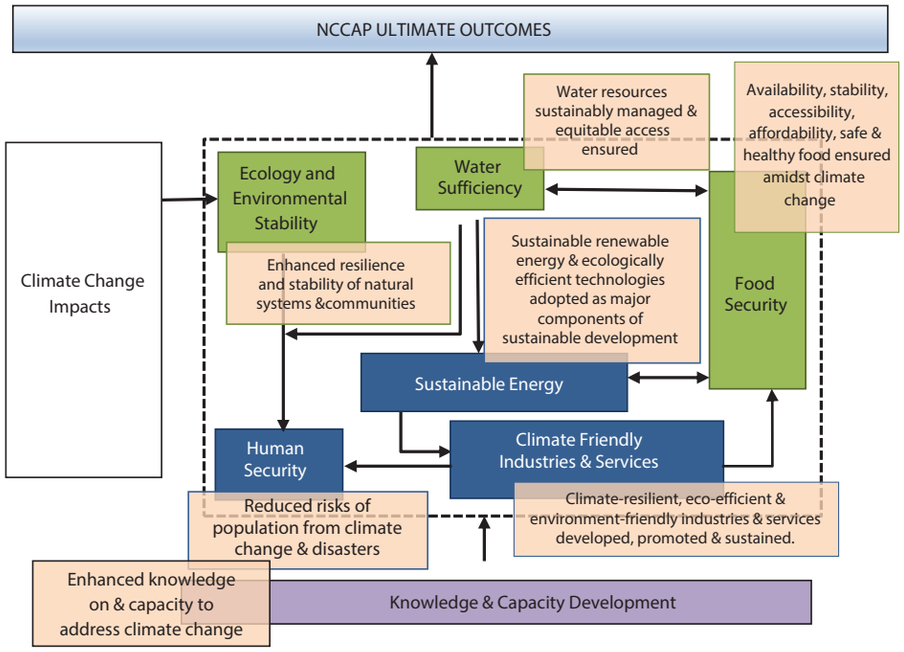


Table 3 NCCAP strategic priorities and respective immediate and intermediate outcomes, 2011-2028..

Ultimate Outcomes	Enhanced adaptive capacity of communalities, resilience of natural ecosystems and sustainability of built environment to climate change				Successful transition towards climate smart development		
Strategic Priorities	Food Security	Water Sufficiency	Ecological and Environmental Stability	Human Security	Climate Smart Industries and Services	Sustainable Energy	CC Knowledge and Capacity Development
Intermediate Outcomes	Availability, stability, accessibility, Safe and healthy food ensured amidst climate change.	Water resources sustainably managed and equitable access ensured.	Enhanced resilience and stability of natural systems and communities.	Reduced risks of the population from climate change and disasters.	Climate-resilient eco-efficient and environment- friendly industries and services developed, promoted and sustained.	Sustainable renewable energy and ecologically efficient technologies adopted as major components of sustainable development.	Enhanced knowledge on and capacity to address climate change.
Immediate Outcomes	Enhanced CC resilience of agriculture & fisheries production & distribution systems Enhanced resilience of agricultural & fishing communities from climate change	Water governance restructured towards integrated water resources management in watersheds and river basins. Sustainability of supplies and access to safe water ensured. Knowledge and capacity for CC adaptation in the water sector enhanced.	Ecosystems protected, rehabilitated, and ecological services restored.	CCA and DRR practiced by all sectors at the national and local levels Health and social sector delivery systems are responsive to climate change. CC-adaptive human settlements and services developed, promoted & adopted.	Climate-smart industries and services promoted, developed and sustained. Sustainable livelihood and jobs created from climate-smart industries and services Green cities and municipalities developed, promoted and sustained.	Nationwide energy efficiency and conservation promoted and implemented Sustainable renewable energy development enhanced Environmentally sustainable transport promoted and adopted Energy systems and infrastructure climate-proofed, rehabilitated and improved.	Knowledge on the science of climate change enhanced. Capacity for CC adaptation and mitigation at the national and local level enhanced. CC knowledge management established and accessible to all sectors at the national and local levels.

As shown in Table 3, NCCAP's seven strategic priorities would lead to two ultimate outcomes; first, enhanced adaptive capacity of communities, resilience of natural ecosystems, and sustainability of built environment to climate change, and second, successful transition towards climate-smart development. For the intermediate outcomes, each strategic priority has one intermediate outcome, thus, there are seven intermediate outcomes that will contribute to the two ultimate outcomes. There are 19 immediate outcomes, with Sustainable Energy having four immediate outcomes, three each for Water Sufficiency, Human Security, Climate Smart Industries and Services and CC Knowledge and Capacity Development. Food Security has two immediate outcomes and only one for Ecosystem and Environmental Services.

The NCCAP Integrated Results Model illustrates the importance and roles of acquiring proactive knowledge and capacity development program appropriate to changing climate-induced weather aberrations to improve human and institutional capacity to addressing spatial and temporal moving targets and uncertainties of climate change events and impacts. The provision of well-designed knowledge and awareness of human and institutions improves the country's ability to adapt and reduce mal-adaptation, as well as combating impacts of climate change on the delivery of services and functional roles of natural and built environment on inter-related needs for food and water security and sustained human wellness and safety. The integrated results model illustrates the critical "action-to-result chain" of different programs and activities NCCAP priority themes for avoiding, preventing and reducing risks and opportunities (gainers-losers) from climate change in order to attain the desired outputs and targeted ultimate NCCAP outcomes.

To illustrate further Figure 7, key output areas needed to achieve the intermediate outcomes are detailed in Figure 8. Figure 8 provides the framework for the identification of key functions of "NCCAP defined output areas" for each priority theme that shall contribute to the attainment of NCCAP outcomes, to wit, a) Enhanced adaptive capacity of communities, resilience of ecosystems, and sustainability of built environment to Climate Change and b) Successful transition towards climate - smart development. It is assumed that the successful attainment of the outcomes of the priority theme shall contribute to the a) reduction of ecological risks and losses attributed to the different impacts of climate change and the process shall help other associated priority themes attain their respected outcomes. It is likewise illustrated that the selected key function of priority theme are directly linked to the specific attainment of either NCCAP Outcome 1 or Outcome 2 or both. With the exception of Human Security function on creating able bodied and healthy manpower for agriculture and industries, all functions in each priority theme are clearly stated in the NCCAP for 2011-2028. It is considered in the RBMES that functions and selected output areas with benefits shared between one or more priority themes are considered key to the attainment of Outcomes 1 and 2. They must be identified as key output areas that must be closely monitored and their method of analysis be closely agreed by implementing agencies. Some key examples of inter-thematic exchange of output areas are the following:

- For Human Security (HS), "ensuring able bodied, healthy man-power" assure the contribution of Human Security theme to the attainment of Outcome 1 and that such mass of able-bodied and healthy communities shall likewise function as b) potential consumers and market for products and services that is linked to Outcome 2. These provide co-benefits to the attainment of outcomes of Climate Smart Industries and Services (CSIS) and Food Security (FS);

- The Sustainable Energy (SE) theme, recognize the urgency of the need to develop alternate clean energy sources to ensure early development of small power structure (mini-hydro). Furthermore, there is recognition of the proactive and early consideration for augmenting water supplies the immediate future rather than pushing the dam capacity to its maximum limits through the planning, climate proofing of investments and implementation of off-grid water supply systems and infrastructures for the waterless areas and small island provinces. The well - defined function of the SE theme is to develop community-based, alternative clean energy augmentation program to support the future requirements of climate smart development (Outcome 2). This output area is strategically important for enhancing the attainment of specific inter-thematic outcomes of SE with other equally important priority themes – Climate Smart Industries and Services, Food Security and Water Sufficiency – and their aggregated contributions to the attainment of NCCAP Outcomes 2.

- The Climate Smart Industries and Services has the inherent function, aside from its intended

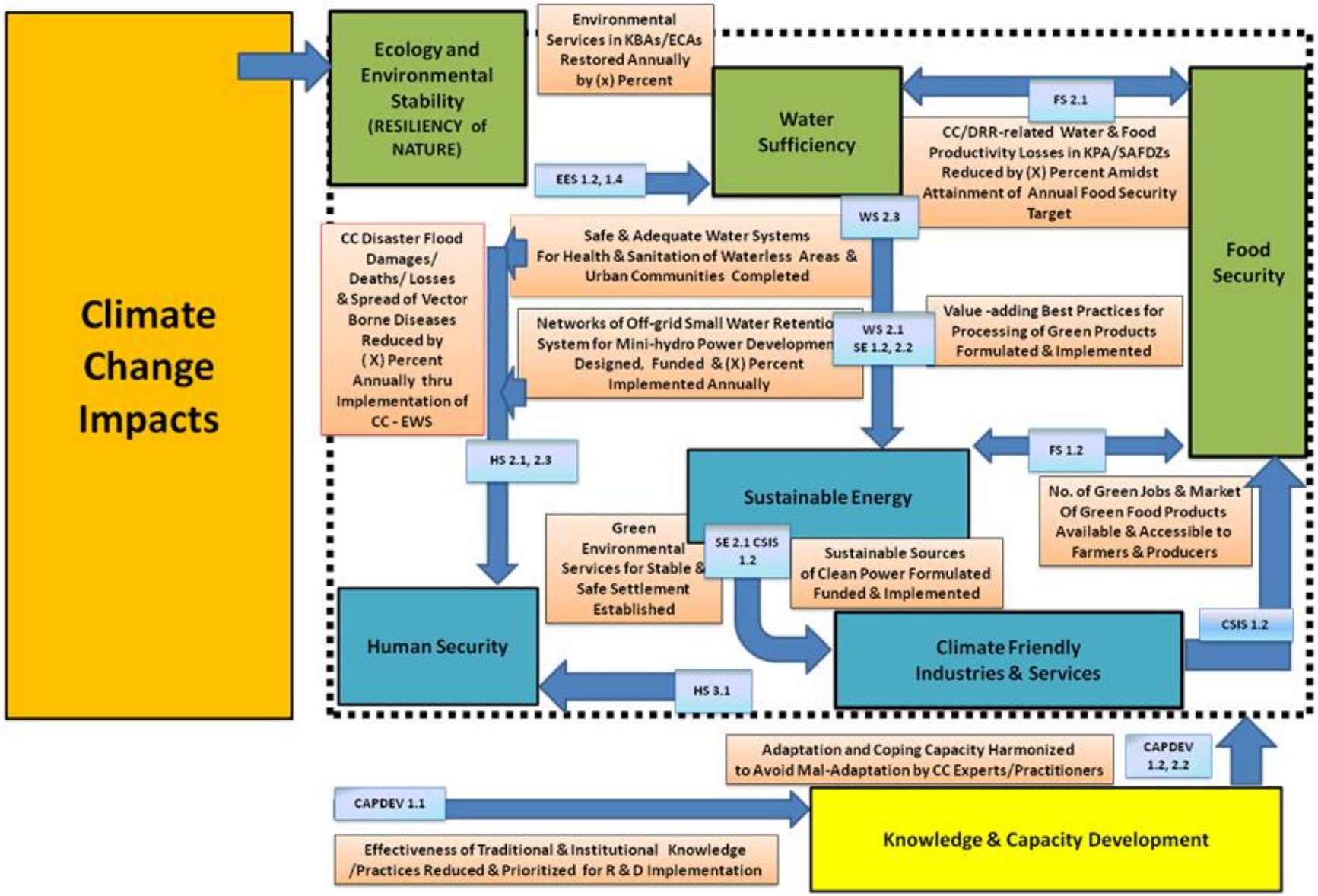
role in enhancing environmental conditions of the country's protected forest ecosystem, of providing a) job opportunities and stable incomes for able-bodied human power in Human Security and b) alternate cost effective green production of processed food and agri-fishery based SME's. The successful implementation these output areas for CSIS will likewise enhance the attainment of outcomes of Priority Themes FS, HS, SE and EES.

Figure 8 recognized the immediacy and relevance of "supply and demand" of water as the common response to addressing climate change risks and impacts to food, health, livelihood and safety. Supply and demand of fresh water is the critical multi-functional ecological goods and services that link EES and WS to a) for irrigation (Food Security), b) power (Sustainable Energy) and c) domestic water supply (Human Security). This multiple function of water under Water Sufficiency already provide clear idea that one function of theme can have co-benefits to other themes to achieving common goal, the NCCAP Ultimate Outcomes 1 and 2.

The inter-thematic output chain in Figure 8 (which list the output areas for reference) are representative analysis of actions and output areas and illustrate how each output areas are functionally linked to the achievement of the ultimate outcomes of the priority theme itself and the NCCAP ultimate outcomes as well. The summarized illustrations below include, but not limited to, the following examples:

- The major and immediate climate change impacts shown in Figure8 that may trigger series of actions and relevant output areas are:
    - Climate change has immediate effect on the reduction of the capacity of natural resources to provide ecosystem services; e.g., providing stable supply of water and its role of watershed in controlling run-off and flood mitigation;
    - Almost at the same time, the changing EES resilience to impacts of climate change has parallel effects on the effectiveness of traditional knowledge and institutional practices in reducing the climate change risks under various priority themes. The first effort of the Knowledge and Capacity Development theme is to review the knowledge gaps due to the incremental impacts of climate change to reduce risks.
- As EES loses its resilience, the immediate effects on HS will be in the form of loss of lives from climate-related disasters and spread of climate sensitive diseases. HS addresses these effects through its output area which implements key activities and actions to capacitate health personnel and communities on CC health adaptation and risk reduction and at the same time establish the health emergency response and post-disaster management to immediately protect vulnerable communities. This particular effort of the HS priority theme translates into mass of able-bodied communities that can be mobilized for agriculture and industry works. In the end, sustaining these output areas will contribute to Ultimate Outcome 1.
- Two key output areas of EES in restoring environmental services of Key Biodiversity Areas (KBAs) which refer to management and improvement of protected areas and KBA and capacity for integrated ecosystem management approach in protected areas and KBAs will improve levels of water generation under WS Priority Theme
- While EES develops the effort of stabilizing watershed and as flooding remain unmitigated, parallel actions and output areas from FS are systematically put in place to capacitate the agriculture and fishery sectors for CCA-DRR to reduce, in the interim, risks from flooding and other climate related events.
- As WS priority theme improve the water supply to help SE theme to stabilize power, the output area that implement development of alternative clean energy (National Renewable Program) offers opportunity for FS to participate in the processing of green products and contribute to NCCAP Ultimate Outcome 2.
- Other pathways are CSIS key actions and output area that explicitly increased productive employment and livelihood opportunities, when linked as co-benefit with FS, shall enhance agriculture and fishery sectors another sources of income to enhance their food security objectives.
- The Inter-thematic linkages of key output areas in Figure 8 ensure sustainable rural and urban development and poverty alleviation, develop climate change resilient communities and natural systems, and contribute to the attainment of climate smart development.

Figure 8. Illustrative output areas that contribute to the NCCAP ultimate outcomes cited in Figure 7.



THE NATIONAL CLIMATE CHANGE ACTION PLAN IMPLEMENTATION FRAMEWORK

The preceding chapter has underscored the complexity of climate change impacts on ecosystems, communities and the country as a whole. The National Climate Change Action Plan was formulated as a key instrument to address these impacts. The NCCAP 2011- 2028 outlines the Philippines' agenda for adaptation and mitigation to comprehensively address the challenges of climate change. It is a comprehensive plan with key actions that enhances adaptive capacity and resilience of communities and natural ecosystems to climate change.

The Action Plan recognizes the importance of convergence planning among national agencies and concerted efforts for implementation and M&E. It is realistically phased into three 6-year plan periods – short, medium and long terms – corresponding to regular development planning cycles corresponding to government administration term of office. NCCAP monitoring is planned annually and evaluation every three years. Annual monitoring provides information that sets directions in setting priorities and budgets every year. Evaluation will focus on efficiency, effectiveness and impacts.

The Action Plan is broad in scope and intention and reflects the best ideas on the subject at the time of preparation. It has adopted a practical approach in clustering programs and activities along seven priority themes which sectoral agencies and interest groups can refer to. The conscious decision to veer away from conventional sectoral planning to thematic outcomes was motivated by the desire to focus the NCCAP on results. The key actions in the strategic priorities are defined along thematic outcomes – food security, water sufficiency, ecosystem and environmental stability, human security, climate smart industries and services, sustainable energy, knowledge and capacity development. There are at least 326 initial activities in the NCCAP as summarized by priority theme (see Table 4).

It is evident from the table that most of the initial activities are preparatory in nature (46%), and of these 59% are of knowledge and capacity development (KCD) type. The preparatory, precursor and/or foundation activities include the following:

a. Enabling the policy environment;
b. Establishment of databases and baseline indicators;
c. Characterization of vulnerable areas/ communities and mapping of vulnerable sectors;
d. R&D for adaptive technology development;
e. Capacity building; and
f. Piloting of innovative strategies.

There is a collective assumption that to apply effectively the priority interventions as identified, it is necessary to build appropriate capabilities, systems and schemes among providers, be it institutions, industries and enterprises. It is also expected that as the preparatory activities are successfully implemented, the next logical activities that have substantial contribution towards the attainment of desired outcomes will also be planned, funded and implemented.

Table 4 Summary of NCCAP initial activities.

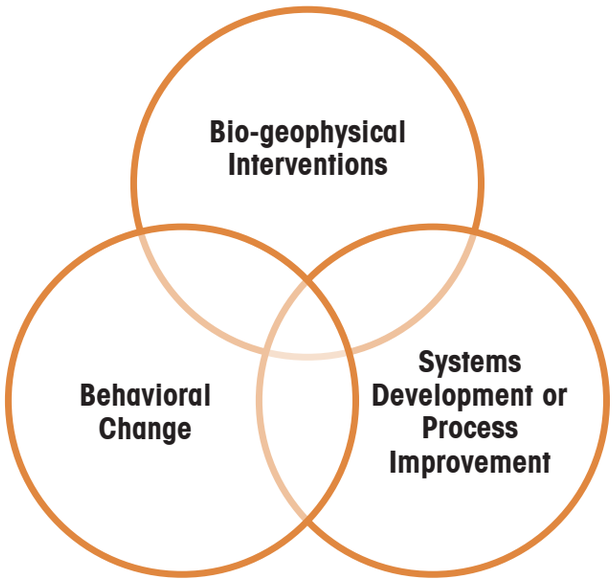
Priority Theme	Total	Preparatory		Main Action		Indirect Action
		KCD	Cluster Specific	KCD	Cluster Specific	
Food Security	36	15	6	4	8	3
Water Sufficiency	60	9	23	14	13	1
Ecosystem and Environmental Stability	43	12	12	13	6	
Human Security	30	6	5	6	13	
Climate Smart Industries & Services	69	22	6	21	20	
Sustainable Energy	53	13	10	20	10	
Knowledge & Capacity Development (KCD)	35	12		23		
Total	326	89	62	101	70	4

Of the identified CC actions or those that would lead to actual adaptation or mitigation outcome, also 59% are of KCD in nature. The KCD intervention may include initial training of responsible persons before actually carrying out the desired activities. There are varying degrees of detail in the proposed intervention among priority themes reflecting the different levels of knowledge and/or effort devoted by the sectoral agencies and interest groups in their cluster planning. While the desired outcomes, directions and initial activities by priority themes are already identified, further investigation of options, planning and consultation are now in order to develop appropriate implementation strategies and schemes. The NCCAP may need further refinement as new ideas and evidences emerge to strengthen the concepts and principles. As an initial document, it should be viewed as work in progress that can be improved as new tools are developed to analyze and interpret evidence of climate change adaptation and provide guides for effective implementation of necessary activities.

To better appreciate the challenges in implementing the NCCAP, it is necessary to analyze the proposed activities, desired outcomes and identified success or monitoring indicators among the priority themes, understand their similarities and differences, and evolve a "conceptual implementation model" or framework. The framework should consist of interacting elements that can easily be understood and/or measured. The underlying guideline is that any proposed climate change adaptation measure should eventually lead to the desired outcome(s) and must recognize that in the process there are facilitating or constraining factors. A unifying feature will be the identification of target beneficiaries or vulnerable groups that are addressed and potential benefits of proposed actions. While initial efforts may be based on historical or observed impacts, there should be a gradual shift toward science-based and objectively formulated hypothesis of causality leading to the desired outcomes. New information and knowledge are continuously being generated and emerging evidences should be received with open mind and their potential implications should be recognized. However, scientific bases should recognize contribution of various disciplines and indigenous knowledge in explaining complex relationships of key actors and dynamics in evolving climate change actions.

An analytical tool illustrating the relationship of contributing factors toward the attainment of desired outcomes has been conceptualized as shown in Figure 9. By and large, very few of the identified actions could directly result to the desired outcomes. Most contributing actions have other equally important objectives but a confluence or collaboration of one or more actions would be more effective. From the range of desired outcomes, we can infer that the effective attainment of most of the outcomes will involve the synergistic effects of three major factors or influences: a) bio-geophysical interventions (hardware); b) systems development or process improvement (software); and c) behavioral change (knowledge, attitudes and practice) of target beneficiary groups. The absence of one of the key interventions can be the limiting factor. The proposed physical interventions in the NCCAP are extensive, and capable executing and implementing agencies have been identified. The implementation of the interventions needs to be further elaborated and the relevant agency, which can devote focused attention to their implementation, is the CCC.

Figure 9. Analytical Model Showing the Contributory Factors to Climate Change



Elements

Based on the approach described above, the framework of implementation will have the following elements:

a. Goals and Objectives, translated into:
   i. Vulnerable groups that need to be protected or assisted and
   ii. Benefits from the efforts;
b. CC Impacts and Implications, translated into
   i. Spatial or geographic distribution of the vulnerable groups and
   ii. Causes and degrees of vulnerability of various groups;
c. Current, pipeline and proposed intervention activities aim to help the identified vulnerable groups;
d. Phased implementation with timing, logic and features of each phase;
e. Responsible parties and delineation of roles for the identified interventions;
f. Estimated budgetary resources needed; and
g. Monitoring and evaluation system.

The NCCAP Implementation Framework relates the proposed intervention with the resulting outcome indicators. This leads to regrouping or reclassification of certain activities along common purpose of target beneficiary groups rather than on the main function of the implementing agencies.

Phasing and Priorities for Implementation

By Priority Themes

The implementation of the NCCAP in the initial stage (up to 2016) will be planned, implemented and monitored along the priority themes. Consolidation efforts have been invested in and a cluster-approach of working relationships have been developed among the key players in each of the NCCAP thematic priority. The working groups have identified the necessary preparatory or foundation activities that have to be carried on the ground at national and sub-national levels. Of necessity, they are developmental and pilot in nature, and must be national or centrally directed as "anchor or flagship" programs. The interventions can be implemented with minor adjustment or CCA mainstreaming in the sectoral agencies and can ride along the agencies' main functional outputs. Moreover, the initial implementation efforts should already build the capability at the regional and sub-national government units.

By Flagship Programs as Collaboration Among Priority Themes

In the succeeding Philippine Development Plan (2016-2022), further collaboration among priority themes should focus along common intermediate outcomes. The programs can be organized into anchor or flagship programs along vulnerable ecosystems, vulnerable settlements or cities, major infrastructure and building and/or along industry groups. The implementation should be regional or provincial for vulnerable ecosystem, by city or municipality for vulnerable settlements, and by sectoral industry groups for climate-smart providers. Capability building should be extended down to the local levels.

By beneficiary or vulnerable group with decentralized planning and implementation

In the third Philippine Development Plan (2022-2028), further collaboration among concerned agencies, civil societies and private companies should focus on specific beneficiary or vulnerable groups. The implementation would be mostly local but guided by lessons learned from implementation experiences in earlier stages. The intervention should be locally planned and implemented based actual needs. This should lead to the institutionalization of successful

intervention across the archipelago, and the implementation should cover the remaining 60% of the vulnerable areas or groups.

Phasing and flexibility of Implementation

While the above proposed options describe the essential characteristics of activities under each phase, there should be tolerance for flexibility and piloting of approaches in various phases as long as there is a clear logic for the deviation. New ideas may emerge in the future and new opportunities for funding may arise that could justify adjustment and experimentation. However, there should be good documentation and monitoring of such activities so that valuable lessons can be gleaned and used to improve the overall effectiveness in the implementation of NCCAP.

Implementing Strategies/Schemes

The implementation of various climate change actions may be guided by the following concepts:

- Focus on vulnerable sectors/areas to highlight the impact of CC initiatives/intervention. Rank order of vulnerabilities as basis for prioritization
- Determine which on-going or main program of sectoral agencies in which the proposed CC programs can be piggy-backed for cooperative implementation and maximum impact
- Package anchor programs for the implementation of foundation or precursor activities
- Package banner or flagship programs by typical vulnerable sectors/areas
- Implement prototype programs in priority regions/areas
- Determine incremental effects of CCAs and adjust in order to optimize benefits or minimize negative effects

Options for Financing

Strategic leveraging or matching grants

Despite the popularity of CCA in the near term, the available resources would still be limited and only be incremental to resources available for major and recurrent programs. A prudent and effective use of limited CCA resources is through leveraging and application as matching grants. Partners should use the own resources for their main programs, but complemented by CCA funds for those aspects that have significant CCA impacts.

Financing and rewarding success instead of effort

The limited funds for CCA should made available to all interested groups that could meaningfully contribute to overall efforts, and not allocated by formula to sectoral agencies or supply groups. This can be done through competitive grants to brilliant or innovative groups for useful 'products' or 'services' and these include knowledge products or technologies. Or it could be used to buying finished 'winner' products. Together with this concept is level playing field with greater reliance on the private sector or civil societies.

NCCAP RESULTS-BASED MONITORING AND EVALUATION FRAMEWORK

Introduction

Results-based monitoring and evaluation (RBME) is central to the system, strategy, protocol and routines that will be established for tracking and measuring the outputs and outcomes of the NCCAP. It is founded mainly on the adaptation hypotheses and theories of change elucidated in previous chapters. It also draws from the major lessons learned from the review of M&E literature, cursory evaluation of existing monitoring mechanisms of key government agencies, and numerous discussions and workshops among relevant stakeholders.

Review of experiences in M&E of development interventions and climate actions found in the literature indicate that while M&E is well integrated into the planning, implementation and coordination cycles of most international donor-assisted development programs or projects, it is still an evolving field of literature in concept and practice (ADB, 2006; IFAD, 2002; Lamhauge, et. al., 2012; Spearman and Mc Gray, 2011; UNFCCC, 2010). Some key lessons learned from the review of experiences of international development agencies in M&E of sustainable development and climate change interventions are as follows:

a. Results-based M&E – Whether sustainable development or climate change related, RBMES (and specifically, the logical framework approach) is integral to the management by these agencies of development assistance. It provides the logic for putting in place appropriate interventions, and tracking the progress of implementation and measuring outcomes. It is a systematic way of analyzing the results/impact chain.
b. Identifying unique CC adaptation actions – What determines whether or not a certain SD intervention can be categorized as CC action will be dictated by its climate change context and the vulnerability of stakeholders to CC impacts.
c. Indicators – A good mix of indicators (qualitative, quantitative and binary; process, output and outcome) should be considered in developing an M&E system.
d. Establishing baselines and counterfactuals – This is important in developing an effective M&E but it will depend so much on available authoritative vulnerability assessments and historical data, among others.
e. Time frame – The M&E system envisioned must consider the long period before the outcomes of CC actions are felt, and this will have a major implication in the choice of indicators across a long time horizon.
f. M&E at the national level – Project level M&E is far more advanced than national level's owing to the former's time-bound, focused and short term nature. Further, little progress in evaluating national adaptation plans has been documented.
g. Complementing existing M&E systems - M&E tools and systems for CC actions must complement or be complementary to existing M&E systems.

Elements of the NCCAP RBME Framework

Scope of the Monitoring and Evaluation

As indicated, the NCCAP outlines the roadmap for CC actions for 2011-2028 using existing government budgets and new sources of financing from the private sector and international community by aligning programs along the national framework strategies and actions for climate change. In short, it is supposed to direct all CC actions of and for the Philippines. However, even before the advent of the Climate Change Commission, there were already on-going programs, projects and activities of the public and private (including civil societies) sectors on or related to climate change. The CCC is expected to influence and set, by way of the NCCAP, the directions of major CC actions of the country. The RBME framework, therefore, sets in place a mechanism that can monitor uniquely: (1) in the short term, all current CC actions that are to be "aligned" to the NCCAP desired outputs and outcomes, and (2) in the long term when the

strategic CCC role of direction-setting is well in place, all future NCCAP-driven results-based CC actions.

All CC actions covered by the NCCAP, in the strictest sense, are planned adaptation measures[1]. Ideally, NCCAP measures should correspond to relevant agencies' respective programs, activities and projects (PAPs) as the operational translations of their respective major final outputs (MFOs) – the "binding" measure of the extent of public product and services delivered to its clients. However, a closer scrutiny of these MFOs and PAPs is needed to identify CC actions that contribute to the achievement of the outcomes stated in the NCCAP.

To address these limitations, the DBM and the CCC with support from key oversight and sectoral agencies, instituted the Programmatic Budget Approach (PBA) and Climate Change Expenditure Tagging (CCET) to support institutional reforms to mainstream priority climate change actions in the planning and budgeting processes. In the FY 2014 Budget Priorities Framework of the government, climate change adaptation and disaster risk reduction was identified as a major expenditure priority in the preparation of the FY 2014 Agency Budget Proposals.

JMC No. 2013-01 "Guidelines in Tagging/Tracking Government Expenditures for Climate Change in the Budget Process" and JMC No. 2014-1 "Tagging/ Tracking Government Expenditures in the Local Budget" was issued by DBM and CCC for national agencies and by DBM, CCC and DILG for local governments, respectively. The purpose are to identify, tag and prioritize climate change-related activities for all government agencies; and to take stock of relevant climate change PAPs to enable oversight and line department managers to track and report climate change-related expenditures. Additionally, for local governments, JMC No. 2014-1 clarifies responsibilities among LGUs, DBM, CCC and DILG relative to the tagging of climate change expenditures in the Annual Investment Program of the LGUs.

The results of the 2014 tagging provided the national government a portfolio of CC expenditures for FY 2015. It enabled DBM to identify:

- PAPs that are CC responsive (adaptation or mitigation)
- Percentage/ share of CC expenditure vis-à-vis total budget
- Budget responsive to national CC priorities, i.e. NCCAP
- Budget classified into different instrumentalities (e.g. policy, research and development, etc.)

The results of the CCET guide the sequencing and prioritizing projects and activities to maximize benefits in light of limited resources and worsening impact of climate change. The CCC intends to use CCET as a tool to monitor the implementation of the NCCAP and to serve as evidence for policy formulation and discussion on climate change.

It is important to note that the NCCAP RBMES do not intend to duplicate the existing M&E system of government agencies. Rather, it will build on previous and current government initiatives to integrate climate risks into the planning process and focus on results that:

a. target the most vulnerable subsector, area, or population relevant to the strategic priority based on climate change vulnerability and risk assessments ;
b. makes a contribution to adaptation that can be described based on the nature of its achieved objectives;
c. lay the foundation for future climate change actions without which results achieved in the Philippine Development Plan cannot be sustained amidst climate change;
d. can be plausibly attributed to the NCCAP results at the higher outcome level; and are therefore
e. indicative of progress being made in the strategic priority.

Indicators for NCCAP Outputs and Outcomes

Indicators are the cornerstones of an effective M&E system. Hence, the indicators were thoroughly reviewed by output areas (related to immediate outcomes) for each NCCAP priority theme. Possible indicators for the outcomes which have remained unspecified in the NCCAP were also formulated by the NCCAP RBMES Technical Working Group. It was found that a wide variety of possible indicators of outcomes can be specified for the different NCCAP priority themes. It suggests the following criteria for shortening the list to a few key indicators:

a. Ability to measure or represent the differential or incremental change in outcome attributable to specific outputs from CC action(s) directed to alleviating vulnerability to CC impacts;
b. Availability of data collected at regular intervals;
c. Representativeness of the chosen indicator as proxy for the pattern or variability of other indicators used to measure the results from or outcomes of a specific set of CC actions' outputs; and
d. Commonness as indicator for many outputs or many outcomes.

The NCCAP RBMES distinguishes between three types of indicators: Output (Critical), Immediate Outcome and Intermediate (Key) indicators. Outputs are goods, products and services produced by NCCAP activities that contribute to an outcome. Critical indicators output indicators were identified to measure outputs that are antecedent/precursor to immediate outcomes.

Outcomes are conditions that result from the outputs generated by NCCAP. There are two types of outcomes: Immediate outcomes, which are observable between 2011 and 2016 and intermediate outcomes, which are observable from 2016 onwards. One major consideration in the final choice of key indicators pertains to striking a balance between process and outcome indicators. Process indicators, which can be applied at short time scales, support ongoing learning and capacity development. However, these may not show evidence of success of CC actions. Outcome indicators buttress the "accountability" role of M&E but require a long time horizon to measure outcomes that result specifically from CC actions.

Process and outcome indicators were identified that reflect evidence of progress in the proposed priorities. The selected indicators were cross-referenced with the PDP Results Matrices and the performance indicators and major final outputs of relevant sectoral agencies, i.e., Department of Agriculture for the strategic priority on Food Security. As much as possible and where applicable, indicators common to all the three major reference for targeted development results were selected.

A "factsheet" accompanies each selected indicator that serves as a detailed documentation essential for operationalizing the RBMES. The indicator factsheet (see Table XX5) contains fields of information that shall guide the reporting of involved agencies on the agreed indicator.

Table 5. Indicator Factsheet Template.

