WATER AND CLIMATE CHANGE

421 PRINCIPAL RIVERS

59 NATURAL LAKES

4 MAJOR GROUNDWATER RESERVOIRS

TOO MUCH, TOO LITTLE

THE PHILIPPINE WATER SECTOR AMIDST A CHANGING CLIMATE

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.

GROUNDWATER[1]

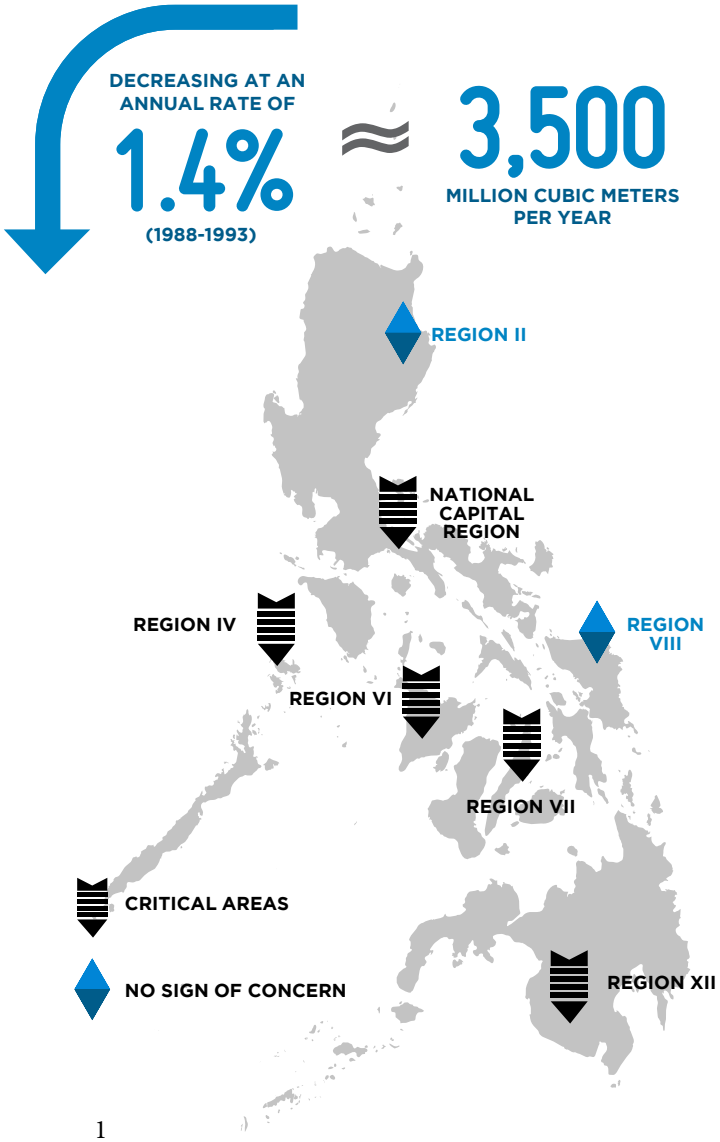
Stock of groundwater has been **decreasing** at an annual rate of 1.4 percent (1988-1993), equivalent to an average of 3,500 million cubic meters (MCM) per year. Volume of **withdrawals exceeded the recharge volume** by an average of 400.7 MCM.

The increasing abstraction of groundwater coupled with diminishing recharge led to the **shrinkage of the overall supply** of groundwater.

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.



SURFACE WATER[2]

13,700
MILLION CUBIC METERS PER YEAR

Stock of surface water is **diminishing** at an annual average of 13,700 million cubic meters (1988-1993). The reduction in surface water volume was attributed mainly to the **low rate of recharge** rather than the abstraction during the period.

