Component One

Environmental Conditions and Quality

COMPONENT ONE

ENVIRONMENTAL CONDITIONS AND QUALITY

The environment provides goods and services essential to human well-being. The human sub-system uses the environment for habitat, to obtain important physical resources and as a recipient or sink for various residuals. Human societies, as well as their production and consumption patterns, affect the quality and condition of the environment, its natural processes and its capacity to provide goods and services *(UN FDES, 2013)*. The changing environment, in turn, affects humans in different ways over time. Hence, Environmental Conditions and Quality is central to the Framework for the Development of Environment Statistics (FDES) including five other components which were established based on their relationship with Component One.

This component covers statistics on the physical, biological and chemical characteristics of the environment and their changes over time. These are strongly interrelated fundamental background conditions that determine the types, extent, conditions, and health of ecosystems. Environmental condition refers to the state of the environment at a given time point. Environmental quality on the other hand refers to a measure of the condition of the environment relative to a requirement or threshold of one or more species or to any human need or purpose.

Statistics gathered for Component One are useful in compiling environmental accounts as described in the System of Environmental Economic-Accounting (SEEA). Particularly, Component 1 is closely related to the SEEA Experimental Ecosystem Accounts (SEEA-EEA). The SEEA-EEA is a companion to the SEEA Central Framework which extends the accounting to the measurement of flows of services to society that ecosystems provide, as well as to the measurement of ecosystem capital in terms of the capacity and changes in ecosystems providing those services in physical terms. It describes the valuation of ecosystems insofar as it is consistent with the market valuation principles of the System of National Accounts *(SEEA-CF, 2012)*.

In addition to its links with the SEEA, statistics collected for Component One are inputs to the indicators in monitoring the Sustainable Development Goals (SDGs). These include the following: Goal 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture; Goal 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all; Goal 13: Take urgent action to combat climate change and its impacts; Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development; and Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse *(Sustainable Development Knowledge Platform)*.

Component One consists of three sub-components, namely: Physical Conditions; Land Cover, Ecosystems and Biodiversity; and Environmental Quality. The Compendium of Philippine Environment Statistics (CPES) 2016 compiled nineteen (19) out of the thirty-two (32) core statistics. Additionally, four (4) Tier 2[1] statistics were compiled for sub-component 3: Environmental Quality. The core statistics on coastal area and some indicators on soil characteristics, air quality, freshwater quality and marine water quality were not yet included in the current publication due to data unavailability.

[1] Tier 2 statistics includes environment statistics which are of priority and relevance to most countries but requires greater investment of time, resources or methodological development.

1.1 Physical Conditions

This subcomponent aims to capture the physical aspect of the environment and focuses on statistics on the meteorological, hydrographical, geological and geographical conditions and soil characteristics. Compilation of this subcomponent is important as it can assist in determining the scope and influences on the environmental resources of a country. Furthermore, these statistics provide baseline information that may aid the government in assessing the need for and the effectiveness of environment-related policies.

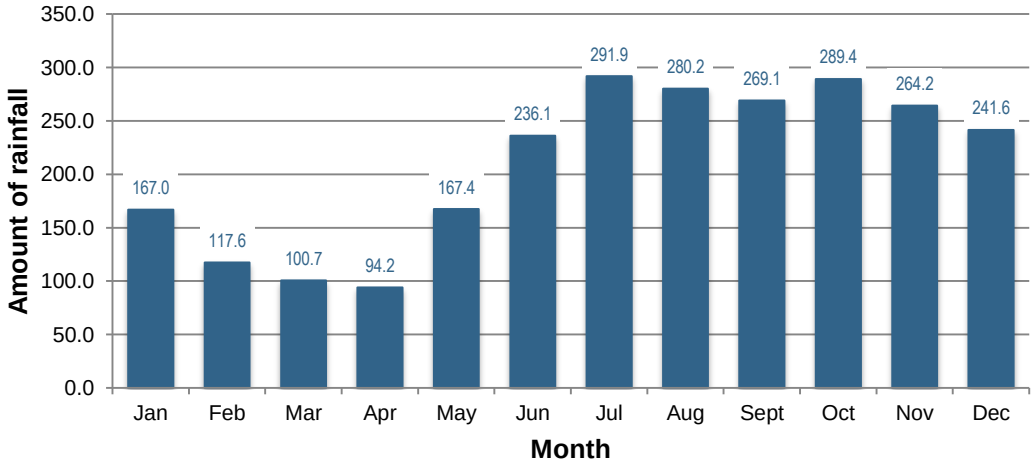
Physical Conditions is linked to the SEEA Ecosystem Condition. For the CPES 2016 compilation, the Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA), the Department of Environment and Natural Resources (DENR), the National Mapping and Resource Information Authority (NAMRIA) and the Bureau of Soils and Water Management (BSWM) were the main sources of data.