Fact Sheet Author	Name, Position Agency Contact Information
Last Update	Date
Next Update	Date

Indicator	Short title of the indicator
Level of Result	The level of result measured by the indicator whether at the immediate, intermediate, or ultimate outcome level
Definition and underlying concepts	Brief description of the indicator and the conceptual framework behind it. If possible, include comments on the strengths and weaknesses of the indicator with respect to the issue or result it is supposed to measure.
Computation	Unless it is a straightforward adoption of data, indicate the mathematical formula for calculating the indicator especially where it involves the use of an index (set of aggregated or weighted parameters or indicators that describes a situation).
Unit of Measurement	Unit of measurement in which the indicator is calculated
Interpretation of the Indicator Value	Provide guidance for explanation indicated by high or low indicator values, especially of indicators based on complex calculations or of indicators without unit of measurement (dimensionless, as in ratios)
Unit of Analysis / System of Interest	System of interest (human, natural, economic) is the unit chosen to be assessed in respect to the result being monitored. It may be determined at different levels, e.g. a single crop system, an ecosystem, a region—depending on the objective of the analysis. Defining systems of interest provides the reference for determining whether and how climate change impacts might be important and how adaptation can be attributed.
Geographical Coverage	Indicate the specific area or location for which the indicator will be calculated (e.g., national, regional or local – province, municipalities, cities, barangays)
Linkage with other NCCAP Thematic Priority	Note if the indicator is also used to measure results from other thematic priorities of the NCCAP and at what result level
Linkage with existing M&E system	Include a statement whether the indicator is contained in other indicator systems or recorded in M&E system of other agencies. Note also the reporting format or publication in which the indicator is made available.
Frequency of measurement	Specify how often the indicator will be measured
Baseline and Reference Year	Two sets of reference value used to measure achievement of results referring to: a. Normal Year: referring to the year prior to the start of the NCCAP implementation (ideally, 2010 as the latest census year prior to the NCCAP); and b. Year of extreme event that is relevant to the measurement of the indicator (e.g., 1997 ENSO event)
Data / Information Source	Identify the agency from where the data or information is derived
Lead Agency	Identify the agency that is responsible for calculating or reporting (in cases where the indicator is a straightforward adoption of data) and analyzing the indicator for the purposes of the NCCAP RBMES and submitting the analyses to the Climate Change Commission for integration with the results of the other NCCAP thematic priorities.
Contributing Agency	Enumerate the agencies that contribute data or information that is necessary to measure the indicator. This is especially important in sectors where the lead agency need submission of data / information from agencies with shared mandate (e.g., water sector).
Feasibility of the Indicator	Rate and explain the implementability of the indicator or describe the conditions needed for its measurement to be accomplished. Use the following rating scale as a guide and provide additional explanations/details if deemed needed: 1. Indicator can be implemented on the basis of available data using existing data sharing agreement and/or M&E system of key agencies 2. Indicator can be implemented on the basis of available data but subject to data sharing agreement among key agencies 3. Indicator can be implemented on the basis of available data, however, additional calculations are needed and timely implementation seems probable. This is usually the case for indicators using indices based on available data. 4. Further development stage(s) is/are required to calculate the indicator such as improvement of survey instruments to include additional fields or based on new methods. However, there are already on-going initiatives related to this and implementation in the next 3 years seems probable 5. Further development stage(s) is/are required to calculate the indicator such as creation of new survey instrument or development of new methods. However, there are only on-going discussions related to this and implementation in the next 3 years seems improbable.
REMARKS Further information such as references to literature (full citation) that provides further details concerning the indicator or any other relevant remarks that are not captured in any of the fields provided in the Factsheet.	

Baselines and Counterfactuals

Baselines and counterfactuals (comparison between what actually happened and what would have happened in the absence of the intervention) are reference values used to measure achievements, in terms of outputs and outcomes, of the NCCAP. It is agreed that data are gathered only for baselines or counterfactuals for the selected key outcome and output indicators. These data may come from available secondary data sources, vulnerability mapping and assessments, simulation models of future impacts and vulnerabilities, and other literature or studies.

M&E Time Horizons

The RBME framework will break down the monitoring timeline of the implementation period (2011-2028) of the NCCAP into 3 sequential time horizons in view of the distinct type or level of M&E that can feasibly be accomplished within specific time horizons as follows:

1. Short term (up to 2016) – Mainly implementation monitoring of various PAPs on or related to CC, and evaluation of short-duration CC actions with final outputs and discernible outcomes;
2. Intermediate term (up to 2022) – Continue implementation monitoring and focus more on evaluation of emerging outcomes of PAP outputs of medium duration CC actions; and
3. Long term (up to 2028) – Continue implementation monitoring and evaluation of output-outcome causalities but mostly evaluation of final outcome translation (and impact).

This is only illustrative since planning and implementation of CC actions during the entire NCCAP period is a continuous or even iterative process. It merely meant to highlight that the type/level of M&E that can be done is dependent heavily on the fact that achieving the desired output and more importantly, the final outcomes takes time, and these may only be realized beyond the CC action implementation period.

Implementation monitoring will have to rely mainly on process indicators to track the progress of CC actions in the short term (up to 2016) since the PAPs may not yet yield measurable outputs. A mix of mostly output and some outcome indicators may already be measurable in the medium term (up to 2022), and ultimate and/or impact indicators must ultimately provide solid measures over the long term (up to 2028) on the results of the NCCAP in building CC resilient communities and climate smart industries.

Communicating M&E Findings

The communication of M&E findings and NCCAP key results shall be at the following intervals:

- Annual – As part of the monitoring report and/or reportorial requirements to the Philippine President (as chairman of the CCC Board);
- Every 3 years – This is to coincide with the mid-term review of the PDP;
- Every 6 years – As input to the preparations and drafting of a new 6-year PDP;
- Every 1st Quarter of Calendar Year – As part of the IEC strategies to communicate NCCAP status targeting DBM budget call and preparation for succeeding year's General Appropriations Act (GAA);
- Semestral – As part of the regular IEC strategies and materials to update the Filipino people on CC and the results of the NCCAP in alleviating the vulnerability of the country to CC impacts;
- Ad Hoc – In response to status reporting as a result of any major CC event.

Institutional Arrangement

The present institutional arrangements entrust the actual and direct implementation and supervision of specific climate change actions to respective agencies and government instrumentalities. The CCC translates its overall-coordination mandate, as mandated in the Climate Change Act, into specific operational strategies for direction setting, coordination of implementation, monitoring of outcome and evaluation of results of CC actions under the NCCAP. This is not a sole undertaking of the CCC, however, but necessarily supported by other oversight agencies such as the Department of Budget and Management and the National Economic and Development Authority.

Implementation-based (or progress) monitoring of the PAPs achievement of the MFOs will be the sole responsibility of respective government agencies. In some agencies, e.g., the DENR and DA, a "Climate Change Office" provides overall coordination (including sector-wide progress monitoring) of and

has oversight responsibility over all major PAPs on or related to climate change that are being implemented directly by the various bureaus/units of these sectoral agencies. Absent such organic CC office, the Planning Office (or similar organic structure) of the other agencies may perform implementation monitoring of CC-related PAPs.

At the LGU level, implementation monitoring of CC-related PAPs may have to be lodged with the Planning and Development Office except when a unique CC unit, for instance the Provincial Government of Albay, has been established to singularly focus on coordination, monitoring and implementation of CC-related PAPs. The NCCAP RBME framework will provide guidance to determine: (1) which LGUs need to be included in the monitoring, (2) up to what level in the LGU hierarchy (provincial, municipal, village) will monitoring be appropriate and relevant. Some considerations may pertain to: (1) the vulnerability of geo-political jurisdiction of specific LGUs, (2) ecosystem approach to addressing CC vulnerability but M&E mechanism remains LGU-based and (3) the feasibility of "localized" M&E but integrated into the whole NCCAP RBMES.

Results monitoring, i.e., tracking the extent by which the outputs of PAPs are contributing to achieving the desired outcomes/impacts of the NCCAP, will be the strategic role of the CCC. At the outset and given the present CCC organizational structure, RBME will be the major mandate of the CCC-CCO Implementation Oversight Division. However, the effectiveness and sustainability of the RBME are enhanced if a separate Planning and Evaluation Division is established by the CCC, at the soonest possible time, to lead in the RBME of the whole NCCAP.

The role of the Inter-Agency M&E Group for the NCCAP will have to be viewed as a short-term, transitory measure. It will be a "bridging mechanism" to link the implementation monitoring of sectoral agency MFO-driven but CC-related PAPs to the results based (i.e., adherence to the desired outcomes/impacts of NCCAP) monitoring of the CCC. Its technical secretariat will be the CCC Implementation Oversight Division. The more permanent option, as already mentioned previously, is to establish an organic unit to lead in the M&E of the NCCAP, and a strong and concerted capacity development of the CCC on tracking results at the short, medium and long-term.

Food Security

Food security exists when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life. The concept of food security includes both physical and economic access to food that meets people's dietary needs as well as their food preferences (World Food Summit, 1996). More recently however, the operational definition of food security was further refined and broadened to include "social access" to put emphasis on consumption, the demand side, and the issue of access by vulnerable people to food (FAO, 2002) wherein vulnerability may occur both as a chronic and transitory phenomenon (FAO, 2003). A useful, working definition is put forward by FAO that:

Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life. Household food security is the application of this concept to the family level, with individuals within households as the focus of concern (FAO, 2003).

The agriculture and fisheries sector remains the main driver of the Philippine economy and the country's backbone for the sustainable attainment of food security. The country's Gross Domestic Product (GDP) posted a 7.18 percent growth in 2013 wherein agriculture and fishing contributed 10 percent with Gross Value Added (GVA) in agriculture and fishing going up by 0.90 percent. The 2013 production performance in the crop subsector shows mixed results wherein production of palay showed an increase by 2.26 percent while that of corn decreased by 0.40 percent. Other major crops such as coconut, sugarcane, banana, coffee, abaca and calamansi also registered output declines. Livestock subsector posted overall improvement of 1.76 percent. The fisheries subsector also showed recovery from previous year's decline with 1.24 percent increase in the 2013 production. In terms of employment contribution, 31 percent of the national employment is from the agriculture sector which employed 11.84 million persons in 2013[2]. Gross Value Added (GVA) in agriculture and fishing grew by 0.90 percent in 2013 at constant 2000 prices. The average annual rate of increase was 2.05 percent over the period 2011 to 2013[3].

However, despite the growth registered by the sector, changes in temperature regimes and rainfall patterns affect the productivity of the agriculture sector and provide added shocks to 31% of the country's population whop depend on agriculture for livelihood and sustenance.

Climate Change Impacts in Crop and Livestock Production

Agricultural planning, production and overall productivity of farming systems will be heavily influenced by significant changes in annual rainfall totals together with the changes in the onset and recession of rainy season and the increase in nighttime temperature (Tibig, 2001). Decreases in yields from exceeded temperature threshold values have been documented particularly for palay production (PAGASA, 2011). Climate related extremes such as heat waves cause disruption and losses in livestock production and performance (e.g., dairy production, eggs laid). Changes in the timing and onset of seasons, if favorable, can be more suitable for and hence increase the incidence of weeds, pests and diseases (MO, 2011); increase the rate of development of parasites and pathogens and cause changes in spatial distribution of diseases (Comiso et. al., 2014).

Studies show that increased carbon dioxide concentration in the atmosphere has a direct fertilization effect that will increase crop yields, although this may not offset the negative impacts of increasing temperatures and decreasing water availability on crop yield (Long et. al., 2006). According to a study by Cline (2007) on global warming and agriculture including the effects of CO2 fertiliation, the Philippines will have a -5% to -15% change in productivity assuming an average increase of 2.7 0C in temperature and a very slight increase in rainfall. Simulation studies to show the effects of increasing temperature and carbon dioxide concentration on yields of rice, corn and other crops in the Philippines show that the increased yield in carbon dioxide enrichment will be offset by the yield reduction due to temperature increase (Lansigan et. al., 2007). Simulation results also indicate decrease in rice yield from 8 to 14 percent for every 1 0C increase in temperature depending on locations in the Philippines (Comiso et. al., 2014) as well as on the crop variety, growth development stage and the period that the rice has been subjected to stress (DA, 2009) as indicated in Tables 6–8.

Table 6. Rice yield reduction coefficients due to drought (Source: DA, 2009).

Period of Stress	% Yield Loss
Early vegetative stage (Transplanting to tillering)	30-50
Early vegetative stage to reproductive stage (Transplanting to panicle initiation)	60-75
Early vegetative stage to reproductive stage (Transplanting to heading)	65-70
Maximum vegetative to reproductive stage (Maximum tillering to heading)	45-50
Reproductive to maturity stage (Panicle to maturity)	60-100
Reproductive to maturity stage (Booting to maturity)	60-100
Reproductive to maturity stage (Flowering to maturity)	60-100
Late reproductive to maturity stage (Milking to maturity)	45-60
Maturity stage (Soft dough to maturity; Hard dough to maturity)	10 or less
Transplanting to maturity stage (Minimum tillering to maturity)	95-100

Table 7. Estimated crop yield loss for rice due to typhoon-induced strong wind (Source: DA, 2009).

Crop Growth stage	Wind velocity (kph)					
	70-100			101-150		>150
	Period of Exposure (hrs)					
	< or =12	>12	< or =12	>12	< or =12	>12
	Estimated Yield Loss (%)					
Booting	<10-15	15-20	15-25	20-30	15-30	25-35
Flowering	10-25	25-30	15-30	30-35	25-40	35-50
Maturity	<10-15	15-20	10-20	20-25	15-25	25-30

Table 8. Estimated rice crop yield loss due to flood at different stages of plant growth and development (Source: DA, 2009).

Plant Growth Stage	Clear Water				Muddy Water			
	Days of submergence							
	1-2	3-4	5-6	7	1-2	3-4	5-6	7
Minimum tillering/ Maximum tillering	10	15-20	20-30	30-50	10-20	20-30	30-50	50-100
Panicle initiation/ Booting stage (Partially inundated, i.e. 9-12 cm long remains above water)	10	20-30	30-65	40-80	10-20	30-50	40-85	50-100
Panicle initiation/ Booting stage (Fully inundated)	15-25	20-45	30-80	50-100	15-30	40-70	40-85	50-100
Flowering stage/ Maturity stage	10-15	15-45	20-30	30-70	15-30	40-70	50-90	60-100
Ripening stage	0	10-15	15-20	15-20	5	10-20	15-30	15-30

Climate Change Impacts in Fishery and Aquaculture Production

The impacts of climate change on fisheries are due to the effects of a number of physical and chemical factors, which include temperature, winds, vertical mixing, salinity, oxygen, pH and other factors. The direct effects act on the physiology, development rates, reproduction, behaviour and survival of individuals while indirect effects act via ecosystem processes and changes in the production of food or abundance of competitors, predators and pathogens (Brander, 2010). The IPCC Fifth Assessment Report (2014) recognized that the sustained provision of fisheries productivity and other marine ecosystem services will be challenged by global marine-species redistribution and marine-biodiversity reduction in sensitive regions due to projected climate change. Furthermore, tropical countries like the Philippines face the risk of reduced supplies, income and employment in the fishery sector with potential implications for food security due to the redistribution of marine fisheries catch potential towards higher latitudes. These spatial shifts of marine species will cause high-latitude invasions with the corresponding projected average increase on species richness and fisheries catch potential at mid and high latitudes. On the other hand, a decrease is projected in the tropics and semi-enclosed seas due to the high local-extinction rates resulting from the spatial shifts. Fish habitat will be further constrained by the progressive expansion of oxygen minimum zones and anoxic "dead zones."

The IPCC (2014) found medium to high confidence in the evidence and agreement that marine ecosystems, especially coral reefs, confront substantial risks from ocean acidification. Reef-building corals are also more sensitive to ocean acidification, along with highly calcified mollusks and echinoderms, compared to crustaceans and fishes. Ocean acidification also exacerbate heat-induced mass coral bleaching that cause reduction in biodiversity, fisheries decline, and deterioration of coastal protection by coral reefs beyond effects of degradation due to fishing and pollution. All these impacts have potentially detrimental consequences for fisheries and livelihoods where climate change adds to the threats of overfishing and other non-climatic stressors.

Documented cases of fishery sector impacts during the 1997-1998 ENSO event in Comiso et al., (2014) showed that high sea surface temperature affected fisheries production, particularly aquaculture which accounted for 91.7 % of the estimated total production loss and 85% of the total economic loss. Brackish water ponds and seaweed culture suffered the bulk of the losses in aquaculture while the municipal and commercial fishing subsectors suffered production losses of of 11.7% and 3.05%, respectively. Extreme weather and climate events like drought and typhoons are also expected to impact aquaculture more than capture fisheries in the short to medium term:

a. Freshwater ponds are dependent on irrigation and groundwater supply and compete with other major water users during drought;
b. Heat stress on cultured fish slows down growth and cause mortality due to diseases;
c. Low water levels and high surface temperature will affect fish in cages;
d. Brackish water aquaculture affected by high saline and temperature conditions during dry spells;
e. High temperature of shallow coastal waters reduce the growth of seaweeds and make them susceptible to diseases;
f. Loss of cultured fish stocks from flooding and inundation of fishponds; and
g. Siltation from sediments brought by floods.

A study conducted by Barange et al. (2014) to project climate change yield impacts in countries with different dependencies on marine fisheries shows that predicted changes in fish production potential by 2050 indicate increased productivity at high latitudes and decreased productivity at low/mid latitudes, with considerable regional variations, estimated at <10% (mean +3.4%) from present yields. In the Philippines, the volume production by species in the marine municipal fisheries shows interesting trends in some species that may be correlated with climate data for further analysis and possible attribution to changing climatic conditions. To illustrate a few examples:

- Decrease in round scad *(galunggong)* production in 2008 and in frigate tuna *(tulingan)* in 2009
- Sharp increase in indian sardines *(tamban)* production in 2004 and drop in production in 2005 and 2007

- Sharp increase in big-eyed scad *(matangbaka)* in 2008
- Almost continuous decrease in production in fimbriated sardines *(tunsoy)* since 2010; anchovies production in 20009
- Sharp increase in big-eyed tuna *(tambakol / bariles)* production in 2004 and equally sharp decline in 2008

The localized impacts of climate change in the Philippine fisheries and aquaculture sector are still less well understood despite being one of the top fish producing countries in the world for both capture fisheries and aquaculture production. Table 9 summarizes the potential impacts of climate change in the fisheries and aquaculture sector that may serve as a guide in analyzing the potential impacts of climate change in the Philippines fisheries and aquaculture sector. More research is still needed on the impacts of climate change as it affects the local availability or quality of fish for food and causes instability in livelihoods of communities heavily dependent on fishery resources.

Table 9. Ways in which climate may directly affect production from fisheries and aquaculture. Source: World Fish Center (2007).

Drivers	Biophysical Effects	Implications for Fisheries and Aquaculture
Changes in sea surface temperature	More frequent harmful algal blooms; Less dissolved oxygen; Increased incidence of disease and parasites; Altered local ecosystems with changes in competitors, predators and invasive species; Changes in plankton composition.	For aquaculture, changes in infrastructure and operating costs from worsened infestations of fouling organisms, pests, nuisance species and/or predators. For capture fisheries, impacts on the abundance and species composition of fish stocks.
	Longer growing seasons; Lower natural mortality in winter; Enhanced metabolic and growth rates.	Potential for increased production and profit, especially for aquaculture.
	Enhanced primary productivity.	Potential benefits for aquaculture and fisheries but perhaps offset by changed species composition.
	Changes in timing and success of migrations, spawning and peak abundance, as well as in sex ratios	Potential loss of species or shift in composition in capture fisheries; Impacts on seed availability for aquaculture.
	Change in the location and size of suitable range for particular species	Aquaculture opportunities both lost and gained. Potential species loss and altered species composition for capture fisheries.
	Damage to coral reefs that serve as breeding habitats and may help protect the shore from wave action (the exposure to which may rise along with sea levels).	Reduced recruitment of fishery species. Worsened wave damage to infrastructure or flooding from storm surges.
El Niño-Southern Oscillation	Changed location and timing of ocean currents and upwelling alters nutrient supply in surface waters and, consequently, primary productivity.	Changes in the distribution and productivity of open sea fisheries.
	Changed ocean temperature and bleached coral.	Reduced productivity of reef fisheries.
	Altered rainfall patterns bring flood and drought.	See impacts for precipitation trends, drought and flooding above.
Rising sea level	Loss of land.	Reduced area available for aquaculture. Loss of freshwater fisheries.
	Changes to estuary systems.	Shifts in species abundance, distribution and composition of fish stocks and aquaculture seed.
	Salt water infusion into groundwater	Damage to freshwater capture fisheries. Reduced freshwater availability for aquaculture and a shift to brackish water species.
	Loss of coastal ecosystems such as mangrove forests.	Reduced recruitment and stocks for capture fisheries and seed for aquaculture. Worsened exposure to waves and storm surges and risk that inland aquaculture and fisheries become inundated.
Higher inland water temperatures	Increased stratification and reduced mixing of water in lakes, reducing primary productivity and ultimately food supplies for fish species.	Reductions in fish stocks.
	Raised metabolic rates increase feeding rates and growth if water quality, dissolved oxygen levels, and food supply are adequate, otherwise possibly reducing feeding and growth. Potential for enhanced primary productivity.	Possibly enhanced fish stocks for capture fisheries or else reduced growth where the food supply does not increase sufficiently in line with temperature. Possible benefits for aquaculture, especially intensive and semi-intensive pond systems.
	Shift in the location and size of the potential range for a given species.	Aquaculture opportunities both lost and gained. Potential loss of species and alteration of species composition for capture fisheries.
	Shift in the location and size of the potential range for a given species.	Aquaculture opportunities both lost and gained. Potential loss of species and alteration of species composition for capture fisheries.
	Reduced water quality, especially in terms of dissolved oxygen; Changes in the range and abundance of pathogens, predators and competitors; Invasive species introduced.	Altered stocks and species composition in capture fisheries; For aquaculture, altered culture species and possibly worsened losses to disease (and so higher operating costs) and possibly higher capital costs for aeration equipment or deeper ponds.
	Changes in timing and success of migrations, spawning and peak abundance.	Potential loss of species or shift in composition for capture fisheries; Impacts on seed availability for aquaculture.

Changes in precipitation and water availability	Changes in fish migration and recruitment patterns and so in recruitment success.	Altered abundance and composition of wild stock. Impacts on seed availability for aquaculture.
	Lower water availability for aquaculture. Lower water quality causing more disease. Increased competition with other water users. Altered and reduced freshwater supplies with greater risk of drought.	Higher costs of maintaining pond water levels and from stock loss. Reduced production capacity. Conflict with other water users. Change of culture species.
	Changes in lake and river levels and the overall extent and movement patterns of surface water.	Altered distribution, composition and abundance of fish stocks. Fishers forced to migrate more and expend more effort.
Increase in frequency and/or intensity of storms	Large waves and storm surges. Inland flooding from intense precipitation. Salinity changes. Introduction of disease or predators into aquaculture facilities during flooding episodes.	Loss of aquaculture stock and damage to or loss of aquaculture facilities and fishing gear. Impacts on wild fish recruitment and stocks. Higher direct risk to fishers; capital costs needed to design cage moorings, pond walls, jetties, etc. that can withstand storms; and insurance costs.
Drought	Lower water quality and availability for aquaculture. Salinity changes.	Loss of wild and cultured stock. Increased production costs. Loss of opportunity as production is limited.
	Changes in lake water levels and river flows.	Reduced wild fish stocks, intensified competition for fishing areas and more migration by fisherfolk.

Government Initiatives

Climate change would increase variability and uncertainty in the sector beyond the range considered as normal and would therefore threaten food security as it affects the productivity of most agricultural systems. The government plays an active role in achieving food security and self-sufficiency in staples as outlined in the 2011-2016 Philippine Development Plan (PDP), the country's economic blueprint. The Department of Agriculture, responsible agency for the promotion of agricultural development, ensures that policies and measures to address climate change are integrated in development planning and sectoral decision-making as mandated by the Climate Change Act of 2009, through a Climate Change Systems-wide Programs (DA, 2013). One of its strategic objectives is to increase the adaptive capacity and productivity potentials of agriculture and fisheries livelihoods. Other objectives are directed towards redefining the Strategic Agriculture and Fisheries Development Zones (SAFDZ) and the agriculture development planning framework based on climate change vulnerabilities and risk assessments. Based on these, the Department intends to provide "new" government agriculture services towards the accelerated development of climate smart agriculture and fisheries industries.

The Climate Change Systems-wide Programs (CCSWP) cut across policy instruments and agencies of the Department to better address climate change vulnerabilities and risks in crafting and implementing the nation's agriculture and fisheries modernization programs. It is composed of seven programs on:

1. Mainstreaming Climate Change Adaptation and Mitigation Initiatives in Agriculture (AMIA). The aims are to minimize DA's institutional risks and protect government investments; and adjust development programs/projects and approaches to address CC risks.
2. Climate Information System (CIS). The objective is to have a common database to generate timely and reliable data for disaster risk reduction, planning, and management. The first prong is the conduct of vulnerability and risk assessments of productive areas, and the second is the establishment of agro-meteorological (agromet) stations in highly vulnerable areas.
3. Philippine Adaptation & Mitigation in Agriculture Knowledge Toolbox. The objective is to inventory, generate, and disseminate adaptive tools, technologies, and practices, which users can readily use through the extension services of the country, while

research will pursue new tools and knowledge in partnership with the scientific community.

4. Climate-Smart Agriculture Infrastructure. DA will support the development of new designs and construction protocols for agricultural infrastructure to withstand adverse effects of extreme weather events, repair of existing systems to enhance resilience where necessary and improvement of the design and management of irrigation systems to reduce leakage and optimize water use. Likewise, production and postharvest facilities, including fishery infrastructure, will be made more climate-resilient.
5. Financing and Risk Transfer Instruments on Climate Change. DA will develop new innovative financing schemes to help the agriculture producers obtain financing, insurance, and guarantees for climate change related projects and events especially vulnerable stakeholders in the agriculture and fishery sector. A quick response fund will be set up to provide emergency support to farmers in affected production areas.
6. Climate-Smart Agriculture & Fisheries Regulations. The DA regulatory agencies will redesign their services to take into consideration new technologies towards the promotion/development of climate-smart agriculture. This is to ensure, among others, that new kinds of pesticides, fertilizers and other inputs, as well as genetically modified crops and organisms, that may be created or brought in to address the changing weather patterns will comply with effectiveness and safety standards.
7. Climate-Smart Agriculture Extension System. Led by the ATI and in partnership with the LGUs, SCUs, NGOs, and the private sector, the entire agriculture and fishery extension infrastructure will be mobilized to develop and implement a national extension system that will educate and equip the stakeholders to deal with climate change including adaptation and mitigation measures available for the agriculture and fishery industries.

Each of the seven programs greatly contributes in achieving the objective of the NCCAP strategic priority on Food Security which is "to ensure availability, stability, accessibility, and affordability of safe and healthy food amidst climate change." It is the intention of the NCCAP RBMES to complement the monitoring and evaluation of the DA's Climate Change Systems-wide Programs by focusing on agreed outcome indicators – specifically on two immediate outcomes on enhanced resilience of:

a. Agriculture and fisheries production and distribution systems; and of
b. Agricultural and fishing communities in the midst of climate change.

Food Security Theory of Change

Figure 10 summarizes the planned outputs and major activities for the plan period (2011-2028). For the short-term (2011-2016) period, specific activities will focus on the following interventions:

1. To enhance site-specific knowledge on the vulnerability of agriculture and fisheries;
2. To establish gender-responsive, climate-smart policies, plans and budgets;
3. To build adaptive capacity of farming and fishing communities taking into account the differentiated impacts of climate change on women and men; and
4. To build the resilience of men and women in agriculture and fishing communities, study, design and develop appropriate climate risk transfer and social protection mechanisms. Social protection is defined as "constituting policies and programs that seek to reduce poverty and vulnerability to risks and enhance the social status and rights of the marginalized by promoting and protecting livelihood and employment, protecting against hazards and sudden loss of income, and improving people's capacity to manage risks (Social Development Committee Resolution No. 1 Series of 2007)."

Activities for 2017 and beyond shall be focused on updating scientific information and database, reviewing the sector plans, scaling up the implementation of adaptation measures and technologies, and evaluating progress towards resilience to climate change.

The actions to be conducted for improving food security situation include mutually reinforcing targeted activities on improving knowledge of

communities in vulnerable areas and to implement climate sensitive policies, plans and programs. The activities listed in the NCCAP strategic actions on Food Security are preparatory action road map to establishing resilience of production and distribution systems of the agriculture and fisheries sub-sector, as illustrated below:

Output 1.1 Enhanced knowledge on the vulnerability of agriculture and fisheries to the impacts of climate change. Basically, this the initial step of climate change adaptation where vulnerable communities participate in knowledge generation to ensure that they can acquire capacity in risk avoidance and in developing their own early warning and risk communication system. The following priority activities are considered fundamental to achieving this output 1.1 and are described to form part of the desired changes in affected sectors to reduce immediate and long term impacts on food self-sufficiency (Household level) and food security (National level):

Activity 1.1.1 Vulnerability mapping with the intention of creating better understanding of the location-specific vulnerability of areas and communities which create pool of knowledge about the special temporal and spatial needs and priorities of the agriculture and fishery sub-sector. This activity is the most critical phase of action that will create common information arranged into their order of priority and help national and local government in assessing their own capacity to manage climate risks in the agriculture and fishery sectors. This activity lay the foundation of needs-based research and development and ensure the efficiency and relevance of research systems to becoming tools for reducing impacts of climate change.

Activity 1.1.2 This activity responds to parallel activity 1.1.1 and provide basis for the conduct of applied research to formulating science-based solutions and measures in reducing climate risks and science-informed livelihood options for use of local people and local government units. The research activities, likewise, should identify strategic actions and issues to ensure sustainability of the researches in the affected areas and ensure that local communities are equipped with knowledge to support the improvement of their adaptation practices and measures.

Activity 1.1.3 This activity directly supports NCCAP's strategic priority on 'Knowledge and Capacity Development', whose action points include the (1) establishment of web based network and resource centers, (2) implementation of a gendered information, education and communication (IEC) campaign on climate change adaptation and mitigation and (3) validation and monitoring of the implementation of the NCCAP.

Output 1.2 Climate- sensitive agriculture and fisheries policies, plans and programs formulated. This output provides the sustainability of Output 1.1 by creating the mechanisms for mainstreaming knowledge and awareness gained from the formulated support activities. This creates the mechanisms for the transfer of sustainable climate change actions/adaptation from the local communities to the local government units.

The following priority activities are considered fundamental to achieving this output 1.2 and are described to form part of the desired changes in affected sectors to reduce immediate and long term impacts on food self - sufficiency (Household level) and food security (National level):

Activity 1.2.1 Integrate and harmonized community adaptation (CCA) with the planned Disaster Risk Reduction (DRR) in the national and local agriculture and fisheries policies and plans, including the Philippine Development Plan. This activity is crucial to the establishing of cost efficient measures for reducing short and long term social cost and recurrent, temporal and spatial impacts of climate change.

Activity 1.2.2 Scaled-up implementation of best practices, help reduce the time frame for climate change research and development. It will also ensure the early validation of the limits and potential values of best practices giving way to the initiation of the formulation and implementation of need-based research and development.

Activity 1.2.3 Monitor and evaluate implementation of CCA and DRR plans in agriculture and fisheries sub-sector. This activity ensures that the real impacts of investments and inputs to CCA and DRR are properly evaluated. This improves the current performance evaluation by MFOs where the government agencies are measured on their capacity to deliver the interventions such as seeds, fertilizers, and irrigation for the purposed of accounting their expenditures and as basis for the annual budget request from the Department of Budget and Management. MFO is a measure of an agency's absorptive capacity or performance measurement.

Output 2.1 Enhanced capacity for CCA and DRR of government farming and fishing communities and industry. This is a continuation of activities and efforts from output 1.1. This output serve the complementary/parallel measure to ensure that the knowledge and practices development are put into practice and actually implemented by the targeted stakeholders and local government units as inherent part of CCA and DRR.

Activity 2.1.1 Build capacity of farming and fishing communities on adaptation and DRR is the critical intervention that supports the sustainability of the process of knowledge generation and builds up in the overall efforts to creating critical mass of communities and stakeholders that will ultimately have the capacity to implement the CCA and DRR strategies.

Activity 2.1.2 Integrate CCA and DRR in agriculture and fishery curricula and training programs is the establishment of the "seeds for future generation of well informed and capacitated communities and LGUs who will continue the combat against the progression of climate change.

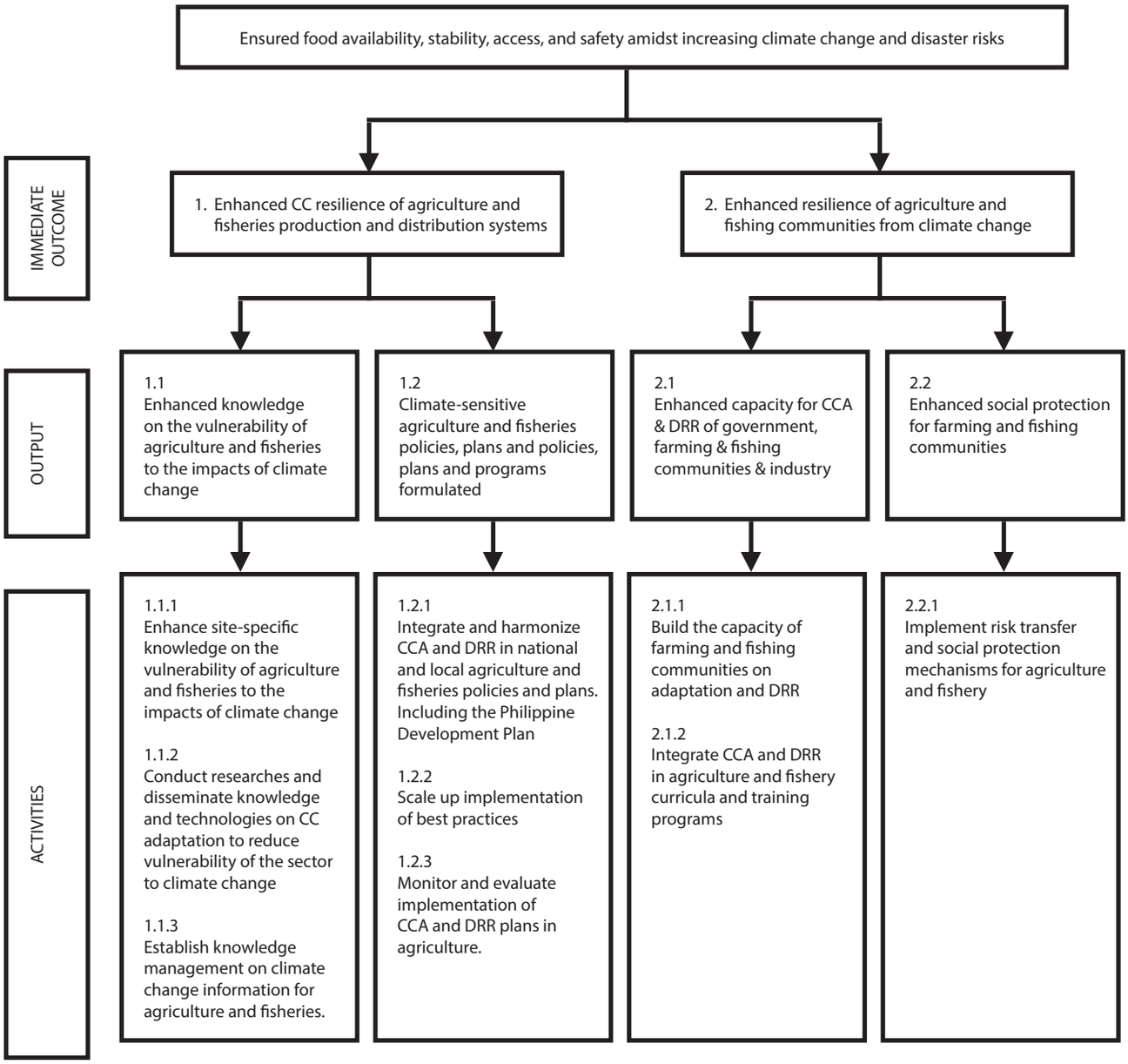
Output 2.2 Enhance social protection for farming & fishing communities implement risk transfer and social protection mechanisms for agriculture and fishery sub-sector is the additional layer of protection by the national and local government for the vulnerable communities as incentives for continuous farming and fishing communities support to attaining food self - sufficiency at the household level and national food security, as well.