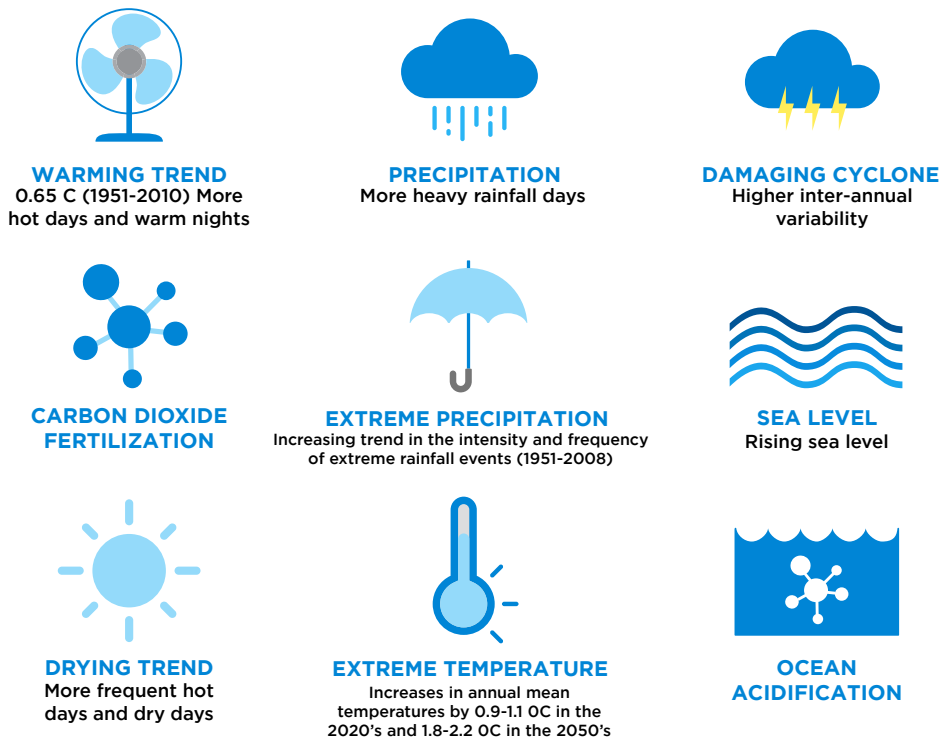
Three regions – the Central Luzon, Western Visayas and Central Visayas Regions – will have **long-run surface water problems** based on comparison of surface water flows against the projected withdrawals. Regions II, VIII, and IX as areas of concern.[3]

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

T he problem of water scarcity is already felt in many areas of the country at certain seasons and this problem is likely to be exacerbated by climate change. Climate projections of wetter climate during the wet season and drier climate during the dry season will most certainly impact on stream flow, dam operation and water allocation, domestic water supply, irrigation, hydro power generation, depth and recharge of aquifers, water quality, watersheds, and fishery. The changes in water supply and quality due to changing climates are expected to affect food and human security and the economy if water governance and adaptive measures are not robust enough to cope with the risks and impacts of climate change.

FIGURE 1. PHILIPPINE CLIMATE TRENDS & PROJECTIONS (PAGASA, 2011)[4]



In already 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, 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 tests 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.

PROJECTED CHANGES IN CLIMATE UNDER A MID-RANGE SCENARIO

All areas of the Philippines will get warmer, more so in the relatively warmer summer months

Annual mean temperatures in all areas in the country are expected to rise by 0.9 °C to 1.1 °C in 2020 and by 1.8 °C to 2.2 °C in 2050

Increase in seasonal mean temperatures consistent in all the provinces

Reduction in rainfall in most provinces during the dry season (MAM) making the usually dry season drier

Rainfall increases are likely in most areas of Luzon and Visayas during the southwest monsoon (JJA) and the SON seasons, making these seasons still wetter, and thus with likelihood of both droughts and floods in areas where these are projected

Northeast monsoon (DJF) season rainfall is projected to increase, particularly for areas characterized by Type II climate with potential for flooding enhanced

During the southwest monsoon season (JJA), larger increases in rainfall is expected in provinces in Luzon (0.9% to 63%) and Visayas (2% to 22%) but generally decreasing trends in most of the provinces in Mindanao in 2050

Hot temperatures (number of days with maximum temperature exceeding 35 °C) will continue to become more frequent

Number of dry days (days with less than 2.5mm of rain) will increase in all parts of the country

Heavy daily rainfall (exceeding 300mm) events will also continue to increase in number in Luzon and Visayas.

