Climate Change Adaptation in the Philippine Setting

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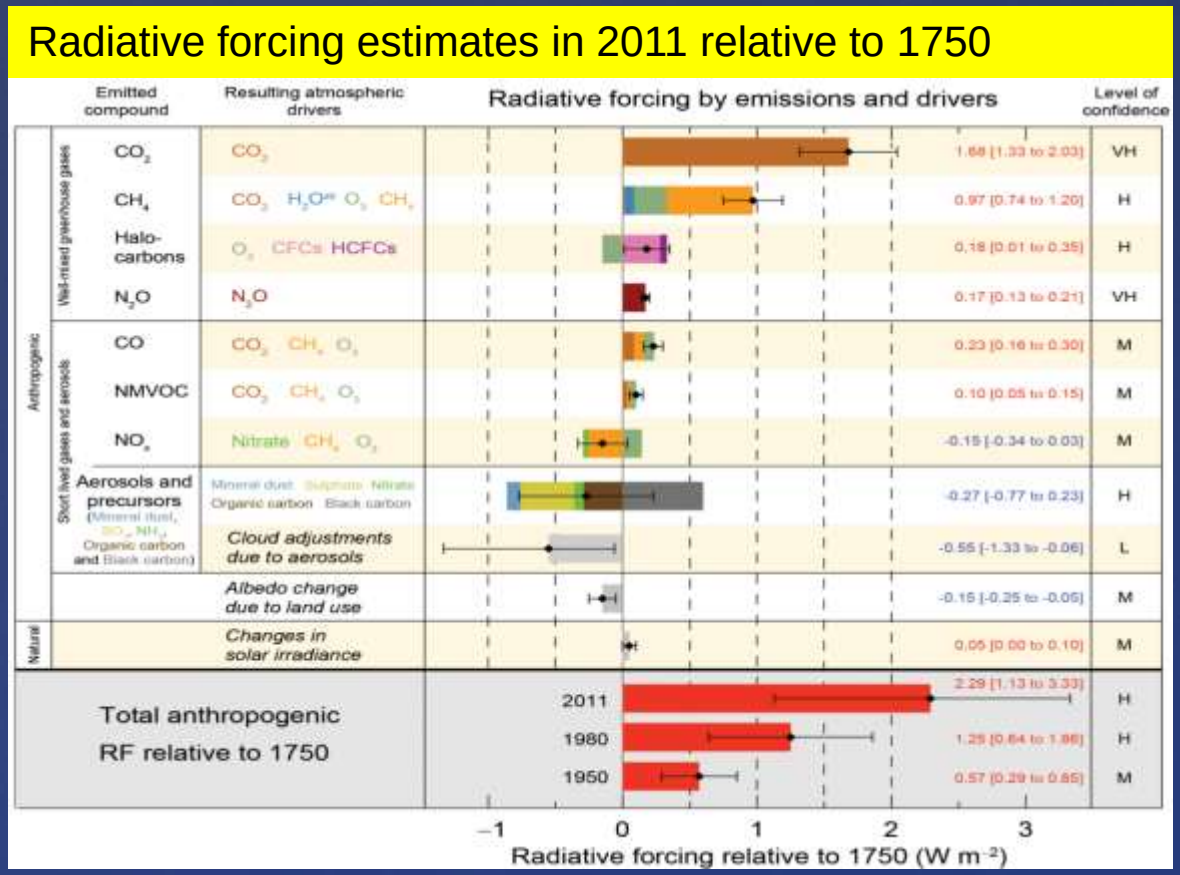
What is happening?

A recent report by the Working Group 1 to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC-AR5)), a global group of experts on climate studies had recently been released in September 2013.

"Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millenia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased."

(IPCC-AR5)