Activity 2.2.1 Implement risk transfer and social protection mechanism for agriculture and fishery sub-sector, creates additional incentives to food producers by giving them proactive, advance assurance and protection against potential damages from unpredictable extreme climate change disasters.

The chains of interventions create changes along the process of nation-wide actions and support to attaining self - sufficiency and food security that ensure food availability, stability, access and safety amidst increasing climate change and disaster risks. The outputs 1.1 and 1.2 complement each other to meet the desired Immediate Outcome 1, "Enhanced CC resilience of agriculture and fishery sub-sector production and distribution system. " Congruent to the above outputs are the spatial and temporal establishment of parallel Immediate Outputs 2.1 and 2.2 are complementing each other to achieve the desired immediate Outcome 2, which is basically the enabling mechanism that provided the elements of sustainability in the attainment of immediate outcomes defined for the Food Security.

Having gone into the different stages of transformation of communities, local government have finally acquired knowledge and capacity for self-protection against climate change and have created political will for adopting climate-sensitive policy, plans and programs to suit changing climate and environment, the continuing activities and outputs shall establish the platform for the Intermediate Outcome, "Ensured food availability, stability, access and safety amidst climate change and disaster risks."

Figure 10. NCCAP Strategic Actions on Food Security, 2011-2028.



Sets of indicators were identified at the NCCAP outcome and critical output levels (see Table 10 for the results matrix of the Food Security theme). The NCCAP defined the priority unit of analysis or system of interest in some strategic priorities. For Food Security for example, the NCCAP prioritizes in the immediate medium term (by 2016) the vulnerability assessment in the top food producing provinces:

1. Cagayan Valley, Pangasinan, Isabela, Nueva Ecija, Iloilo, and Camarines Sur (rice)
2. North Cotabato and Maguindanao (Mindanao food basket)

Based on the consultations conducted with members of the NCCAP M&E Technical Working Group, it has been suggested to include the following system of interest for monitoring and evaluation of agricultural production:

1. Major rice and corn producing regions
2. Major fishing ground of fish for domestic food consumption
    a. Visayan Sea, Macajalar Bay, Iligan Bay, Tayabas Bay (sardines)
    b. Iligan Bay, Macajalar Bay, Batanes Waters (roundscad)
    c. Visayan Sea, Tayabas Bay, Davao Gulf, Cagayan Waters (mackerels)
    d. Batanes Waters, Tayabas Bay, Cagayan Waters, Visayan Sea (anchovies)
3. Major aquaculture production of fish for domestic food consumption
    a. Milkfish
    b. Tilapia

For the agricultural distribution, the major farm to market roads (FMR) in key production areas or main strategic zones for palay, corn and fish production (e.g. Central Philippines and Mindanao Super Region) were proposed as unit of analysis or system of interest.

Table 10. Food Security Results Matrix

Ultimate Outcome	Enhanced adaptive capacity of communities, resilience of natural ecosystems and sustainability of built environment to climate change.			
Ultimate Outcome Indicators	Food security (satisfactory balance between food demand and food supply at reasonable prices) • Decreased food subsistence incidence (% population) • Stable average inflation rates among basic food commodities (in %)			
Intermediate Outcome	Ensured availability, stability, accessibility, affordability, safe and healthy food amidst increasing climate change and disaster risks.			
Intermediate Outcome Indicators	Annual self-sufficiency ratio in rice, white corn and fish of key food production areas, island provinces & municipalities			
Immediate Outcome	1. Enhanced CC resilience of agriculture and fisheries production and distribution systems		2. Enhanced resilience of agricultural and fishing communities from climate change	
Immediate Outcome Indicators	Average annual production loss due to weather and climate-related disasters	% change in agriculture and fisheries gross value added (GVA)	Annual average income of families in AF sector (in pesos, real terms, based on 2000 prices)	% by geographic distribution of AF households covered by innovative financing scheme (credit, insurance, guarantee, quick-response fund)
Output Areas **[DA MFO]**	1.1 Enhanced knowledge on the vulnerability of agriculture and fisheries to the impacts of climate change. [DA 2.0 Technical & Support Services]	1.2 Climate-sensitive agriculture and fisheries policies, plans and [investment] programs formulated. [DA 1.0 A&F Policy Services]	2.1 Enhanced capacity for CCA and DRR of government, farming and fishing communities and industry. [DA 2.0 Technical & Support Services]	2.2 Enhanced social protection for vulnerable farming & fishing communities. [DA 1.0 A&F Policy Services] [DA 2.0 Technical & Support Services]
Critical Output Indicators	No. of vulnerability and risk assessments for food production & distribution available at the provincial and regional scale	No. of CC-related policies enacted and plans and program implemented* *Consistent with CC-tagging	No. of climate-adaptive tools, technologies and practices transferred and adopted by communities and industry	No. of weather index-based and area-based yield crop insurance products accessed for different AF commodity
	No. of CC-related R&D projects		No. of beneficiaries of capacity development programs implemented for AF by sectoral agencies	
NCCAP Activities and Indicators [DA MFOs and Sub-MFOs]	1.1.1 Site-specific vulnerability assessments [DA 2.3 Extension and DA 2.4 R&D]	1.2.1 Integration of CCA-DRR in policies and plans [DA 1.0 A&F Policy Services]	2.1.1 Capacity building [DA 2.3 Extension]	2.2.1 a. Development of risk transfer and social protection mechanisms [DA 1.0 A&F Policy Services]
	Provincial level AF sector VA & risk assessment conducted	Existing policies and industry resource management & development plans reviewed Annual CCA plans & budgets formulated	Communities reached by AF extension services CCA-DRR trainings conducted Farmers field school established	Policy studies conducted and mechanisms designed & implemented

	1.1.2 Research, knowledge & technology dissemination [DA 2.3 Extension and DA 2.4 R&D]	1.2.2 Scale-up implementation of best practices [DA 2.3 Extension]	2.1.2 CCA-DRR in curricula and training programs [DA 2.3 Extension]	2.2.1 b. Development of innovative financing schemes [DA 7.0 Credit Support Services]
	Researches on AF adaptation measures conducted & technologies developed	Climate-responsive CNFIDP programs implemented		Innovative financing schemes developed and implemented
	Appropriate CC adaptation technologies identified and implemented	BPs adopted by communities and industries		
		Irrigation systems repaired & rehabilitated		
		Waste recycling & composting implemented		
	1.1.3 Establish KM system [DA 2.3 Extension]	1.2.3 M&E of CCA-DRR in Agriculture [DA 1.0 A&F Policy Services]		2.2.1 c. Community organizing [DA 2.3 Extension]
	Knowledge products developed	Performance monitoring indicators developed and utilized		Farmers and fisherfolk organized and trained on OD and fund management
	Climate information system & database for AF Sector and resource network established	Regular review and evaluation of adaptation practices conducted		
	Persons and communities (i.e., farmers, fishers) reached by IEC activities			
Intervention Fields	KNOWLEDGE MANAGEMENT	POLICY REFORMS	CAPACITY DEVELOPMENT	SOCIAL PROTECTION & FINANCING

FS Indicator Fact Sheet: Food Security (with proxies)

Indicator	Food Security
Proxy Indicator(s)	Decreased food subsistence incidence (in percent population) from 10.8% in 2009 to 8.3% in 2015 Stable average inflation rates among basic food commodities (in percent) from 6.4% (2004-2010) to 3.0 to 5.0% (2011-2016)
Level of Result	Ultimate Outcome Indicator
Definition and underlying concepts	Food security is defined as existing "when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life," the concept of food security includes both physical and economic access to food that meets people's dietary needs as well as their food preferences (World Food Summit, 1996)
Interpretation of the Indicator Value	Generally, vulnerable households will constitute three groups (FAO, 2003): a. Income-poor: those which would be vulnerable under any circumstances: for example, where the adults are unable to provide an adequate livelihood for the household for reasons of disability, illness, age or some other characteristic; b. Asset-poor: those whose resource endowment is inadequate to provide sufficient income from any available source; c. Uncertain income sources / fragile resource base: those whose characteristics and resources render them potentially vulnerable in the context of social and economic shocks: e.g. those who find it hard to adapt to sudden changes in economic activity brought about by economic policy. A significant increase in the consumer price of staple foods might be an example. Vulnerability may occur both as a chronic and transitory phenomenon: a. Chronic food insecurity is associated with problems of continuing or structural poverty and low incomes b. Transitory food insecurity involves periods of intensified pressure caused by natural disasters, economic collapse or conflict.
Unit of Analysis / System of Interest	Vulnerable households in ten provinces with high magnitude of poor households (2010) and 10 provinces with highest poverty incidence based on population (2012) Proxy: Household income: Estimates of income or how poor is a particular household measured against some established criterion or 'poverty-line' and characteristics of household: • Location: rural/urban; small village/large village; remote province/near to capital city etc.; • Composition: size, age and dependency ratios; male/female head; • Sources of income: production, employment, trade, remittances and other transfers. <u>Purchasing power</u>
Geographical Coverage	Category 1: Ten provinces with high magnitude of poor households, 2010 1. Zamboanga del Sur 2. Cebu 3. Pangasinan 4. Negros Occidental 5. Camarines Sur 6. Leyte 7. Iloilo 8. Sulu 9. Quezon 10. Davao Del Sur Category 2: Ten provinces with highest poverty incidence based on population, 2012 (%) 1. Lanao Del Sur 2. Maguindanao* 3. Eastern Samar 4. Apayao 5. Zamboanga del Norte 6. Camiguin 7. Saranggani 8. North Cotabato 9. Masbate 10. Northern Samar Category 3: Thirty provinces exposed to multiple hazards 1. Zamboanga del Sur 2. Leyte 3. Iloilo 4. Quezon 5. Eastern Samar 6. Northern Samar 7. Ilocos Norte 8. Ilocos Sur 9. Abra 10. Benguet 11. Cagayan 12. Quirino 13. Isabela 14. Nueva Vizcaya 15. Zambales 16. Pampanga 17. Aurora 18. Cavite 19. Laguna 20. Rizal 21. Albay 22. Catanduanes 23. Antique 24. Bohol 25. Southern Leyte 26. Zamboanga Sibugay 27. Dinagat Islands 28. Agusan del Sur 29. Surigao del Norte 30. Surigao del Sur

Linkage with other NCCAP Thematic Priority	
Linkage with existing M&E systems	Philippine Development Plan Sector Outcome (Goal 4a): Food security improved
Frequency of measurement	Annual
Baseline and Reference Year	a. Normal year: 2010 b. Year of extreme climate event: 1997-1998 ENSO event
Data / Information Source	Bureau of Agricultural Statistic http://countrystat.bas.gov.ph/?cont=6
Lead Agency	Department of Agriculture
Contributing Agency	NEDA
Feasibility of the Indicator	Indicator can be implemented on the basis of available data using existing data sharing agreement and/or M&E system of key agencies
REMARKS The PDP 2011-2016 use the following indicators for Sector Outcome (Goal 4a) Food security improved: i. Decreased food subsistence incidence (in percent population) from 10.8% in 2009 to 8.3% in 2015 ii. Increased rice self-sufficiency ratio (in percent) from 80% in 2010 to 100% in 2013 iii. Stable average inflation rates among basic food commodities (in percent) from 6.4% (2004-2010) to 3.0 to 5.0% (2011-2016)	

FS Indicator Fact Sheet: Self-sufficiency Ratio

Indicator	Self-sufficiency Ratio
Level of Result	Intermediate Outcome Indicator
Definition and underlying concepts	Self-sufficiency ratio is the satisfactory balance of food production, supply, and demand. It shows the magnitude of production in relation to domestic utilization
Computation	SSR = [Production / (Production + imports - exports)] x 100
Unit of Measurement	Percentage
Interpretation of the Indicator Value	The SSR can be calculated for individual commodities, groups of commodities of similar nutritional values and, after appropriate conversion of the commodity equations, also for the aggregate of all commodities (http://www.fao.org/docrep/003/X9892E/X9892e04.htm) A sufficiency ratio of rice, white corn and fish higher than the baseline value means cc actions contribute to access to adequate food
Unit of Analysis / System of Interest	Rice, corn and fish of key food production areas and selected vulnerable provinces & municipalities
Geographical Coverage	Nationwide (aggregate of zonal/regional results) Area-specific (by 2016): a. Cagayan Valley, Pangasinan, Isabela, Nueva Ecija, Iloilo, and Camarines Sur (rice) b. North Cotabato and Maguindanao (Mindanao food basket) c. Major rice and corn producing regions d. Major fishing ground of fish for domestic food consumption i. Visayan Sea, Macajalar Bay, Iligan Bay, Tayabas Bay (sardines) ii. Iligan Bay, Macajalar Bay, Batanes Waters (roundscad) iii. Visayan Sea, Tayabas Bay, Davao Gulf, Cagayan Waters (mackerels) iv. Batanes Waters, Tayabas Bay, Cagayan Waters, Visayan Sea (anchovies)
Linkage with other NCCAP Thematic Priority	EES, WS
Linkage with existing M&E systems	PDP 2011-2016 Sector Outcome (Goal 4a): Food security improved Department of Agriculture M&E System
Frequency of measurement	Annual
Baseline and Reference Year	2010 and year of extreme climate event (drought, typhoon, ENSO): 1997-1998 ENSO event
Data / Information Source	Complete List Data Base http://countrystat.bas.gov.ph/?cont=6
Lead Agency	Department of Agriculture
Contributing Agency	PhilRice
Feasibility of the Indicator	Indicator can be implemented on the basis of available data, however, additional calculations are needed but timely implementation seems probable.

Temperature and rainfall threshold of selected crops

By Dr. Rosa Perez

Climate change can affect agriculture in a variety of ways. Beyond a certain range of temperatures, warming tends to reduce yields because crops speed through their development, producing less grain in the process. And higher temperatures also interfere with the ability of plants to get and use moisture. Evapotranspiration, the combined effect of evaporation from the soil and transpiration from plant, accelerates when temperatures rise resulting to lose more moisture from their leaves. Climate change is likely to increase rainfall, the net impact of higher temperatures on water availability is a competition between higher evapotranspiration and higher precipitation; and typically, evapotranspiration prevails. Tables 11–13 show temperature and rainfall ranges for some major crops suited for their development and production. Checking these values against the climate change projections in one area can provide some guidance on crop suitability as one of the information needs for decision support system.

Table 11. Temperature requirements for most major crops' development (Reddy et al., 2011)

Crop	Base Temperature °C	Optimum Temperature °C	Opt Temp Range Reproduction Yield, °C	Failure Temperature °C
Rice	8	36	23 - 26	35 - 36
Maize / Corn	8	34	18 - 22	35
Soybean	7	30	22 - 24	39
Wheat	0	26	15	34
Rice	8	36	23 - 26	35 - 36
Sorghum	8	34	25	35
Cotton	14	37	25 - 26	35
Peanut	10	>30	20 - 26	39
Bean			23 - 24	32
Tomato	7	22	22 - 25	30

Table 12. Temperature effects on crop yield of several major crops' productivity (DaMatta and Cochicho Ramalho, 2006)

Crop	Topt, °C	Tmax, °C	Yield at Topt, t/ha	Yield at 28 °C, t/ha	Yield at 32 °C, t/ha	% decrease (from 28 C to 32 °C)
Rice	25	36	7.55	6.31	2.93	54
Soybean	28	39	3.41	3.41	3.96	10
Dry bean	22	32	2.87	1.39	0.0	100
Peanut	25	40	3.38	3.22	2.58	20
Grain sorghum	26	35	12.24	11.75	6.98	41

Table 13. Ideal range of temperature and rainfall for selected commodities (DaMatta, and Cochicho Ramalho, 2006).

Crop	Annual Rainfall (mm)	Temperature (°C)
Coconut	>1500	27
Tea	2500 – 3000	18 - 25
Rubber	1650 – 3000	23 - 28
Cashew	1000 (sufficient for production) 1500 - 2000 (optimal)	25 (monthly mean, optimal)
** Robusta Coffee Arabica Coffee	* 1200-1800 (adapts well even >2000) 1200-1800 (requires less humid environment)	 22 - 30 18 - 21

*Rainfall requirements depend on the retention properties of the soil, atmospheric humidity and cloud cover, as well as cultivation practices.
** Both are sensitive to high wind stress

Water Sufficiency

The country is well endowed with freshwater resources with approximately 421 principal rivers (with drainage areas ranging from 40 to 25,469 square kilometers), 59 natural lakes, and 4 major groundwater reservoirs (areas range from 6,000 to 10,200 square kilometers) that, when combined with other smaller reservoirs, would aggregate to an area of about 50,000 square kilometers. Although there is a relatively abundant source of freshwater in the country, demand still greatly exceeds supply.

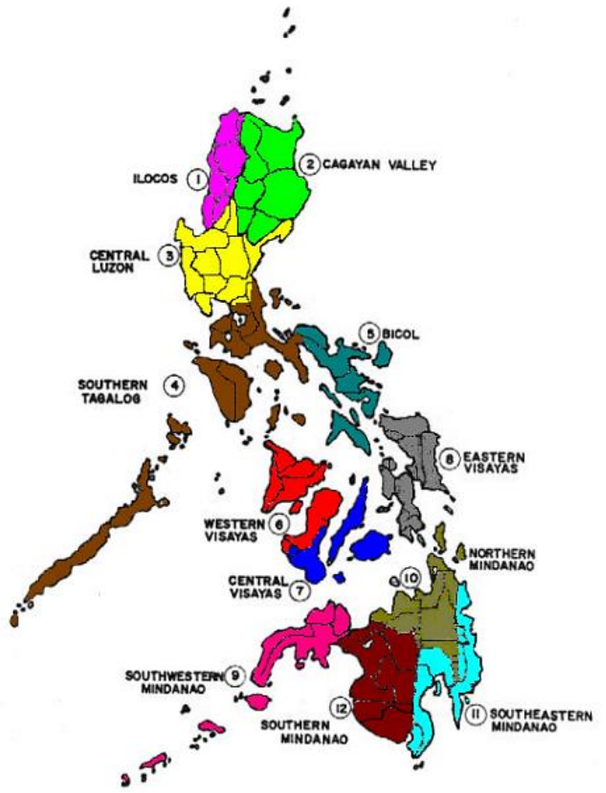
The National Statistical Coordination Board (NSCB), using the Philippine System of Integrated Economic and Environmental Accounts (more popularly known as Environmental Accounting), estimated the country's water resources to support the need to come up with indicators of the country's consumption and stock of water resources. The study determined the availability of the natural supply and consumption patterns of the water subsectors (agriculture, domestic, commercial, industrial) in the 12 water resources regions set by the National Water Resource Board (see Figure 11). The delineation is meant to facilitate the comprehensive planning of water resources development by regional basins based on hydrological boundaries. Minor deviations in political boundaries affected Ilocos, Cagayan Valley, and Central Luzon regions in Luzon and the Northern Mindanao region in Mindanao.

The Environmental Accounting revealed that surface water resources in the Philippines have not been fully utilized due to limited number of reservoirs that serve as water storage. The study also identified the areas of possible depletion and where the intermittent supply from surface water makes the groundwater a regular or buffer source of water leading to its extensive extraction. The following section is an excerpt from the report.

The Philippine Water Resources Account (NSCB, 1998)

The compilation of the asset accounts for water resources covers the physical, i.e., both the quantitative and qualitative aspects of water, and the monetary accounts. The accounting period for the groundwater resource started in 1988 and ended in 1994,while only the years 1988 to 1993 are covered for the surface water. For the physical accounts, the water resource was classified into the groundwater stocks (volume of water available from the aquifers) and surface water flows and estimated for each region before assembling the environmental accounts at the national level.

Figure 11. Philippine Water Resources Regions. Source: 1972 Economic Atlas.



Groundwater

The volume of groundwater available from aquifers were estimated using storage capacity while depletion was estimated as the difference between the water volume that recharges the groundwater reservoirs (aquifers) and the volume of water withdrawn or pumped (see Figure 12). The estimated inflow was based on the assumption that 10 percent of rainfall recharged the aquifers while the volume abstracted from groundwater is estimated by computing the demand requirements of the various sectors (e.g., agriculture, domestic, industrial, commercial). Domestic demand was estimated by multiplying the population figure with the water requirement per person which the Local Water Utilities Administration estimated to be 103.4 litres per day for the regions and estimated by MWSS at 180 litres per day for Metro Manila. The estimated industrial and commercial water demand followed the MWSS formula which made use of the level of production, growth rates (GVA for industry and services), inflation rates for water, and output and price elasticities. However, no information was available regarding the use of groundwater for agriculture during the preparation of the report.

Table 14. Temperature requirements for most major Crops' development (Reddy et al., 2011)

PHILIPPINES	1988	1989	1990	1991	1992	1993	1994
Opening Stock	267,960.14	265,523.08	262,856.76	259,924.72	256,456.58	252,745.25	248,980.83
Changes in Quantity							
Withdrawal	(4,298.17)	(4,522.00)	(4,826.11)	(4,974.61)	(5,134.45)	(5,391.81)	(5,856.39)
Other Accumulation							
Net recharge	1,861.11	1,855.68	1,894.07	1,506.46	1,423.13	1,627.38	1,480.87
Closing Stock	265,523.08	262,856.76	259,924.72	256,456.58	252,745.25	248,980.83	244,605.30
Changes in Quality							
Saltwater intrusion	1,758.03	1,767.00	1,776.33	1,417.63	1,330.76	1,529.22	1,374.67

Table 14 shows that for the period 1988 to 1994, the stock of groundwater has been decreasing at an annual rate of 1.4 percent, equivalent to an average of 3,500 million cubic meters per year. The volume of withdrawals exceeded the volume of recharge by an average of 400.7 MCM. The increasing abstraction of groundwater coupled with diminishing recharge led to the shrinkage of the overall supply of groundwater. Depletion of groundwater increased from 2.4 billion cubic meters in 1988 to 4.4 billion cubic meters, registering an annual rate of depletion of 10.2 percent.

In terms of the regional outlook, Regions IV, VI, VII, XII, and the NCR are critical areas. Only Regions II and VIII did not show any cause for concern. The over extraction or continuous excessive pumping above the natural recharge rates resulted in declining water tables in the NCR even during the wet or rainy season. Over extraction in some areas in the country has resulted in the intrusion of salt water, affecting the following 5 cities and 11 municipalities in the MWSS service areas, namely: Pasay City, Makati City (western part); Manila, Caloocan City (south); Las Piñas City, Parañaque, Valenzuela, Malabon, and Navotas in the National Capital Region (NCR); and Bacoor, Imus, Kawit, Noveleta, and Rosario in Cavite (northern part). The other critically affected provinces/cities identified are Capiz, Cebu City, and Obando in Bulacan.

Figure 12. Groundwater Availability Map. Source: MGB (n.d.).

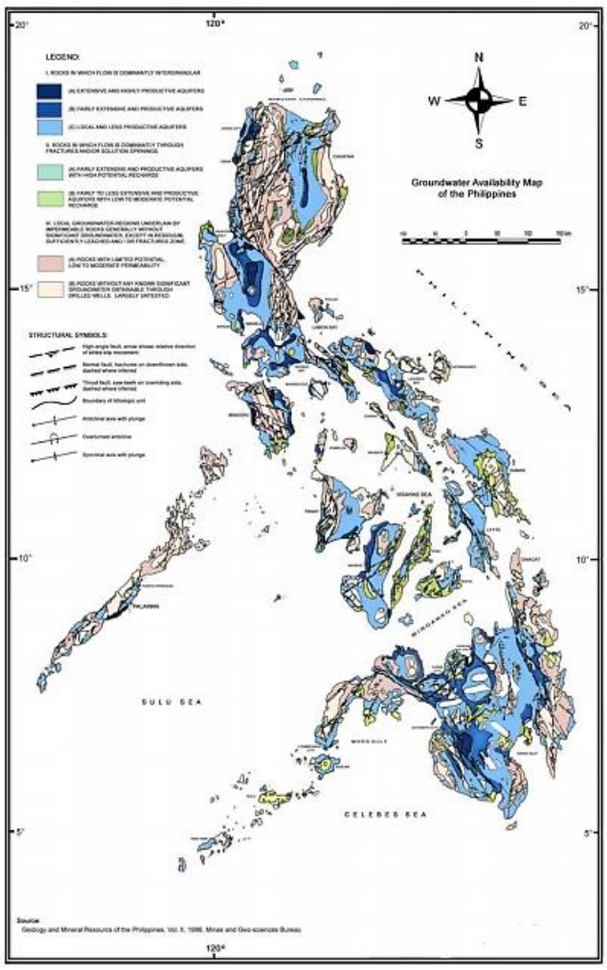


Table 15. Physical Accounts of Surface Water in the Philippines, 1988-1993 (in million cubic meters). Source: NSCB, 1998.

PHILIPPINES	1988	1989	1990	1991	1992	1993
Opening Stock	220,400.00	198,402.39	189,172.35	152,373.05	144,709.73	156,919.22
Changes in Quantity						
Withdrawal	(35, 468.97)	(37,600.12)	(38,446.31)	(40,229.76)	(40,159.77)	(41,223.27)
Other Accumulation						
Additions	13,471.36	28,370.08	1,647.01	32,566.44	52,369.26	42,800.58
Closing Stock	198,402.39	189,172.35	152,373.05	144,709.73	156,919.22	158,496.53

Surface Water

Runoff figures for only one principal river in each water resources region were collected using the rainfall data from PAGASA and the stream flow data from DPWH to estimate the basin recharge (see Table 15 for the national estimate). Similar to groundwater, the water volume diverted from the surface water resource was estimated by computing the demand requirements of for domestic, agricultural, industrial, and commercial use. Agricultural water requirement was estimated using water requirement for rice crop production at 1.5 liters per second per hectare. Initial demand estimates were also prepared for sugarcane and livestock based on its projected growth rates. Non-consumptive water uses were not included in the report. Although these uses do not affect the water quantity, it may affect water quality if accompanied by discharges of untreated wastes and thereby limiting the potential beneficial use of water.

The withdrawal of surface water grew at an annual rate of 1.2 billion cubic meters from 35.4 billion cubic meters in 1988 to 41.2 billion cubic meters in 1993. The stock of surface water is diminishing at an annual average of 13,700 million cubic meters during the accounting period 1988-1993. The reduction in surface water volume was attributed mainly to the low rate of recharge rather than the abstraction during the period. The recharge rate from 1992 to 1993, however, was higher than abstraction which slightly improved the stock of surface water.

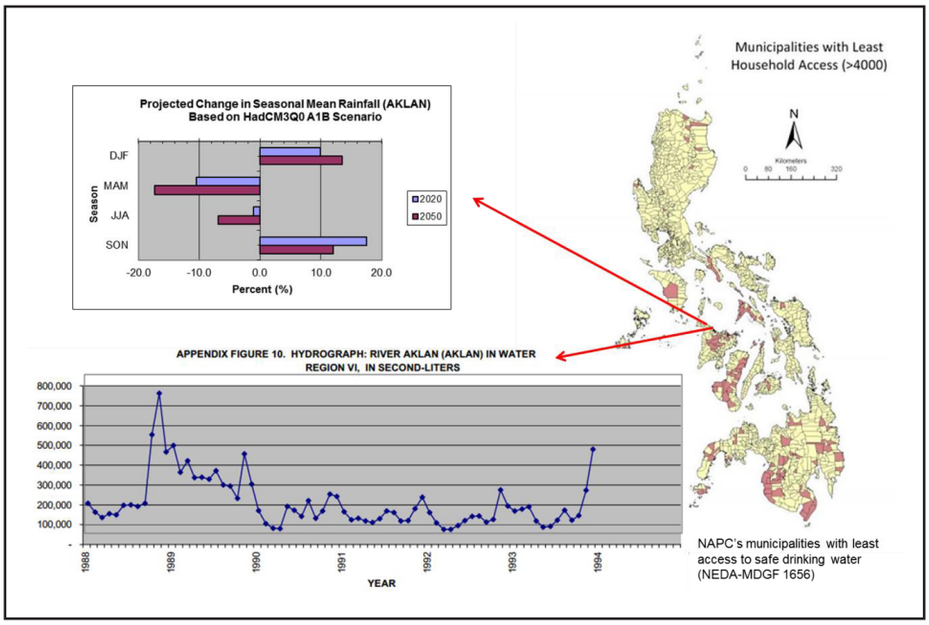
An earlier report, the First National Assessment on Philippine Water Resources (1976)[5], found that three regions – the Central Luzon, Western Visayas and Central Visayas Regions – will have long-run surface water problem based on comparison of surface water flows against the projected withdrawals. This accounting report identified Regions II, VIII, and IX as areas of concern.

With regards to water quality, the National Capital Region faces a critical problem of poor water surface quality attributed not only to pollution but also due to increasing siltation and sedimentation from deforestation and land use changes. The deterioration in water quality further widened the gap between increasing demand and declining supply.

Climate Change Impacts in Water Resources

The impacts of climate change in the Philippine water sector can be described as unsteady (sometimes extreme) shift between too much and too little water. In some critical areas like highly urbanized cities and metropolis, climate change will exacerbate water shortages from increasing and competing demand and deteriorating water supplies, both in terms of quantity and quality. In other parts of the country, the problem will be more of increases in runoff and flooding that spread pollutants, contaminates water sources and overwhelms water infrastructures. Extreme climate and weather events are also of serious concern where it puts to the test the integrity of water supply infrastructure and disrupts socio-economic services. Freshwater resources of coastal communities are also threatened with salt water intrusion from over extraction of groundwater and can be further exacerbated by sea level rise.

Figure 13. Composite illustration of waterless municipalities in the country (NEDA-MDGF 1656) with hydrograph of Aklan River (NSCB, 1998) and the projected changes in seasonal rainfall in Aklan (PAGASA, 2011).



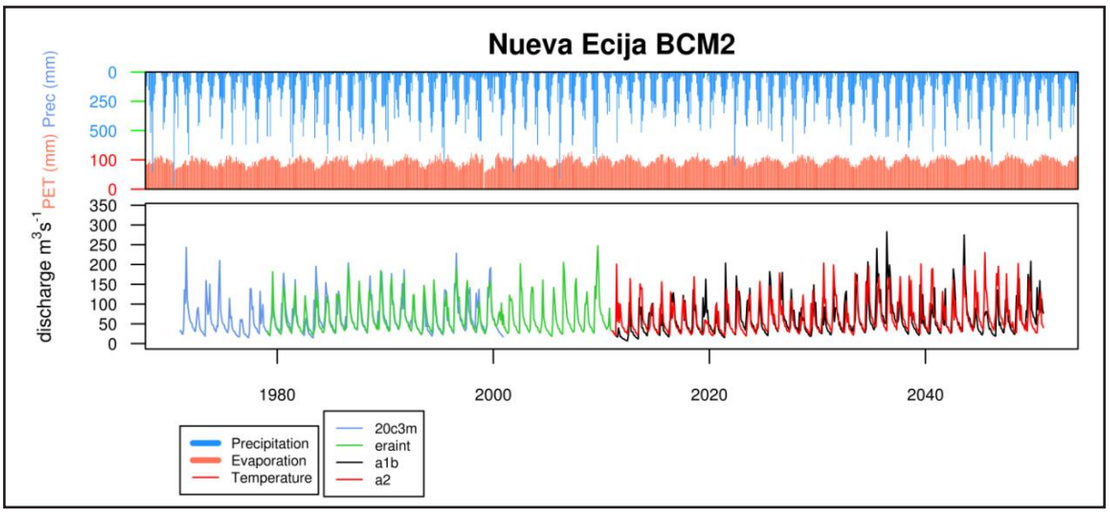
The projected changes in climatic conditions present significant challenges for flood management, drought preparedness, water supplies and other water resources management concerns. The impacts of climate change in the water sector redound to other sectors, affecting ecosystems, agriculture, human health, energy production and tourism among others. Seasonal variations in river flow affects availability of irrigation water for crop production. Changes in the frequency and intensity of rainfall are more examined in terms of the occurrence of drought or flooding and less in terms of its impacts on groundwater recharge. The water requirement for sustaining wetland ecosystems is usually least priority in terms of competing water uses.

