ADDRESSING CLIMATE CHANGE THROUGH SCIENCE

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The Philippines is projected to be one of the most vulnerable countries to the impacts of future climate change. At the same time, it is one of the most disaster-prone countries in the world, mostly due to climate-related disasters. More alarming still, climate change is expected to exacerbate extreme events such as heavy precipitation and tropical cyclones. The science community must do its share in helping the country prepare for the onslaught of a warming world.

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Climate Change Scenarios for the Philippines

Future Changes in Mean Air Temperature (Figure 1)
- Mean temperature will increase by about 0.7°C to 1.0°C by 2020.
- Mean temperature will increase by about 1.6°C to 2.0°C by 2050.
- Temperature will increase by about 2.5°C to 3.4°C by 2100.

Observed and Projected Annual Mean Temperature Anomalies for the Philippines
Period 1951 to 2100 (Departures from 1971-2000 normal values)

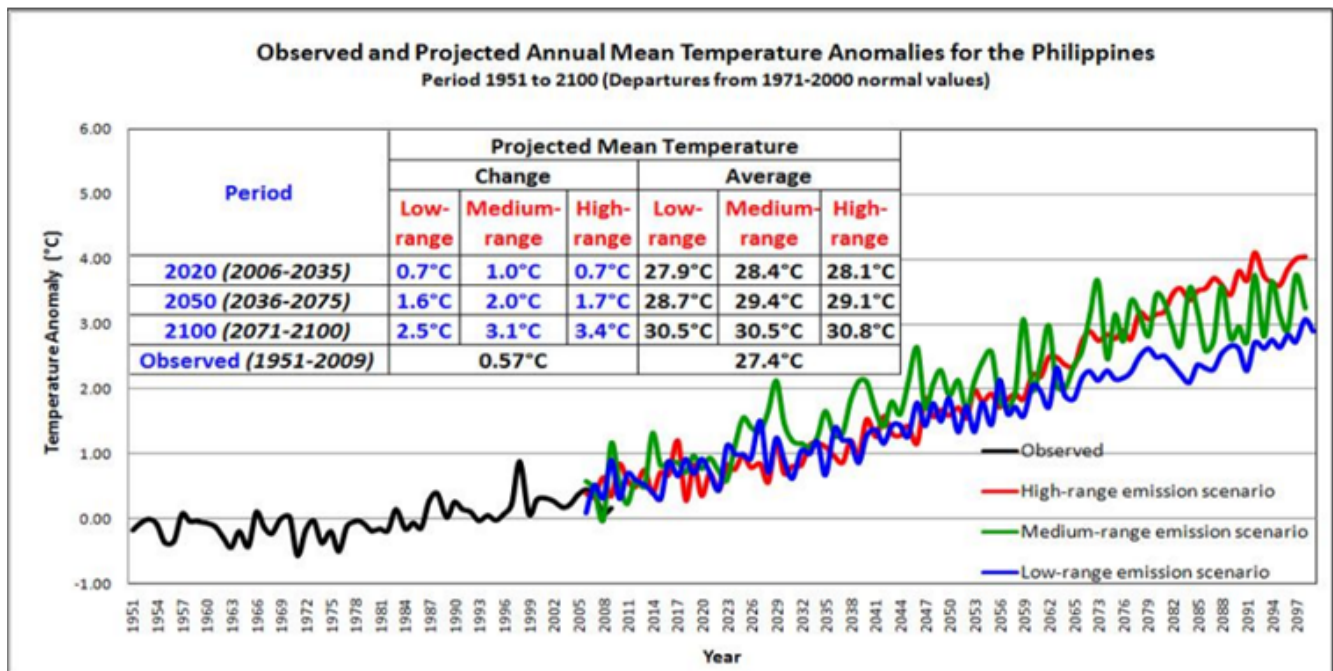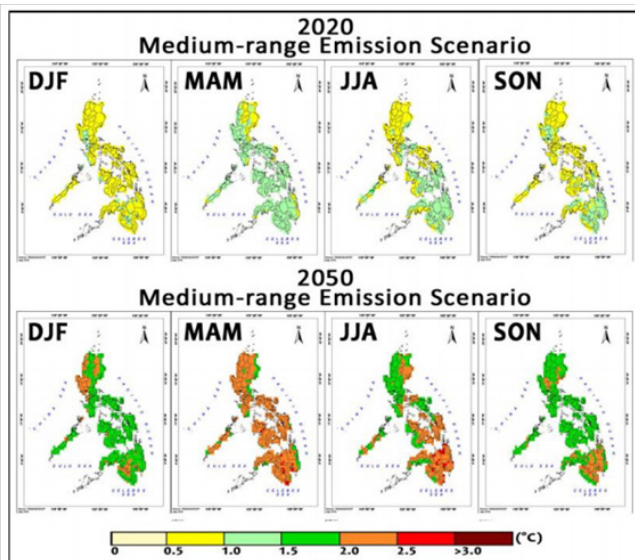| Period | Projected Mean Temperature | | | | | |
| | Change | | | Average | | |
	Low-range	Medium-range	High-range	Low-range	Medium-range	High-range
2020 (2006-2035)	0.7°C	1.0°C	0.7°C	27.9°C	28.4°C	28.1°C
2050 (2036-2075)	1.6°C	2.0°C	1.7°C	28.7°C	29.4°C	29.1°C
2100 (2071-2100)	2.5°C	3.1°C	3.4°C	30.5°C	30.5°C	30.8°C
Observed (1951-2009)	0.57°C			27.4°C		