Working Group 1 Contribution to the IPCC 5th Assessment Report



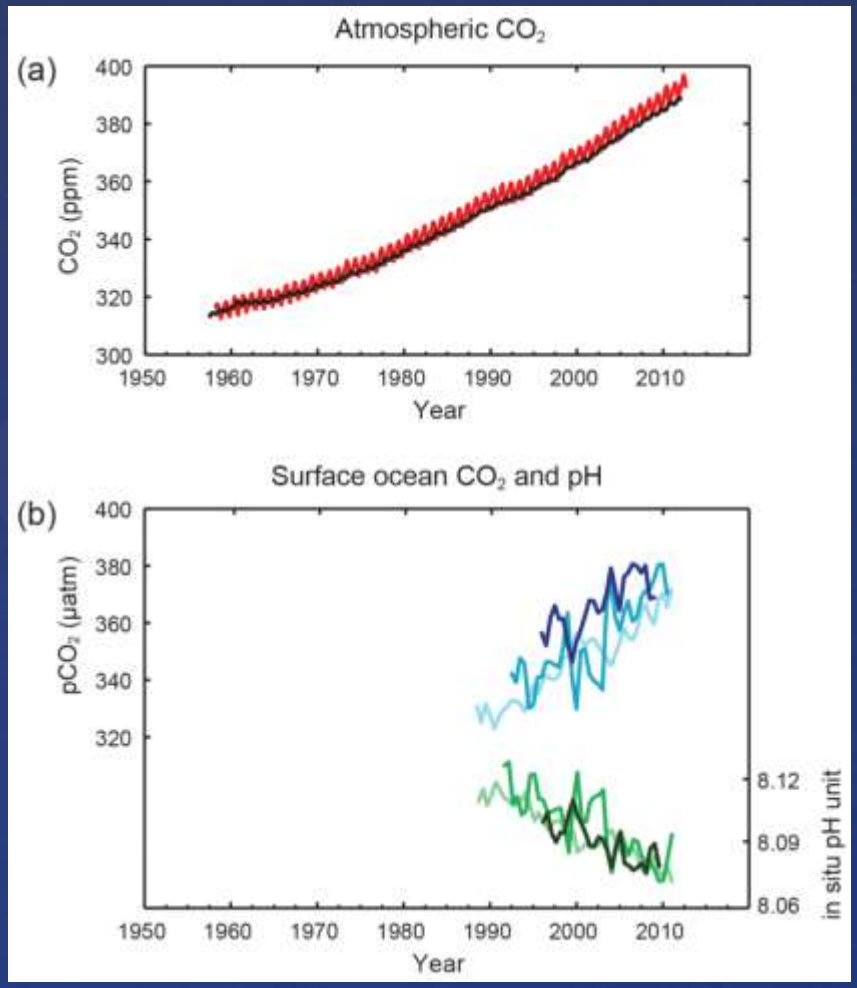
IPCC AR5 WG1

Human influence on the climate system is clear. This is evident from the increasing greenhouse gas concentrations in the atmosphere, positive radiative forcing, observed warming, and understanding of the climate system.

Working Group 1 Contribution to the IPCC 5th Assessment Report

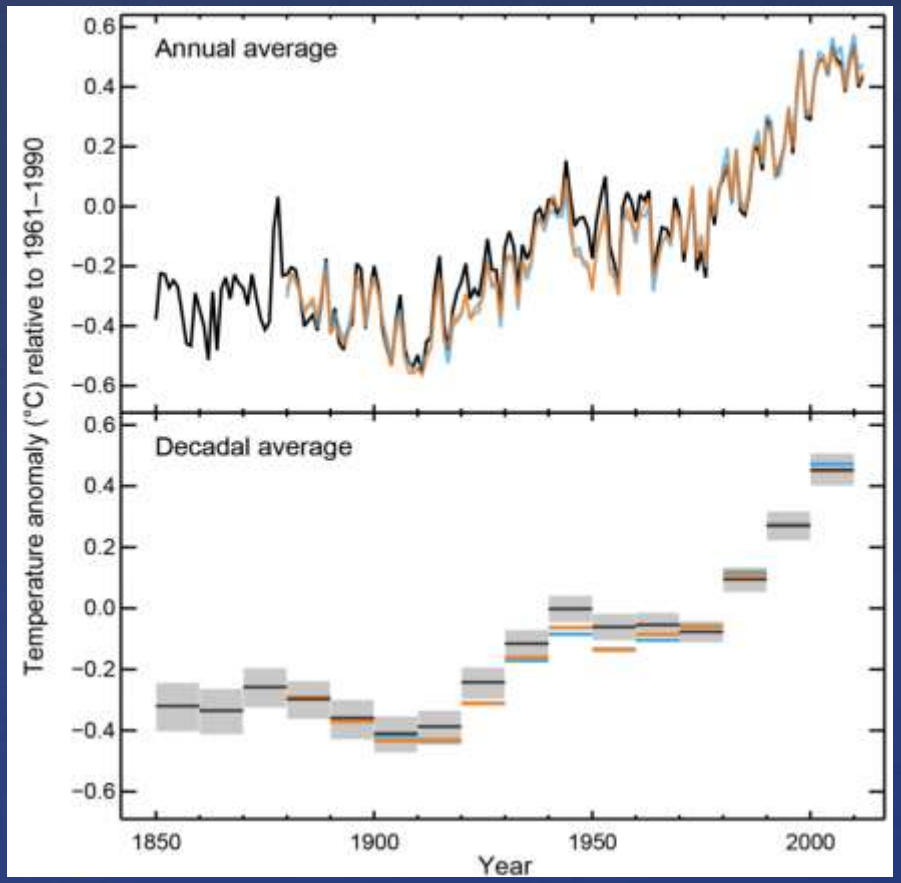
Multiple observed indicators of a changing global carbon cycle