While the Environmental Accounting recognized the impacts of both climatic and non-climatic influences on the availability of water resources, the estimates in the study do not yet consider the projected changes in rainfall conditions brought by climate change and its impacts, for example, in the hydrology of the river and availability of surface water resources (see Figure 13). The report did note that in 1989-1991, almost all of the regions in the country experienced lower rainfall rates that affected the recharge rates of both types of water resources. A similar assessment using the climate projections of PAGASA (2011) need to be conducted to assess the impacts of climate change and examine the vulnerabilities of the sector.

David and Tolentino (2014) conducted an analysis of climate change impacts on stream discharges in 14 river basins[6] using three (3) global circulation models. They observed that under A1B and A2 scenarios, most basins show an increasing trend in annual discharge and variation in the min/max discharge. The 14 basins covered under the study are all projected to increase in discharge except for Agusan del Sur. Significant changes in discharge are observed in the Cagayan, Nueva Vizcaya, Bicol, Isabela, Mindoro, Capiz, Zamboanga, Agusan del Sur and Sultan Kudarat basins.

The study further pointed out that while annual discharge increases, the increase is mainly during the wet season and decrease in discharge is still projected for most basins during their dry season average (see Figure 14 as an example). This study underscores the reality that while water may be more available in an increasing rainfall scenario, it will not be available when and where it is needed most.

Figure 14. Discharge projection for Nueva Ecija using the Bergen Climate Model (BCM) Version 2 of the Bjerknes Centre for Climate Research (BCCR), Univ. of Bergen, Norway. Source: David and Tolentino (2014).



Better data and improved model projections as well as enhanced understanding of both the impacts of climate change and the role of climate-adaptive water governance are needed to respond to these challenges. Significant gaps remain in the knowledge base that informs both projections of climate impacts on water resources and governance strategies that can build the adaptive capacity of the sector. Improved network design for hydrologic data collection, monitoring the effects of climate change on stream flow behavior and methods of hydrologic analysis for water infrastructure projects are research priorities identified for the sector (CCC, 2013). This is needed to support numerical modeling to establish required hydrologic parameters to establish flow characteristics at representative locations to make modeling and validation possible. Currently, only a few of the major river basins have instruments installed to measure stream flow and other parameters.

Government Initiatives

There are about 30 national agencies with shared mandate in the planning, management and regulation of the country' water resources. The key national agencies involved in the sector are the Department of Environment and Natural Resources, Department of Finance, Department of Interior and Local Government, Department of Public Works and Highways, Local Water Utilities Administration, National Anti-Poverty Commission, National Economic and Development Authority, National Water Resources Board. These agencies share oversight responsibilities for the resource and economic regulation of the sector wherein, except for LWUA and NWRB that are dedicated sector agencies, sector involvement merely form part of their overall mandate.

Local government units also play a crucial role in the management of water resources and delivery of water supply and sanitation services. There are also special bodies created by law to regulate specific water utilities such as the MWSS Regulatory Office for the water concessionaires of Metro Manila (i.e., Manila Water and Maynilad Water Services) and Subic Bay Water Regulatory Board for the Subic Bay Freeport.

Policy formulation, sector coordination, and resource and economic regulation are the main mandates of the National Water Resources Board. . It is responsible for ensuring the optimum exploitation, utilization, development, conservation and protection of the country's water resource, consistent with the principles of Integrated Water Resource Management. The Master Plan Study on Water Resources Management in the Philippines (1998) and the more recent IWRM Framework Plan are NWRB's bid to fully rationalize the sector and revitalize it in terms of the efficiency and sufficiency of its service and resources. The IWRM Plan Framework is NWRB's blueprint to secure sustainable water for all (NWRB, 2006). Climate change is reflected in the document under "Increasing Frequency and Intensity of Extreme Climate Events and Variability" as part of the issues and concerns confronting the Philippine Water Sector. One of

the four sustainable outcomes in the IWRM Plan Framework is "adaptive and proactive response to emerging /future challenges" which includes climate change. The nine Strategic Themes supporting the four Sustainable Outcomes includes "managing and mitigating risks from climate change events and water related disasters" for effective protection and regulation for water security and ecosystem health as one strategic theme. The NWRB 2015 Plans and Program already address some of the key drivers of vulnerability in the water sector especially pertaining to restructuring water governance and ensuring sustainable and equitable access to water supply which were identified as priority areas in the NCCAP. A rapid self-assessment of the adequacy of the adaptive capacity of the NWRB was conducted to identify the key areas needing attention to enhance knowledge and capacity on IWRM and adaptation planning.

The National Economic and Development Authority (NEDA) play a key role in sector policy, planning and programming. NEDA defines the institutional roles and responsibilities of sector agencies; sets broad coverage targets for the country; and defines broad policies particularly regarding access of low-income groups to services, cost recovery to support sustainability, incentives to improve operational efficiency, and mechanisms for private sector improvement (NEDA, 2010). Under the leadership of the NEDA and NWRB, key players in the water sector collaborated for the preparation of the Philippine Water Supply Sector Roadmap (2008, updated in 2010) that provides the direction to be followed to achieve the long-term vision of access to safe, adequate and sustainable water supply for all by 2025. The Roadmap also informs the preparation of the Medium Term Philippine Development Plan (now the Philippine Development Plan) where the policies and development goals of the sector are further institutionalized and consolidates the targets committed by relevant agencies.

The current PDP 2011-2016 prioritizes increasing the water supply coverage and capacity development particularly in rural and hard-to-reach areas and waterless poor areas. It also targets the improvement of water quality with intensified monitoring of water quality standards as well as investing in adequate wastewater management for the treatment and proper discharge of wastewater. The Sagana at Ligtas na Tubig sa Lahat (SALINTUBIG) Program of the Department of the Interior and Local Government (DILG), DOH and National Anti-Poverty Commission (NAPC) provided water supply systems and capacity building measures to 37 waterless municipalities, 16 basic emergency obstetric and newborn care units, 11 resettlement areas, and 21 poorest barangays (as of August 2013) to help attain 100-percent coverage. The full implementation of the operational plan of the National Sewerage and Septage Management Program (NSSMP), which started in December 2012, will be undertaken to improve water quality and public health in highly urbanized cities (HUCs), as also required by the Clean Water Act of 2004.

The PDP 2011-2016 is also pursuing water security as a strategy to enhance competitiveness and increase productivity in the industry, services and agriculture sectors. Under this strategy:

"…river basin master plans will be developed, including water resource assessments or water availability studies particularly for water-critical areas, to identify new water sources for domestic, commercial, industrial, irrigation and other needs. Surface water will be prioritized over groundwater resources, where appropriate. Studies will be undertaken in water-critical areas, such as Metro Manila, Metro Cebu, Metro Davao, Angeles City, Metro Iloilo, Cagayan de Oro City and Bulacan, among others. For Metro Manila, new water sources will be identified and developed to eliminate the risks arising from being dependent on a single water source for various consumption needs.

Raw water pricing will also be explored and complemented with capacity development for stakeholders, particularly for the agriculture sector (which is the largest consumer of water), to promote efficient water utilization/extraction. Domestic and municipal water supply provision targets the increase of Level III and 24-hour service coverage and the reduction of non-revenue water. In addition, the government will ensure adequate water supply in priority tourism destinations under the National Tourism Development Plan" (NEDA, 2014, p. 255).

The Plan also recognized the critical role of water supply and sanitation in ensuring the immediate recovery of areas hit by disasters. It intends to establish a coordinated response strategy for the immediate rehabilitation/provision of necessary infrastructure for disaster relief and recovery as well as the promotion of mainstreaming water supply and sanitation in

emergency/disaster response as part of strengthening resilience to CC and disasters.

In terms of water sector governance, the PDP 2011-2016 acknowledged that a comprehensive review and subsequent restructuring of water sector governance will help address fragmented and weak water resources management resulting from shared mandates among key agencies. This includes the review of the Implementing Rules and Regulations of the Water Code as priority ENR legislation to strengthen resource regulation and promote more efficient use of water resources; adoption of Integrated Water Resources Management (IWRM); economic regulation of waterworks, water supply, and sewerage service providers; and strengthened enforcement of water-related policies. The need to reform the institutional arrangement in the water sector is reflected in the legislative measures filed in Congress. There are currently five major bills filed in the House of Representatives that seek to institute reforms in the country's water sector mostly pertaining to the economic regulation of water utilities and the creation of a Water Regulatory Commission (CPBRD, 2012).

Water Sufficiency Theory of Change

NCCAP's priority on water sufficiency is that water resources are sustainably managed and equitable access ensured. In light of climate change, a comprehensive review and subsequent restructuring of the entire water sector governance is required. It is important as well to assess the resilience of major water resources and infrastructures, manage supply and demand, manage water quality, and promote conservation.

The objective of the strategic priority on water sufficiency is water resources sustainably managed and equitable access ensured – with three immediate outcomes: 1) water governance restructured towards a climate and gender-responsive water sector, 2) sustainability of water supply and access to safe and affordable water ensured, and 3) knowledge and capacity of the water sector to adapt to climate change enhanced (see Figure 15 and Table 16).

The actions for achieving water sufficiency has dominant focus on harmonization of policies, programs and implementation plans along and consistent with the convergence creation for the awareness, knowledge, and capacity building and governance of some 30 national water-related institutions and other stakeholders. Since water resources are not adequately documented and locally quantified and that water has multiple roles to economic and social development, well focused and targeted research-based and action agenda for policy and programs are paramount for sustainability and access of vulnerable areas and communities to safe and sufficient water supply.

The ensuing changes in temperature and rainfall regimes will directly affect the hydrology of watersheds and increase the uncertainty of the dependability of water resources. This creates urgency of the actions and timely monitoring of the progress of works and activities for the Water Sufficiency program. Similar to the Food Security, whose success is dependent on the success of Water Sufficiency, the activities and outputs provide the logical pathways for the attainment of sustainable water resources management and equitable access, as outlined below:

Output 1.1 Enabling policies for IWRM and adaptation created, provide the first critical step in guiding the positive changes desired for the achieving the role of water sufficiency as foundation of sustainable strategic programs for food security, human security and the rest of the NCCAP strategic program themes. The following priority activities are necessary preparatory steps towards the long road to meeting desirable immediate and key outcomes for the NCCAP:

Activities 1.1.1 Review and streamline water resources management and institutional structures, establishes the premises and scenarios for the undefined "surprises" of climate change. It establishes the scope of short and medium risks and opportunities that need to be addressed for the orderly coordination and inter- institutional convergence by the partners, as one of the prime bases for the efficient inter-agency coordination and implementation of climate change programs and monitoring with the Climate Change Commission.

Activities 1.1.2 Review and amend Water Code (PD 1067) is an important step to re-examine the fragmentation of actions

and consolidation of data base for proper accounting and monitoring of water use rights, permits for various community and individual household uses. Several institutional and technical policy issues need thorough review especially the institutional and human capacity of the NWRB to adequately implement the mandate guided by overall IWRM principles of equitable management of shared resources and shared benefit between and among stakeholders.

Output 1.2 CC Adaptation and vulnerability reduction measures implemented, provide the creation/establishment of spatial and temporal basis for localization of allocation and utilization plans for each and every priority watershed for conservation, protection and socio-economic utilization. To achieve these formulation of guideline for changing needs of waters the following activities are highly considered, to wit:

Activities 1.2.1 Complete the profiling of watersheds and river basins, serves as the inventory of the ecological and economic capacity as well as limits of the watershed to providing water for social, economic and environmental purposes. This will be the important primary step to localizing actions to support water issues and water sufficiency. The IWRM GIS maps and data base shall become the key support output of this activity to the rest of water change management activities of the strategic program.

Activities 1.2.2 Conduct gendered VRA of water resources and structures, provides the social aspects of water program, assuring role and participation of women in all aspects of water planning and program implementation. Women are most affected by the changes in water degradation and declining access to safe and adequate water.

Activities 1.2.3 Develop and implement CCA plans for priority watersheds, after the preceding activities, CCA plans for priority watershed which emphasize key actions and priority areas that will ensure sustainability of water sufficiency plans and programs.

Activities 1.2.4 Rehabilitate degraded watersheds and river basins, provide the actions derived from watershed profiling and gendered VRA. This will initiate the formulation of appropriate planning and implementation arrangement that resolve conflict from the traditional "turfing" of water related agencies. This is the portion of water sufficiency program that relates to convergence program that introduces changes in institutional arrangements for relevant water related agencies.

Activities 1.2.5 Review and develop financing plan for water sector CCA plan, provides the identification and prioritization of activities for funding in the implementation of priorities to initiating CCA-based water sufficiency programs.

Output 2.1 Water supply and demand management of water improved, is the related results of the preparatory actions from Outputs 1.1 and 1.2 where spatial and temporal quantification of allocation of available supply in response to the demands of the water users in the watershed.

Activities 2.1.1 Conduct water supply and demand analysis under various hydrologic conditions and scenarios, the mobilization of technical teams and water experts to undertaking evaluation and measurements of available water supply under different climate change – based hydrology scenario of the watershed. This activity creates guidelines on the scope and limits water supply and demand of the watershed.

Activities 2.1.2 Review and modify, as appropriate management processes of existing water supply systems and uses to consider potential impacts of climate change, this represents the review processes involved for ensuring sustainable spatial and temporal uses of the water supply and thus ensure inter-generational equity on socio-economic and environmental uses of water.

Output 2.2 Quality of surface and ground water improved, represents adoption of proper measures and guidelines for the sustainable exploitation of surface and groundwater resources.

Activities 2.2.1 Fully implement the Clean Water Act and the National Sewerage Program. Both Laws are based on the recognition that water use in the country is affected the apparent lack of appreciation that water is a common/public goods where every citizen of the country share the responsibility of the wise and judicious use of water and water resources.

"The Clean Water Act provides incentives to local government units, water districts, enterprises, private entities, and individuals to develop or undertake efforts that would result to effective water quality management and pollution abatement. Specifically, it encourages efforts on wastewater treatment, cleaner production, and adoption of technologies that minimizes waste. Incentives specifically mentioned in the law are tax and duty exemption on imported capital equipment and tax credit on domestic capital equipment." The National Sewerage and Septage Management Program (NSSMP) are implemented by the Department of Public Works and Highways and key partner agencies. The work "entails assisting with the implementation of sewerage and septage systems across the country in accordance with the goals of the Clean Water Act, developing supporting regulations and codes of conduct and building the capacity of key agencies, local governments, water utilities and other relevant partners in the implementation of the program."

Activities 2.2.2 Improve sanitation infrastructures, this is adjunct to Activity 2.2.1 where sanitation infrastructures are made part and parcel of the DPWH NSSMP implementation. Both activities 2.2.1 and 2.2.2 are directed towards ensuring "saving clean water" from water use malpractices in many urban and informal settlement areas.

Output 2.3 Equitable access of men and women in sustainable water supply. This is a reiteration of the equal treatment of men and women in the process of development of sustainable water supply to ensure better on-the ground implementation of clean water programs. Different modes of supplying and developing water supplies to increase coverage as adaptation measures to reducing climate change impacts on health and sanitation poor and vulnerable communities, particularly women and other vulnerable members of poor households.

Activities 2.3.1 Increase safe water coverage in waterless municipalities and communities. The national government, jointly implemented by the National Anti-Poverty Commission and the Department of Public Works and Highways, have officially identified through the 2000 NSO Household level water adequacy survey, some 432 waterless municipalities. This Presidential Priority for water (P3W) refers water municipalities as "the municipality in a given province with less than 50% of the total households having access to potable water." The program was provided with an annual budget of Pesos 500 million for 5 years to construction, rehabilitation and upgrading of level 1 and level 2 water systems.

Activities 2.3.2 Implement time linked groundwater abstraction licenses to provide flexibility to respond to extreme climate conditions. This is the facilitation of granting licenses as one of the assistance to respond to extreme climate conditions.

Activities 2.3.3 Review and expand the implementation and coverage of water harvesting technologies. This action provides practical measures of reaching out isolated upland communities as a cost-efficient alternative to extracting groundwater sources.

Output 3.1 Knowledge and capacity for IWRM adaptation planning improved. This is targeted output to emphasize the value of IWRM to the formulation of CC adaptation plans and programs for the poor and vulnerable areas and communities. The activities are selected and designed to improve capacity based on knowledge, database and partnerships on IWRM approach to water use planning and allocation.

Activities 3.1.1 Develop the capacities of relevant government agencies in IWRM and adaptation planning. This is the capacity

development component for achieving Output 3.1 which will establish convergence of CCA-based knowledge and plans for actions and implementation for sustainable water use and allocation.

Activities 3.1.2 Improve and update water resources database and information system. This is a critical phase of knowledge development where data collected by different agencies share one common database platform for easier exchange of information and knowledge that will have value for the development of Common Early Warning Systems for Water Sufficiency for various water related agencies.

Activities 3.1.3 Develop gender responsive knowledge products on water and climate change. In addition to the technical dimensions for achieving Output 3.1, this activity will ensure that decision making is supportive of gender-related concerns

Activities 3.1.4 Implement IEC nationwide in partnership with private sector, academe and civil society operations. This will transform collected data into information and education system to effectively communicate risks and disasters related to climate change-related degradation of water resources.

For the short-term period (2011-2016), specific activities will focus on the comprehensive review and subsequent restructuring of the entire water sector governance is required. Laws and policies governing the water sector need to be reviewed in the light of the sector's vulnerability to climate change. In addition, it is important as well to assess the vulnerability of major water resources and infrastructures, manage supply and demand, manage water quality, and promote conservation.

The chains of inter-related actions/activities that revolved around re-visiting the existing water sufficiency plans and programs provide fundamental basis for establishing knowledge and network of new and traditional knowledge systems for a well-informed bureaucracy collectively working in harmony to reduce the impacts of climate change "surprises". A well-informed Bureaucracy will lead to well-informed decision making and prioritization of actions. The immediate gains from these chains of actions that manage changes in IWRM-based decision making and water sufficiency policy, programs and plans are improved governance, affordable/cost efficient and non-exclusionary, gender-sensitive water supply and demand management. The immediate Outcomes include:

Immediate Outcome 1 Water governance restructuring towards a climate and gender responsive sector. As the result of directed actions for IWRM approach for data development, storage and exchange, water leaderships have science-based tools to establish restructured and climate change resilient water governance.

Immediate Outcome 2 Sustainability of water supply and access to safe and affordable water ensured. As a result of fulfilling Outcome 1, the element of sustainability, access to safe and affordable water become achievable and recognized as Outcome 2.

Immediate Outcome 3 Knowledge and capacity of the water sector to adapt to climate change enhanced. This outcome is an adjunct of the Outcome 1 and 2, where governing institutions for achieving water sufficiency are resilient enough and acquire capacity to make flexible decision making for timely implementation of adaptation measures to climate change.

The series of changes in decision making, knowledge development, and facilitation of water related agencies ultimate lead to sustainable and harmonized management of multiple agencies for water resources against highly variable and unpredictable climate change to achieve the intermediate outcome of "Water resources sustainably managed and equitable access ensured" under the Water Sufficiency strategic priority.

Figure 15. Strategic Actions on Water Sufficiency, 2011-2028.

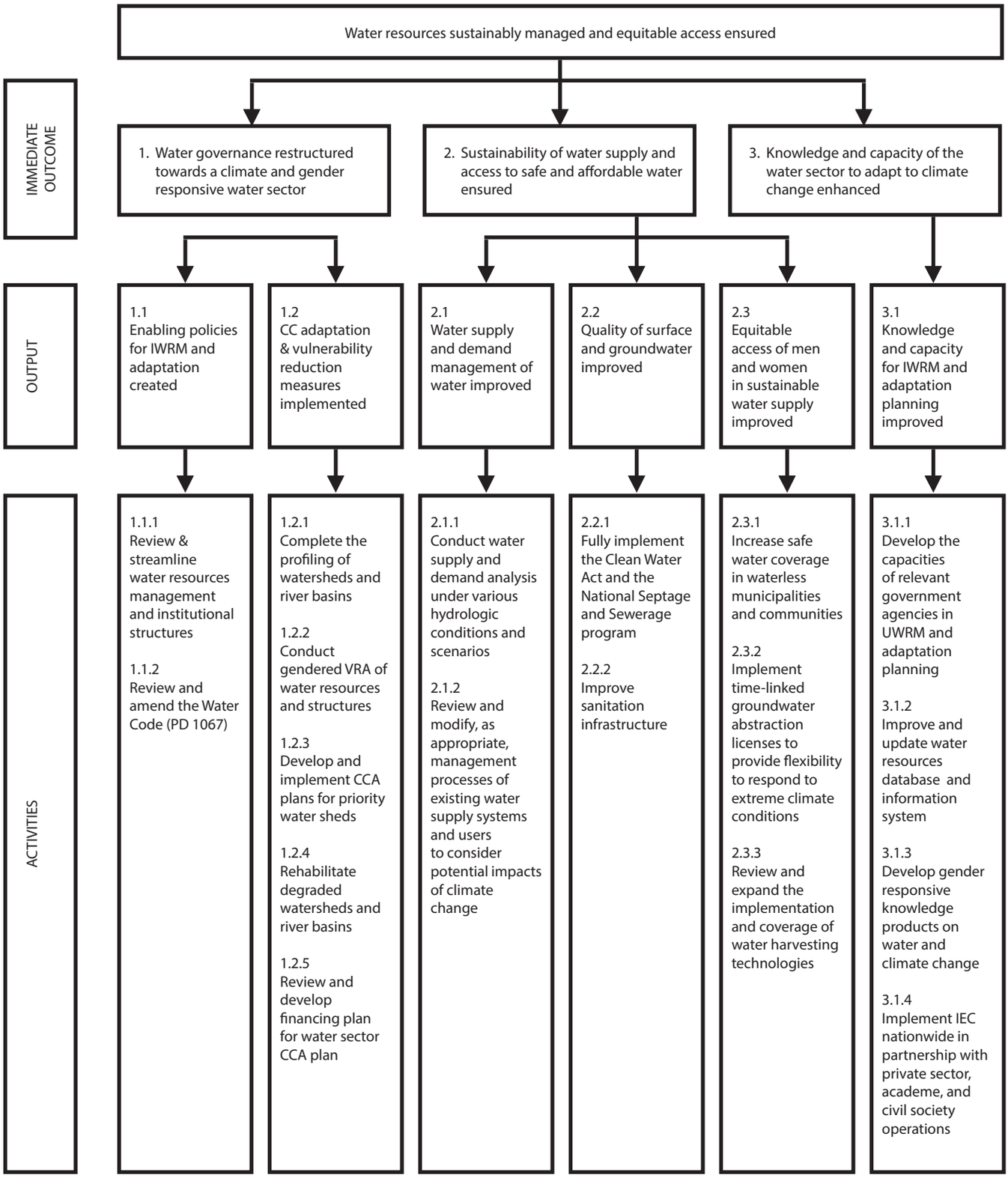


Table 16. Water Sufficiency Results Matrix

Ultimate Outcome	Enhanced adaptive capacity of communities, resilience of natural ecosystems and sustainability of built environment to climate change.					
Ultimate Outcome Indicators	Water availability per capita (WAPC) ratio			Disaster Risk Index		
Intermediate Outcome	Water resources sustainably managed and equitable access ensured.					
Intermediate Outcome Indicators	Water Resources Vulnerability Index Water withdrawal to availability (WTA) ratio		% water supply coverage		Change in institutional adaptive capacity	
Immediate Outcome	1. Water governance restructured towards IWRM in watersheds and riverbasins.		2. Sustainability of water supply and access to safe and affordable water ensured.			3. Knowledge and capacity for CCA in the water sector enhanced.
Immediate Outcome Indicators	No. of institutions (RBOs, LGUs) implementing IWRM		% ratio of water supply to water demand in critical areas (million liters per day)	Water quality of priority river systems improved (by BOD water criteria: Class C <= 7mg/L; Class D >7mg/L & >= 10mg/L)	% population with access to improved water sources* * climate proofed	Institutional capacity of key agencies in the water sector for water allocation and regulation improved
Output Areas **[Agency MFO]**	1.1 Enabling policies for IWRM and CCA created. [DENR and NWRB MFOs]	1.2 CC adaptation and vulnerability reduction measures for the water sector implemented. [DA, NIA, DENR, NWRB MFOs]	2.1 Water supply and demand management of water improved. [NWRB, NIA MFOs]	2.2 Quality of surface and ground water improved. [DENR, NWRB MFOs]	2.3 Equitable access of men and women to sustainable water supply improved. [DENR, NWRB MFOs]	3.1 Knowledge and capacity for IWRM and adaptation planning improved. [DENR, NWRB MFOs]
Critical Output Indicators	No. of CC-related water policies and legislations	No. of measures implemented	No. of site specific water supply and demand (water balance) studies conducted	No. of Water Quality Management Areas (WQMA) established	% household in waterless municipalities with access to climate resilient water systems	No. of staff from key institutions trained on IWRM and climate change adaptation and mitigation
	No. of river basin organizations institutionalized	% coverage of water license	No. of water supply infrastructure assessed and climate proofed	Incidence of water-borne, climate sensitive diseases		No. of KM products produced and accessed by IWRM practitioners at the national and local levels
	No. of CC-enhanced river basin master plans			No. of cities, municipalities served by sewerage / septage system		Updated water resources database accessible to various users
NCCAP Activities and Indicators **[Agency MFOs and Sub-MFOs]**	1.1.1Streamline water governance structure [NWRB MFO]	1.2.1Watershed and river basins profiling [DENR MFO]	2.1.1Conduct water resource supply and demand analysis under various hydrologic conditions and climate scenarios [DENR, NWRB MFOs]	2.2.1Implement Clean Water Act and National Septage and Sewerage Program [DENR, NWRB MFOs]	2.3.1Increase safe water supply coverage for waterless communities [NWRB, DILG, LWUA MFOs]	3.1.1Develop the capacity of relevant government agencies on IWRM and climate change action planning [DENR, NWRB MFOs]

	1.1.2Research, knowledge & technology dissemination	1.2.2Conduct gendered vulnerability and risk assessment of water resources and infrastructures [NWRB, DILG, LWUA, DOE, NIA, MWSS MFOs]	2.1.2Review and modify management processes of existing water supply systems and users to consider potential impacts of climate change [NWRB, DILG, LWUA MFOs]	2.2.2Improve sanitation infrastructures [DENR, DPWH, NWRB MFOs]	2.3.2Implement time-bound groundwater abstraction licenses [NWRB MFO]	3.1.2Improve and update water resources database and information system [NWRB MFO]
	1.1.3Establish KM system [NWRB MFO]	1.2.3Develop & implement CCA plans for priority watersheds and river basins [DENR, NWRB MFO]	2.1.3Implement water harvesting technologies [NWRB, DILG, LWUA, NIA, MWSS MFOs]			3.1.3Develop a gender responsive R&D agenda and knowledge products on water and climate change [DENR, NWRB MFO]
		1.2.4Rehabilitate degraded watersheds and river basin and protect existing ones [DENR, NWRB MFO]				3.1.4Nationwide IEC in partnership with private sector, academe and CSO [NWRB, DILG, LWUA, DOE, NIA, MWSS MFOs]
		1.2.5Review and develop financing plan for water sector climate change action plan [NWRB, DILG, LWUA, DOE, NIA, MWSS MFOs]				
Intervention Fields	INSTITUTIONAL REFORMS	RESOURCE MANAGEMENT	WATER SUPPLY AND DEMAND MANAGEMENT			KNOWLEDGE MANAGEMENT & CAPACITY DEVELOPMENT

WS Indicator Factsheet

Indicator	Water availability per capita (WAPC) ratio
Level of Result	Ultimate Outcome Indicators
Definition and underlying concepts	Also known 'water stress index' or as 'Falkenmark indicator' after the Swedish hydrologist Malin Falkenmark who pioneered the idea. This index defines water scarcity in terms of the total annual renewable water resources that are available to the population; measuring scarcity as the amount of renewable freshwater that is available for each person each year. The water stress index method is commonly used because it is straightforward, easy to use, and the data needed is readily available. However, such a simplistic approach has its limitations:[7,8] • It does not consider the uneven spatial distribution of water resources • It fails to account for whether or not those water resources are accessible (e.g., deeply stored groundwater or heavily polluted surface water) or available at the time when it is most needed • It does not include man-made sources of freshwater (e.g., desalination plants) or reuse of treated water which increase water availability beyond what is naturally available; • It does not account for the fact that amount of water use differ in countries and regions within countries
Computation	WAPC = Annual total renewable water resources / population
Unit of Measurement	Cubic meter per capita per year
Interpretation of the Indicator Value	Thresholds for Falkenmark Index (Perveen and James, 2010) Adapted 'water scarcity' index or 'Falkenmark indicator' (cu.m./capita/year) — Water Stress Implication <1700 — Water stress <1000 — Chronic water scarcity <500 — Beyond the water barrier / Absolute water scarcity If the amount of renewable water in a country is below 1,700 m3 per person per year, that country is said to be experiencing water stress; below 1,000 m3 it is said to be experiencing water scarcity; and below 500 m3, absolute water scarcity.
Unit of Analysis / System of Interest	Freshwater resources Population
Geographical Coverage	12 Water Resources Regions 1. Ilocos 2. Cagayan Valley 3. Central Luzon 4. Southern Tagalog 5. Bicol 6. Western Visayas 7. Central Visayas 8. Eastern Visayas 9. Southwestern Mindanao 10. Northern Mindanao 11. Southeastern Mindanao 12. Southern Mindanao 18 Major River Basins 1. Cagayan River Basin 2. Mindanao River Basin 3. Agusan River Basin 4. Pampanga River Basin 5. Agno River Basin 6. Abra River Basin 7. Pasig-Laguna River Basin 8. Bicol River Basin 9. Abulug River Basin 10. Saug-Libuganon River Basin 11. Ilog-Hilabangan River Basin 12. Panay River Basin 13. Tagoloan River Basin 14. Agus River Basin 15. Davao River Basin 16. Cagayan De Oro River Basin 17. Jalaur River Basin 18. Buayan-Malungon River Basin
Linkage with other NCCAP Thematic Priority	Human Security (Health)
Linkage with existing M&E systems	This indicator is one of the UN-Water set of key water sector indicators for which data are available for a majority of countries, and for which global information systems exist and could support updating them. These indicators are used to illustrate global water issues.3
Frequency of measurement	Annual[9]
Baseline and Reference Year	a. Normal Year: 2010 b. Year of extreme event: 1997-1998 ENSO event

Data / Information Source	National Water Resources Board National Statistical Authority
Lead Agency	National Water Resources Board
Contributing Agency	NSA, DENR-MGB, LWUA, DPWH, DILG
Feasibility of the Indicator	Indicator can be implemented on the basis of available data from the NWRB and NSA and water resources regulation system of NWRB
REMARKS Suggested References a. Falkenmark, M. (1989) The massive water scarcity now threatening Africa: Why isn't it being addressed?, Ambio, vol 18, no 2, pp112–118. b. Parish et. al. (2012) developed a simple methodology based on projected changes in climate and population to estimate future global per capita water availability aggregated by watershed and political unit. Parish, E.S., Kodra, E., Steinhaeuser, K., Ganguly, A.R., 2012. Estimating future global per capita water availability based on changes in climate and population. Computers & Geosciences 42 (2012) 79–86. doi:10.1016/j.cageo.2012.01.019 This publication is available at http://www-users.cs.umn.edu/~ksteinha/papers/CAGEO12.pdf	

WS Indicator Factsheet

Indicator	Water withdrawal to availability (WTA) ratio
Level of Result	Intermediate Outcome Indicator
Definition and underlying concepts	Sometimes referred to as 'Water Resources Vulnerability Index' it measures the proportion of total annual withdrawals (of ground and surface water) as a percent of available water resources. Limitations of the approach: [10, 11] • Accurate and complete data are scarce • It does not consider man-made increases in water supply (such as desalination); • It ignores water withdrawals that are recycled and reused; • It doesn't consider the capacity of countries to adapt to lower water availability through changing behavior or new technology
Computation	Total water abstractions divided by available water. For groundwater: Volume of water that recharges the groundwater aquifers (cubic meters): estimated inflow based on the assumption that 10% rainfall recharges the aquifers Storage capacity of groundwater aquifers (cubic meters) Volume of water withdrawal (cubic meters) of the agriculture, domestic, commercial and industrial water sectors For surface water: Volume of stream flow (cubic meters per second) Volume of water withdrawal (cubic meters) of the agriculture, domestic, commercial and industrial water sectors
Unit of Measurement	Percentage
Interpretation of the Indicator Value	Characterization of Criticality Ratio (Source: UN/WMO/SEI 1997)[12] Percent Withdrawal — Technical Water Stress <10 — Low water stress 10-20 — Medium low water stress 20-40 — Medium high water stress >40 — High water stress A country is considered water scarce if annual withdrawals are between 20 and 40% of annual supply, and severely water scarce if withdrawals exceed 40% (Raskin et al., 1997). This method and 40% threshold is commonly used in water resources analyses and has been termed the "criticality ratio"—the ratio of water withdrawals for human use to total renewable water resources (Alcamo et al., 2000).
Unit of Analysis / System of Interest	Groundwater and Surface Water Agriculture, domestic, commercial and industrial water sectors

Geographical Coverage	12 Water Resources Regions 1. Ilocos 2. Cagayan Valley 3. Central Luzon 4. Southern Tagalog 5. Bicol 6. Western Visayas 7. Central Visayas 8. Eastern Visayas 9. Southwestern Mindanao 10. Northern Mindanao 11. Southeastern Mindanao 12. Southern Mindanao
	18 Major River Basins 1. Cagayan River Basin 2. Mindanao River Basin 3. Agusan River Basin 4. Pampanga River Basin 5. Agno River Basin 6. Abra River Basin 7. Pasig-Laguna River Basin 8. Bicol River Basin 9. Abulug River Basin 10. Saug-Libuganon River Basin 11. Ilog-Hilabangan River Basin 12. Panay River Basin 13. Tagoloan River Basin 14. Agus River Basin 15. Davao River Basin 16. Cagayan De Oro River Basin 17. Jalaur River Basin 18. Buayan-Malungon River Basin
	9 Critical Groundwater Areas 1. Baguio City 2. Angeles City 3. Metro Manila a. Pasay City b. Makati City c. Manila d. Caloocan City e. Las Piñas City f. Parañaque g. Valenzuela h. Malabon i. Navotas 4. Iloilo City 5. Bacolod City 6. Metro Cebu 7. Cagayan de Oro City 8. Davao City 9. Zamboanga City
Linkage with other NCCAP Thematic Priority	EES Intermediate Outcome Indicator
Linkage with existing M&E systems	Monitored by the United Nations Food and Agriculture Organization (FAO) at the international level. Indicator available for the main river basins in the world. Through Google Earth it is possible to access the layer on Global water resources by Alcamo et al. (2007), which contains world projections on water stress for 2050 using different indicators. Information in Google Earth presented in cells which allow for a regional assessment.
Frequency of measurement	Annual
Baseline	a. Normal Year: 2010 b. Year of extreme event: 1997-1998 ENSO event
Data / Information Source	National Water Resources Board
Lead Agency	National Water Resources Board
Contributing Agency	LWUA, DILG, DPWH
Feasibility of the Indicator	Indicator can be implemented on the basis of available date (subject to political agreement among the key water sector agencies)

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Alcamo, Joseph, Thomas Henrichs, and Thomas Rosch. World Water in 2025: Global modeling and scenario analysis for the World Commission on Water for the 21st Century. Kassel World Water Series Report No. 2, Center for Environmental Systems Research, Germany: University of Kassel, 2000, 1-49.