1.1.1 Atmosphere, Climate and Weather

This topic covers data on atmospheric, climatic and weather conditions across territories and over time. Weather describes the atmosphere's behavior over a short period of time while climate is determined by long term weather conditions, both of which are recorded through monitoring stations. Information about the atmosphere, climate, and weather is important to understand the conditions and trends to explain other phenomena such as ecosystem change, biodiversity and living conditions, among others.

In general, the Philippine climate has two seasons: rainy season, which lasts from June to December, and dry season, from January to May. From 1981 to 2010, the average amount of rainfall ranged from 236 to 292 millimeters per month during rainy season; and at 94 to 167 millimeters per month during the dry season. As seen in Figure 1.1, the average amount of rainfall changes throughout the year, with months January to May, observed as relatively lower. Moreover, the month of July had the highest recorded average amount of rainfall (291.9 millimeters), while the month of April had the lowest average (94.2 millimeters).

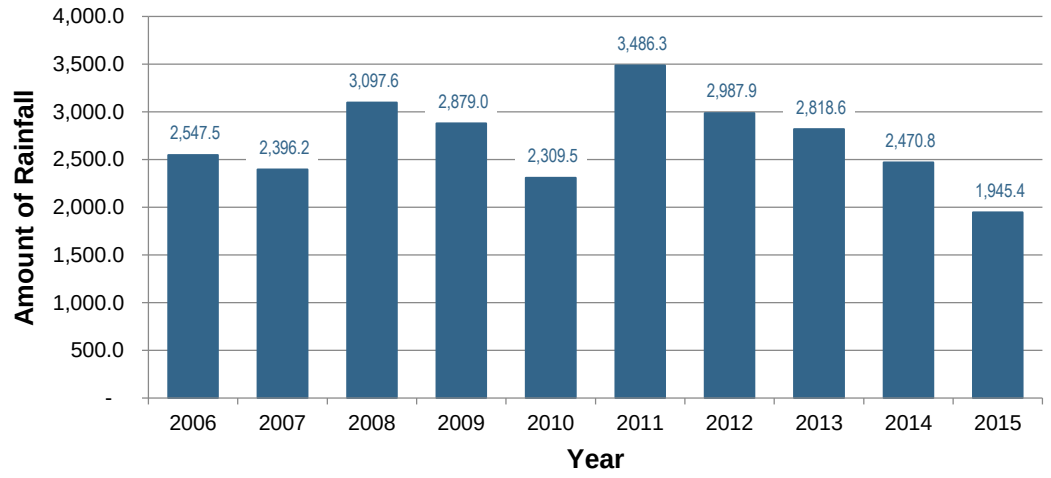
Figure 1.1. Average Monthly Rainfall from 1981 to 2010, in millimeters



Source: Philippine Atmospheric, Geophysical and Astronomical Services Administration

The rainfall distribution throughout the Philippines varies depending on the direction of the moisture-bearing winds and the location of the mountain systems *(PAGASA)*. Based on Figure 1.2, the annual average amount of rainfall fluctuated from 2006 to 2010 while decreasing from 2011 to 2015. The year 2011 had the highest recorded average of 3,486 millimeters while the year 2015 had the lowest average at 1,954 millimeters. Also, the average amount of rainfall in 2015 was less than that of 2014 by 525 millimeters.

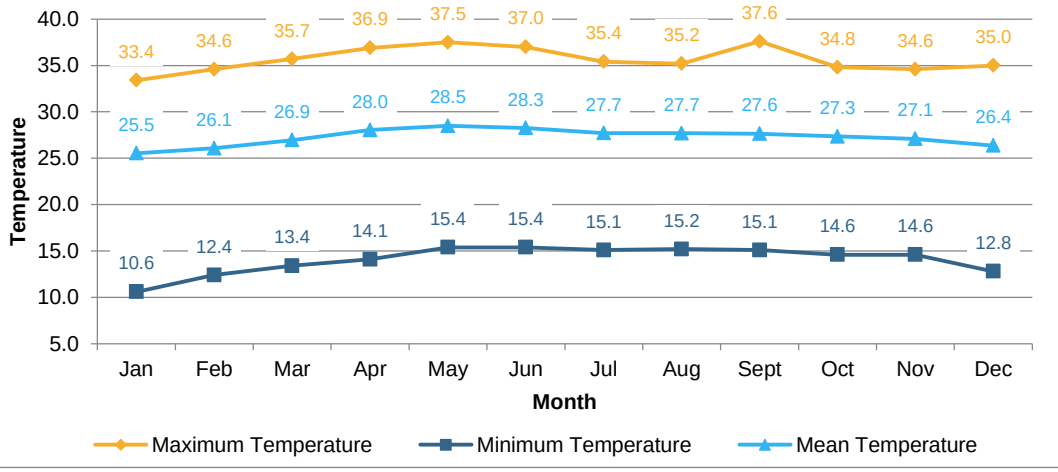
Figure 1.2 Annual Average Rainfall of Selected Stations from 2006 to 2015, in millimeters