The atmospheric concentrations of CO_2, CH_4 and N_2O have increased to levels unprecedented in at the last 800,000 years. CO_2 concentrations have increased by 40% since the pre-industrial times. **The ocean has absorbed 30% of the emitted anthropogenic CO2, causing ocean acidification.**



Working Group 1 Contribution to the IPCC 5th Assessment Report

Observed globally averaged combined land and ocean surface temperature anomaly 1850-2012



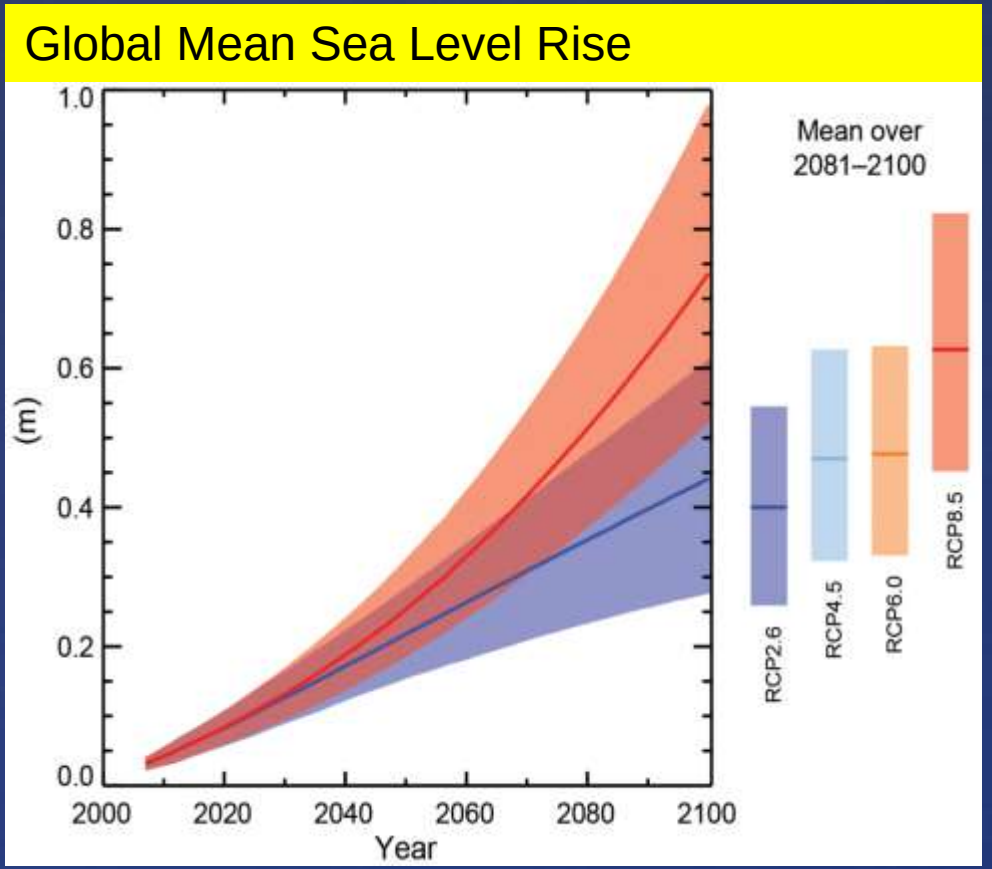
IPCC AR5 WG1

The globally averaged combined land and ocean surface temperature data show a warming of 0.85 [0.65 to 1.08° C over the period 1880-2012. The total increase between the average of the 1850-1900 period and the 2003-2012 period is 0.78 [0.72 to 0.85] ° C.

