Title: Drought conditions and management strategies in the Philippines 1/

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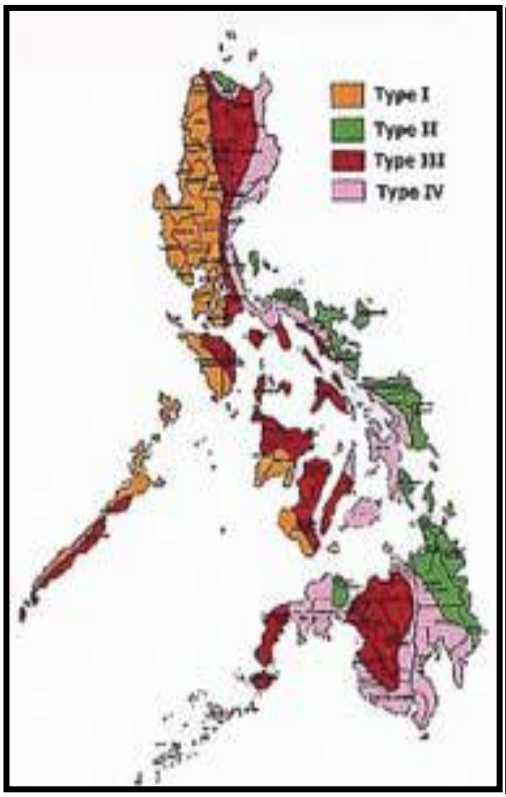
Background:

The climate of the Philippines is influenced by the complex interaction of various factors such as the country's geography and topography; principal air streams; ocean currents; linear systems such as the intertropical convergence zone; and tropical cyclones which are classified as tropical depression, tropical storm or typhoon, depending on their intensities.

The entire country, however, may be characterized by four types or classifications of climate based on the distribution of rainfall**. (Figure 1)**



Type I—has two pronounced seasons: dry from November to April and wet throughout the rest of the year. The western parts of Luzon, Mindoro, Negros, and Palawan experience this climate. These areas are shielded by mountain ranges but are open to rains brought in by Habagat and tropical cyclones.
Type II—characterized by the absence of a dry season but with a very pronounced maximum rain period from November to January. Regions with this climate are along or very near the eastern coast (Catanduanes, Sorsogon, eastern part of Albay, eastern and northern parts of Camarines Norte and Sur, eastern part of Samar, and large portions of Eastern Mindanao).
Type III—seasons are not very pronounced but are relatively dry from November to April and wet during the rest of the year. Areas under this type include the western part of Cagayan, Isabela, parts of Northern Mindanao, and most of Eastern Palawan. These areas are partly sheltered from tradewinds but are open to Habagat and are frequented by tropical cyclones.
Type IV—characterized by a more or less even distribution of rainfall throughout the year. Areas with this climate include Batanes, Northeastern Luzon, Southwest Camarines Norte, west of Camarines Sur, Albay, Northern Cebu, Bohol, and most of Central, Eastern, and Southern Mindanao.

Figure 1: Climate type in the Philippines based on Coronas Classification

Seasonal and inter annual extrewme climate variability in the Philippines, as in many parts of the world, are significantly influenced by the El Niño Southern Oscillation Phenomenon (ENSO). Historical records from the **Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA),** showed that major drought events in the Philippines are associated with the occurrences of El Niño events, which refer to the warm phase of the ENSO Phenomenon in the Eastern and Central Pacific Ocean (CEEP). During the last half century (1960-2010), there have been 15 weak to strong El Niño episodes which caused adverse socio-economic impacts in the country. The most recent El Niño episode was in 2010.

Seasonal aridity in the Philippines is exacerbated by the increasing incidence of El Niño events, which is now occurring at a two- to three-year cycle from previous five-year interval**.**

Looking on the future scenario, the climate projections done by the PAGASA (i.e., under the mid-range emission scenario) for 2020 and 2050 indicate that all areas of the Philippines will get warmer, with largest increase in temperatures in the summer months of March, April and May (MAM). Mean temperatures in all areas in the Philippines 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. Generally, there is reduction in rainfall in most parts of the country during the summer (MAM) season. However, there is likely increase in rainfall during the southwest monsoon season in June, July and August (JJA) until the transition months of September, October and November (SON) in most areas of Luzon and Visayas. Increase in rainfall is also likely during the northeast monsoon months of December, January and February (DJF), particularly in provinces/areas characterized as Type II climate. There is, however, a generally decreasing trend in rainfall in Mindanao, especially by 2050 (PAGASA 2011).