Source: Philippine Atmospheric, Geophysical and Astronomical Services Administration

From Figure 1.3, the maximum, mean, and minimum temperatures follow the same trend, increasing from January to May; and decreasing from June to December. However, there were sudden increases in the trend of maximum temperature in September and December. Overall, the minimum temperature recorded was 10.6 degrees Celsius; while the maximum was 37.6 degrees Celsius. The coolest month was recorded as January with an average of 25.5 degrees Celsius, while the warmest month was May with an average temperature of 28.5 degrees Celsius.

Figure 1.3 Monthly Maximum Temperature, Monthly Mean Temperature, and Monthly Minimum Temperature of Selected Stations from 2006 to 2015, in degrees Celsius



Source: Philippine Atmospheric, Geophysical and Astronomical Services Administration

1.1.2 Hydrographical characteristics

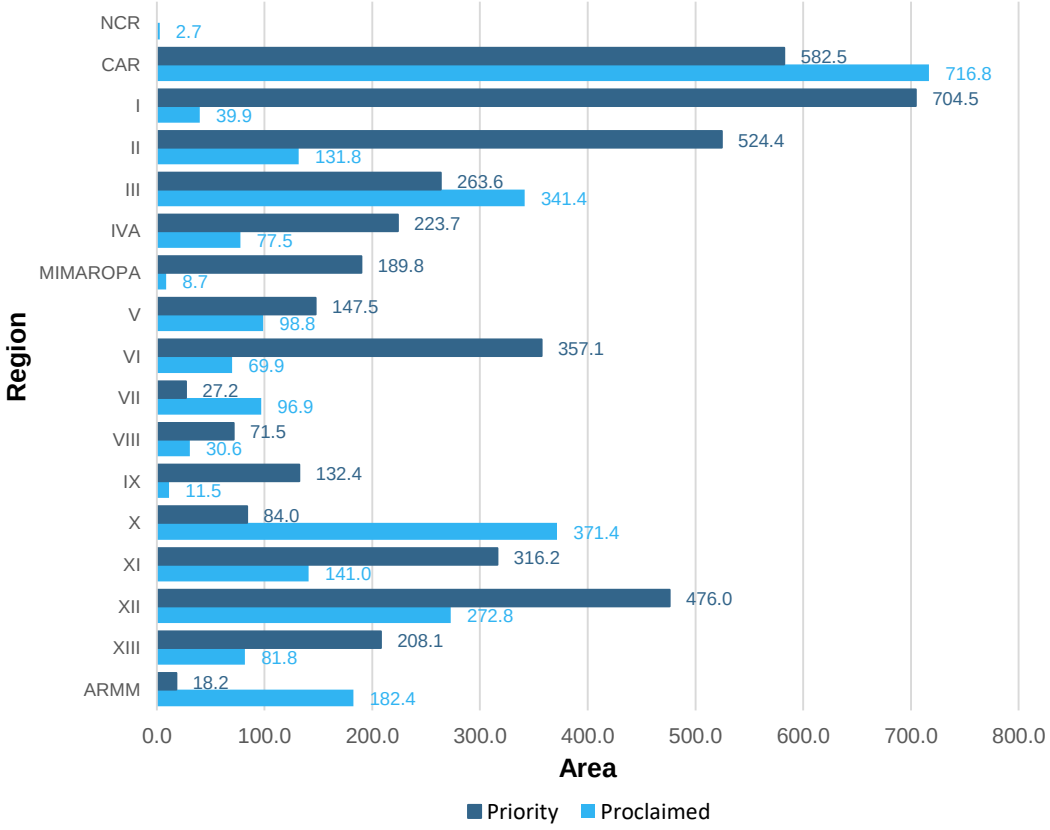
Hydrographical characteristics include information on the location, extent and characteristics of lakes, rivers, and streams, artificial reservoirs, watersheds, seas and aquifers. This information is compiled to serve as basis for understanding water and flows of water.

The core indicator for this topic relates to the description of main watersheds. Data compiled for CPES 2016 include area of proclaimed and protected watersheds by region. Proclaimed watersheds are those that were specifically designated for various purposes such as domestic water supply, irrigation, and power generation *(Forest Management Bureau, DENR)*. On the other hand, priority watersheds, also known as critical watersheds, are those where essential functions are already critically impaired or are likely to be critically impaired thus needing immediate rehabilitation *(Basics of Watershed Management, Mekong Watersheds Information)*.

As of 2015, the Cordillera Administrative Region (CAR) has the largest share in the total area of proclaimed watersheds in the country, although Region III (Central Luzon), with 28 proclaimed watersheds, has the most number. Meanwhile, the National Capital Region (NCR) has the least number, with only one watershed, and with the least share in the total area of proclaimed watersheds of only 2.7 thousand hectares.