PHILIPPINE ATMOSPHERIC, GEOPHYSICAL AND ASTRONOMICAL SERVICES ADMINISTRATION (PAGASA) 2011: CLIMATE CHANGE IN THE PHILIPPINES. TAGUIG CITY, PHILIPPINES: DEPARTMENT OF SCIENCE AND TECHNOLOGY.

CLIMATE CHANGE IMPACTS AND RESPONSES IN THE PHILIPPINES: WATER RESOURCES

AIDA M. JOSE, NATHANIEL A. CRUZ

CLIM RES 12: 77–84, 1999

CASE STUDY: VULNERABILITY ASSESSMENT OF ANGAT RESERVOIR[5]

936

SQUARE KILOMETER TOTAL DRAINAGE AREA OF THE ANGAT RIVER BASIN LOCATED ON THE ISLAND OF LUZON

31,484

HECTARES OF TOTAL SERVICE AREA IRRIGATED BY THE ANGAT MAASIM RIVER IRRIGATION SYSTEM (AMRIS) OF THE NATIONAL IRRIGATION ADMINISTRATION (NIA) FROM ANGAT DAM

90%

OF THE MUNICIPAL WATER SOURCE FOR METRO MANILA AND SOME ADJOINING TOWNS

- 10 or 20% increase in rainfall would mean an increase in runoff by 8 or 18%, respectively
- 10 or 20% of reduction in rainfall means reduction in runoff by 15 or 25%, respectively, is to be expected
- 2°C increase in temperature would only lead to a 1% reduction in runoff

FUTURE DOMESTIC, COMMERCIAL, AND INDUSTRIAL NEEDS WOULD BE THE MAIN PROBLEM FOR THE WATER MANAGEMENT AGENCIES.

Potential impacts of climate change as well as adaptation assessments for other subsectors – such as drainage, flood control, water quality, salinity control, fisheries, protection of aquatic life, and navigation – have not been assessed.

Non-climate stressors such as overexploitation of water resources through degradation of watersheds, unchecked extraction of groundwater, rapid pollution brought about by industrialization, saltwater intrusion along coastal areas, and sedimentation of reservoirs could also contribute to the modification of the water supply-demand relationship in the future.

FRESHWATER RESOURCES: KEY RISKS AT THE GLOBAL SCALE

Freshwater-related risks of climate change increase significantly with increasing greenhouse gas concentrations (robust evidence, high agreement).

Climate change over the 21st century is projected to reduce renewable surface water and groundwater resources significantly in most dry subtropical regions (robust evidence, high agreement), intensifying competition for water among sectors (limited evidence, medium agreement).

So far there are no widespread observations of changes in flood magnitude and frequency due to anthropogenic climate change, but projections imply variations in the frequency of floods (limited evidence, medium agreement).

Climate change is likely to increase the frequency of meteorological droughts (less rainfall) and agricultural droughts (less soil moisture) in presently dry regions by the end of the 21st century under the RCP8.5 scenario (medium confidence). This is likely to increase the frequency of short hydrological droughts (less surface water and groundwater) in these regions (medium evidence, medium agreement).

Climate change negatively impacts freshwater ecosystems by changing streamflow and water quality (medium evidence, high agreement).

Climate change is projected to reduce raw water quality, posing risks to drinking water quality even with conventional treatment (medium evidence, high agreement).

IPCC FIFTH ASSESSMENT REPORT 2014 CHAPTER 3 FRESHWATER RESOURCES[6]

Changes in the hydrological cycle due to climate change can lead to diverse impacts and risks, and they are conditioned by and interact with non-climatic drivers of change and water management responses.