Working Group 1 Contribution to the IPCC 5th Assessment Report

- The rate of sea level rise since the mid-19th century has been larger then the mean rate during the previous two millennia. Over the period 1901 to 2010, global mean sea level rose by 0.19 [0.17 to .21] meters.

- Sea level rise will occur mostly as a result of the thermal expansion of warming ocean waters, the influx of freshwater from melting glaciers and ice, and vertical movements of the land itself.



IPCC AR5 Working Group 1

THE PHILIPPINE STAR
TRUTH SHALL PREVAIL

Asia is most disaster prone region – UN report

By Pia Lee-Brago (The Philippine Star) | Updated April 1, 2013 - 12:00am

MANILA, Philippines - Asia again topped the list as the most disaster-prone region in the world, both in terms of number of disasters and victims, the United Nations Office for Disaster Risk Reduction (UNISDR) said recently.

One of the most damaging disasters was typhoon "Pablo," which left at least 1,900 dead or missing in Mindanao last December. It also destroyed more than 210,000 houses, vital infrastructure, and vast tracts of agricultural lands.

The UNISDR said thousands of people died in extreme disasters in 2012, and property worth more than $100 billion was lost for the third year in a row.

Philippine News
Since 1961

By CARLO SUERTE FELIPE

MANILA, Philippines — The Philippines is the most disaster-prone country among five Southeast Asian countries that also includes Cambodia, Laos, Indonesia and Vietnam, a senior researcher fellow at the Philippine Institute for Development Studies (PIDS) said.

The Philippines had 228 weather and climate-related natural disasters in the last two decades, according to PIDS environment researcher Danilo Israel.

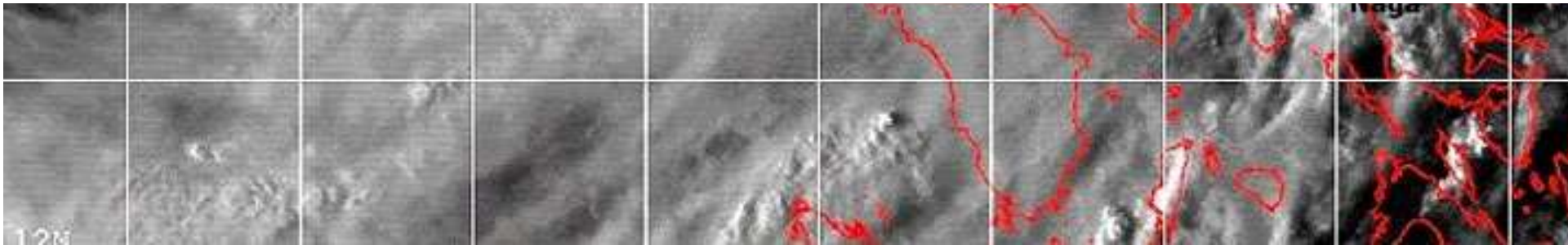
From 2000 to 2009 there were 320 climate-related disasters in the five countries, almost twice the 195 that occurred during the 1990s, Israel said.

Relatively, the total number of people affected rose from 69.5 million in the 1900s to 84.3 million in the 2000s, he said.

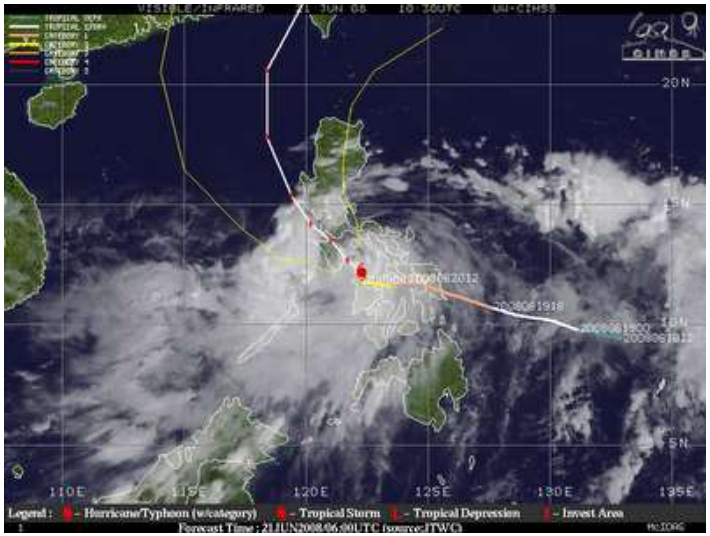
In his Policy Notes published last 2011, around 15 to 20 typhoons annually occur in the Philippines causing major floods, landslides and other related disasters.