Alcamo, J. and Henrichs, T. (2002) Critical regions: A model-based estimation of worldwater resources sensitive to global changes, Aquatic Sciences, vol 64, no 4, pp352– 362.

Alcamo, J., Florke, M., Marker, M. (2007) Future long-term changes in global water resources driven by socio-economic and climatic changes. Journal of Hydrological Sciences: Vol. 52, No. 2, pp. 247-275

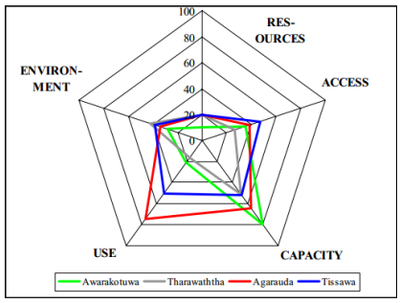
WS Indicator Factsheet

Indicator	Disaster Risk Index[13]
Level of Result	Ultimate Outcome Indicators
Definition and underlying concepts	This indicator compares the average population exposed to water-related hazards with average annual deaths caused by these hazards. Risk is modelled using socio-economical parameters. Disaster: destructive event triggered by natural hazards, with impacts on human life and activities; overwhelming the capacity of available relief response Deaths: human life lost directly as a result of the disaster (e.g. drowning in the event of a flood). Number of people living in flood-prone areas (per year or other period) Number of deaths in this population directly caused by disasters (e.g. flooding) in the same year or over the same period
Computation	Estimation of risk (expressed in number of people killed) $K = C*(PhExp)^{\alpha} * V1^{\alpha 1} * V2^{\alpha 2} * V^{p\alpha p}$ Where: K = number of persons killed by a certain type of hazard C = Multiplicative constant PhExp = Physical Exposure: population living in exposed areas multiplied by the frequency of occurrence of the hazard V_i = Socio-economical parameters α_i = Exponent of Vi which can be negative The weight for each variable is calibrated using past casualties in the period 1980-2000, parameters and variables being different for each hazard (as computed from geophysical datasets) was always selected by the statistical analysis. But then the socio-economical parameters were: *For floods*: GDP per capita and local population density *For cyclones*: HDI and percentage of arable land *For drought*: percentage of population with access to improved water supply
Unit of measurement	Risk expressed in number of people killed
Interpretation	The number of deaths per unit of exposed population would give an indication of the vulnerability of the nation to the impacts of disasters. The higher the rate of deaths per unit of exposed population, the more vulnerable a nation is to the impacts of disasters. The Disaster Risk Index provides statistical assessment of countries according to their relative vulnerability. Although informative about the rate of exposed people dying of natural hazards, additional explanations can be found in the report Reducing Disaster Risk (UNDP). From this information can be developed a global ranking of the relative risk and vulnerability of nations exposed to water-related and other natural hazards.
Unit of Analysis / System of Interest	Floods, Cyclones, Drought
Geographical Coverage	Category 1: Ten provinces with high magnitude of poor households, 2010 1. Zamboanga del Sur 2. Cebu 3. Pangasinan 4. Negros Occidental 5. Camarines Sur 6. Leyte 7. Iloilo 8. Sulu 9. Quezon 10. Davao Del Sur Category 2: Ten provinces with highest poverty incidence based on population, 2012 (in percent) 1. Lanao Del Sur 2. Maguindanao* 3. Eastern Samar 4. Apayao 5. Zamboanga del Norte 6. Camiguin 7. Saranggani 8. North Cotabato 9. Masbate 10. Northern Samar

Geographical Coverage	Category 3: Thirty provinces exposed to multiple hazards 1. Zamboanga del Sur 11. Cagayan 21. Albay 2. Leyte 12. Quirino 22. Catanduanes 3. Iloilo 13. Isabela 23. Antique 4. Quezon 14. Nueva Vizcaya 24. Bohol 5. Eastern Samar 15. Zambales 25. Southern Leyte 6. Northern Samar 16. Pampanga 26. Zamboanga Sibugay 7. Ilocos Norte 17. Aurora 27. Dinagat Islands 8. Ilocos Sur 18. Cavite 28. Agusan del Sur 9. Abra 19. Laguna 29. Surigao del Norte 10. Benguet 20. Rizal 30. Surigao del Sur
Linkage with other NCCAP Thematic Priority	Human Security
Linkage with existing M&E Systems	NDRRMC Philippine Development Plan
Frequency of measurement	Annual
Baseline and Reference Year	a. Normal Year: 2010 b. Year of extreme event i. Flooding: TY Ondoy ii. Cyclones: TY Frank, Pablo, Haiyan (Yolanda) iii. Drought: 1997-1998 ENSO event
Data / Information Source	NEDA, NDRRMC
Lead Agency	OCD-NDRRMC
Contributing Agency	CSCAND Agencies Collective Strengthening on Community Awareness on Natural Disasters (CSCAND) Agencies is a Subcommittee under the Preparedness Committee of the National Disaster Coordinating Council (NDCC) as per a NDCC Special Order issued in 2003. OCD is the Chairman of the Steering Committee; PHIVOLCS as Chairman of the Technical Working Group and CSCAND members are PAGASA, MGB, NAMRIA.
Feasibility of the Indicator	Indicator can be implemented on the basis of available data, however, additional calculations are needed but timely implementation seems probable.
REMARKS The prioritization of the Provinces were derived from the spatial considerations in the Updated PDP 2011-2016 that will deliberately address the constraints faced by the poor as summarized by their province of residence.	

WS Indicator Factsheet

Indicator	Water poverty index (WPI)
Level of Result	
Definition and underlying concepts	An integrated assessment of water stress and scarcity, linking physical estimates of water availability with socio-economic variables that reflect poverty (Sullivan, 2002). This approach attempts to take into account the role of income and wealth in determining water scarcity by measuring: (1) the level of access to water; (2) water quantity, quality, and variability; (3) water used for domestic, food, and productive purposes; (4) capacity for water management; and (5) environmental aspects (Sullivan et al. 2003). The complexity of this approach, however, means that it is more suited for analysis at a local scale, where data is more readily available, than on a national level.
Computation	The WPI as developed by Sullivan (2002)[14] is given by the weighted arithmetic mean function of 5 components (R, A, C, U, E) each having a value between 0 and 100: $WPI = \sum w (R, A, C, U, E) / \sum w$ where: w : weight of the item (equal indicator weights are preferred) R : Physical availability of water resources A : Extent of access to water and sanitation C : Peoples ability and capacity for sustaining access U : Use of water for different purposes E : Environmental factors which impact on the water supply to ecosystems

	An improved method for WPI was introduced by Garriga and Foguet (2010) to address two conceptual weaknesses in the current index referring to (1) inadequate technique to combine available data and (2) poor statistical properties of the resulting composite. The proposed method has been designed for universal application at local scale. It uses weighted multiplicative function based on principal component analysis for the selection of indicators at the sub-index level and weighted geometric mean of sub-indices as aggregation function.
Unit of Measurement	Dimensionless numerical index
Interpretation of the Indicator Value	If the components of the WPI are presented as a pentagram, the specific attributes of the water sector that needs to be developed the most is easier to understand.  Example of WPI pentagram. Source: http://portals.wi.wur.nl/files/docs/ppme/Water_poverty_index.pdf
Unit of Analysis / System of Interest	Common Waterless Municipalities in Category 1 and 3 and Category 2 and 3 Provinces. 'Waterless municipalities" is defined as municipalities with less than 50 percent service coverage. The DOH, NAPC and DILG used the data from the National Household Targeting System for Poverty Reduction for identification of the target municipalities which compose of the following: 1. 115 Waterless Municipalities 2. Waterless Areas based on the following thematic concerns: a. Poorest waterless barangays with high incidence of water borne diseases b. Resettlement areas in Bulacan, Rizal, Cavite, Laguna, Batangas and Albay c. Health Centers without access to safe water
Geographical Coverage	Waterless Municipalities in Category 1 & 3 Zamboanga del Sur: Lapuyan, Midsalip, Tigbao, Bayog, Dumalinao, Dumingag, Labangan, Margosatubig, San miguel, Sominot (Don Mariano Marcos), Tukuran Leyte: Abuyog, Alangalang, Bato, Calubian, Carigara, Dagami, Santa fe, Tabango, San isidro Iloilo: Ajuy, Alimodian, Balasan, Batad, Bingawan, Calinog, Carles, Dueñas, Estancia, Igbaras, Janiuay, Lambunao, Leon, Maasin Quezon: Buenavista, Burdeos, Calauag, Catanauan, General luna, General nakar, Guinayangan, Gumaca, Lopez, Macalelon, Panukulan, Patnanungan, Perez, Plaridel, San andres, San francisco (Aurora), San narciso, Tagkawayan, Unisan Waterless Municipalities in Category 2 & 3 Eastern Samar: Taft Northern Samar: Biri, Bobon, Las Navas, Mapanas, Laoang
Linkage with other NCCAP Thematic Priority	None
Linkage with existing M&E system	M&E System of the Sagana at Ligtas na Tubig Sa Lahat (SalinTubig) Program
Frequency of measurement	Annual

Baseline and Reference Year	2010 1997-1998 ENSO event
Data / Information Source	No singular, unified source of data / information – must be gathered individually from contributing agencies.
Lead Agency	DILG (arbitrary selection; as lead of Salintubig Program)
Contributing Agency	NWRB, LWUA, DPWH, DOH, NAPC
Feasibility of the Indicator	Indicator can be implemented on the basis of available data, however, additional calculations are needed and timely implementation seems probable. Creation of an interagency TWG may be needed that will analyze the WPI five components.

REMARKS

In December 2010, the DILG entered into a Memorandum of Agreement (MOA) with DOH and NAPC for the implementation of the Provision for Water Supply, also known as the Sagana at Ligtas na Tubig Sa Lahat Program. The Program is designed to provide water supply systems for the 455 waterless municipalities, waterless barangays, waterless health centers, and waterless resettlement sites; and enhance the capacity of the LGUs/water service providers in the planning, implementation, and operation of water supply facilities. The following are the Salintubig Program Targets:

1. Increased water service for the waterless population by 50%
2. Reduced incidence of water-borne and sanitation related diseases by 20%
3. Improved access of the poor to sanitation services by at least 10%
4. Sustainable operation of all water supply and sanitation projects constructed, organized and supported by the Program by 80%.

For 2011, the Program covers 115 waterless municipalities, 62 waterless barangays, 55 waterless health centers, and 24 waterless resettlement sites, using the P 1.5 Billion Funds released to DBM. For 2012, the Program was transferred to DILG and will cover 150 municipalities, 43 barangays, 46 health centers, and 12 resettlement sites. The remaining 290 of the 455 waterless municipalities, and a number of waterless barangays, health centers and resettlements sites will be covered from 2013-2016

Ecological and Environmental Stability

The premise of this strategic priority is that a healthy and stable ecosystem is a necessity amidst a changing climate because of the goods, services and benefits derived by society for human well-being. Figure 16 illustrates the conceptual model developed by Fisher et al. (2009) that shows the connections between ecosystem structure, processes, services and benefits.

In this model, ecosystem structure refers to the configuration of ecosystem structure and process required for 'healthy' functioning and service provision. It is considered a "service" to the extent that it provides the platform from which ecosystem processes occur. The processes or functioning of ecosystems become services if there are humans that benefit from them arising from additional capital inputs (human, social and built capital) needed to realize the gain in welfare.

This conceptual model is helpful in examining the potential impacts of climate change that may be differentiated in terms of its effect on the physical constitution of ecosystems; processes or functioning of ecosystems; and the services, goods and benefits derived for human well-being. It also guides the logic of the results chain for the EES priority and the linkage of this priority to the other strategic priorities of the NCCAP (e.g., Water Sufficiency, Human Security). The succeeding discussion on the state of the environment and various ecosystems will be guided by this conceptual framework.

Three broad environmental challenges categorized as urban air and water pollution, natural resource degradation, and the declining quality of coastal and marine resources faced the country more than a decade ago (WB, 2000). Despite the numerous development interventions targeted at improving the quality of the environment, these challenges are still highly relevant today. Pollution problems are still widespread in the country particularly affecting air and water quality in urban areas. Environmental degradation and natural resources deterioration continue unabated despite intensified government and private sector efforts across various sectors. A recent report on the state of the Philippine environment by Naz (2013) provides a summary of key issues per environment and ecosystem (see Table 17).

Figure 16. Conceptual relationship between intermediate and final services, also showing how joint products (benefits) can stem from individual services. Intermediate services can stem from complex interactions between ecosystem structure and processes and lead to final services, which in combination with other forms of capital provide human welfare benefits (Fisher et al., 2009).

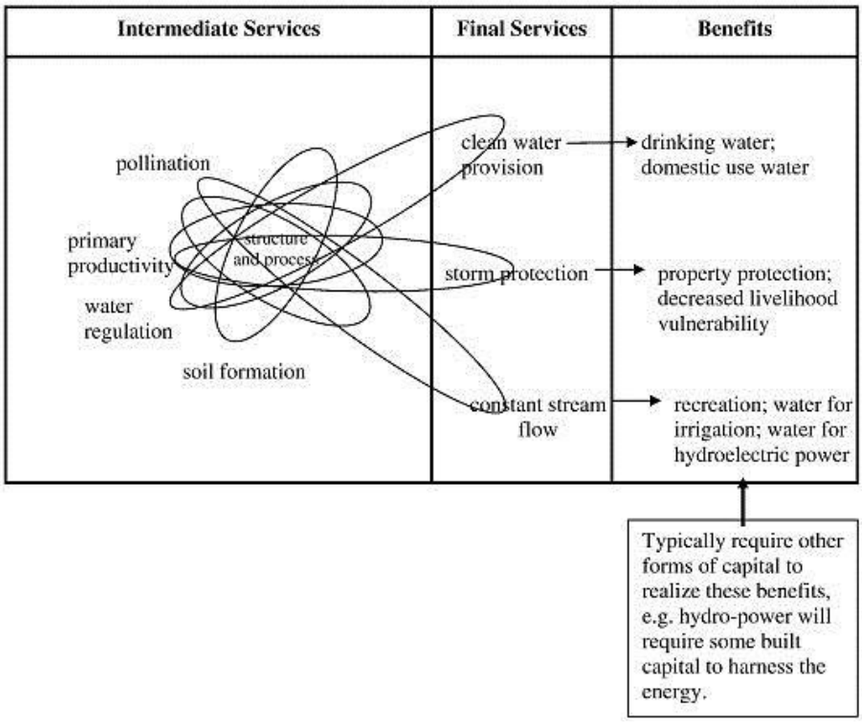


Table 17. Some key issues per environment and per ecosystem. Source: Naz (2013)

Green	Blue	Brown
1. Forest Ecosystem	1. Groundwater and Freshwater Ecosystem	1. Urban Ecosystem: Air Quality
• Declining forest cover • Forested lands are shrinking • Degradation of forestland • Watershed degradation • Compromised integrity of watersheds	• Increased run-off from agricultural lands • Limited aquifer recharge • Saltwater intrusion into wells and aquifers especially in coastal areas • Threatened habitats of inland fishery resources due to aquaculture and other activities	• Declining air quality in Metro Manila and key urban centers
2. Critical Habitats and Biodiversity	2. Water Supply	2. Urban Ecosystem: Water Quality
• Loss of critical habitats/biodiversity • Unique biodiversity is under severe pressure • Coastal and marine resources are under threat • Loss of natural habitats that support biodiversity	• Water supply unable to keep up with demand • Competing water uses • Water is becoming scarcer • Insufficient storage and distribution of water to deficient areas	• Declining water quality in lakes, rivers and coastal waters
3. Agricultural Ecosystem	3. Coastal and Marine Ecosystem	3. Solid and Hazardous Wastes, Toxic Chemicals and Other Pollutants
• Land conversion, decreasing soil fertility, aggressive use of chemical inputs such as fertilizers, pesticides, soil erosion • Quality of farm land is deteriorating • Inappropriate and unsustainable land use and agricultural practices in upland areas	• Declining coastal and marine resources due to overfishing and destructive fishing methods • Environmental degradation of near shore coastal areas due to sedimentation from upstream sources • Overexploitation of fisheries and permanent loss of coastal ecosystems from changes in land use due to urbanization, industrialization, and other land conversion, including aquaculture	• Increasing waste generation and improper waste management Solid waste remains a major source of pollutants • Hazardous wastes and toxic chemicals pose health risks • Persistent organic ollutants • Depletion of the ozone layer • Acid deposition
Global Environment		
• Climate change and other global issues covered by Multilateral Environmental Agreements • Extreme vulnerability to environmental hazards and climate-related risks • Impacts of extreme weather events and climate change		
Institutional Issues		
• Implementation is confused by overlapping and conflicting policies • Government capacity for resource management is wanting: overlapping jurisdictions, technical expertise, information systems • Enforcement of environmental laws and policies is inadequate • Absence of a financing strategy for environment and natural resources programs and climate change adaptation		

Air Quality

Air and water pollution remains a serious concern particularly in major urban centers. Poor air quality and climate change are different phenomena that share a common major cause – that of burning fossil fuel. Burning fossil fuel releases pollutants such as particulate matter (PM) and ground-level ozone (O3) — the key ingredients of smog — along with nitrogen oxides (NOx), sulphur oxides (SOx), volatile organic compounds (VOCs) and carbon monoxide (CO) as well as GHGs, specifically carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O). Ozone and particulate matter contribute to climate change. Ozone is a contributor to climate warming while different types of particulate matter have different impacts on climate (e.g., black carbon warms while sulfates and nitrates cool). Jacob and Winner (2009) reviewed the sensitivity of air quality to climate change based on recent studies and found that the future climate is expected to be more stagnant climate due to a weaker global circulation and a decreasing frequency of mid-latitude cyclones. They also found out that climate change alone will increase summertime surface ozone in polluted regions by 1–10 ppb over the coming decades, with the largest effects in urban areas and during pollution episodes. However, the effect of climate change on particulate matter (PM) is more complicated and uncertain than for ozone. This supports the findings that rising temperatures affect air quality by worsening smog pollution and increasing the number of days with bad air quality thereby affecting people with respiratory diseases like asthma. A study conducted by Horton et al. (2014) projected increases of up to 40 days per year of air stagnation occurrences that control air pollutant build-up and dispersal throughout the majority of the tropics and subtropics, as well as within isolated mid-latitude regions. Urban areas with dense population and concentrated sources of pollution from vehicles, factories, and other sources are particularly exposed to poor air quality. Rural areas are not spared where wildfires are expected to contribute to increasing amount of particulate matter in the air and rising carbon dioxide levels are expected to cause plants to produce more pollen thereby further increasing the amount of allergens in the air. In any case, measures to address pollution from burning fossil fuel will tackle deteriorating air quality from the release of pollutants as well as reduce GHG emissions that cause global warming.

Water Quality

Water quality is defined as "the characteristics of water which define its use in terms of physical, chemical, biological, bacteriological or radiological characteristics by which the acceptability of water is evaluated" in the Republic Act 9275 or the Philippine Clean Water Act of 2004. Assessment of the water quality is according to the beneficial uses to which the water is put and a water body that sustains its beneficial uses is considered as having good water quality. Conversely, a water body that does not sustain its beneficial uses has poor quality. Clean and pure water containing almost no chemical, bacteriological and radiological constituents is desirable for water intended for drinking and food preparation but it is not really necessary or even advisable to have the same water quality for other uses (EMB-DENR, 2008).

Water quality is influenced by changes in climate through the alteration of the balance between the interwoven atmospheric, terrestrial, and aquatic processes in watershed, and the effects of human resource use on these processes. However, effects of land and water use changes in water quality often mask the effects of climate change which makes the prediction of ecological responses of aquatic ecosystems difficult and further complicated by the lack of quality-controlled, well-distributed, long-term data on water-quality trends (Murdoch et al., 2000). In general, water quality might improve or deteriorate depending on the magnitude of climate change and the initial water quality condition. For example, the oxygen-holding capacity of surface waters decreases with increases in water temperature which then decrease the productivity in surface waters already stressed by biological oxygen demand (Murdoch et al., 2000). Delpla et al. (2009) provides a synthesis of the most recent interdisciplinary literature on the consequences of climate change on water quality – a field that the authors claim to be just beginning to be studied compared to climate change impacts on water availability and hydrological risk[15]. The study concluded that in terms of water quality parameters, climate change impacts will vary according to the type of water body (e.g., lakes, rivers) and its characteristics (e.g., water residence times, size, shape, depth). Dissolved organic matter and nutrients are the main parameters affected for streams while pathogens and cyanobacteria/cyanotoxins are more related to lakes. Organic or inorganic micropollutants are also affected

where drought, for example, have impacts on metal concentrations while changes in rainfall seasonality and intensity and increased air temperatures drive changing pesticides fate and behavior.

The Environmental Management Bureau – DENR monitors the physical, chemical and biological properties of water by which its quality is measured. Water quality monitoring reports indicate that, while the biochemical oxygen demand (BOD) levels of rivers have generally improved and are already within standards, waterways in major urban centers are still heavily polluted despite clean-up efforts. Coliform contaminated up to 58% of groundwater sources in Metro Manila which makes an already scarce resource even more limited in beneficial use. The degradation of watersheds and lack of storage and distribution facilities compound the threat of emerging water scarcity arising from uneven distribution and deteriorating quality of water resources. Increasing water demand, particularly for irrigation and domestic water supply, puts further pressure on already water-stressed urbanized cities that rely mostly on groundwater for water supply. Hazardous waste is also an increasing concern with the lack of expertise and disposal facilities to deal with such. Solid waste disposal is also a pressing concern in urban centers, particularly Metro Manila.

Forest, Forest Land

Deforestation and forest degradation attributed to inequitable land distribution, insecure tenure and rural poverty, remain a serious development issue despite intensified government efforts. Various estimates place the country's remaining forest cover at about 20%.[16] Trends in forest cover is obscured by changes in definitions such as the apparent increase in forest cover between 1997 (at 5.4 million hectares) and 2003 (7.2 million ha) which is probably due to a redefinition of what is included in forest cover based on percent canopy cover and other factors (Naz, 2013). Reported increases in forest cover is also credited to intensified government efforts that included the declaration of around 2.7 million ha of primary forest lands as part of the National Integrated Protected Areas System (NIPAS) since 1992 and the more recent National Greening Program that targets to plant 1.5 billion tree seedlings in 1.5 million hectares nationwide from 2011 to 2016.

The country's land resources is under stress from competing pressures and conflicts for agriculture, industry, settlements, recreation, nature reserves, and others. Of the country's total land area, 76% is said to face some extent of degradation. Approximately 27.3 percent is vulnerable to drought, alternating with yearly floods and typhoons (Castro, n.d.). Productivity of land resources are declining from soil erosion, loss of soil nutrients and organic matter, salinization and pollution.

Coastal and Marine Ecosystem

Ranked as the fifth country with the longest coastline at 36,289.00 km, the country's coastal and marine resources are characterized by diverse ecosystem with significant economic value. It provides economic goods such as fish and fishery products, and ecological services such as shoreline protection, sustaining biodiversity, transportation and recreation. The annual economic benefits from the coastal ecosystems are estimated at 3.5 billion USD with the coral reefs alone contributing about 1.4 billion USD annually to the economy or about 1.4 percent of GDP (WB, 2005). However, unregulated development activities threaten the health of the coastal and marine ecosystem with only 4-5% of the coral reefs remaining in excellent condition; more than 70% of the mangrove forests converted to aquaculture, logged or converted to other land uses; lost or severely degraded seagrass beds; eroded beaches and/or uncontrolled development in foreshore areas. Coastal communities dependent on these resources for livelihood remain among the poorest in the country. Competition over declining fish stock leads to over exploitation of fishery resources and employment of destructive fishing practices. The inequitable distribution of benefits sharing in coastal resources management also results to marginalized fishing communities and underdeveloped fishing industry.

Biodiversity

The Philippines is a biodiversity hotspot and one of the 17 megadiversity countries with more than 52, 177 described species, of which more than half are found nowhere else in the world. This rich biodiversity is the foundation of healthy and functioning ecosystems which are essential for stable and thriving societies. However, the country has lost more than 75% of its original habitat, putting severe pressure on the

country's unique biodiversity. This placed the country among the first countries in the world predicted to suffer a total environmental collapse and large scale, simultaneous species extinction (Ong, 2004).

Ecological and Environmental Stability Theory of Change

Maintaining a healthy and stable ecosystem is a necessity in the face of changing climates. Ecosystem provides an essential services for communities: food and water; regulating functions on climate, floods and diseases; cultural and recreational benefits; support functions such as nutrient cycling, water cycling, soil formation and retention, and others.

Climate change, coupled with destructive human activities, exerts tremendous pressure on ecosystems' resiliency to capacity to resist and adapt. NCCAP's objective on ecological and environmental stability is to enhance resilience and stability of natural systems and communities. As an immediate outcome, the focus would be on ecosystem protected, rehabilitated and ecological services restored (Figure 17). To achieve this outcome, the following activities shall be pursued:

- Conduct nationwide ecosystem vulnerability and risk assessment;
- Derive and implement mitigation and adaptation strategies for key ecosystems; Implement the National REDD Plus Strategy (NRPS);
- Expand the network of protected areas (PAs) and key biodiversity areas (KBAs);
- Establish ecosystem towns or ecotowns in protected areas and key biodiversity areas;
- Design gender-fair innovative financing mechanisms and a bundle of CC adaptation assistance for ecotown communities;
- Implement moratorium on polluting and extractive industries in PAs, KBAs and other environmentally critical areas;
- Increase knowledge and capacity for integrated ecosystem-based management at the national, local and community level;
- ¬Review and revise knowledge policy on Phil. Economic-Environmental and Natural Resources Accounting; and
- Implement training program on wealth accounting or ENRA for key government agencies.

For the short-term (2011-2016) period, ecological and environmental stability is considered a top priority given that without stable and resilient ecosystems, the impacts of climate change on communities and the ecosystem would be more severe. Priority will be given to the mainstreaming of climate and disaster risk reduction, the convergence of adaptation and mitigation actions as well as a demonstration of integrated ecosystems-based management approach (Table 18). The specific activities will focus on the following concerns:

- Climate change mitigation and adaptation strategies for key ecosystems developed and implemented;
- Management and conservation of protected areas and key biodiversity areas improved;
- Environmental laws strictly implemented;
- Capacity for integrated ecosystem-based management approach in protected areas and key biodiversity areas enhanced; and
- Natural resource accounting institutionalized.

Figure 17. Strategic Actions on Environmental and Ecological Stability, 2011-2028.

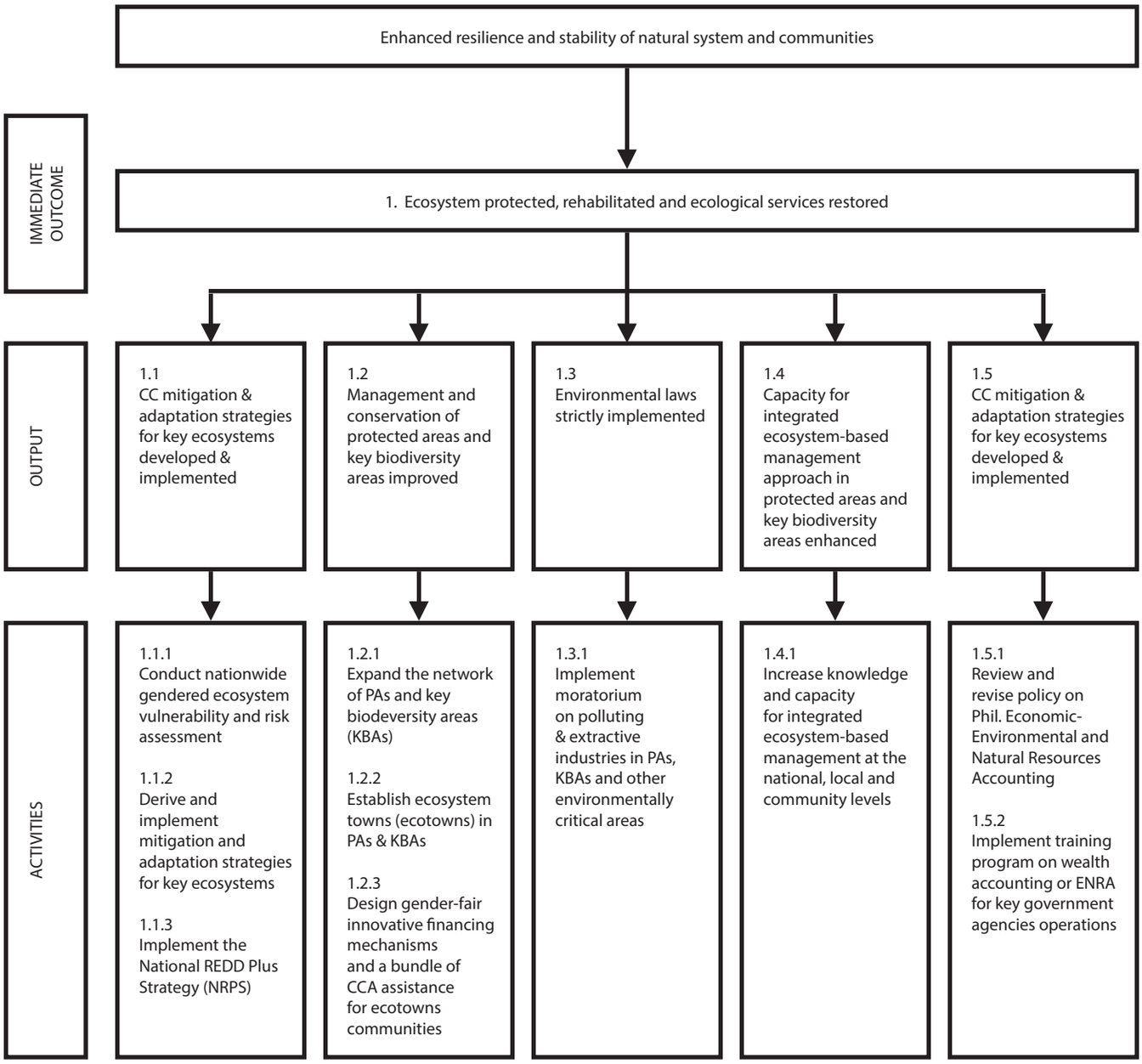


Table 18. Ecological and Environmental Stability Results Matrix

Ultimate Outcome	Enhanced adaptive capacity of communities, resilience of natural ecosystems and sustainability of built environment to climate change.				
Ultimate Outcome Indicators	Trends in abundance and distribution of selected species (e.g. Tamaraw, Philippine Cockatoo and Philippine Eagle)			Amount of damage caused by major natural disasters (in Peso)	
Intermediate Outcome	Enhanced resilience and stability of natural systems and communities.				
Intermediate Outcome Indicators	Change in conservation status of threatened and/or protected species		Change in water quality: Water quality of priority river systems improved (by BOD water criteria: Class C <= 7mg/L; Class D >7mg/L & >= 10mg/L)		% change forest cover using land use definition
Immediate Outcome	Ecosystems protected, rehabilitated and ecological services restored				
Immediate Outcome Indicators	Area of forest, agricultural, fishery and aquaculture ecosystems under sustainable management	Extinction of threatened species of listed wild flora & fauna prevented		% land area covered by forest from 23.8% in 2003 to 30% in 2016 using land use definition	% of critical coastal and marine habitats effectively and equitably managed
Output Areas	1.1 CC mitigation and adaptation strategies for key ecosystems developed and implemented.	1. 2. Management and conservation of protected areas and key biodiversity areas improved.	1. 3. Environmental laws [in the context of climate change] strictly implemented.	1. 4. Capacity for integrated ecosystem-based management approach in protected areas and key biodiversity areas enhanced.	1. 5 Natural resources accounting institutionalized.
Critical Output Indicators [DENR MFOs]	No. of strategies and policy frameworks developed	% CLUP-CDP climate proofed	% CLUPs climate proofed	No. of communicated best practices	% LGUs implementing wealth accounting for valuation of ecosystem services
	No. of types of CCAM programs in key ecosystems implemented in the 21 MRBs and 8 PRBs and other areas	% PA and KBAs plans climate proofed		CC information management system established at the national level (CC Act) No. of gender-sensitive KM products developed and disseminated	
		No. of staff trained in ecosystem-based management approaches		% staff trained ad implementing EBAs (NGAs and LGUs)	
NCCAP Main Activities	1.1.1 Vulnerability Assessment	1.2.1 PAs and KBAs network expansion	1.3.1 Moratorium on polluting and extractives industries in PAs, KBAs and ECAs	1.4.1 Increase knowledge and capacity for ecosystem-based management at national, local and community levels	1.5.1 Review and revise policy on PENRA
	1.1.2 Implementation of adaptation and mitigation strategies for ecosystems	1.2.2 Establishment of ecotowns in PAs and KBAs			1.5.2 Implement training program on wealth accounting or ENRA for key government agencies
	1.1.3 Implementation of the National REDD+ Strategy	1.2.3 Innovative financing mechanisms and bundle of assistance			
INTERVENTION FIELDS	Ecosystem-based Adaptation		Environmental Policy & Law Enforcement	Capacity Development	Natural Resource Accounting

EES Indicator Factsheet

Indicator	Trends in abundance and distribution of selected species (e.g. Tamaraw, Philippine Cockatoo and Philippine Eagle)
Level of Result	Ultimate outcome indicator
Definition and underlying concepts	This indicator measures the following drivers of changes in the abundance and distribution of species: o Changes in land use lead to loss and fragmentation of habitats o Persecution o Impact of alien species o Climate change Climate change impacts on species can be assessed by tracking over time the distributional ranges of species, the timing of onset of seasonal cycles and population growth rates. Alongside information on local climate these data can provide evidence that climate change is affecting species distributions or viability. In certain cases these studies, which are primarily correlational, may need to be supported by experimental studies. Establishing indicators for climate change will involve selecting some indicators, particularly susceptible species and habitats, and instituting annual recordings of the locations and timing of key events into such a scheme to provide a long term data set. This indicator requires high-quality, long-term data on distribution and abundance for accuracy. It can be easily aggregated but large-scale trends may hide local deviations from the overall trend. It is essential to select appropriate indicator species for a particular environment since different species will respond differently to particular drivers.
Computation	Analysis of long-term data on distribution and abundance of species
Unit of Measurement	To de determined with BMB-DENR
Interpretation of the Indicator Value	Viable populations indicate the presence of healthy habitats and ecosystems.
Unit of Analysis / System of Interest	To de determined with BMB-DENR
Geographical Coverage	PAs and KBAs (nationwide)
Linkage with other NCCAP Thematic Priority	
Linkage with existing M&E system	Philippine Development Plant Subsector Outcome 9b: Sustainably Managed Natural Resources Achieved
Frequency of measurement	Annual
Baseline and Reference Year	To de determined with BMB-DENR
Data / Information Source	NSCB: No. of threatened species, observed population of threatened species
Lead Agency	Biodiversity Management Bureau
Contributing Agency	Forest Management Bureau-DENR; Bureau of Fisheries and Aquatic Resources-DA NGOs (e.g., Conservation International, Haribon) and Academe
Feasibility of the Indicator	Implementability of the indicator or the conditions needed for its measurement to be accomplished: 1- Indicator can be implemented on the basis of available data using existing data sharing agreement and/or M&E system of key agencies. However, for some species groups, distribution data may be available but fragmented, out of date, or with varying quality levels. Collection of new data can be expensive especially for little-studied taxa but data collected by non-government institutions (NGOs, research organizations, academe, etc.) can be tapped.
REFERENCES EASAC, 2005. A user's guide to biodiversity indicators. London, UK.	