Figure 1. Response in local climate (temperature increases) to the high-, mid- and low-range emission scenarios and how these values will diverge in the future (PAGASA, 2011).

Figure 2. Maps showing the projected seasonal temperature increase (in °C) in the Philippines in 2020 and 2050 (PAGASA, 2011).

Future Changes in Seasonal Temperature (Figure 2)
- The highest increase in temperature will be during the summer months (March, April and May).
- In general, Mindanao will experience higher temperature increase than the northern part of the country.
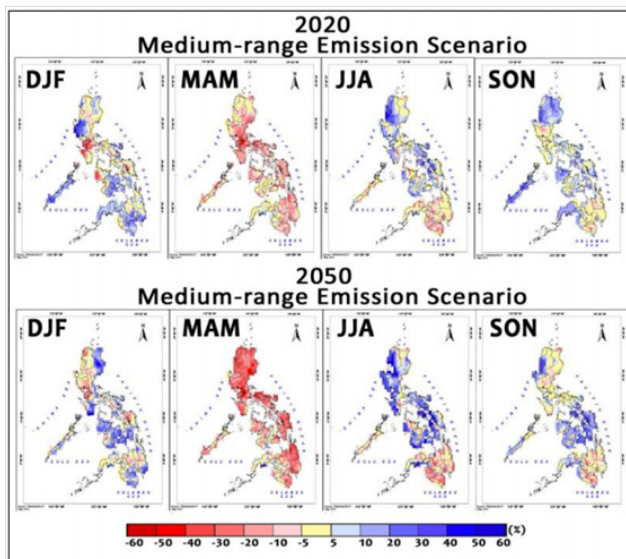
Future Changes in Rainfall (Figure 3)
• A reduction in rainfall for seasons DJF, MAM and SON in most parts of the country both in 2020 and 2050.
• Significant increase in rainfall during JJA is likely in most parts of Luzon and Visayas in 2020 and 2050.
• Dry season will be longer as shown by reductions in rainfall from DJF, SON, and MAM in most parts of the country.

Figure 3. Maps showing the projected rainfall change (increase/decrease) in % in 2020 and 2050 in the Philippines (PAGASA, 2011).

Future Changes in Extreme Events
• It is very likely that hot temperature and heavy precipitation will continue to become more frequent in the future.
• Number of days with maximum temperature >35°C is expected to increase in all parts of the country in 2020 and 2050.
• Extreme rainfall is projected to increase in Luzon and Visayas in 2020 and 2050.

Climate Change Impacts and Research Priorities

While there is unanimity that climate change could adversely affect natural and social systems in the country, with the poorest of the poor especially vulnerable, there are very limited evidence-based information. As a result, policy-makers remain largely in the dark on the specifics of how to prepare for climate change. In what follows, we provide a succinct account of how climate change may impact various sectors and what are the key priority research areas.