Water is the agent that delivers many of the impacts of climate change to society, for example, to the energy, agriculture, and transport sectors. Even though water moves through the hydrological cycle, it is a locally variable resource, and vulnerabilities to water-related hazards such as floods and droughts differ between regions. Anthropogenic climate change is one of many stressors of water resources. Non-climatic drivers such as population increase, economic development, urbanization, and land use or natural geomorphic changes also challenge the sustainability of resources by decreasing water supply or increasing demand. In this context, adaptation to climate change in the water sector can contribute to improving the availability of water.

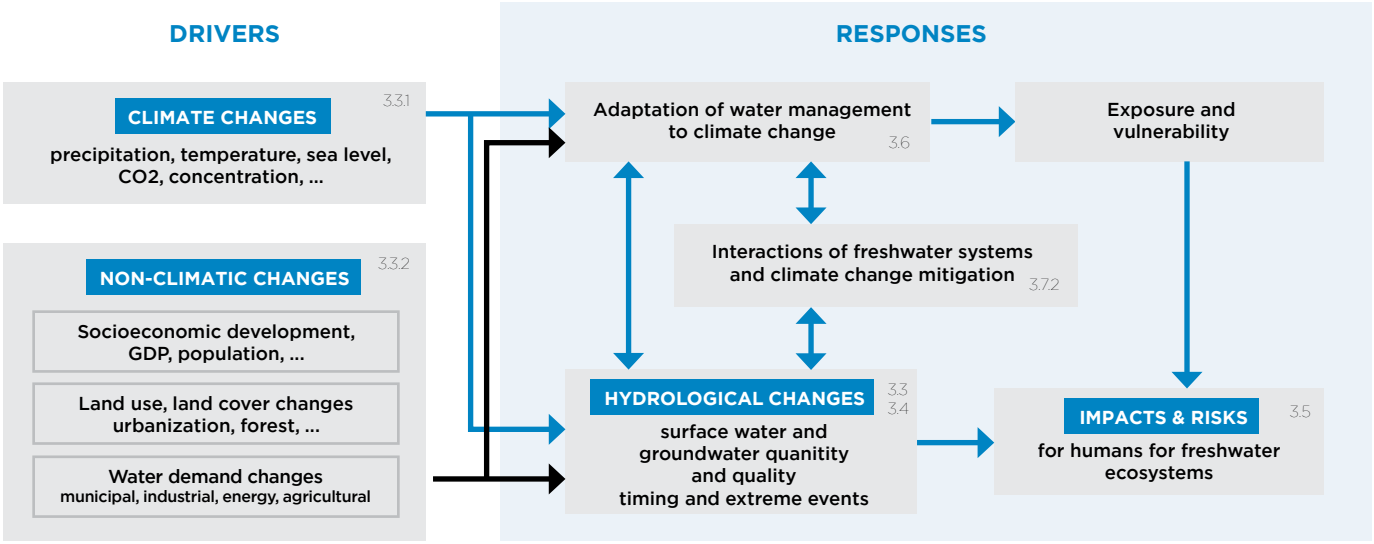
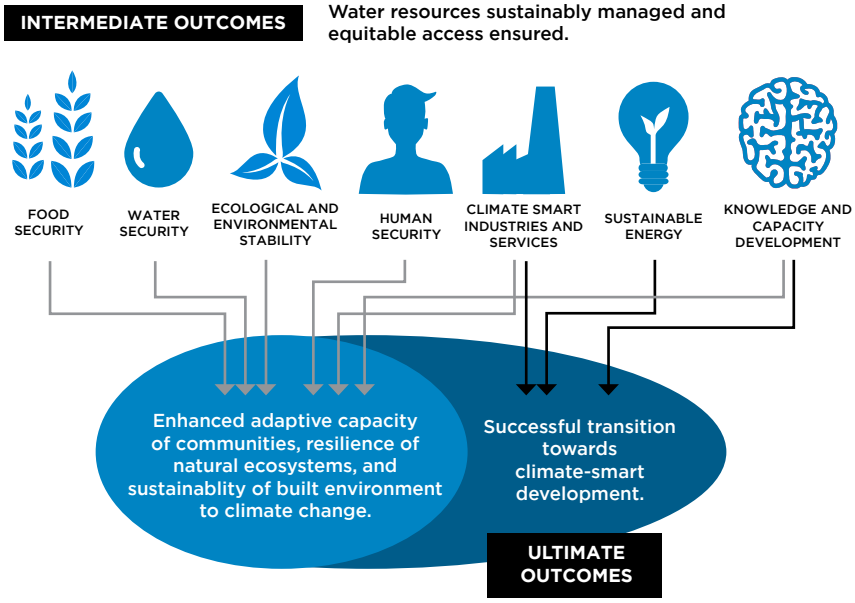