Drought monitoring and early warning systems:

Drought is a deficiency in precipitation that leads to deficits in water supply relative to human and environmental needs. It has physical components (i.e. deficiency in precipitation) and environmental, social, or economic components (i.e. need or demand) (Adler___). The government has put in place monitoring and early warning systems since the early 1980s, organized task forces, and implemented relevant programs and projects. These include

- The **Drought Early Warning and Monitoring System (DEWMS)** was developed in 1986-1987 El Niño. The main objective is to provide timely weather condition assessments and other information needed by various end-users particularly policy-decision makers, economic planners and other concerns on crisis management regarding food security, water and energy resources, among others, for purposes of mitigating potential adverse impact of drought.

- An **Inter-agency Task Force on El Niño** was created in September 1997 to formulate action plan and develop strategic programs to help affected population cope with the phenomenon and to minimize its adverse effects.

- Recently, there are two methods of monitoring drought in the Philippines: **network of meteorological stations established nationwide**; and **information that may be generated from other sources such as local information, drought indices and hazard map and use of empirical and statistical computer-generated prediction models**. However, considering its high reliability, faster and larger range of visually monitoring drought incidence, the use of remote sensing is becoming a vital tool in estimating and forecasting spatial extent, intensity and duration of drought in a given area.

Meteorological Observation Networks such as Agro-meteorological stations, meteorological and synoptic stations established in strategic sites in the country gather near-real time meteorological parameters such as ambient air temperature, relative humidity, solar incidence, evapotranspiration, wind speed and direction, and other parameters. These data are compiled in databases and analyzed for historical trend and in development of forecasting or prediction computer models for spatial and temporal probability models of drought occurrence. From these information, drought forecasts, climate updates, drought advisories, water supply condition and potential impact assessment reports are generated and transmitted to the end-users through modern communication technology.

Vulnerability assessment:

Based on previous drought events brought by El Niño the most vulnerable sectors of the economy are:

1. **Agriculture and Fisheries**

   According to Benson (2009), the toll of disasters is already high in the Philippines which significantly affect agriculture. Between 1990 and 2006, agricultural damage alone stood at PhP12.431bn per year (63% of the total damage) of which about PhP2.23bn per year or 17.9% are due to drought. The most affected crops are rice, corn, vegetables and fisheries usually being raised by small-holder farmers and fisher folks due to crop failures and reduced irrigated areas. For instance, during the 1997-1998 El Niño, the growth of agriculture suffered a contraction or a negative growth of 6.6%. Swine and poultry incurred huge losses during the period with 79% and 67% change in population while the fishery sector incurred losses amounting to about PhP 7.2 Bn. There was always a slump in rice production every El Niño event (i.e. 1982, 1987, 1992, 1998)

2. **Domestic water supply and power sector**

El Niño induces drought and delays the onset of monsoons**.** It may result to scarcity in drinking water in urban areas and shortfalls in hydro-electricity generation because of reduced water levels in major dams. During the period 1989-1990, due to drought events, the country incurred a hydropower generation loss of PhP 348M while the water production in Metro Manila was cutback. During a severe drought during the period 1991-1992, a 20% shortfall in Metro Manila's water supply.

In 1997-1998, about 70% of the country experienced a severe drought due to El Niño. Major dams' water level went down to critical level. In Angat Dam, the major source of water supply for Metro Manila, monthly inflows were just 31.6% of normal. Reduction in power generation from 26.4% to 58.9% was experienced during the same period

3. **Environment and Natural Resources**

Drought also had tremendous impact on the environment and natural resources. Marine resources were affected. Mass coral bleaching was observed during the 1997-98 ENSO. The decrease in coral cover ranged from 46% to as high as 80% in Bolinao, Pangasinan (Guiang, 2004). The same ENSO caused extensive destruction of watershed areas through forest fire. (Jegillos et, al.). Decrease in stream flow was observed during the 1997-98 ENSO events in Pantabangan-Carranglan watershed, that serves a total area of about 103,000 hectares across 24 municipalities in Nueva Ecija, Bulacan and Pampanga provinces (Lasco et, al., 2006). The environmental impacts also include degradation of soil especially in areas where there had been prolonged drought conditions, high forest fire risk coupled with degradation in forest growth, and others.