Moreover, Region I (Ilocos Region) has the largest share on the total area of priority watersheds, although Region IV-A (CALABARZON), with its 24 priority watersheds, has the most number. On the other hand, NCR has no determined priority watershed.

Figure 1.4 Area of Proclaimed Watersheds by Region as of 2015, in thousand hectares



Source: Forest Management Bureau, Philippine Forestry Statistics 2015

1.1.3 Geological and Geographical Information

Geological and geographical information involves general geological and topographic information along with the characteristics of the country's territory and relief. This information is normally static, that is, it changes very slowly through time. It is helpful to present these statistics in a form of a map. Data for geological and geographical information are helpful to know the agreement on boundaries and understand geological events.

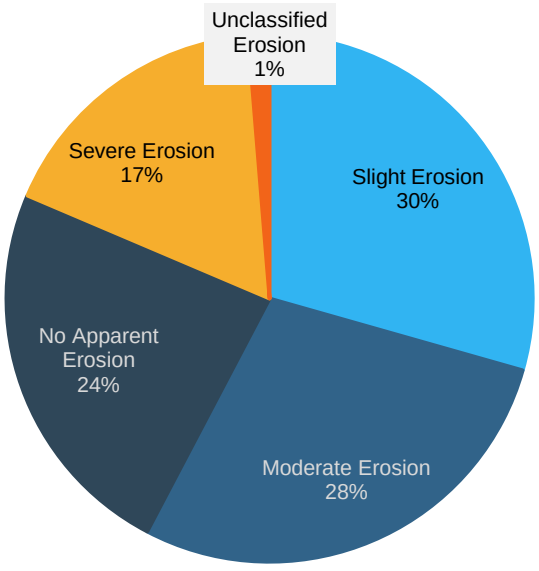
One of the core statistics for this subcomponent is the *area of country or region*. However, there is no available data yet for the total land area of the Philippines and its regions. The data on land cover classifications from NAMRIA, which is used for the core statistics *area under land cover categories* under subcomponent 1.2, can be used as a proxy indicator for this topic. This data is disaggregated by region and land cover categories. The latest available publication is as of 2010.

1.1.4 Soil Characteristics

Soil has many functions to the environment. It serves as base to support the production and cycling of biological resources, provides foundation for establishments, source of nutrients for forest and agricultural matters, and as habitat for other organisms. Based on the FDES, statistics for soil characteristics include soil types and soil degradation which are important in determining the soil's ability to sustain livelihood and human activities.

Based on the latest available data on soil erosion, most (8.8 million hectares) of the soil area of the country were slightly eroded, 8.5 million hectares (28 percent) were moderately eroded and 5.2 million hectares (17 percent) were severely eroded. On the same period, only 7.1 million hectares (24 percent) of the total land had no apparent erosion observed.

Figure 1.5. Area Distribution of Erosion Classes in 1993



Source: Bureau of Soils and Water Management

1.2 Land Cover, Ecosystems and Biodiversity

This subcomponent organizes the interrelated environment statistics on land cover, ecosystems and biodiversity, as well as their recordable changes over time and across locations. Land cover, as defined by the Food and Agriculture Organization (FAO), is the observed (bio)physical cover of the earth's surface. It is one of the indicators of ecosystem type. Ecosystems are community of organisms which have interacting and interdependent relationship. Biodiversity, a measure of ecosystem health, is the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part, including diversity within species, between species and of ecosystems. Biodiversity is a fundamental characteristic of ecosystems, while variability among ecosystems is a fundamental driver of biodiversity.

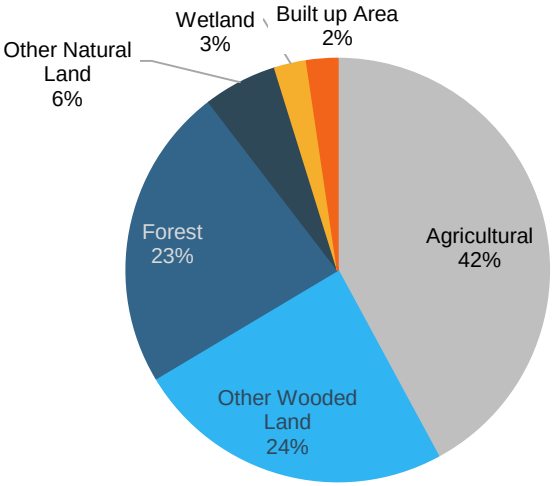
Statistics for this subcomponent are linked to the SEEA Ecosystem Extent, Condition and Biodiversity. For the CPES 2016 compilation, NAMRIA, DENR, specifically the Biodiversity Management Bureau (BMB) and the Forest Management Bureau (FMB) were the main sources of data.