1. Food security

Climate change threatens food production through a number of ways. First, warming temperature and changing rainfall patterns could affect the physiology of major crops. Preliminary research has shown a potential decline of rice yield and those of other major crops. However, global studies on rice and other crops show that the CO_2 gas fertilization could lead to higher yields. Second, sea level rise could inundate crop growing areas, thus, reducing total arable land. Third, extreme events such as tropical cyclones could increase in intensity and frequency leading to greater damage to crops and infrastructure. Fourth, changing rainfall patterns could lead to flooding and droughts which will depress crop yields.

Research priorities:
• Modeling research using downscaled climate scenarios to project yields of crops, livestock and fisheries in the future
• Socio-economic research on the impacts of climate change to small holder farmers
• Assessment of adaptation strategies for small holder farmers and fisherfolks

2. Water

Climate change could bring higher rainfall during the wet season and drier climate during the dry season. These will modify stream flow, dam operation and water allocation, domestic water supply, irrigation, hydro power generation, depth and recharge of aquifers, water quality, watersheds, and fishery. These, in turn, could adversely affect food and human security and the economy.

Research priorities:
• Modeling climate change impacts on water supply for domestic, power, and irrigation needs
• Identifying most vulnerable river basins
• Assessment of adaptation strategies focusing on water infrastructure, flooding, drought, and increasing water use efficiency

3. Natural ecosystems

Climate change could alter our forest ecosystems

and the biodiversity they harbor. Initial research has shown the drier forest types maybe the most vulnerable as overall rainfall increases. Modeling of the potential impacts at the species level of both flora and fauna is still in its infancy. Forest ecosystems are also vital in the mitigation of greenhouse gases in the atmosphere through carbon sequestration. Natural forests in the Philippines store significant amount of carbon while open areas could be reforested to sequester more carbon.

Coastal and marine ecosystems such as mangroves and coral reefs could be affected by sea level rise and warming temperatures. These will lead to loss of mangrove forests, coral bleaching, landward intrusion of seawater in estuaries and aquifers, and submergence and inundation of low-lying areas.

Research priorities:
• Modeling of climate change impacts at the ecosystems and species levels
• Assessment of adaptation strategies for natural ecosystems and local communities living within and around forests
• Measurement of carbon sequestration rates of individual species and at various ecological zones

4. Health

It is expected that the health sector will likewise share the brunt of the impacts of climate change. This could include increases in endemic morbidity and mortality due to diarrheal disease, exacerbation of the abundance and/or toxicity of cholera due to increases in coastal water temperature, and an expansion of the natural habitats of vector-borne and water-borne diseases.

Research Priorities:
• Assessment of the vulnerability of the health sector to climate change
• Improvement of climate-sensitivity and increase in responsiveness of public health systems and service delivery mechanisms to climate change
• Establishment of mechanisms to identify, monitor and control diseases brought about by climate change

Climate Change Mitigation

The Philippines' contribution to the total global greenhouse gas (GHG) emissions is insignificant compared to the rest of the world. In spite of this, the country can help mitigate climate change by cost-effective measures to reduce GHG emissions,

including increased energy efficiency and conservation, development and increased utilization of appropriate low carbon and renewable energy technologies, and by reducing emissions from deforestation and forest degradation. To maximize the contribution of forest ecosystems, the Philippines is exploring carbon credits from the so-called REDD+ or reducing emissions from deforestation, forest degradation, and carbon sequestration.

The Way Forward

As one of the most vulnerable countries in the world to climate change, it is to our best interest to develop evidence-based climate-risk adaptation policies, strategies, and technologies. The science community will continue to play a critical role in defining how we respond to the challenge of climate change.

References

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The NAST Climate Change Task Force has held several roundtable discussions which have enabled scientists and policy-makers to interact and explore ways by which the country can address climate change. Among the topics that have been addressed by previous RTDs include the links of climate change to the following: water resources, agriculture and food security, biodiversity and the economy.

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