Philippine Vulnerabilities to Climate Change

ACCORDING TO THE UNITED NATIONS, VULNERABILITY TO CLIMATE CHANGE WILL BE GREATER IN DEVELOPING COUNTRIES, WHICH ARE LOCATED IN WARMER LATITUDES, LIKE THE PHILIPPINES.

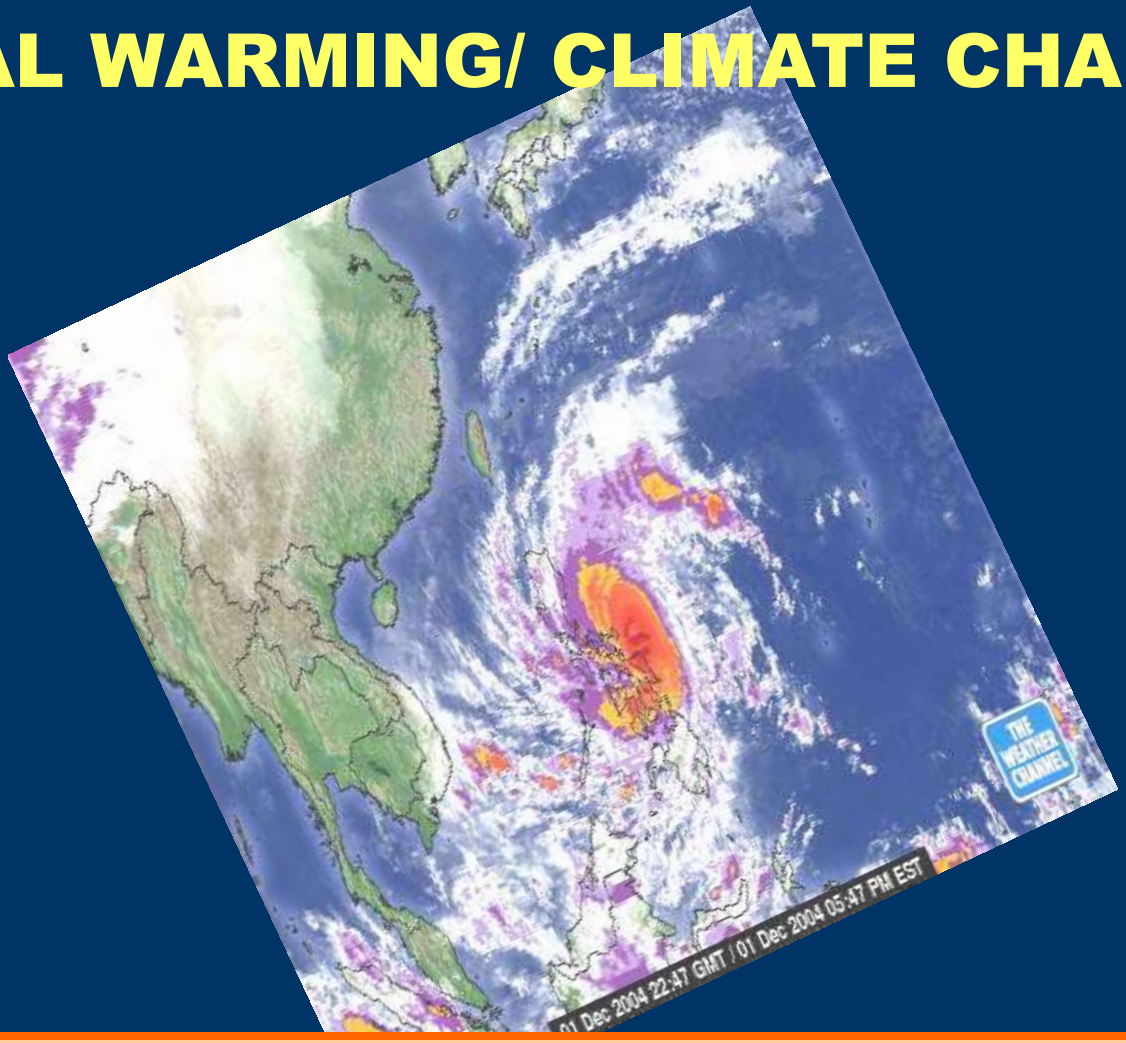


RP: Highly Vulnerable

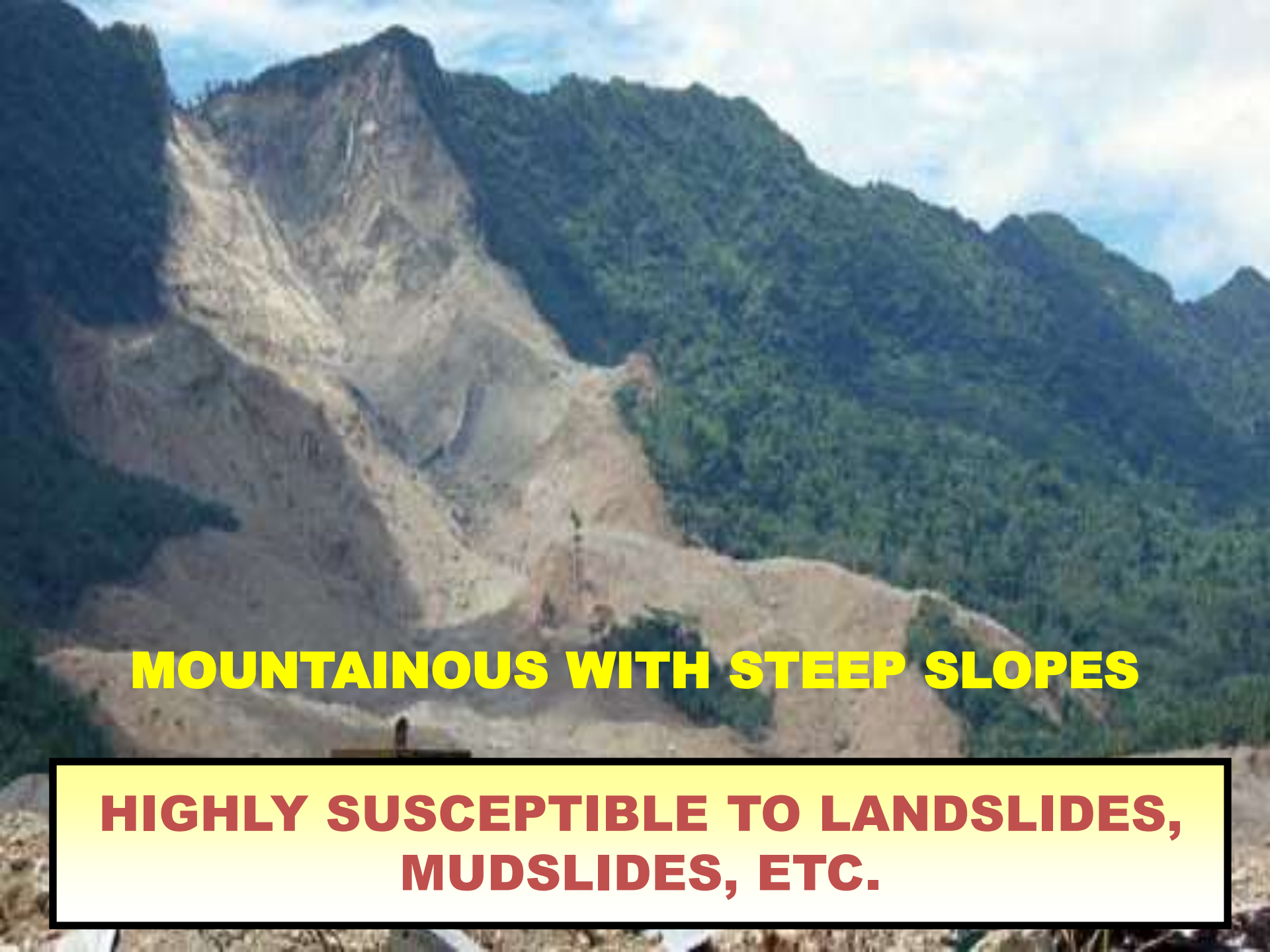


- humid equatorial climate, with an average of 20 tropical cyclones a year
- other natural hazards: landslides; active volcanoes; earthquakes
- forest cover decline rate: 2%/yr (INC)
- poverty incidence: 33% of pop (2006)
- major infectious diseases:
  - food/water-borne
  - vector-borne

PHILIPPINE VULNERABILITIES TO GLOBAL WARMING/ CLIMATE CHANGE



HIGHLY SUSCEPTIBLE TO TYPHOONS –
LOCATED WITHIN PACIFIC TYPHOON BELT AREA


MOUNTAINOUS WITH STEEP SLOPES
HIGHLY SUSCEPTIBLE TO LANDSLIDES, MUDSLIDES, ETC.