1.2.1 Land Cover

Statistics on land cover include the land area and the area under inland water, coastal water bodies and inter-tidal areas, excluding marine water. It is important to compile data on land cover because human activities are the main drivers in the change of land cover.

As of 2010, the Philippines has about 12.4 million hectares of agricultural land (42 percent), which is the largest share in the country's total land cover area. Other wooded land, which includes areas classified as fallow, shrubs, and wooded grassland, is the second largest land cover, having 7.2 million hectares (24 percent). Forest land is the third largest land cover with an area of 6.8 million hectares (23 percent). Built up area has the smallest land area of only 692 thousand hectares (2 percent).

Figure 1.6 Area Distribution of Land Cover as of 2010



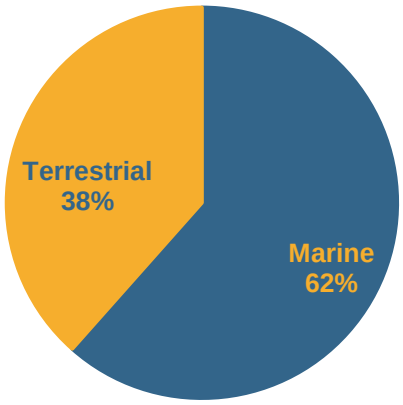
Source: National Mapping and Resource Information Authority

1.2.2 Ecosystems and Biodiversity

Statistics related to ecosystems and biodiversity are critical given the increasing understanding of the role ecosystems play in human well-being and the evidence of biodiversity loss across the planet. Maintaining biodiversity and ecosystem health is necessary to preserve the genetic and ecosystem inheritance of a country, as well as its ecological productivity. This also protects, subsequently, the productivity of ecosystems for the use of the economy and society, which depend heavily on the diversity of ecological systems for human livelihoods (e.g., production, distribution and consumption).

From Figure 1.7, protected areas under the National Integrated Protected Areas System (NIPAS) in the terrestrial ecosystem have larger total area (62 percent) than those in the marine ecosystem (38 percent). Terrestrial ecosystem has 84 protected areas comprising almost 2.2 million hectares. On the other hand, marine ecosystem has 29 protected areas of approximately 1.4 million hectares.

Figure 1.7 Area Distribution of Protected Areas under NIPAS by Ecosystem Type as of 2015

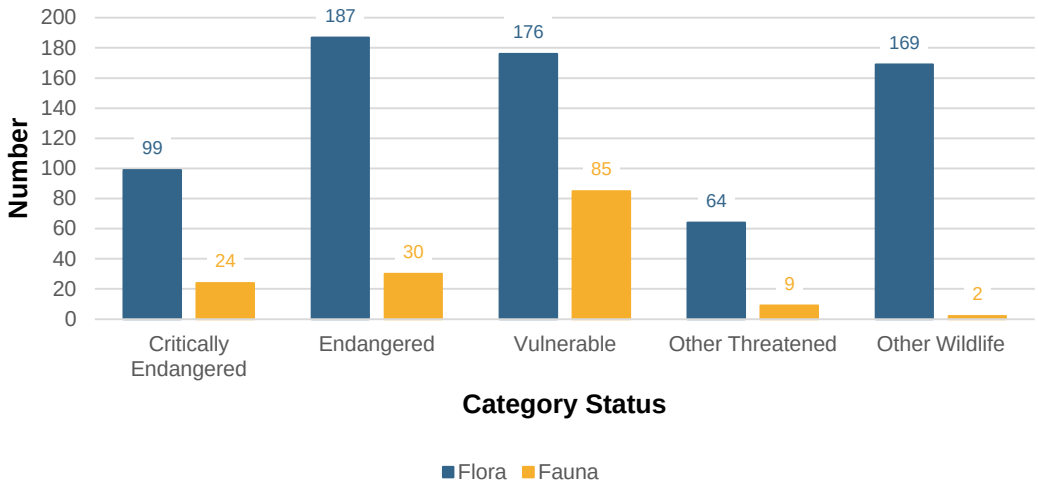


Source: Biodiversity Management Bureau

In the Philippines, the DENR released two administrative orders numbered: 2005-14 with the subject of establishing the list of terrestrial threatened species and their categories, and the list of other wildlife species pursuant to Republic Act No. 9147, and 2007-01 with the subject of establishing the national list of threatened Philippine plants and their categories, and the list of other wildlife species. Based on these, 187 flora species (27 percent) are endangered, 176 (25 percent) are vulnerable, and 169 (24 percent) are other wildlife[2]. For the fauna species, 85 (57 percent) are vulnerable, 29 (19 percent) are endangered, and 24 (16 percent) are critically endangered *(Figure 1.8)*.