EES Indicator Factsheet

Indicator	Change in conservation status of threatened and/or protected species
Level of Result	Intermediate outcome indicator
Definition and underlying concepts	This indicator is based on the IUCN-SSC Red List Program. It has high public resonance and high biological relevance because it measures trends in species closest to extinction. It is a measure of both biodiversity loss and the effectiveness of policies and actions designed to halt the decline of species faced with extinction. The indicator can be easily aggregated and disaggregated by geographical area or taxonomic group.
Computation	
Unit of Measurement	To de determined with BMB-DENR
Interpretation of the Indicator Value	Viable populations indicate the presence of healthy habitats and ecosystems. Change in conservation status, from vulnerable to non-vulnerable or critically endangered to endangered.
Unit of Analysis / System of Interest	Critically endangered 38 species of fauna and 55 flora species (IUCN Red List 2011)
Geographical Coverage	Nationwide
Linkage with other NCCAP Thematic Priority	
Linkage with existing M&E system	
Frequency of measurement	Annual
Baseline and Reference Year	To de determined with BMB-DENR
Data / Information Source	NSCB: No. of threatened species, observed population of threatened species
Lead Agency	Biodiversity Management Bureau
Contributing Agency	NGOs (e.g. Conservation International, Haribon), Academe
Feasibility of the Indicator	Implementability of the indicator or the conditions needed for its measurement to be accomplished: 1- Indicator can be implemented on the basis of available data using existing data sharing agreement and/or M&E system of key agencies. Data are readily available for selected species. However there is a strong bias towards birds, large mammals, higher plants, etc. while most invertebrates are poorly covered such as are freshwater and marine species.
REMARKS EASAC, 2005. A user's guide to biodiversity indicators. London, UK.	

EES Indicator Factsheet

Indicator	Area of forest, agricultural, fishery and aquaculture ecosystems under sustainable management
Level of Result	Immediate outcome indicator
Definition and underlying concepts	This indicator relates to both individual drivers (e.g., unsustainable forestry practices) and multiple or complex drivers (e.g., spread of unsustainable agriculture due to economic pressures on traditional farming). It has the potential to provide information on success or otherwise of conservation policies in all ecosystems, including the marine.
Unit of Measurement	Square kilometer
Interpretation of the Indicator Value	
Unit of Analysis / System of Interest	18 Major River Basins
Geographical Coverage	Nationwide
Linkage with other NCCAP Thematic Priority	
Linkage with existing M&E system	
Frequency of measurement	Annual
Baseline and Reference Year	To be determined
Data / Information Source	NSCB: No. of threatened species, observed population of threatened species
Lead Agency	Biodiversity Management Bureau
Contributing Agency	NGOs (e.g., Conservation International, Haribon) Academe
Feasibility of the Indicator	Implementability of the indicator or the conditions needed for its measurement to be accomplished: 1- Indicator can be implemented on the basis of available data using existing data sharing agreement and/or M&E system of key agencies. Data are readily available for selected species. However there is a strong bias towards birds, large mammals, higher plants, etc. while most invertebrates are poorly covered such as are freshwater and marine species.
REMARKS EASAC, 2005. A user's guide to biodiversity indicators. London, UK.	

Human Security

Human security is defined by the Philippine Development Plan as the state where the rights of the Filipino family and individuals, especially the poor and vulnerable, are protected and promoted through access to education, health, housing, and social protection, while ensuring environmental sustainability. Security concerns associated with climate change include the potential for conflict over natural resources, population displacement and migration as a result of sea level rise or other large-scale biophysical, ecological or social disruptions, and the prospect of increasingly frequent humanitarian disasters as the results of extreme climate events. With climate change and the expected increase in the severity and frequency of extreme weather, disaster risk management will not be sufficient. Climate change adaptation should be a complementary action to disaster risk management to reduce the risks and impacts of additional hazards brought by extreme climate events, as well as the creeping long-term effects of sea level rise, rising temperatures, and changes in the pattern of precipitation.

The NCCAP's human security agenda is to reduce risks of men and women and other vulnerable groups (children, elderly and persons with disability, etc.) from climate and disasters. Figure 18 presents the theory of change on human security for 2011-2028. The immediate outcomes are the following:

a. Climate change adaptation and disaster risk reduction implemented in all sectors at the national and local levels;
b. Health and social protection delivery systems are responsive to climate change risks; and
c. CC-adaptive human settlements and services developed, promoted and adopted.

For 2011-2016 planning period, the activities will focus on laying the foundation or inform more long-term actions to enhance human security in ways that will reduce risks to climate change and disasters. The activities are:

1. Climate change adaptation and disaster risk reduction practiced by communities and sectors at all local levels. This will entail that a) CCA-DRRM are integrated in local plans, and b) Knowledge and capacity for CCA-DRRM are developed and enhanced.
2. Health and social protection delivery systems are responsive to climate change risks.
    a. Health personnel and communities develop capacity to CC health adaptation and risk reduction
    b. Public health surveillance system are developed and implemented in all provinces, and
    c. Health emergency response, preparedness and post-disaster management are implemented at the national level.
3. CC- adaptive settlements and services are developed, promoted and adopted.
    a. Adaptive and secured settlement areas for vulnerable communities and climate-refugees are defined, and
    b. Population congestion and exposure to CC risks are reduced.

The NCCAP's human security agenda is to reduce risks of men and women and other vulnerable groups (children, elderly and persons with disability, etc.) from climate and disasters. For 2011-2016 planning period, the activities will focus on laying the foundation or inform more long-term actions to enhance human security in ways that will reduce risks to climate change and disasters. One preparatory activity is the knowledge and capacity for CCA and DRRM developed and enhanced through training of trainers.

As shown in Figure 18, the input would the available funds for a training of trainers program to respond to the needs of communities for CCA-DRRM. The assumption is that there is already a pool of workers at the community level already identified and organized. The activities to be conducted are development of training materials for CCA-DRRM, conduct of training of trainers program and the development of monitoring and evaluation system of the training program. The underlying assumption is that the local multi-stakeholder planning on CCA and DRRM already conducted. The expected outputs are the training materials for CCA-DRRM, the number of number of trainers trained, and the monitoring and evaluation system for the training program. The assumption is that CCA and DRRM measures to be used for already tested and applied. These measures will part of the training modules to be analyzed and enhanced. These outputs would then lead to the immediate outcome of CCA and DRRM practiced by communities and sectors at all levels and to the intermediate outcome of reduced risks of men and women and other vulnerable groups (children, elderly and persons with disability) from climate disasters.

Figure 18. Strategic Actions on Human Security, 2011-2028.

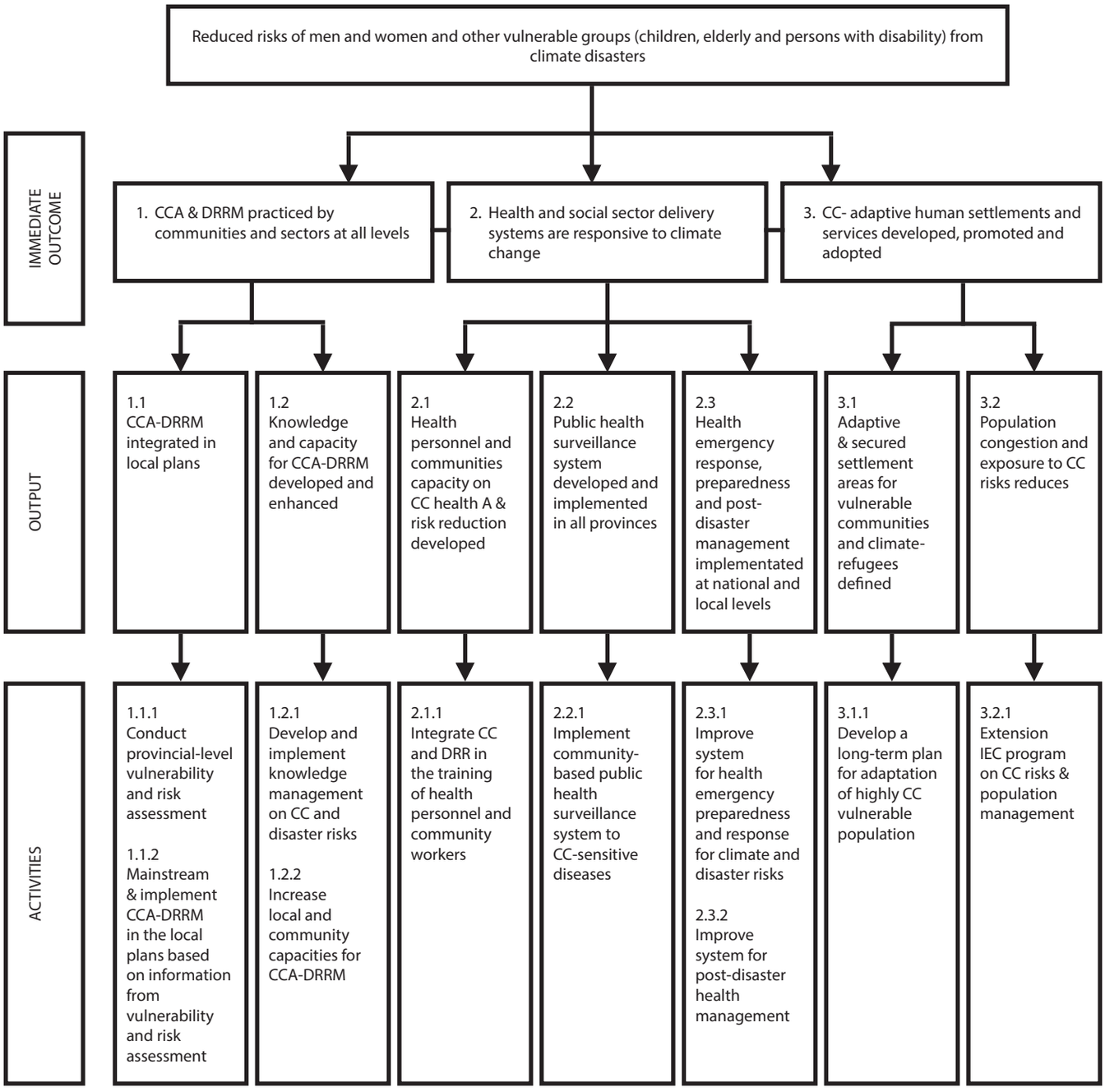


Table 19. Human Security Results Matrix

Ultimate Outcome	Enhanced adaptive capacity of communities, resilience of natural ecosystems and sustainability of built environment to climate change.						
Ultimate Outcome Indicators	No. of lives lost due to emerging and re-emerging climate-sensitive diseases		Disaster Risk Index				
Intermediate Outcome	Reduced risks of the population from climate change and disasters.						
Intermediate Outcome Indicators	Incidence of emerging and re-emerging climate-sensitive diseases in vulnerable areas (Dengue, Leptospirosis, Malaria, Cholera, Typhoid)		No. of beneficiaries of health services rendered for emerging and re-emerging climate-sensitive diseases			Amount of damage caused by major natural disasters (in Peso)	No. of lives lost due to extreme hydro-meteorological events
Immediate Outcome	1. CCA and DRR practiced by all sectors at the national and local levels		2. Health and social sector systems are responsive to CC			3. CC adaptive human settlements and services developed, promoted and adopted	
Immediate Outcome Indicators	No. of early warning system for emerging and re-emerging climate-sensitive diseases established in vulnerable areas		No. of health services rendered for emerging and re-emerging climate-sensitive diseases			No. of internally displaced persons (IDPs) and vulnerable groups	
Output Areas	1.1 CCA-DRRM integrated in local plans.	1.2 Knowledge and capacity for CCA-DRRM developed and enhanced.	2.1. Health personnel and communities capacity on CC health adaptation and risk reduction developed.	2.2. Public health surveillance system is developed and implemented in all provinces.	2.3. Health emergency response, preparedness and post-disaster management implemented at the national and local levels.	3.1. Adaptive and secured settlement areas for vulnerable communities and climate-refugees defined.	3.2. Population congestion and exposure to CC risks reduced.
Critical Output Indicators	Percentage of CC-DRRM sensitive CLUPs and CDPs formulated	No. of documented incidence cases of climate-sensitive emerging and re-emerging diseases	% community health workers capacitated on CCA-DRRM	No. of preventive health services rendered in disaster-prone areas	No. of climate-proofed infrastructure for health services (safe hospitals)	% of CC-DRRM sensitive CLUP-CDP formulated	No. of households vulnerable to hydromet disasters resettled in safe and secure settlement areas
			% DRRMO functional		No. of beneficiaries of preventive and post-disaster health services rendered in disaster-prone areas		

<table>
<tr><td rowspan="5">NCCAP Main Activities</td><td>1.1.1 Conduct provincial-level vulnerability and risk assessments (climate & geologic risks and adaptation measures)</td><td>1.2.1 Develop and implement knowledge management on CC and disaster risks</td><td rowspan="2">2.1.1 Integrate CC and DRR in the training of health personnel and community workers</td><td rowspan="2">2.2.1 Implement community-based public health surveillance system for CC-sensitive diseases</td><td>2.3.1 Improve system for health emergency preparedness and response for climate and disaster risks</td><td rowspan="2">3.1.1 Develop a long term plan for adaptation of highly CC vulnerable population and climate refugees</td><td rowspan="2">3.2.1 Extensive IEC program on CC risks and population management</td></tr>
<tr><td>1.1.2 Mainstream and implement CCA-DRRM in the local plans</td><td>1.2.2 Increase local and community capacities for CCA-DRRM</td><td>2.3.2 Improve system for post-disaster health management</td></tr>
<tr><td></td><td>forecasting, early warning and disaster risk communication indigenous early warning systems</td><td>including policies for integration of CC and DRR concepts and approaches in medical and allied health training courses</td><td colspan="2">post-disaster epidemic outbreak management and disease surveillance system</td><td colspan="2">profile highly disaster prone areas and communities</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">monitoring health infrastructure damage and rehabilitation plan</td><td colspan="2">plan to secure and manage conflict-affected resettlements</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">post-disaster resettlement and counseling of displaced families and communities</td><td colspan="2">settlement adaptation and resettlement plan, financing plan</td></tr>
<tr><td></td><td></td><td></td><td colspan="2"></td><td colspan="2">sustainable livelihood and social protection programs for resettled and vulnerable poor families</td></tr>
<tr><td>INTERVENTION FIELDS</td><td>Risk Assessment and Mainstreaming</td><td>Knowledge Management</td><td>Capacity Development</td><td colspan="2">Health Surveillance and Post-Disaster Management</td><td>Risk Management and Resettlement</td><td>IEC</td></tr>
</table>

HS Indicator Fact Sheet

Indicator	Disaster Risk Index[17]
Level of Result	Ultimate Outcome Indicators
Definition and underlying concepts	This indicator compares the average population exposed to water-related hazards with average annual deaths caused by these hazards. Risk is modelled using socio-economical parameters. Disaster: destructive event triggered by natural hazards, with impacts on human life and activities; overwhelming the capacity of available relief response Deaths: human life lost directly as a result of the disaster (e.g. drowning in the event of a flood). Number of people living in flood-prone areas (per year or other period) Number of deaths in this population directly caused by disasters (e.g. flooding) in the same year or over the same period
Computation	Estimation of risk (expressed in number of people killed) $K = C*(PhExp)^{\alpha} * V1^{\alpha 1} * V2^{\alpha 2} * Vp^{\alpha p}$ Where: K = number of persons killed by a certain type of hazard C = Multiplicative constant PhExp = Physical Exposure: population living in exposed areas multiplied by the frequency of occurrence of the hazard Vi = Socio-economical parameters αi = Exponent of Vi which can be negative The weight for each variable is calibrated using past casualties in the period 1980-2000, parameters and variables being different for each hazard (as computed from geophysical datasets) was always selected by the statistical analysis. But then the socio-economical parameters were: For floods: GDP per capita and local population density For cyclones: HDI and percentage of arable land For drought: percentage of population with access to improved water supply
Unit of measurement	Risk expressed in number of people killed
Interpretation	The number of deaths per unit of exposed population would give an indication of the vulnerability of the nation to the impacts of disasters. The higher the rate of deaths per unit of exposed population, the more vulnerable a nation is to the impacts of disasters. The Disaster Risk Index provides statistical assessment of countries according to their relative vulnerability. Although informative about the rate of exposed people dying of natural hazards, additional explanations can be found in the report Reducing Disaster Risk (UNDP). From this information can be developed a global ranking of the relative risk and vulnerability of nations exposed to water-related and other natural hazards.
Unit of Analysis / System of Interest	Floods, Cyclones, Drought
Geographical Coverage	Category 1: Ten provinces with high magnitude of poor households, 2010 1. Zamboanga del Sur 2. Cebu 3. Pangasinan 4. Negros Occidental 5. Camarines Sur 6. Leyte 7. Iloilo 8. Sulu 9. Quezon 10. Davao Del Sur Category 2: Ten provinces with highest poverty incidence based on population, 2012 (in percent) 1. Lanao Del Sur 2. Maguindanao* 3. Eastern Samar 4. Apayao 5. Zamboanga del Norte 6. Camiguin 7. Saranggani 8. North Cotabato 9. Masbate 10. Northern Samar

Geographical Coverage	Category 3: Thirty provinces exposed to multiple hazards 1. Zamboanga del Sur 2. Leyte 3. Iloilo 4. Quezon 5. Eastern Samar 6. Northern Samar 7. Ilocos Norte 8. Ilocos Sur 9. Abra 10. Benguet 11. Cagayan 12. Quirino 13. Isabela 14. Nueva Vizcaya 15. Zambales 16. Pampanga 17. Aurora 18. Cavite 19. Laguna 20. Rizal 21. Albay 22. Catanduanes 23. Antique 24. Bohol 25. Southern Leyte 26. Zamboanga Sibugay 27. Dinagat Islands 28. Agusan del Sur 29. Surigao del Norte 30. Surigao del Sur
Linkage with other NCCAP Thematic Priority	Water Sufficiency
Linkage with existing M&E Systems	Philippine Development Plan
Frequency of measurement	Annual
Baseline and Reference Year	Normal Year: 2010 Year of extreme event • Flooding: TY Ondoy • Cyclones: TY Frank, Pablo, Haiyan (Yolanda) • Drought: 1997-1998 ENSO event
Data / Information Source	NEDA, NDRRMC
Lead Agency	OCD-NDRRMC
Contributing Agency	CSCAND Agencies Collective Strengthening on Community Awareness on Natural Disasters (CSCAND) Agencies is a Subcommittee under the Preparedness Committee of the National Disaster Coordinating Council (NDCC) as per a NDCC Special Order issued in 2003. OCD is the Chairman of the Steering Committee; PHIVOLCS as Chairman of the Technical Working Group and CSCAND members are PAGASA, MGB, NAMRIA.
Feasibility of the Indicator	Indicator can be implemented on the basis of available data, however, additional calculations are needed but timely implementation seems probable.
REMARKS The prioritization of the Provinces were derived from the spatial considerations in the Updated PDP 2011-2016 that will deliberately address the constraints faced by the poor as summarized by their province of residence.	

HS Indicator Fact Sheet

Indicator	Incidence of emerging and re-emerging climate sensitive diseases in vulnerable areas
Level of Result	Intermediate Outcome Indicator
Definition and underlying concepts	Climate-sensitive diseases are diseases that are outbreak-prone due to hydromet events (floods, droughts, cyclones). Immediate Term: dengue, leptospirosis, malaria, cholera, typhoid Intermediate Term: schistosomiasis, heat stress Include injuries/mortality from extreme weather events (event-based) in highly vulnerable areas (area-based)
Unit of Measurement	Incidence per 100,000 population
Interpretation of the Indicator Value	Increase in the incidence of climate-sensitive diseases despite efforts to minimize them amidst climate change could mean many things as outbreak of some diseases though climate-sensitive are multifactorial thus incidence should be correlated to climate data.
Unit of Analysis / System of Interest	System of interest (human, natural, economic) is the unit chosen to be assessed in respect to the result being monitored. It may be determined at different levels, e.g. a single crop system, an ecosystem, a region—depending on the objective of the analysis. Defining systems of interest provides the reference for determining whether and how climate change impacts might be important and how adaptation can be attributed.
Geographical Coverage	Indicate the specific area or location for which the indicator will be calculated (e.g., national, regional or local – province, municipalities, cities, barangays)
Linkage with other NCCAP Thematic Priority	Note if the indicator is also used to measure results from other thematic priorities of the NCCAP and at what result level
Frequency of measurement	Annual
Baseline and Reference Year	2010 and 2012
Data / Information Source	National Epidemiology Center Philippine Integrated Diseases Surveillance and Response (PIDSR) Event-based Surveillance and Response Surveillance in Post Extreme Emergencies and Disasters (SPEED)
Lead Agency	National Epidemiology Center Department of Health
Feasibility of the Indicator	Indicator can be implemented on the basis of available data using existing data sharing agreement and/or M&E system of key agencies

HS Indicator Fact Sheet

Indicator	Number of climate-proofed infrastructure for health services, such as safe hospitals Structural Indicators: a. building location b. design specifications c. materials used for the hospital or health facility Non-structural indicators essential for the daily operations: a. architectural elements (e.g., ceilings, windows and doors) b. medical and laboratory equipment c. lifelines (mechanical, electrical and plumbing installations) d. safety and security issues Functional indicators important for continuous operation: a. site and accessibility b. internal circulation and interoperability c. equipment and supplies d. emergency standard operating procedures and guidelines e. logistic system and utilities f. security and alarm g. transportation and communications systems h. human resources i. monitoring and evaluation
Level of Result	Critical Output Indicator
Definition and underlying concepts	"During emergencies or disasters, hospitals and other health facilities must remain safe, accessible and functioning at maximum capacity in order to help save lives. They must continue providing critical services such as medical and nursing care, laboratory and other health care services as well as respond to increased requirements related to the emergency. A safe hospital must remain organized with contingency plans in place and health personnel trained to keep the network operational (WHO, 2010)"
Unit of Measurement	Quantity (number)
Frequency of measurement	Annual
Baseline and Reference Year	Baseline year: 2010 Reference year: 2012
Data / Information Source	Health Facility Database System: Health facilities are places that provide health care. These may include hospitals, clinics, outpatient care department and specialized care centers, e.g. birthing home and psychiatric care centers. The Health Facility Database System establishes the DOH central database that geographically references all health care facilities in the country. All licensed health facilities approved by the Bureau of Health Facilities and Services, data submitted by rural health units and barangay health stations were provided with unique codes. To expand the usefulness of the database, there is a provision to enter the different services provided by a health facility, facilities and equipment available [Architecture – Online; Current Status: Developed and for Implementation].
Lead Agency	Department of Health
Contributing Agency	Department of Public Works and Highways World Health Organization
Feasibility of the Indicator	Indicator can be implemented on the basis of available data using existing data sharing agreement and/or M&E system of key agencies
REFERENCE www.wpro.who.int/emergencies_disasters/documents/SafeHospitalsinEmergenciesandDisasterswebоptimized.pdf	

Climate Smart Industries and Services

The objective of climate-smart industries and services is to have climate resilient, eco-efficient and environment-friendly industries and services developed, promoted and sustained. NCCAP uses the term "climate-smart" to emphasize the need for "adaptive mitigation," that is to use mitigation measures as integral part of adaptation and to integrate adaptation and mitigation in core business policies and operation.

The Manila Declaration on Green Industry in Asia (2009), a non-binding agreement, recognized that the greening of industries and the mainstreaming of green growth on government policies and programs are integral measure in addressing climate change. Although the Philippines is not a significant emitter of greenhouse gases globally, green growth is recognized as a relevant approach to sustainable economic growth and development. For the NCCAP, the long-term goal is the promotion, development and sustaining of climate-change resilient, eco-efficient and environment friendly industries and services, and sustainable towns and cities.

The first focus is on promoting climate-smart industry or green industry which is defined as the business and enterprises that provide products that are aimed at utilizing resources more efficiently, providing renewable resources of energy, lowering greenhouse gas emissions, or otherwise minimizing adverse environmental impacts. Green services, on the other hand, may pertain to consumed and produced goods and services for environmental benefits. These types of services can be derived from the creation of environment-friendly businesses and facilities that will generate employment.

The second focus of NCCAP is the creation of green jobs. The recently enacted Republic Act 10771 or the Philippine Green Jobs Act of 2016, define green jobs as referring to

"…employment that contributes to preserving or restoring the quality of the environment, be it in the agriculture, industry or services sector. Specifically, but not exclusively, this include jobs that help to protect ecosystems and biodiversity, reduce energy, materials and water consumption through high efficiency strategies, decarbonize the economy, and minimize or altogether avoid generation of all forms of waste and pollution. Green jobs are decent jobs that are productive, respect the rights of workers, deliver a fair income, provide security in the workplace and social protection for families, and promote social dialogue."

Green Jobs are decent jobs that help protect the environment, ensure a shift to a low carbon development and adapt to the effects of climate change. These include jobs that reduce the environmental impacts of enterprises and economic sectors, ultimately to levels that are sustainable; protect ecosystems and biodiversity or combat desertification; reduce the use of energy, raw materials, and natural resources including water, through high efficiency strategies, techniques and technologies, and; minimize or altogether avoid generation of all forms of wastes and pollution.

Thirdly, the NCCAP focuses on the development of sustainable cities and municipalities. An ecotown is a city/town designed in consideration of the following:

a. Environmental impacts and protection of ecosystems;
b. Efficient in use of land, energy, water and food (i.e., eco-efficient);
c. Minimizing waste products, and
d. Creating sustainable jobs.

Ecotown's main elements are the creation of the smallest possible ecological footprint, reduction of its overall contribution to climate change, and building resilient communities and ecosystems.

Figure 19, a diagrammatic flow of strategic actions on climate smart industries and services, can somehow be used to trace the impact pathway of specific CC actions toward achieving the ultimate goal of successful transition towards climate-smart development. It underscores the role of green growth in achieving sustainable economic growth and development. This economic growth strategy is well-embedded in the Manila Declaration on Green Industry in Asia (signed in September 2009) which recognized that "greening of industries and the mainstreaming of green growth strategies on government policies and programs are integral measure in addressing the dangerous consequences of climate change" (CCC, 2011).

Transitioning to a climate-smart development calls for the emergence of industries and service sectors that are not only climate change-resilient but also eco-efficient and environment friendly, as well. It also emphasizes that the sustainability of towns and cities, as base of these sectors, hinges critically on climate change resiliency strategies for and by these towns and cities. The NCCAP identified 3 focal strategies to achieve this in the long run, as follows: (1) promotion of climate-smart industry and services sectors, (2) creation of green jobs and sustainable livelihoods, and (3) emergence of green cities and municipalities.

CCC (2011) defines green industry to be composed of "businesses and enterprises that provide products and services that are aimed at utilizing resources more efficiently, providing renewable sources of energy, lowering GHG emissions, or otherwise, minimizing environmental impact. It includes businesses that help other businesses and individuals lower their carbon emissions and avoid toxic chemicals. Green services

may pertain to consumed and produced goods and rendered services for environmental benefits." Founding climate-smart industry/services sectors entails 3 interlinked development efforts related to: (1) enabling policy and institutional environment for the emergence and viability of these climate-smart industries and services, (2) adoption of eco-efficient production by these sectors, and (3) strengthening of CC-focused knowledge and capability development programs. The NCCAP provides the framework for achieving this through various CC actions like: establishing a data base on and formulation of policies and institutional arrangements, e.g., public-private partnerships (PPPs) promoting climate-smart industries/services in support of No.1; providing assistance and incentives for businesses adopt eco-efficient production practices as well as enforcing environmental laws and regulations in view of No. 2; and developing CC-focused knowledge products and training programs in support of No.3.

Consistent with the definition of RA 10771, the UNEP and International Labor Organization (ILO) includes in this job category those that "reduce the environmental impact of enterprises and economic sectors, ultimately, to levels that are sustainable (UNEP, 2008). It can be found in many sectors of the economy and help reduce the use of energy, raw materials and natural resources (including water) through high efficiency strategies, techniques and technologies, and minimize or altogether avoid generation of all forms of wastes and pollution."

The NCCAP envisions that the generation of green jobs and sustainable livelihoods is influenced significantly by CC actions such as, but not limited to, climate-smart driven labor force supply-demand matching, M&E system for green job creation and employment and innovative financing mechanisms for livelihoods and rural enterprises in CC vulnerable areas of the country.

Finally, the blossoming of green cities and municipalities entails massive re-thinking and reconfiguration of national and local plans and programs related to land use planning and zoning, public infrastructures and waste management. The NCCAP identified climate-proofing of public infrastructures, development of CC-adaptive housing and land use, and full implementation of ecological waste management as strategic priority actions that redound to climate-smart development of these localities in the long run.

Figure 19 and Table 20 shows the results chain of climate-proofing local infrastructure as a component of the strategic priority on climate industries and services. NCCAP focuses on the development of sustainable cities and municipalities. The input would be the availability of a technical and financial assistance for LGUs to undertake climate-proofing local infrastructure. The assumption is that the LGUs and the stakeholders are willing to participate with the project. The activities would include the identification and inventory of local infrastructure to be climate-proofed, consultation with the stakeholders, and the development of guidelines for climate proofing local infrastructure. The assumption is that an incentive mechanism for climate-proofing local infrastructure is already in place. The outputs are the guidelines for climate proofing local infrastructure and the number of local infrastructure climate-proofed. The underlying assumption is that financing for climate-proofing the local infrastructure is available. The immediate outcome is infrastructure in cities & municipalities climate-proofed with the assumption that the building and land use planning are strictly implemented. The intermediate outcome is green cities and municipalities developed, promoted and sustained.

Figure 19. Strategic Actions on Climate-Smart Industries and Services, 2011-2028.