FIGURE 3-1 | FRAMEWORK (BOXES) AND LINKAGES (ARROWS) FOR CONSIDERING IMPACTS OF CLIMATIC AND SOCIAL CHANGES ON FRESHWATER SYSTEMS, AND CONSEQUENT IMPACTS ON AND RISKS FOR HUMANS AND FRESHWATER ECOSYSTEMS. BOTH CLIMATIC (SECTION 3.3.1) AND NON-CLIMATIC (SECTION 3.3.2) DRIVERS HAVE CHANGED NATURAL FRESHWATER SYSTEMS (SECTION 3.2) AND ARE EXPECTED TO CONTINUE TO DO SO (SECTION 3.4). THEY ALSO STIMULATE ADAPTIVE MEASURES (SECTION 3.6). HYDROLOGICAL AND WATER MANAGEMENT CHANGES INTERACT WITH EACH OTHER AND WITH MEASURES TO MITIGATE CLIMATE CHANGE (SECTION 3.7.2). ADAPTIVE MEASURES INFLUENCE THE EXPOSURE AND VULNERABILITY OF HUMAN BEINGS AND ECOSYSTEMS TO WATER-RELATED RISKS (SECTION 3.5).

GOVERNMENT INITIATIVES

NCCAP 2011-2028 | WATER SECURITY



In light of climate change, a 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 resilience of major water resources and infrastructures, manage supply and demand, manage water quality, and promote conservation.

The Water Security thematic priority of the National Climate Change Action Plan (NCCAP) 2011-2028 gives emphasis on the sustainable management and equitable access to water resources. This will be achieved through climate-responsive water governance, ensuring sustainable and equitable access to water supply and enhancing knowledge and capacity on Integrated Water Resource Management (IWRM) and adaptation planning.

ADAPTATION, MITIGATION, AND SUSTAINABLE DEVELOPMENT

Of the global cost of water sector adaptation, most is necessary in developing countries where there are many opportunities for anticipatory adaptation (medium evidence, high agreement). There is limited published information on the water sector costs of adaptation at the local level. {3.6.1, 3.6.3}

An adaptive approach to water management can address uncertainty due to climate change (limited evidence, high agreement).

Adaptive techniques include scenario planning, experimental approaches that involve learning from experience, and the development of flexible and low-regret solutions that are resilient to uncertainty. Barriers to progress include lack of human and institutional capacity, financial resources, awareness, and communication. {3.6.1, 3.6.2, 3.6.4}

Reliability of water supply, which is expected to suffer from increased variability of surface water availability, may be enhanced by increased groundwater abstractions (limited evidence, high agreement). This adaptation to climate change is limited in regions where renewable groundwater resources decrease due to climate change. {3.4.5, 3.4.8, 3.5.1}

Some measures to reduce GHG emissions imply risks for freshwater systems (medium evidence, high agreement). If irrigated, bioenergy crops make water demands that other mitigation measures do not. Hydropower has negative impacts on freshwater ecosystems, which can be reduced by appropriate management. Carbon capture and storage can decrease groundwater quality. In some regions, afforestation can reduce renewable water resources but also flood risk and soil

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 Local Water Utilities Administration (LWUA) and National Water Resource Board (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.