HIGHLY SUSCEPTIBLE TO FLOODINGS AND INUNDATIONS

- Archipelago, composed of low lying small islands
- 70% of cities and municipalities are coastal areas
- Highly susceptible to **flooding** and **storm surges**

Low Agricultural Productivity

Rice production will largely be affected because of changes in temperature and rainfall. For every 1° C increase in temperature, rice yields will decrease by 10%-15% (IRRI). This will directly threaten food security.

HIGHLY SUSCEPTIBLE TO LOSS OF BIOLOGICAL RESOURCES

ACCORDING TO UN, 20%-30% OF PLANT AND ANIMAL SPECIES MAY BECOME EXTINCT AS A RESULT OF CLIMATE CHANGE

HIGHLY SUSCEPTIBLE TO ILLNESSES

PHILIPPINES AS A TROPICAL COUNTRY

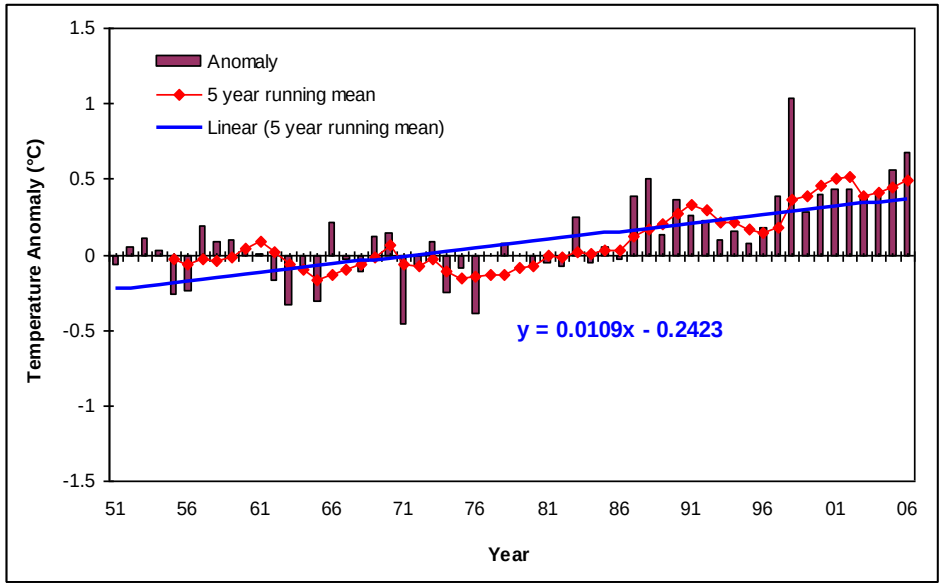
Water-borne and parasitic illnesses will become prevalent with climate change.

Climate Trends and Projections for the Philippines (2020,2050 & 2100)

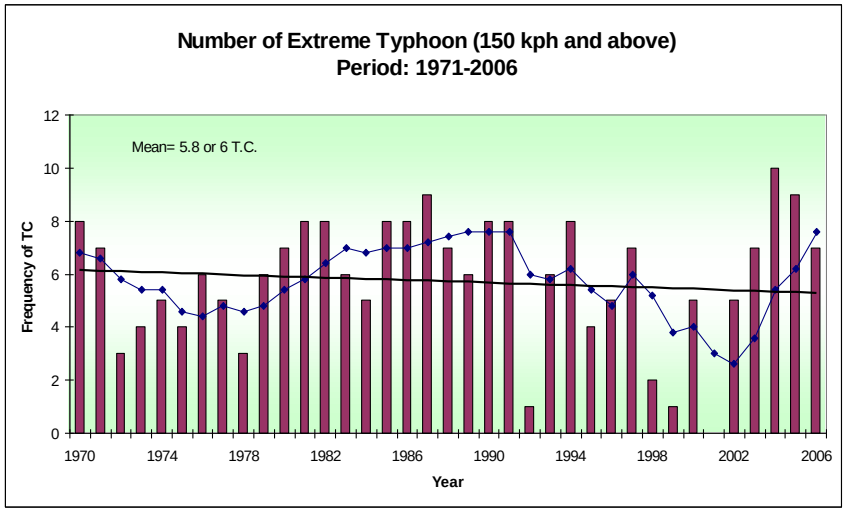
Climate Trends

Second National Communication on Climate Change

Observed Mean Annual Mean Temperature Anomalies in the Philippines Period: 1951-2006 (departures from the 1961-1990 normal values)



- An increase of *0.62°C* from 1951-2006
- From 1960-2003, significant increases in frequency of hot days and warm nights in many areas of the country have been noted while cool days and cool nights have been seen to be generally decreasing.