[2] Other wildlife are those non-threatened species but have the tendency to become threatened due to habitat destruction or other similar causes

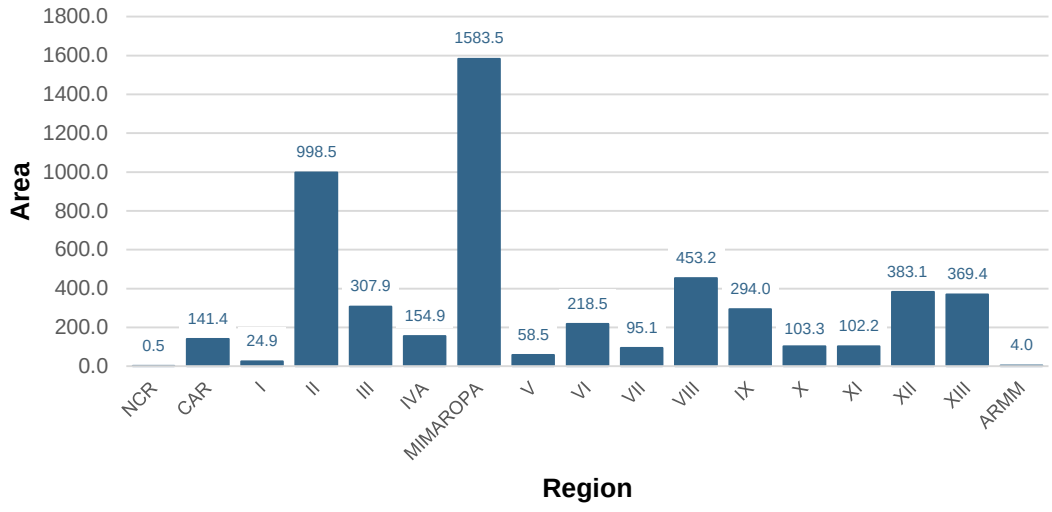
Figure 1.8. Number of Threatened Flora and Fauna by Category Status



Source: Department of Environment and Natural Resources

As of 2012, MIMAROPA has the largest share in the total area of proclaimed protected areas (PA) in the Philippines, which is also the only region having more than one million hectares. However, in terms of the number of proclaimed protected areas in the country, both Region III (Central Luzon) and Region V (Bicol) have the most, with 25 proclaimed PAs each. On the other hand, the National Capital Region (NCR) has the least number, with only 3 PAs and has also the smallest share in the total area with only around 500 hectares *(Figure 1.9)*.

Figure 1.9. Area Distribution of Protected Areas in the Philippines as of 2012, in thousand hectares



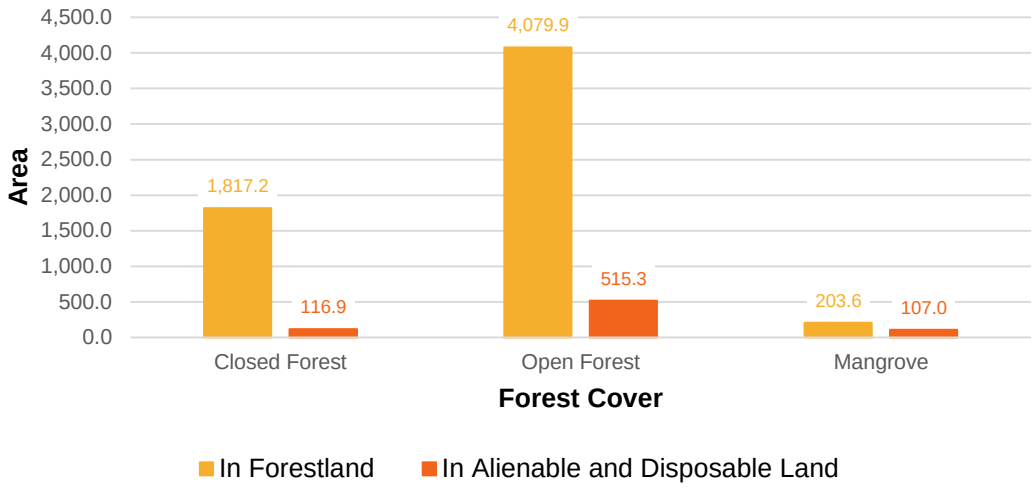
Source: Biodiversity Management Bureau

1.2.3 Forests

Forests provide livelihoods for millions of people around the world. They offer timber, food, shelter, fuel and medicinal products, and also perform significant ecosystem functions such as hydrological regulation, soil protection and biodiversity protection, and act as carbon sinks. The core statistic under this topic is the total forest area.

As seen in Figure 1.10, open forest comprises 67.2 percent of the total forest area in the country. It has a total of 4.5 million hectares wherein 94 percent is in forestland and the remaining six percent is in alienable and disposable (A&D) land. Closed forest has a total of 1.9 million hectares or 28 percent of the total forest area. This cover has more area in forestland than in A&D land. Lastly, Mangrove forest has the least area of about 203.6 thousand hectares or only 4.5 percent of the total forest area in the country.