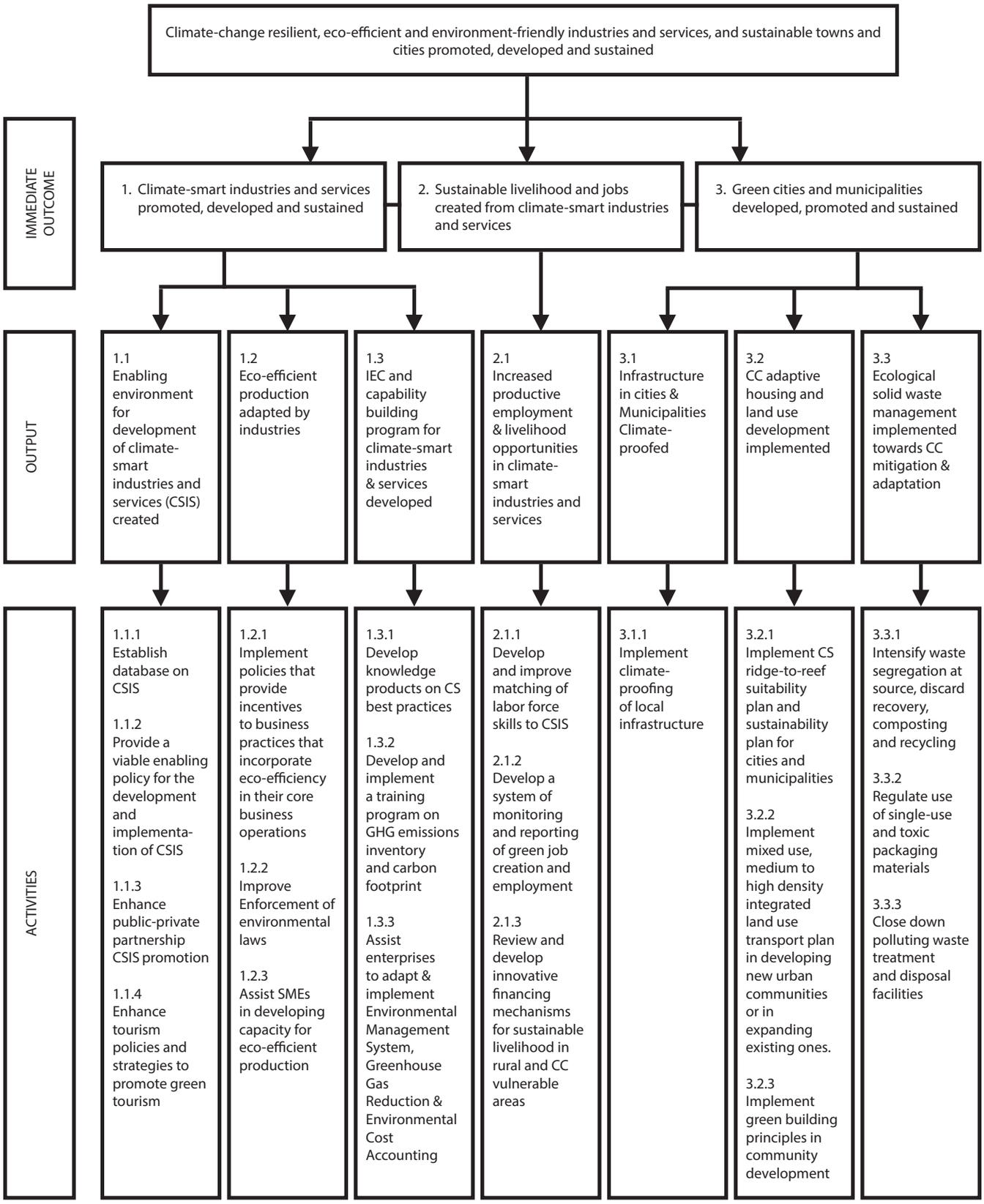


Table 20. Climate-Smart Industries and Services Results Matrix.

Ultimate Outcome	Successful transition towards climate-smart development							
Ultimate Outcome Indicators	Green Industry GDP							
Intermediate Outcome	Climate-resilient, eco-efficient and environment-friendly industries and services developed, promoted and sustained							
Intermediate Outcome Indicators	% contribution of green industries and services to GDP			Energy efficiency ratio	Employment generated by green industries and services by industry group			
Immediate Outcome	1. CSIS promoted, developed and sustained			2. Sustainable livelihood and jobs created from climate smart industries and services	3. Green cities and municipalities developed, promoted and sustained			
Immediate Outcome Indicators	% increase in the number of financial initiatives with financing scheme for climate-proofing	% change in gov't. electricity & fuel consumption and expenditure	Number of capacity building programs for climate-smart MSMEs developed and implemented	Percentage change in the number of jobs for green business	Percentage change in the number of green cities and municipalities	Percentage increase in the number of LGUs implementing the updated National Building Code	Percentage increase in the number of LGUs implementing the BRT scheme	Number of LGUs implementing the BRT system
Output Areas	1.1. Enabling environment for the development of climate-smart industries and services created.	1.2. Eco-efficient production adopted by industries.	1.3. IEC and capability building program for climate-smart industries and services developed.	2.1. Increased productive employment and livelihood opportunities in climate-smart industries and services.	3.1. Infrastructures in cites and municipalities climate-proofed.	3.2. CC adaptive housing and land use development implemented.	3.3. Ecological solid waste management implemented towards climate change mitigation and adaptation.	
Critical Output Indicators	No. of policies creating incentives (phased implementation with mandatory targets) enacted: • Retrofitting building for energy efficiency (as proposed in the Energy Efficiency Bill) • Climate proofing of energy infrastructures • Green building	Energy productivity per industry (as a ratio of GNP/Energy consumption) • Suggestion to prioritize the Transport and power generation sectors for this indicator	Production and distribution of IEC materials targeted according to industries	% increase in the no. of green jobs from green businesses that produce goods or provide services that benefit the environment or conserve natural resources.	No. of local government units localizing CCA-DRR/ retro-fitting in the issuance of building permits and location clearances (Building Code)	No. of cities and municipalities adopting a CC adaptive development for housing and land use development	No. of SWM facilities located in "safe" areas	
			Development of training programs tailored for specific industries		No. of energy, transport and water supply infrastructures climate proofed		Reduction of GHG emission from SWM facilities	

	• Use of renewable energy Passage of the Energy Efficiency Bill						
Proposed additional output indicators	No. of policies disaggregated per industry (e.g. Power, Manufacturing, Tourism, Transport)	Proxy indicators: • Reduction in power consumption • Green procurement • Compliance rate with ISO certification • Compliance rate for LGU ordinances related to climate change • Reduction in energy consumption per industry group • Reduction in GHG emission as a consequence of reduction in E consumption • PROXY Increase in sales of Green products and services	IEC materials produced and capacity development programs developed according to CCC-set standards (content quality)	Annual ratio of green jobs / total jobs	Reduction in degree of damage to local infrastructures due to extreme events	Reduction of disaster incidents and cost involving existing settlement areas	
	Policy for GHG emission regulation (possibly contentious -- related to NAMAs -- but a pollutants cap is already included in the Clean Air Act but not sure if GHGs like CO2 are included)		No. of reviewed IEC materials and capacity development programs	Trend of green jobs / total jobs for the medium term			
INTERVENTION FIELDS	Green Industries			Green Jobs	Green Cities and Municipalities		

CSIS Indicator Fact Sheet

Indicator	% contribution of green industries and services to GDP
Level of Result	Intermediate Outcome Indicator
Definition and underlying concepts	Amount of production of goods & services by green business/industries
Unit of Measurement	Percentage
Interpretation of the Indicator Value	The percentage increased, contribution of green business to national GDP as compared to the baseline data means that the climate change actions contribute to the development, promotion and sustainability of climate-resilient, eco – efficient and environment-friendly industries & services
Unit of Analysis / System of Interest	Agriculture, forestry and fishing Mining and Quarrying Manufacturing Electricity, gas, steam and air-conditioning supply Water supply, sewerage, waste management and remediation activities Construction Transportation and Storage Accommodation and food service activities
Geographical Coverage	National with focus on industrialized and highly urbanized areas
Frequency of measurement	Annual
Baseline and Reference Year	Two sets of reference value used to measure achievement of results referring to: Baseline Year: 2010 as the latest census year prior to the NCCAP; and Reference Year: 2016 based on the Philippine Green Jobs Act of 2016
Data / Information Source	Philippine Statistics Authority
Lead Agency	Department of Labor and Employment (DOLE) Department of Trade and Industry
Contributing Agency	Climate Change Commission (CCC), Commission on Higher Education (CHED) Department of Education (DepED) Department of Environment and Natural Resources (DENR) Department of Finance (DOF) Department of Public Works and Highways (DPWH) Department of Science and Technology (DOST) Department of Trade and Industry (DTI) Department of Transportation and Communications (DOTC) Department of Tourism (DOT) National Economic and Development Authority (NEDA) Professional Regulation Commission (PRC) Technical Education and Skills Development Authority (TESDA)
Feasibility of the Indicator	Further development stage(s) is/are required to calculate the indicator such as improvement of survey instruments to include additional fields or based on new methods. However, there are already on-going initiatives related to this and implementation in the next 3 years seems probable
REMARKS Further information such as references to literature (full citation) that provides further details concerning the indicator or any other relevant remarks that are not captured in any of the fields provided in the Factsheet.	

CSIS Indicator Fact Sheet

Indicator	Climate-proofed waste management systems and infrastructure
Level of Result	Critical Output Indicator
Definition and underlying concepts	Waste management systems and infrastructures may be prone to disasters. Climate change causes extreme rainfall in some areas and effects can be compounded by uncollected waste, exposing the dangers of mismanaged garbage. This results in massive flooding that cause damages to properties and human lives. Heavy rains can also delay the construction and operation of waste management facilities such as sanitary landfills and such need climate-proofing. A major disaster-related occurrence was the Payatas garbage-slide. On July 10, 2000, tragedy befell the site when a hill of garbage caved in, killing 218 people and leaving 300 families homeless. This incident was triggered by heavy rains and buildup of combustible gases from the waste body. In July 2009, the perimeter wall of the Rizal Provincial landfill collapsed amidst heavy rains albeit later investigations found the possibility of the facility's unprotected steep slope as another factor. Similar events happened in Baguio City when Typhoon 'Mina' triggered an avalanche of waste from Irisan dumpsite in August 2011 burying houses downstream and in Olongapo City when a portion of the dumpsite was loosened by rains accompanying Typhoon 'Pedring' in September 2011. Although the indicator measures a critical output, it contributes to the attainment of results at various levels and in terms of: Immediate: • Suitable sites for waste management facilities Intermediate: • Properly sited new waste management facilities • Climate-proofed existing waste management facilities Ultimate Outcome: • Reduced risks for flooding and/or trash-slides in waste management infrastructure
Computation	*For new waste management facilities/infrastructure:* Proposed or new projects should strictly follow NSWMC Resolution No. 2013-64 or the 'Modified Guidelines on Site Identification Criteria and Suitability Assessment for Sanitary Landfills'. This new policy provides guidelines on siting criteria and assessment procedure that are consistent with Sections 40 and 48 of RA 9003 and DENR Administrative Order (DAO) 98-50. *For existing waste management facilities/infrastructure:* After a climate-proofing study, the existing waste management facilities should have implemented recommendations and measures to make its infrastructure and operations more resilient. Alternatively, Risk Index on a per project basis, may be used: Risk = Hazard x Exposure x Vulnerability / Adaptive Capacity
Unit of Measurement	Evaluation matrix/checklist system based on the harmonized guidelines; Subsequent evaluation of climate-proofing measures in existing facilities; Evaluated risks on existing facilities are dimensionless.
Interpretation of the Indicator Value	See NSWMC Resolution No. 2013-64
Unit of Analysis / System of Interest	Most waste management initiatives directly affect local conditions, e.g., improved waste management service delivery, reduced environmental risks to communities and vulnerable groups, reduced costs due to damage, avoided costs for reconstruction.
Geographical Coverage	The indicator should reflect an aggregated state of waste management infrastructure and systems at the national sectoral level. However, the basis of consolidated data follows the complete monitoring and evaluation system that starts with collecting information at the project level, local level, regional and then national level.
Linkage with other NCCAP Thematic Priority	The indicator is directly under the Climate-Smart Industries and Services thematic priority area. Nevertheless, it also partly or indirectly links to Ecological and Environmental Stability as well as Human Security and Knowledge and Capacity Development.
Linkage with existing M&E system	Command-and-control approaches are also within the targets of the Republic Act 9003, the National Solid Waste Management Framework 2004 and the National Solid Waste Management Strategy 2012-2016.
Frequency of measurement	Every two or three years

Baseline and Reference Year	Options for base year: 2000 (Year when RA 9003 was passed); 2010 (NSWMC/EMB data from the National Solid Waste Management Status Report)
Data / Information Source	DENR – Environmental Management Bureau National Solid Waste Management Commission (NSWMC)
Lead Agency	DENR – Environmental Management Bureau, through its Climate Change Office, NSWMC Secretariat and Regional Offices
Contributing Agency	Local Government Units (LGUs), including provinces, cities/municipalities, barangays Private sector, including waste management facility operators and service providers Non-government organizations (NGOs) that support ESWM implementation
Feasibility of the Indicator	For existing related initiative by NSWMC in 2012: 1- Indicator can be implemented on the basis of available data but subject to data sharing agreement among key agencies For future monitoring: 2- Further development stage(s) is/are required to calculate the indicator such as improvement of survey instruments to include additional fields or based on new methods. However, there are already on-going initiatives related to this and implementation

REFERENCES

DENR-EMB/NSWMC, 2014. Draft National Solid Waste Management Status Report 2008-2013.
NSWMC, 2012. Report on the Monitoring of existing Sanitary Landfills in the Philippines
NSWMC, 2012. National Solid Waste Management Strategy 2012-2016
RA 9003. Ecological Solid Waste Management Act of 2000

CSIS Indicator Fact Sheet

<table>
<tr><td>Indicator</td><td>Tons carbon dioxide equivalent (tCO2e) emissions reduced and avoided through ecological waste management (ESWM) implementation</td></tr>
<tr><td>Level of Result</td><td>Critical Output Level</td></tr>
<tr><td>Definition and underlying concepts</td><td>Based on the Second National Communication, the sector “waste and wastewater” is the third largest emitter in the Philippines. Based on 2000 estimates, 11.6 million tCO2e per year is emitted from waste management, which translates to a 9.1% share. The potential impact of municipal waste management systems in enabling other sectors, e.g., industrial processes, energy generation and agriculture, to avoid emissions is an added bonus. A GIZ-supported NSWMC study in 2012 estimated a further 5 to 6% contribution of waste management to other sectors.
The same study estimated a potential annual GHG reduction from fresh incoming waste of about 10 to 14 million tCO2e per year. It was also found that the remaining GHG potential from waste deposited over the past 20 years equals 110 million tCO2e.
The Philippine Development Plan (PDP) for 2011-2016 also coincided with the adoption of the NCCAP and the period covered by the National Solid Waste Management Strategy 2012-2016. The PDP articulated for the SWM sector to improve waste disposal systems while reducing waste generation itself. Specifically by 2016, it was targeted that the rate of diversion of solid wastes away from disposal facilities would be increased by 50% from 2010 baseline level of 33% in Metro Manila and 25% baseline for the entire country, through reuse, recycling and composting activities and other resource recovery activities. The NSWMS adopted these PDP targets and also supplemented the national waste diversion goals with the closure and rehabilitation of all existing dumpsites in the country.
Although the indicator measures a critical output, it contributes to the attainment of results at various levels and in terms of:
Immediate:
• Intensified waste segregation at source and waste avoidance programs;
• Increase in waste diversion through composting, anaerobic digestion, recycling and other resource recovery schemes;
• Closure and rehabilitation of open dumpsites and other non-complying waste management facilities
• Enhanced landfill gas capture, including waste-to-electricity schemes
Intermediate:
• Resulting greenhouse gas (GHG) emissions reduction and/or avoidance
• Green jobs created through ESWM as a climate-smart service
Ultimate Outcome:
• Improved waste management public service delivery Climate change mitigation through reduced GHG release into the atmosphere</td></tr>
<tr><td>Computation</td><td>Rapid Estimation:
Use default IPCC emission factors but preferably using locally generated factors, if available, for either GHG reducing or avoiding activities. The 2012 study found the following factors for the Philippine setting using local data and various categories of disposal facilities:

<table>
<tr><th>SLF Cat</th><th>MSW (tpd)</th><th>SEF1 (tCO2e/tMSW/yr)</th><th>SEF2 (tCO2e/tMSW)</th></tr>
<tr><td>1</td><td><15</td><td>0.59</td><td>0.27</td></tr>
<tr><td>2</td><td>16 to 75</td><td>0.74</td><td>0.33</td></tr>
<tr><td>3</td><td>76 to 200</td><td>1.18</td><td>0.53</td></tr>
<tr><td>4</td><td>>200</td><td>1.48</td><td>0.67</td></tr>
<tr><td colspan="2">Weighted:</td><td>0.94</td><td>0.43</td></tr>
</table>

Accurate Calculations:
For GHG reduction in existing disposal facilities, the estimation of tCO2e reduced is based on a business-as-usual (BAU) baseline against the mitigation baseline on identified projects such as dumpsite closure and rehabilitation and landfill gas capture. In some cases, gas meters are used to measure methane/CO2 concentrations; At times, equipment is also available to directly measure gas flux.
For GHG avoidance in fresh incoming waste, tCO2e avoided is based on a counterfactual scenario that waste is just being disposed at dumpsites or landfills.</td></tr>
<tr><td>Unit of Measurement</td><td>tCO2e reduced or avoided per ton of MSW deposited at disposal sites or per ton of MSW composted, digested, recycled or processed.</td></tr>
<tr><td>Interpretation of the Indicator Value</td><td>High or low achievement of these indicators is based on sectoral targets and plans.</td></tr>
</table>

Unit of Analysis / System of Interest	Most waste management initiatives directly affect local conditions, e.g., local green jobs generation, improved waste management service delivery, cost savings in municipal solid waste management budget, etc. GHG emissions reduction or avoidance, however, contributes to a more global level such as reducing extreme weather events caused by climate change.
Geographical Coverage	The indicator should reflect an aggregated tCO2e emissions reduction or avoidance at the national sectoral level. However, the basis of data/calculations follows the complete measurement, reporting and verification (MRV) system that starts with collecting data at the project level, local level, regional and then national level.
Linkage with other NCCAP Thematic Priority	The indicator is directly under the Climate-Smart Industries and Services thematic priority area. Nevertheless, it also partly or indirectly links to Ecological and Environmental Stability as well as Sustainable Energy, Water and Food Security.
Linkage with existing M&E system	Activity data used to translate initiatives into tCO2e are also within the targets of the Republic Act 9003, the Philippine Development Plan 2011-2016 and the National Solid Waste Management Strategy 2012-2016.
Frequency of measurement	At least once a year
Baseline and Reference Year	Options for base year: 2000 (GHG Inventory year of the SNC); 2010 (NSWMC/EMB data from the National Solid Waste Management Status Report)
Data / Information Source	DENR – Environmental Management Bureau National Solid Waste Management Commission (NSWMC)
Lead Agency	DENR – Environmental Management Bureau, through its Climate Change Office, NSWMC Secretariat and Regional Offices
Contributing Agency	Local Government Units (LGUs), including provinces, cities/municipalities, barangays Private sector, including waste management facility operators and commercial sources Non-government organizations (NGOs) that support ESWM implementation
Feasibility of the Indicator	*For rapid estimation:* Indicator can be implemented on the basis of available data using existing data sharing agreement and/or M&E system of key agencies *For accurate calculations:* Indicator can be implemented on the basis of available data, however, additional calculations are needed and timely implementation seems probable. This is usually the case for indicators using indices based on available data.

REFERENCES

DENR-EMB/NSWMC, 2014. Draft National Solid Waste Management Status Report 2008-2013.
NSWMC/CCC/GIZ, 2013. Proposed NAMA Project: Reducing Emissions from Waste and Resource Depletion (REWARD)
NSWMC/GIZ/Bifa, 2012. GHG Mitigation Options for the Philippine Waste Sector
NSWMC, 2012. National Solid Waste Management Strategy 2012-2016

Sustainable Energy

Another major dimension related to the ultimate goal of, and even to the transition process toward, climate-smart development pertains to sources of energy to fuel the growth of the Philippine economy. The country must not only be energy secure but must also ensure that production and/or extraction of energy is environmentally sustainable. It has "to respond to changes in energy demand brought about by climate extremes, and at the same time ensure that energy systems are able to adapt to the impacts of climate change" (CCC, 2011). In view of this, the NCCAP laid down the long-term goal and framework for developing, promoting, (for wide-scale) adopting and commercializing sustainable and renewable energy (sources) and ecologically-efficient technologies by specifically aiming for:

1. Promotion and implementation of energy efficiency and conservation nationwide;
2. Enhancement in the development of sustainable and renewable energy;
3. Promotion and adoption of environmentally sustainable transport, and
4. Climate-proofing and rehabilitation and improvement of energy systems infrastructure.

In order to achieve No. 1, demand-side management calls for: (1) the full implementation of the Government Energy Management Program (AO 110 and 126) which sets a 10% energy savings targets for all public agencies, and (2) increase private sector and community participation in energy efficiency and conservation programs. However, to ensure private sector and community participation, policy on energy efficiency and conservation (EE&C) must be enabling and its policy environment stable, as well; public-private-civil society participation in EE&C be encouraged and forged; and foster market-driven demand-side energy management.

Enhancing the development of sustainable and renewable energy necessitates the full implementation of the Renewable Energy Act (RA 9513). Among of its salient provisions pertain to strengthening the conduct of R&D on RE, and the implementation of a renewable energy program/roadmap. The roadmap includes the adoption of off-grid, decentralized, community-based RE systems to generate affordable electricity, and thereby, encourages the increase generation capacities of RE systems.

According to Wright (2007), environmentally sustainable transport (EST) principles offer a cost-effective way forward that affords high levels of mobility and access but without the intrinsic problems associated with car-dominated streets. The NCCAP encourages the implementation of CC actions that promote EST through integration of EST strategies and fuel conservation measures in development plans/programs and the establishment of innovative financing mechanisms to promote EST.

And as in other priority themes, transitioning to a climate-smart economy cannot overemphasize the importance of climate-proofing, including climate-proofing of energy systems and infrastructures.

Figure 20 presents the results chain on sustainable energy 2011- 2028. Republic Act 9513 (Renewable Energy Act of 2008) accelerates the development and exploration of the Philippines' renewable energy resources (geothermal, hydropower, wind, solar and biomass). For the short-term, NCCAP's priority actions would be to develop the research and development program in support of expanding the renewable energy agenda and to develop and implement a renewable energy roadmap. The roadmap includes the adoption of off-grid, decentralized, community-based, renewable energy system to generate affordable electricity.

As shown in Figure 20 and Table 21, with available funds, the government embarks for the development of mini hydroelectric facilities to provide affordable electricity in off-grid rural areas. The accompanying assumption is that financing for distribution and maintenance system is also available. The activities would include construction and installation of mini hydroelectric power systems and the required feasibility studies (engineering and economic) and environmental impact assessments. The underlying assumption is that the survey of mini hydroelectric potential in off-grid areas has been conducted.

The outputs would be the increased volume of stored water for hydroelectric power generation, reliable supply of sufficient water for other purposes such as irrigation and fishery. With the affordable electricity, the beneficiary households would be able to increase their productivity, and eventually their income, thus, alleviating poverty in these off-grid areas. The immediate outcome of the activities would be sustainable and renewable energy development enhanced. The underlying assumption is that beneficiaries are willing to pay for the development and maintenance of the mini hydroelectric projects. The immediate outcome would lead to the realization that sustainable and renewable energy and ecologically-efficient technologies adopted as an intermediate outcome.

Figure 20. Strategic Actions on Sustainable Energy, 2011-2028.

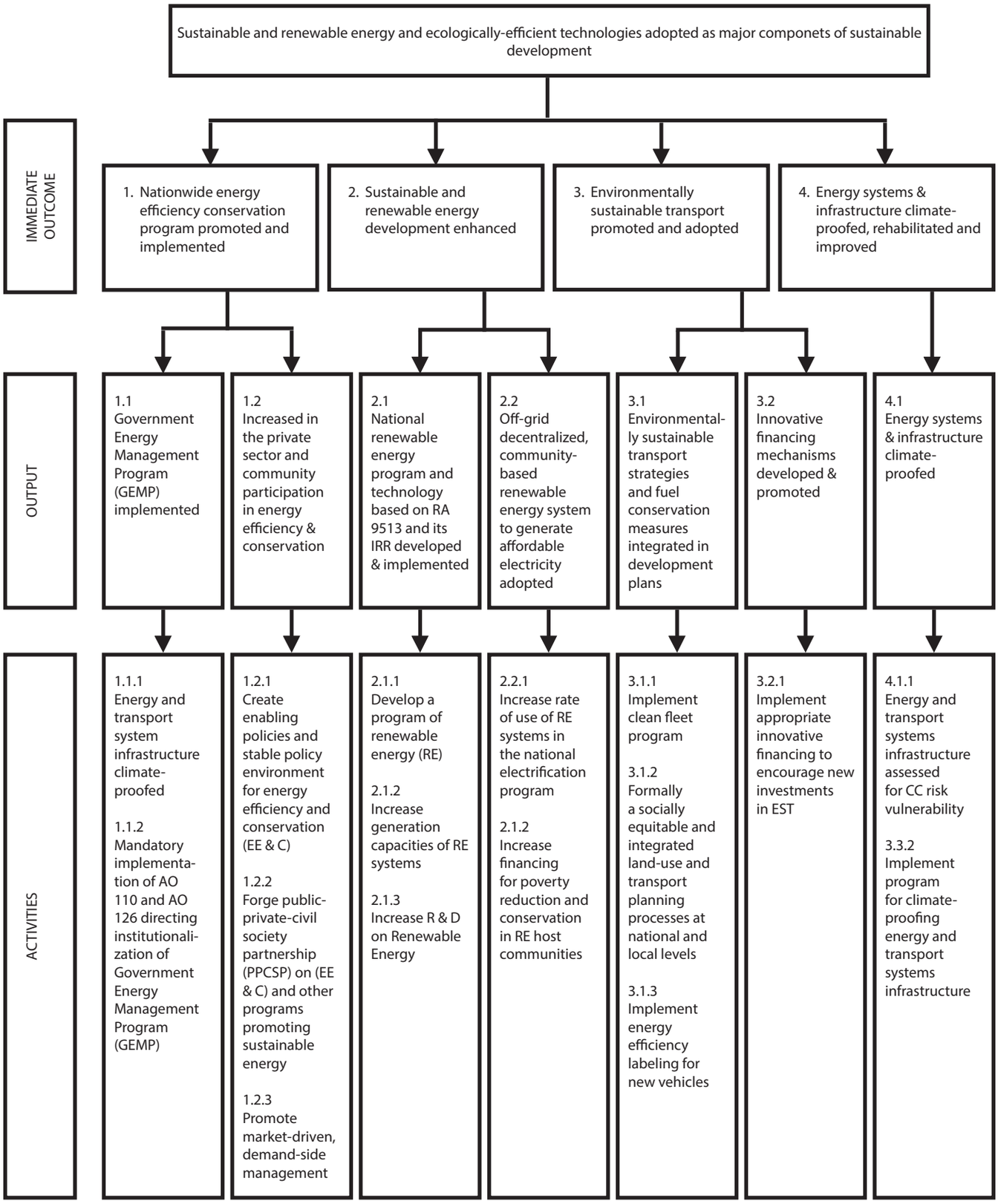


Table 21. Sustainable Energy Results Matrix.

Ultimate Outcome	Successful transition towards climate smart development						
Ultimate Outcome Indicators	Ton CO2 emissions reduction per year from RE production				Ton CO2 emissions reduction per year from transport sector		
	Sustainable RE and ecologically-efficient technologies adopted as major components of the sustainable development						
Intermediate Outcome Indicators	Energy efficiency ratio of industries (Energy cost / Output)		Renewable Energy Ratio (Renewable Energy Supply/Total Supply Energy)		Energy productivity ratio of industries		Extended economic life of infrastructure
Immediate Outcome	1. Nationwide energy efficiency and conservation promoted and implemented		2. Sustainable renewable energy development enhanced		3. Environmentally sustainable transport promoted and adopted		4. Energy systems and infrastructures climate-proofed, rehabilitated and improved
Immediate Outcome Indicators	% change in government electricity and fuel consumption and expenditure		Percentage change in sustainable renewable energy generation capacity		No. of BRT schemes developed for implementation		Amount of damage caused by major natural disasters (in Peso)
Output Areas	1.1. Government Energy Management Program (GEMP) implemented.	1.2. Increased in the private sector and community participation in energy efficiency and conservation.	2.1. National renewable energy program and technology roadmap based on RA 9513 and its IRR developed and implemented.	2.2. Off-grid, decentralized community based renewable energy system to generate affordable electricity adopted.	3.1. Environmentally sustainable transport strategies and fuel conservation measures integrated in development plans.	3.2. Innovative financing mechanisms developed and promoted.	4.1 Energy systems and infrastructures climate-proofed, rehabilitated and improved.

Critical Output Indicators	% reduction in government electricity and fuel consumption and expenditure	No. of industries implementing Energy Management Standards under ISO 50001	% increase in sustainable renewable generation capacity	No. of LGUs adopting off-grid RE systems (This has been revised in the FGD but I don't have notes. Francis kindly review.)	Increase in provision of mass transport system	% increase in new investments on environmentally sustainable transport	No. of vulnerable energy and transport system infrastructures redesigned, retrofitted and rehabilitated
		% reduction in household electricity consumption	RE capacity per type of technology		Number of BRT schemes developed for implementation	No. of financing programs to support upscaling and roll-out of pilot ESTs (e-jeepney, e-trikes, solar bus, etc.)	No. of engineering interventions for mitigation measures
Proposed additional output indicators (corresponding output areas indicated)	Reduction in GHG emission from energy consumption of government institutions	% Reduction in GHG emission from energy consumption of private institutions	Reduction GHG emission from energy production	Increased percentage of households in off-grid areas using RE systems.			Reduction in service interruption due to climate and disaster risks
Intervention Fields	Energy Efficiency and Conservation		Renewable Energy		Environmentally Sustainable Transport		Infrastructure Climate Proofing

SE Indicator Factsheet

<table>
<tr><td>Indicator</td><td>Ton CO2 emissions reduction per year from RE production</td></tr>
<tr><td>Level of Result</td><td>Ultimate Outcome Indicator</td></tr>
<tr><td>Definition and underlying concepts</td><td>The energy sector contributes 72 million tCO2e emission in 2011. It is the biggest contributor of GHG emission in the Philippines. Of the total emission from this sector, electricity generation and transport activities account for 44% and 31%, respectively. The widespread use of fossil fuels (coal, oil and natural gas) in this sector is responsible for the high emission contribution. The GHG emission of the fuels in the energy sector in2010 and 2011 are shown below:
<table>
<tr><td rowspan="2">Fuel</td><td colspan="2">Total CO2 Emission (MtCO2e)</td><td colspan="2">Total Non-CO2 Emission (MtCO2e)</td><td colspan="2">Total GHG Emission (MtCO2e)</td></tr>
<tr><td>2010</td><td>2011</td><td>2010</td><td>2011</td><td>2010</td><td>2011</td></tr>
<tr><td>Oil</td><td>38.51</td><td>35.69</td><td>0.2</td><td>0.19</td><td>38.71</td><td>35.88</td></tr>
<tr><td>Coal</td><td>26.86</td><td>29.59</td><td>0.15</td><td>0.16</td><td>27.01</td><td>29.75</td></tr>
<tr><td>Gas</td><td>7.08</td><td>7.65</td><td>0.01</td><td>0.01</td><td>7.09</td><td>7.66</td></tr>
<tr><td></td><td>72.45</td><td>72.93</td><td>0.36</td><td>0.36</td><td>72.81</td><td>73.29</td></tr>
<tr><td colspan="7">% Distribution</td></tr>
<tr><td>Oil</td><td>53.15</td><td>48.94</td><td>55.56</td><td>52.78</td><td>53.17</td><td>48.96</td></tr>
<tr><td>Coal</td><td>37.07</td><td>40.57</td><td>41.67</td><td>44.44</td><td>37.10</td><td>40.59</td></tr>
<tr><td>Gas</td><td>9.77</td><td>10.49</td><td>2.78</td><td>2.78</td><td>9.74</td><td>10.45</td></tr>
<tr><td></td><td>100</td><td>100</td><td>100</td><td>100</td><td>100</td><td>100</td></tr>
</table>
Source: PEP 2012-2030

The Philippine Energy Plan (PEP) 2012 – 2030 includes the plans and programs for greenhouse gas reduction most notably the Fueling Sustainable Transport Program (FSTP) and the National Renewable Energy Program (NREP). The FSTP was conceptualized in 2011 and aims to convert diesel and gasoline powered vehicles to run on engine with low emission such as compressed natural gas (CNG), liquefied petroleum gas (LPG) and electric power. The FTSP was meant to reduce the GHG emission from road transport in the country by reducing the gasoline and diesel vehicles in the country by 30% in 2020. The PEP also envisioned the increase in biofuels blend to 20% by 2030 from the present 2% coco methyl ester for diesel and 10% bioethanol for gasoline. The biofuels blend targets are mandated under the Biofuels law of 2006 to develop indigenous source of fuel and also to contribute in the reduction of GHG emission in road transport.

The NREP intends to triple the 2010 installed renewable energy (RE) capacity by 2030, leading to a total amount of installed capacity of about 15,304 MW. The main purpose of the NREP is to increase energy security and to reduce greenhouse gas emission from power plants by installing more RE plants rather than fossil based plants. Feed-in-Tariff (FIT), Renewable Porfolio Standards (RPS) and other policy mechanisms were introduced to support the deployment of RE projects.

Under the BAU scenario in the PEP the GHG emission from energy will increase by 4.5% annually resulting in 72 million tCO2e emission in 2011 to 168 million tCO2e in 2030. More than half or 52% will come from electricity generation, while transport will average 25% annually during the planning period. Under the LCS GHG emission will be 3.4% per annum and will result in 137 million tCO2e in 2030. In this scenario electricity will account for 48% of the emission.

The FIT is a support mechanism that offers guaranteed payments on a fixed rate per kilowatt-hour for qualified renewable energy projects. It helps promote RE development and attract investors. The RPS is an enabling mechanism which obligates all electricity generation and distribution companies in on-grid areas to source a portion of their sales from RE plants. The FIT system is fully operational while the RPS rules are still being finalized. These mechanisms will help push for more RE and help attain the LCS.</td></tr>
</table>

<table>
<tr><td>Computation</td><td>For Electricity: Emission from electricity consumption is calculated by applying an emission factor. The emission factor provided below was calculated by the DOE using grid data from 2009 to 2011.