INTEGRATED WATER RESOURCES MANAGEMENT PLAN FRAMEWORK

NATIONAL WATER RESOURCES BOARD

Blueprint to secure sustainable water for all that considers "increasing frequency and intensity of extreme climate events and variability." Adaptive and proactive response to emerging /future challenges" is one of the sustainable outcomes which 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 agency's plans and program 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 are identified as priority areas in the NCCAP.

SAGANA AT LIGTAS NA TUBIG SA LAHAT (SALINTUBIG) PROGRAM

DEPARTMENT OF THE INTERIOR AND LOCAL GOVERNMENT
DEPARTMENT OF HEALTH
NATIONAL ANTI-POVERTY COMMISSION

The program 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% water coverage.

The DILG Salintubig Program, has introduced capacity development measures such as the "Training on Climate Change Adaptation and Disaster Risk Reduction Management for Drought-stricken Municipalities under the SALINTUBIG and Bottom-up Budgeting Water Programs" which enables participating local government partners to assess climate and disaster risks affecting their municipalities / cities and the water system installed under the program.

WATER SECURITY FOR RESILIENT ECONOMIC GROWTH AND STABILITY (BE SECURE) PROJECT

DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
NATIONAL WATER RESOURCES BOARD
PHILIPPINE ATMOSPHERIC, GEOPHYSICAL AND ASTRONOMICAL SERVICES ADMINISTRATION

Promote good governance and build capacity for long-term water security, improve access to water and wastewater treatment services, and build more resilient communities.

The Project is implemented in six focal areas: Basilan, Iloilo, Leyte, Maguindanao and Misamis Oriental Provinces and Tuguegarao City. For local and regional activities, the project works with local government units and water service providers at the watershed scale to improve capacities for integrating climate change into local planning and the provision of water supply and wastewater treatment services.

At the national level, activities focus on strengthening water sector regulatory reform.

PHILIPPINE DEVELOPMENT PLAN

NATIONAL ECONOMIC AND DEVELOPMENT AUTHORITY

The six-year Philippine Development Plan always strives for the improvement of water supply coverage, water quality and water sector governance. The last PDP (2011-2016) prioritized 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 PDP 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.

REFERENCES/RECOMMENDED READINGS

[1] For the period 1988 to 1994, in the Philippine System of Integrated Economic and Environmental Accounts (more popularly known as Environmental Accounting). National Statistical Coordination Board (NSCB) 1998: Philippine Asset Accounts: Forest, Land/Soil, Fishery, Mineral and Water Resources. Available at http://www.nscb.gov.ph/peenra/Publications/asset/water.pdf

[2] ibid

[3] Based on an earlier report, the First National Assessment on Philippine Water Resources (1976).

[4] Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) 2011: Climate Change in the Philippines. Taguig City, Philippines: Department of Science and Technology.

[5] Jose, A. M., and Cruz, N. A., 1999: Climate change impacts and responses in the Philippines: water resources. Quezon City, Philippines. Climate Research 12: 77–84, 1999

[6] Jiménez Cisneros, B.E., T. Oki, N.W. Arnell, G. Benito, J.G. Cogley, P. Döll, T. Jiang, and S.S. Mwakalila, 2014: Freshwater resources. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 229-269.

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Contact
Dr. Bernd-Markus Liss
Cluster Coordinator Climate and Environment
GIZ Philippines Green Sector Forum
T: +63 2 651 5140
E: bernd-markus.liss@giz.de

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9th Floor PDCP Bank Centre
Rufino corner Leviste Streets, Salcedo Village
Makati City 1227 Philippines
T +63 2 651 5100
E giz-philippinen@giz.de
I www.giz.de

Contributor/s
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