Figure 1.10. Area Distribution of Forest Cover as of 2010, in thousand hectares



Source: Department of Environment and Natural Resources

1.3 Environmental Quality

Environmental quality deals with the concentration of pollutants in the environment which results from combined and cumulative impacts of human and natural processes. Statistics on environmental quality are important in monitoring pollution impacts to human sub-system and ecosystems.

Statistics for this subcomponent are linked to the SEEA Ecosystem Condition. For the CPES 2016 compilation, the Air Quality Management Section and the Water Quality Management Section of the Environmental Management Bureau, and the Laguna Lake Development Authority were the main sources of data.

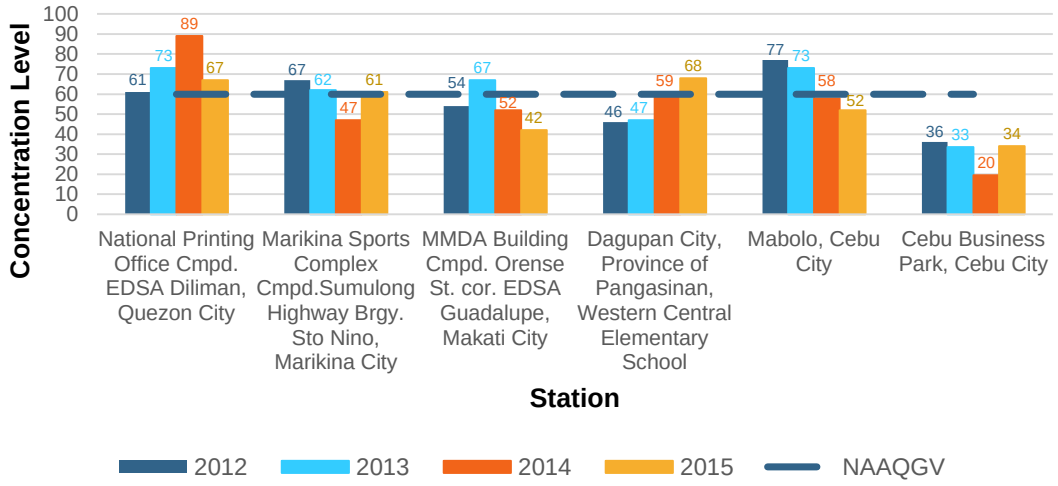
1.3.1 Air Quality

Concentration of air pollutants, suspended solid particles, and other gases are the statistics compiled for this subcomponent. Air quality is measured by monitoring stations which are located mostly near the major sources of pollution. Compilation of these statistics is important to assess the effects of air quality to human and ecosystem health.

Only six out of 73 monitoring stations have complete data on particulate matter 10 (PM_{10}) for years 2012 to 2015. Among these six, Cebu Business Park is the only station that did not exceed 60 microgram per Normal cubic meter (µg/Ncm), which is the annual average for the National Ambient Air Quality Guideline Value (NAAQGV) for PM_{10}.

Meanwhile, monitoring station in the National Printing Office had the most number of exceedances in the guideline for the past four years *(Figure 1.11)*.

Figure 1.11 Concentration Levels of Particulate Mater 10 (PM10) from 2012 to 2015, in micrograms per normal cubic meter