Most affected by drought are the poor due its social and economic impacts. During drought events, there is the disruption of normal human activities, migration to urban communities, human and health problems brought about by scarcity of water. Unemployment due to significant reduction in production, revenue losses of a number of industries affects society but hurt most the resource-poor communities.

Emergency relief and drought response:

An institutional structure was developed in 1987-1988 under the lead of the National Disaster Risk Reduction and Management Council (NDRRMC), upon whom the recommendation of its Council Chairman, will be sent to the Philippine President, who is then responsible to declare that the areas within the country affected by the hazard is declared under the State of Calamity (Lalap, 1991). This proclamation enables the government to immediately provide assistance by:

- controlling overpricing and hoarding of prime commodities;
- delaying payment of taxes and amortizations owed to the government; and
- the release of budget for the calamity fund.

The Inter-agency Committee on Water Crisis Management is responsible for water management during drought situation including setting up of priorities on water use. This committee was created in 1987 and meets regularly during period of water crisis to monitor water supply and identify priorities. Reports issued routinely on water supply or forecast by existing government agencies such as the Weather Bureau or PAGASA are forwarded to this Committee for review and consideration. Recommendations are transmitted to NDRRMC for future action. The media is a major partner of the government in the information and awareness campaign (Lalap, 1991).

The drought response plans are generally connected to food security programs considering that agriculture is most vulnerable to climate change variability. Some of the drought response plans prepared by different concern agencies are the following;

The Action Measures for Vulnerable Areas of the Department of Agriculture, El Nino Briefing Materials, Malacanang, Manila, 28 May 2002

- Ensuring water availability in production areas through irrigation (shallow tube wells) and cloud seeding
- Shifting of planting calendars or early planting
- Planting early maturing crops requiring less water and more tolerant to drought
- Livelihood assistance to compensate for farm/fishery income loss;
- Emergency food assistance
- Provide insurance coverage to affected areas
- Water rationing
- Promotion of alternative crops as replacement for major staples

On the other hand, action measures for Less Vulnerable Areas (DA, El Nino Briefing Materials, Manila 28 May 2002) are:

- Providing seeds, planting materials and fingerlings;
- Fertilizer support (organic/inorganic)
- Further irrigation development

Practices to alleviate drought impacts:

The following measures and practices applied by government and other supporting institution including NGO prior to or during drought in view of reducing drought impacts. This includes:

- Establishment of Small Rainwater Harvesting Structures like Small Water Impounding Projects and Small Farm Reservoirs.
- Rehabilitation of Upland Small Scale Irrigation Systems for Upland Productivity and Natural Resources Sustainability.
- Distribution of pump and engine sets to lowland areas with shallow ground water and surface water.
- Community-based watershed management for Sustainable Water Resources and Livelihood Development in Critical Watershed of selected Irrigation Systems.
- Establishment of Agro- meteorological Stations in Highly Vulnerable Agricultural Areas; A tool for Climate Change Adaptation and Development of Local Early Warning Systems
- Promotion of Farm Wastes Recycling and Re-use for Organic-based Agriculture Development in Vulnerable Upland and Lowland areas.
- Promotion of water–saving technologies (WST) in Irrigated Rice Production System.
- Conduct of cloud seeding operation specially when there is threat of dry spell or drought that may affect standing crops and critical reservoir level.
- Recommend the planting of early maturing varieties and other alternative crops that consumes less water.
- Crop insurance system
- Information campaigns by tri-media

The need for knowledge and skills on drought management:

Proper drought management can be realized through knowledge and skills development focused on the following:

- Knowledge and skill development to better understand the influences of climate variability/extremes particularly drought in agricultural production, watershed management and biodiversity conservation;
- Analytical tools to describe the weather extremes and climate variability such as skill to develop drought forecasting mathematical or statistical stochastic models with high level of adequacy and reliability; decision support system;
- Development of more appropriate monitoring and early warning systems for drought especially the use and application of remote sensing;
- Development of the improvement of the access capacity of the end users to early warning and advisories, to give enough lead time on possible occurrence of extreme events and seasonal anomalies;
- Application of early warnings systems and forecasting in decision making;
- Awareness on weather and climate extremes, variability and change as it impact on agricultural productions, watershed management and biodiversity management;
- Development of policy measures or enabling environment in terms of access to new innovation and technologies to adapt to climate variability and extremes;
- Capacity building (human resource & infrastructure)

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