<table>
<tr><td colspan="3">Philippines' National Grid Emission Factor (NGEF)
(Updated: June 2013)</td></tr>
<tr><td>2009-2011</td><td>Luzon-Visayas Grid</td><td>Mindanao Grid</td></tr>
<tr><td>Operating Margin Emission Factor ($t\text{-}CO_2/MWh$)</td><td>0.6032</td><td>0.2864</td></tr>
<tr><td>Build Margin Emission Factor ($t\text{-}CO_2/MWh$)</td><td>0.4044</td><td>0.7057</td></tr>
</table>
Source: DOE (2013)</td></tr>
<tr><td>Unit of Measurement</td><td>tCO2e reduced or avoided per MWh of RE electricity generated.</td></tr>
<tr><td>Interpretation of the Indicator Value</td><td>Establish trend of tCO2e reduced or avoided per MWh of RE electricity generated against FY 2011 figure</td></tr>
<tr><td>Unit of Analysis / System of Interest</td><td>Aside from contributing enormous GHG emission most of the fossil fuels are imported and put the country at a disadvantage especially in achieving energy security. In contrast the RE resources are indigenous and mostly free source. The use of RE can also contribute in stabilizing electricity prices in the long term. The present trend in RE is that technological advances are being achieved and at the same time system prices are going down. Experiences from other countries also show that RE can create green jobs.</td></tr>
<tr><td>Geographical Coverage</td><td>National Level</td></tr>
<tr><td>Linkage with other NCCAP Thematic Priority</td><td>The indicator is directly under Sustainable Energy</td></tr>
<tr><td>Linkage with existing M&E system</td><td>The PEP is linked with the Philippine Development Plan.</td></tr>
<tr><td>Frequency of measurement</td><td>The indicator for electricity will be measured annually</td></tr>
<tr><td>Baseline and Reference Year</td><td>2011 (Based on PEP 2012-2030)</td></tr>
<tr><td>Data / Information Source</td><td>Department of Energy – Electric Power Industry Management Bureau (EPIMB); Oil Industry Management Bureau (OIMB); Renewable Energy Management Bureau (REMB)</td></tr>
<tr><td>Lead Agency</td><td>Department of Energy – Energy Policy and Planning Bureau (EPPB)

Department of Transportation and Communication</td></tr>
<tr><td>Contributing Agency</td><td>National Power Corporation, National Electrification Administration, Private Sector – Power Plant owners, oil companies.

Transport groups</td></tr>
<tr><td>Feasibility of the Indicator</td><td>The indicator is feasible for the following reasons:
1. Indicator can be implemented on the basis of available data using existing data sharing agreement. The power plant operators are required to submit regularly their operation and generation data to the EPIMB, while oil and biofuel companies report refinery production, importation and sales to the OIMB.
2. Indicator can be implemented on the basis of available data, however, additional calculations are needed and timely implementation seems probable.</td></tr>
<tr><td colspan="2">REMARKS

DOE, 2014. Philippine Energy Plan 2012-2030.

DOE, 2013. National Grid Emission Factor.

DOE, 2010. National Renewable Energy Plan.</td></tr>
</table>

Knowledge and Capacity Development

The last priority area, Knowledge and Capacity Development, is a little bit more complicated than the others.

Firstly, knowledge and capacity development is both a sector and a theme. The knowledge sector is composed of the formal, non-formal and informal education institutions and programs as well as basic, higher and technical-vocational education. In the drafting of the NCCAP, it is represented by agencies such as the Department of Education (DepED), Commission on Higher Education (CHED) and the Technical Education and Skills Development Authority (TESDA). As a crosscutting theme, it is shared by all sectoral agencies, i.e., the Department of Environment and Natural Resources, the Department of Agriculture, the Department of Agrarian Reform, the Department of Interior and Local Governments, the Department of Energy, the Department of Health, the Department of Science and Technology, the Department of Transportation and Communications, the Department of Public Works and Highways and the rest of the line agencies. Hence, there is no single agency that can claim accountability to its outcomes.

Secondly, during the planning of the NCCAP, line agencies were made to identify their respective activities and outputs under this priority area. Although output areas were identified under the Plan, the resulting list of activities and outputs lack coherence and structure.

Thirdly, the lead agency or anchor program for this priority area is still undefined.

Under the circumstances, it is best that the K&CapDev priority area should be coordinated by the CCC. An anchor program can then be organized with its restructuring under NCCAP 2011-28. Figure 21 and Table 22 gives the results chain for the knowledge and capacity development priority area.

The following output areas were identified:

1. Improved capacity for CC scenario modelling and forecasting
2. Improved government capacity for CC adaptation and mitigation planning
3. Identification and establishment of CC resource centers
4. Development of formal and non-formal capacity development program for climate change science, adaptation and mitigation
5. Establishment of gendered CC knowledge management

It is proposed that the above output areas be slightly restructured and rationalized into the following, now re-stated as outputs instead of outcomes (see Figure 22):

1. R&D Programs on CC science including scenario modelling & forecasting
2. Government capacities for CC adaptation & mitigation planning & implementation
3. Philippine Climate Change Knowledge Management System with gendered content
4. Formal and non-formal capacity development programs on climate change science, adaptation and mitigation
5. Climate Change Responsiveness among/ within communities across genders

The change in output areas would not result in a change in immediate outcomes nor in the intermediate outcome. However, these output areas become the basis of components of a Philippine Climate Change Knowledge and Capacity Development Anchor Program to be coordinated by the Climate Change Commission as shown in Figure 21.

If the results chain in the knowledge and capacity development theory of change model presented above is traced, it can be hypothesized that the Research and Development component of the anchor program would contribute to R&D Programs on climate change science. The Institutional Strengthening component will generate government capacity building programs on climate change. Both output areas (R&D and capacity building programs) will result in the "enhanced knowledge on climate change science" immediate outcome, which in turn will contribute to the "enhanced knowledge and capacities among women and men to address climate change" intermediate outcome.

The KM Systems Development component of the anchor program will develop an operational Philippine Climate Change Knowledge Management System which will result in the establishment and accessibility of climate change knowledge management at the national and local levels. This will also contribute to the "enhanced knowledge and capacities among women and men to address climate change" intermediate outcome.

The Formal and Non-formal Education component of the anchor program will produce formal and non-formal capacity development programs on climate change adaptation and mitigation. The Sustained Advocacy/Social Mobilization/Social Marketing program will in turn produce climate change responsiveness (KAP) campaigns. Formal and non-formal capacity development programs and climate change responsiveness campaigns will result in the "enhanced capacities for climate change adaptation and mitigation at the local and community level" immediate outcome. Along with the other immediate outcomes mentioned, this will contribute to the "enhanced knowledge and capacities among women and men to address climate change" intermediate outcome.

Figure 21. Strategic Actions on Knowledge and Capacity Development, 2011-2028.

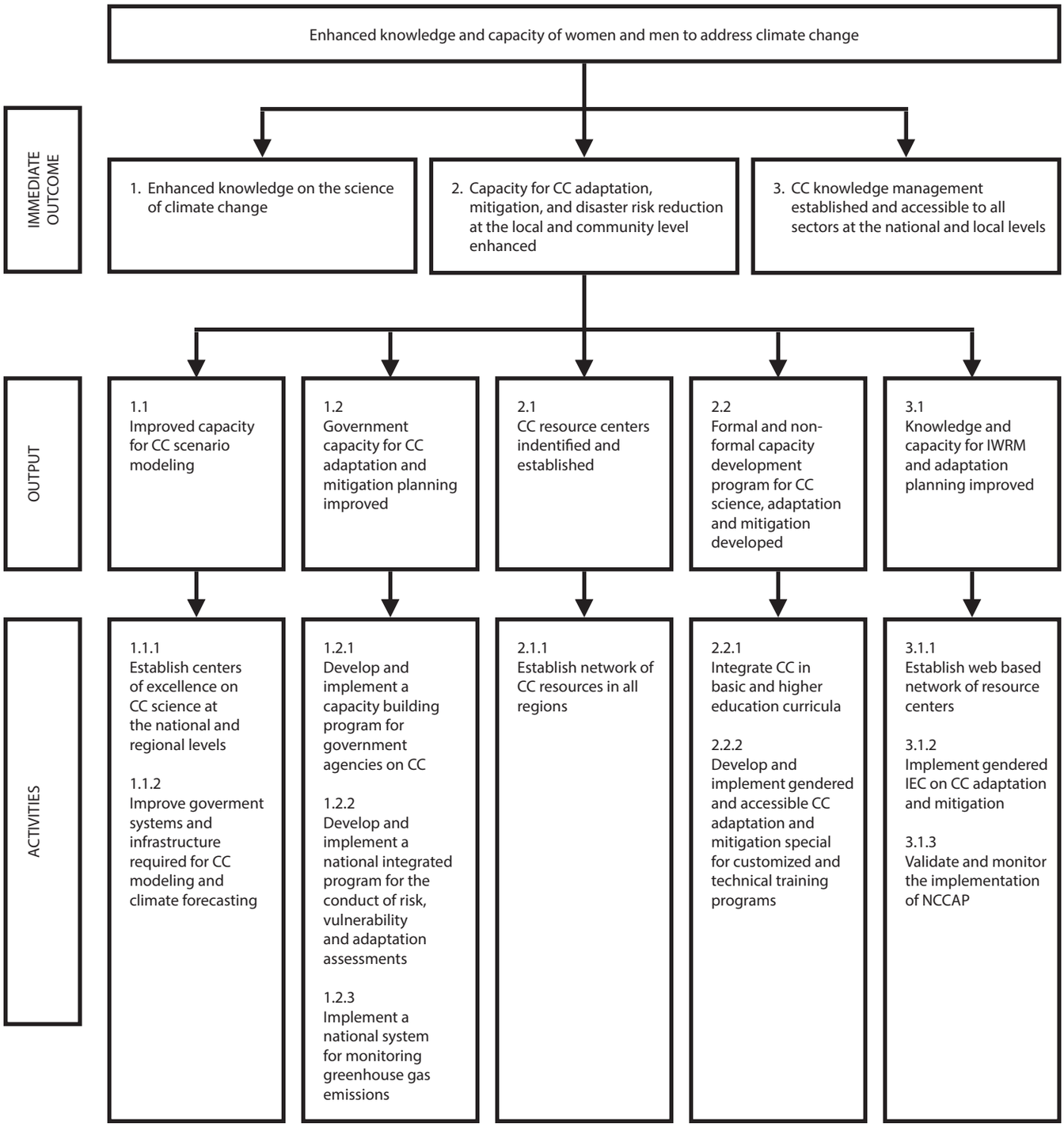


Figure 22. Recommended Restructuring of the Strategic actions on Knowledge and Capacity Development, 2011-2028.

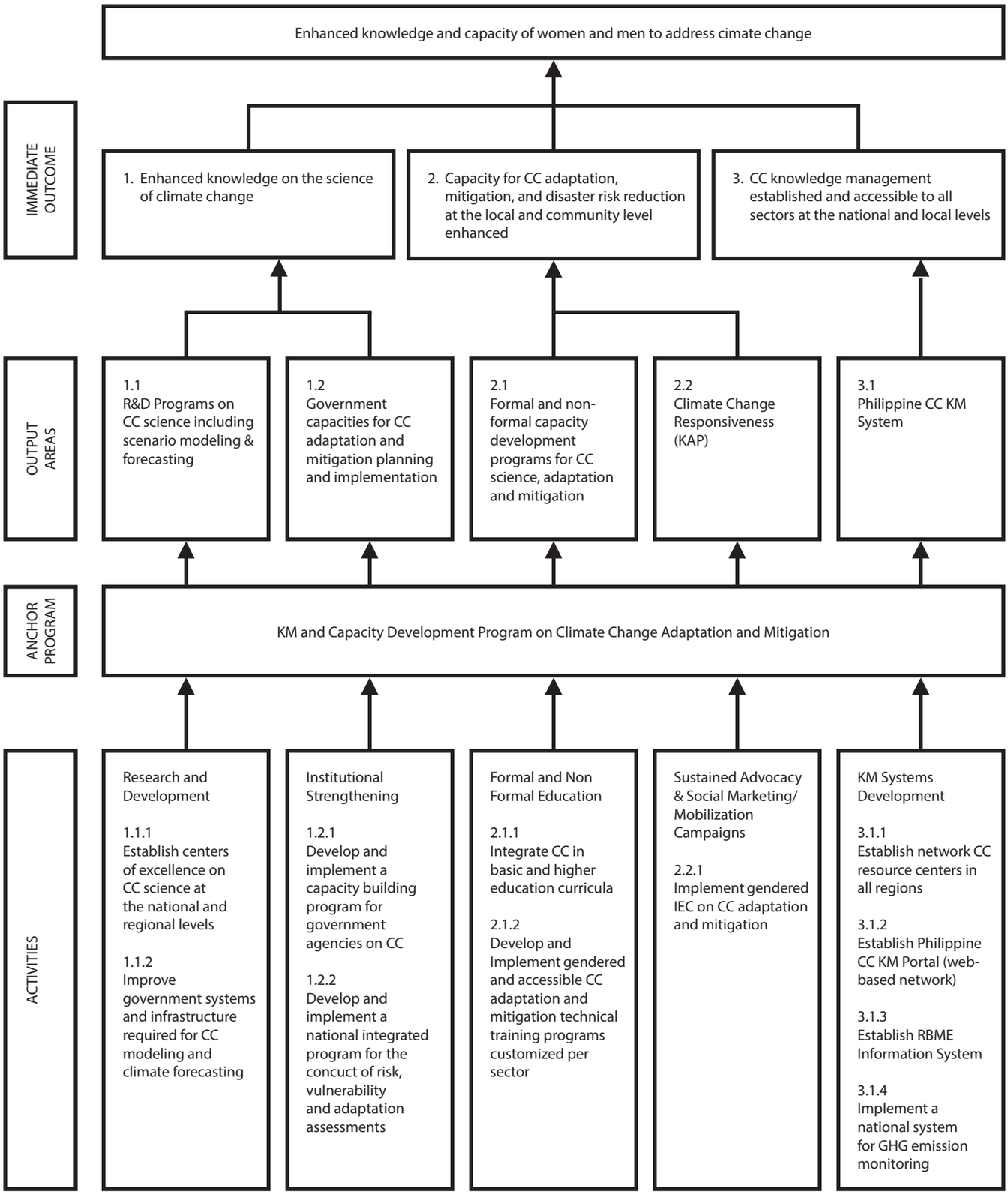


Table 22. Knowledge and Capacity Development Results Matrix.

Ultimate Outcome	Successful transition towards climate smart development				
Ultimate Outcome Indicators					
Intermediate Outcome	Enhanced knowledge on and capacity to address climate change				
Intermediate Outcome Indicators	Knowledge gain on climate change science (ΔK)	Attitude change on each priority area per vulnerable group (ΔA)	No. of climate and disaster risk reduction measures / practices adopted by vulnerable groups ($P_{Adaptation}$)	No. of climate change mitigation measures adopted by industry or sector ($P_{Mitigation}$)	
Immediate Outcome	1. Knowledge on the science of CC enhanced		2. Capacity for CC adaptation and mitigation at the national and local levels enhanced		3. CC KM established and accessible to all sectors at the national and local level
Immediate Outcome Indicators	Degree of maturity of climate change science (body of knowledge) in the Philippines		Degree of participation of various stakeholders in CC projects / programs	Variety of CC adaptation and mitigation projects	% increase in CC adaptation best practices documented and disseminated at national and sub-national levels
	No. of climate information products generated and services rendered by the CC Centers of Excellence	No. of research and publications related to climate change	Proportion of LGUs with "Seal of Disaster Preparedness"	Rate of increase in number of CC instructional materials	% increase in activity of CC COPs
				Percentage of correct answers for CC related questions in civil service, PRC and NAT exams	Level of activity in CC centers of private sector
Output Areas	1.1 R&D Programs on CC science including scenario modelling & forecasting	1.2 Government capacity for CCAM planning and implementation	2.1. CC resource centers identified and established.	2.2. Formal and non-formal capacity development program for climate change science, adaptation and mitigation developed.	3.1. Gendered CC knowledge management established and accessible to all sectors at all levels.

Critical Output Indicators	No. of centers of excellence on CC science (scenario modelling, downscaling, etc.) designated and capacitated.	No. of vulnerability and risk assessments conducted.	No. of resource centers identified and networked	No. of textbooks for pre-elementary, elementary, high school and alternative learning system with CC concepts integrated.	No. of government institutions, centers of excellence and CC resource centers linked to a national web-based CC information hub.
		Percentage increase in budget allocation and spending for CCAM programs, projects and activities	No. of CC resource networks accessed by LGUs and local communities	No. of higher education and technical-vocational curricula with CC subjects integrated	No. of gendered knowledge products for various audience and vulnerable groups accessible
		Percentage increase in the no. of trained personnel on CCAM in key agencies at the national and sub-national levels	No. of CC resource networks accessed by LGUs and local communities	No. of higher education and technical-vocational curricula with CC subjects integrated	No. of gendered knowledge products for various audience and vulnerable groups accessible
		No. of government agencies complying with GHG emissions reporting requirement.		No. of specialized, non-formal training programs on CC adaptation and mitigation developed.	No. of local institutions and communities accessing gendered knowledge products.
Intervention Fields	Climate Information and Services		Knowledge Sharing Platforms		Knowledge Products and Services

KCD Indicator Fact Sheet

Indicator	No. of research and publications related to climate change (Philippines)
Level of Result	Immediate Outcome Indicator
Definition and underlying concepts	The number of climate change refereed researches and published materials is reflective of the maturity of the field in the country.
Unit of Measurement	Number (quantity)
Interpretation of the Indicator Value	Increasing trend in the number of published materials means maturing field of study.
Unit of Analysis / System of Interest	NCCAP thematic priorities
Geographical Coverage	National, International
Linkage with other NCCAP Thematic Priority	None
Linkage with existing M&E system	None
Frequency of measurement	Annual
Baseline and Reference Year	2010
Data / Information Source	Various Sources
Lead Agency	Climate Change Commission
Contributing Agency	Sectoral Agencies, Academic Institutions, Research Institutions
Feasibility of the Indicator	Further development stage(s) is/are required to calculate the indicator such as improvement of survey instruments to include additional fields or based on new methods. However, there are already on-going initiatives related to this and implementation in the next 3 years seems probable
REMARKS The stocktaking of initiatives in the Philippines Research & Development Agenda in support of the National Climate Change Action Plan Strategic Priorities (2011 - 2028) can be used as baseline.	

NCCAP RBMES IMPLEMENTATION PLAN

The preceding chapters provided the framework for the implementation of the NCCAP Results Based Monitoring and Evaluation System. Among other things, it recommended a phased approach initially dovetailing the thematic structure of the Action Plan, moving on to flagship programs and then to targeted monitoring of vulnerable areas.

This chapter operationalizes the implementation framework and presents a plan that, while adopting a phased approach, also takes into consideration the political realities faced by the Climate Change Commission (see Table 23). These realities are: the ex-post facto nature of NCCAP (having been conceptualized after the Philippine Development Plan and thus accommodative to the larger PDP and its sectoral targets); the coordinative (instead of oversight) function of the Commission; and the need for evidence-based conclusions or results attribution. Consideration of these realities is reflected in the Plan's programs, milestones and tasks.

Strategic Framework

Based largely on the Implementation Framework presented in Chapter 5, the RBMES Implementation Plan adopts the following vision, mission and goals.

Vision

The Plan envisions a fully operational results-based M&E system by 1 January 2016 serving as a tool to improve and adjust NCCAP targets and activities from 2014 to 2028.

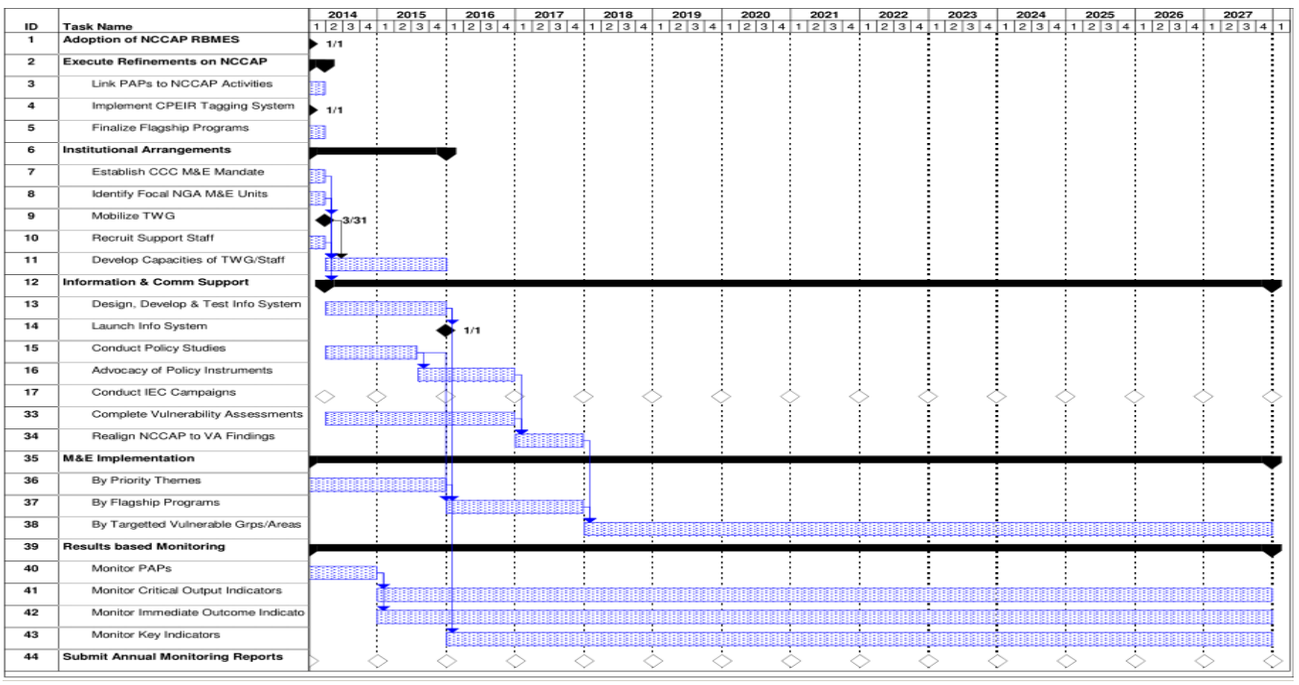
Mission

The mission of the Results Based Monitoring and Evaluation System is to accurately and progressively capture the impact of the National Climate Change Action Program through evidence-based methods and analyses, which will serve as bases for periodic refinements and recalibration of NCCAP strategies and tactics.

Strategic Thrusts

The strategic thrusts of the RBMES Implementation Plan are: continuous improvement of both NCCAP and the RBMES; networking and institutional arrangements; information and communication support; phased implementation; and evidence-based monitoring. Specific activities and tasks of the Plan are clustered under these thrusts.

Table 23. NCCAP RBMES Implementation Gantt Chart.



Targets and Milestones

The following are the targets and milestone of the RBMES Implementation Plan:

a. Adoption of NCCAP RBMES. The NCCAP Results Based Monitoring and Evaluation System have been formally adopted by the Climate Change Commission in March 2014.
b. Implementation of Climate Change Expenditure Tagging System.
c. Functional NCCAP RBMES Technical Working Group composed of planning staff from national government agencies (NGAs).
d. Launch Information System. The launching of a fully tested and operational RBMES Information System becomes another milestone. This is scheduled in 2016.
e. Conduct IEC Campaigns. The Plan targets the conduct of fifteen (15) information, education and communication campaigns on the results of climate change monitoring and NCCAP evaluation.
f. Submit Annual Monitoring Reports. The Plan likewise targets the completion and submission of 14 annual monitoring and evaluation reports by the Climate Change Commission.

Activities

The programs, sub-programs, milestones and tasks that make up the RBMES Implementation Plan total fifty eight (58) items as listed on the Gantt Chart in Table 23. Details of these items are as follows:

1. Milestone: Adoption of NCCAP RBMES. This milestone signals the start-up of the RBMES Implementation Plan stemming from the approval by the CCC Board of the overall NCCAP coordination and implementation framework, strategies and guidelines including the RBME framework and systems.
2. Program: NCCAP Refinements. Chronologically and sequentially, this program should precede the others. Under this program are three items: linking of PAPs to NCCAP activities; implementing the CPEIR tagging system; and the finalization of flagship program designations.
3. Task: Link PAPs to NCCAP Activities. A scoping exercise is necessary to identify all major on-going and proposed CC actions to ensure that these are properly planned, funded and implemented. This is important in determining and measuring the outputs and outcomes of these CC actions in relation to the desired ultimate outcome of the NCCAP. This should enhance the outputs of earlier workshops held in Clark, Tagaytay and Villa Escudero. And it should be able to identify on-going PAPs and CC-related MFOs of NSAs.
4. Milestone: Implement CC Expenditure Tagging System. By 2014, the CCC should be able to put in place a set of criteria to classify and distinguish CC and CC-related actions from those that are purely SD in nature and then classify these CC actions by NCCAP priority theme. The tagging system developed by Climate Public Expenditure and Institutional Review (CPEIR) should be adopted by then.
5. Task: Finalize Flagship/Anchor Programs. As adjuncts to Tasks 3 and 4, the identification and designation of "flagship/anchor programs" should be finalized.
6. Program: Institutional Arrangements. The present institutional arrangements entrust the actual and direct implementation and supervision of specific climate change actions to national government agencies, LGUs and NGOs. Progress monitoring of the PAPs achievement of the MFOs will be the sole responsibility of the NGAs, and for the other PAPs, the LGUs and NGOs. These institutional arrangements should be firmed up. Under this program are Items 7 to 11.
7. Task: Establish CCC M&E Mandate. The CCC needs to translate its overall-coordination mandate into specific operational strategies – from direction setting, coordination of implementation, monitoring of outcome and evaluation of results of CC actions under the NCCAP.
8. Task: Identify Focal NGA M&E Units. In some NGAs, e.g., the DENR and DA, an organic structure loosely termed "Climate Change

Office" provides overall coordination (including NSA-wide progress monitoring) of and has oversight responsibility over all major PAPs on or related CC that are being implemented directly by the various bureaus/ units of these sectoral agencies. Absent such organic CC office, the Planning and Evaluation Office (or similar organic structure) of the other NGAs may perform implementation monitoring of CC-related PAPs.

9. Milestone: TWG Mobilized. The mobilization of the RBMES Technical Working Group composed of planning staff from national government agencies (NGAs) should be implemented by 2014.
10. Task: Recruit Support Staff. Results monitoring, i.e., tracking the extent by which the outputs of PAPs are contributing to achieving the desired outcomes/impacts of the NCCAP, will be the strategic role of the CCC. At the outset and given the present CCC organizational structure, RBME will be the major mandate of the CCC Implementation Oversight Division. However, the effectiveness and sustainability of the RBME are enhanced if a separate Planning and Evaluation Division is established by the CCC, at the soonest possible time, to lead in the RBME of the whole NCCAP. The role of the Inter-Agency M&E Group for the NCCAP will have to be viewed as a short-term, transitory measure. It will be a "bridging mechanism" to link the implementation monitoring of sectoral agency MFO-driven but CC-related PAPs to the results based (i.e., adherence to the desired outcomes/ impacts of NCCAP) monitoring of the CCC. Its technical secretariat will be the CCC Implementation Oversight Division. The more permanent option, as already mentioned previously, is to establish an organic unit to lead in the M&E of the NCCAP, and a strong and concerted human resource development of the CCC by hiring more technical officers and staff, training (both degree and non-degree) to build up and strengthen expertise in technical and managerial (including M&E) aspects of coordination of CC actions.
11. Task: Develop Capacities of TWG/Staff. Strengthening the capability of the TWG members in monitoring their respective CC actions and CC-related projects. Assessment and strengthening of the organizational capability of the CCC on results-based management and in particular, on RBME.
12. Program: Information and Communication Support. This program constitutes the critical path of the RBMES Implementation Plan since it covers Items 13 to 34. Information and communication support covers: the design and development of the RBMES Information System; the conduct of policy studies and advocacy of policy instruments; the conduct of IEC campaigns; and the completion of vulnerability assessments that would inform changes in NCCAP implementation.
13. Task: Design, Develop & Test Info System. An information system (IS) should be designed and developed to manage results based monitoring and evaluation data on NCCAP implementation. Ideally, the RBME IS becomes a subsystem of the Philippine Climate Change Knowledge Management (PCC KM) System.
14. Milestone: Information System Launched. The launching of a fully tested and operational RBMES Information System becomes another milestone. scheduled in January 2016.
15. Task: Conduct Policy Studies and other CC-related Researches. CCC should conduct relevant policy studies that would inform the analyses of monitoring and evaluation data. These policy studies would look into the relationship of sustainable development targets and climate change actions. The parameters of adaptation, maladaptation and mitigation as well as the concept of "no regrets" may very well be established by these studies. If the present statistical system and literature prove inadequate to provide reference values/data to establish the baselines/counterfactuals or, estimate ex-ante the most likely CC impact, the CCC should support the conduct of empirical values, eg., vulnerability and impact studies, to establish these data.
16. Task: Advocacy of Policy Instruments. The above policy studies must recommend relevant policy instruments, which will form part of the advocacy efforts of the NCCAP RBME group.

17 to 32. Milestones: Conduct of IEC Campaigns. The Plan targets the conduct of fifteen (15) information, education and communication campaigns on the results of climate change monitoring and NCCAP evaluation.

33. Task: Complete Vulnerability Assessments. Eventually, the RBMES should focus its monitoring and evaluation on targeted vulnerable areas or groups to achieve genuine results and evidence based findings. This can only be implemented with the completion of vulnerability assessments.
34. Task: Realign NCCAP to VA Findings. Results of the Vas will inform the implementation of NCCAP, specifically on targeting and prioritization.
35. Programs: M&E Implementation. This program was included here to situate the phases of implementation in the Gantt Chart. It is composed of three sub-programs: M&E by Priority Themes; M&E by Flagship Programs; and M&E by Vulnerable Areas/ Groups.
36. Sub-Program: By Priority Themes. Monitoring and evaluation during the Immediate or Short Term of NCCAP Implementation will focus on the seven priority themes: food security; water sufficiency; ecological and environmental stability; human security; sustainable energy; and climate smart industries. In this phase, the PAPs will be classified under the above themes and linked to NCCAP output areas. Critical output indicators will be monitored.
37. Sub-Program: By Flagship Programs. During this implementation phase, critical output indicators will continue to be monitored clustered under identified flagship programs.
38. Sub-Program: By Vulnerable Areas. Once vulnerability assessments are completed, the focus of monitoring and evaluation shifts to immediate then intermediate outcomes on targeted and prioritized vulnerable areas or groups.
39. Program: Results based Monitoring. The success of the NCCAP will be gauged through its results. Its results – outputs or outcomes- can only be measured through indicators. The NCCAP RBMES proposes a set of indicators to measure performance in each level of the results chain: the output area level; the immediate outcome level; and the intermediate outcome level. The indicators were chosen using the indicator selection criteria cited previously, as follows: measurability and comparability, availability (of data), representativeness (as proxy for pattern/ variability), and commonness.
40. Sub-Program: Monitor PAPs. Since many of the PAPs have been identified without considering the NCCAP and without climate change action tagging, these should be revisited and linked to the Action Plan during the initial stage of monitoring and evaluation. By doing so, the RBMES will have a handle on agency activities that may be legitimately considered as climate change actions. Eventually, the focus will shift to NCCAP identified activities once tagging and VA studies are conducted.
41. Sub-Program: Monitor Critical Output Indicators. The NCCAP RBMES distinguishes between three types of indicators: Output, Outcome and Key indicators. Outputs are goods, products and services produced by NCCAP activities that contribute to an outcome. The measurements of these outputs are output indicators. Also called critical indicators, they measure outputs that are antecedents to immediate outcomes.
42. Sub-Program: Monitor Outcome Indicators. Outcomes are conditions that result from the outputs generated by NCCAP. There are two types of outcomes: Immediate outcomes, which are observable between 2011 and 2016 and intermediate outcomes, which are observable from 2016 onwards. Measurements of these outcomes are the outcome indicators. And to complete the indicators systems, a set of indicators on climate change impacts is included.
43. Sub-Program: Monitor Key Indicators. Key indicators are measurements of intermediate outcomes.

44 to 58. Milestones: Annual Monitoring Reports Submitted. The Plan provides for the completion and submission of fourteen (14) annual monitoring and evaluation reports by the Climate Change Commission.

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ENDNOTES

1. Ideally, even autonomous or spontaneous adaptations, i.e., by IPCC definition, those that do not constitute conscious response to climatic stimuli, but triggered by ecological changes in natural systems and by market or welfare changes in human systems, must also be captured by the M&E system for NCCAP.

2. Overview of the Philippine Agriculture. CountrySTAT Philippines in http://countrystat.bas.gov.ph/?cont=9 accessed on October 28, 2014 at 10:52H.

3. From http://countrystat.bas.gov.ph/?cont=3

4. From http://countrystat.bas.gov.ph/?cont=3

5. The report compared available statistics on water supplies with that of current and projected water requirements using 1975 as the base year and the year 2000 A.D. as the time horizon.

6. The 14 river basins investigated were Ilocos, Pampanga, Cagayan, Nueva Ecija, Nueva Vizcaya, Bicol, Isabela, Mindoro, Capiz, Leyte, Bukidnon, Sultan Kudarat, Zamboanga and Agusan Del Sur.

7. http://www.globalwaterforum.org/2012/05/07understanding-water-scarcity-definitions-and-measurements/

8. Sustaining Water, Easing Scarcity: Population and the Future of Renewable Water Supplies. An information update produced jointly by the Union of Concerned Scientists and Population Action International.

9. http://www.unwater.org/downloads/TFIMR_FinalReport.pdf

10. http://esl.jrc.ec.europa.eu/envind/un_meths/UN_ME077.htm

11. http://www.globalwaterforum.org/2012/05/07/understanding-water-scarcity-definitions-and-measurements/

12. As cited in Perveen and James (2010).

13. http://webworld.unesco.org/water/wwap/wwdr/indicators/pdf/I1_Disaster_Risk_Index.pdf

14. See also Mlote et al. (2002).

15. This section of the EES seeks to put equal emphasis on the need to monitor the potential impacts of climate change on water quality. Monitoring of climate change impacts on water availability and hydrological risks are covered in WS and HS thematic priorities, respectively.

16. DENR (n.d.) estimates the forest cover at 7.168 million hectares (or about 23%) of the 30 million hectares of the country's total land area. FAO (2001) gives a more conservative estimate of 19% forest cover.

17. http://webworld.unesco.org/water/wwap/wwdr/indicators/pdf/I1_Disaster_Risk_Index.pdf

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