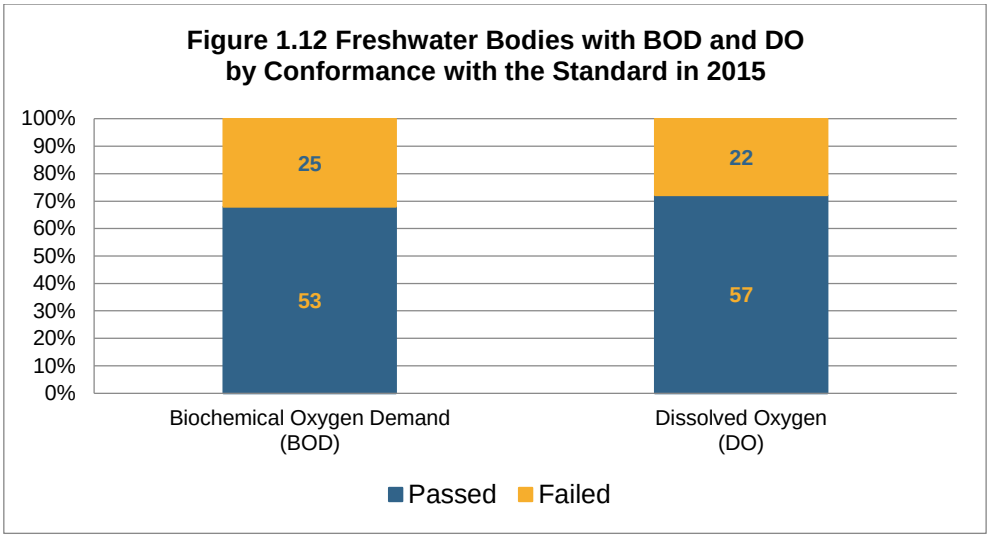
Source: Environmental Management Bureau

1.3.2 Freshwater Quality

Humans and ecosystems cannot survive without sufficient quantities of good quality of freshwater. The quality of freshwater can be described based on the concentrations of nutrients, organic matter, pathogens and contaminants in surface and ground water. Data on water quality are gathered from monitoring stations. Compiling statistics on freshwater quality will be useful for identifying pollutants present in specific locations as well as determining if the quality conforms to the standards.

In the Philippines, the DENR released Department Administrative Order (DAO) No. 1990-34 containing the water classifications *(see Annex)* and water quality criteria for freshwater and marine water bodies. According to this, biochemical oxygen demand (BOD) level for class AA freshwater bodies should be less than one milligram per liter (mg/L) to pass the minimum conditions necessary to assure the suitability of water for its designated use or classification. Also, BOD level should be less than five mg/L for classes A and B, less than seven mg/L for class C, and less than 10 mg/L for class D. Out of 78 selected freshwater bodies in the country, 53 water bodies or 68 percent passed the said criteria while 25 water bodies or 32 percent failed, wherein one is class AA, two are class B, 19 are class C, and one is class D.

On the other hand, dissolved oxygen (DO) level should be greater than five mg/L for classes AA, A, B, and C while greater than three mg/L for class D. Based on the data, 57 water bodies or 72 percent of the 79 selected freshwater bodies passed while 22 water bodies or 28 percent failed, wherein five are class A, 16 are class C, and one is class D.



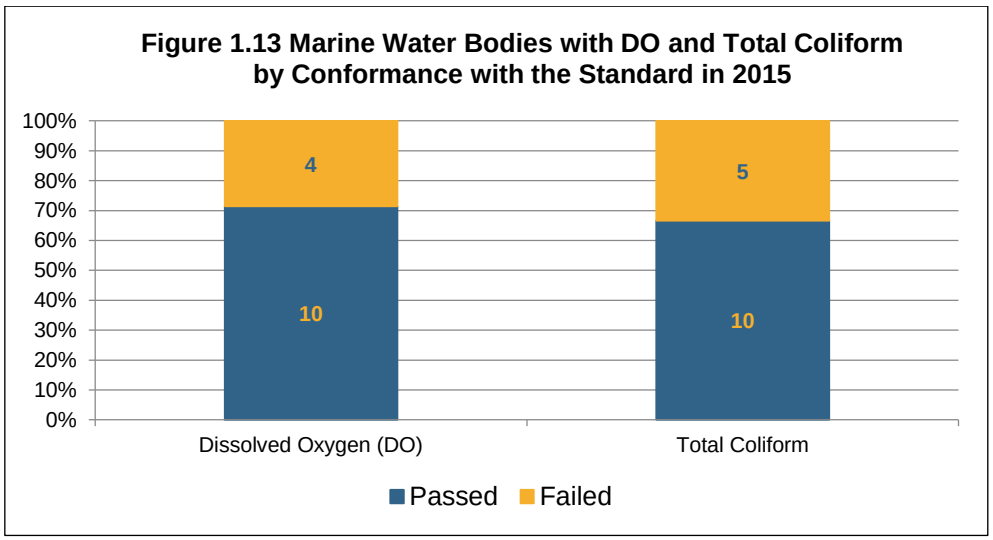
Source: Environmental Management Bureau

1.3.3 Marine Water Quality

Oceans play a significant role in regulating weather and atmospheric processes, absorbing CO_2 emissions and provisioning of food and livelihood to humans. However, due to anthropogenic factors, the marine and coastal waters have been increasingly polluted. With this, compiling statistics on marine water quality is important to address issues on pollution on coastal and marine areas.

According to DAO No. 1990-34, the threshold for classes SA, SB, and SC marine water bodies is five mg/L while for class SD is two mg/L. As seen in Figure 1.13, 10 water bodies or 71 percent of the 14 selected water bodies in the country passed the water quality criteria while four water bodies or 29 percent failed, which are all class SB. *(See Annex for descriptions of classes)*

On the other hand, total coliform geometric mean should be less than 70 most probable number per 100 milliliter (MPN/100 mL) to pass the criteria for class SA; less than 1000 MPN/100 mL for class SB; and less than 5000 MPN/100 mL for class SC. Out of 15 selected marine water bodies, 10 water bodies or 67 percent passed while five water bodies or 33 percent failed, which are also all class SB.



Source: Environmental Management Bureau