Tropical Cyclones

- There is no significant trend in the number of cyclones forming in or entering the Philippine Area of Responsibility in the past 58 years (1948 – 2005)
- The trend in the five year running average of tropical cyclones greater than 150 kph is on the rise and found to be more frequent during El Nino events

What are the manifestations/signals of global warming in the country?

- From 1960-2003, there are already significant trends of increasing number of hot days and warm nights, but decreasing number of cold days and cool nights. Both maximum and minimum temperatures are generally getting warmer.

- An increase of 0.62° C from 1951 to 2006 has been observed.

- Extreme Rainfall Intensity (1951 – 2008)

  In most parts of the country, the intensity of rainfall is increasing with Baguio, Tacloban and Iloilo showing statistically significant increases

- Frequency of Extreme Daily Rainfall (1951 – 2008)

  Most parts of the country are generally increasing. Calapan, Laoag, Iloilo and Tacloban show statistically a significant increasing trend, while a significantly decreasing trend is found in Palawan.

Source: 2012, Punongbayan, R. Mainstreaming DRR/CCA into cLUPs

Other extreme weather/climate events like intense rains have been seen to be more frequent.

Philippine Climate Change Projections: 2020 and 2050

Second National Communication on Climate Change

Changes in Annual Mean Temperature

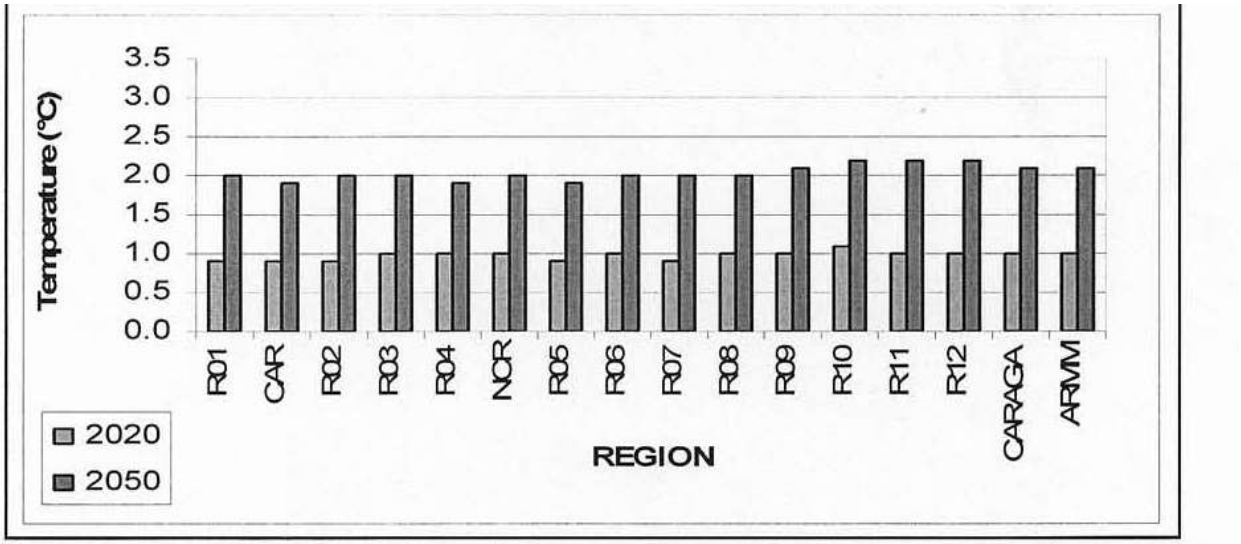


Figure 1: Projected Changes in Annual Mean Temperature for 2020 and 2050, relative to the Baseline 1971-2000 by Region (PAGASA, 2010)

This shows the changes in mean annual temperature by region relative to the baseline period of 1970- 2000. The country's average annual mean temperature is projected to increase by 0.9°C to 1.1°C for 2020 and 1.9°C – 2.2°C by 2050. Higher temperatures are generally expected for all regions of the country by 2050. Warming will be worst in Mindanao.

Changes in Annual Mean Rainfall

Second National Communication on Climate Change

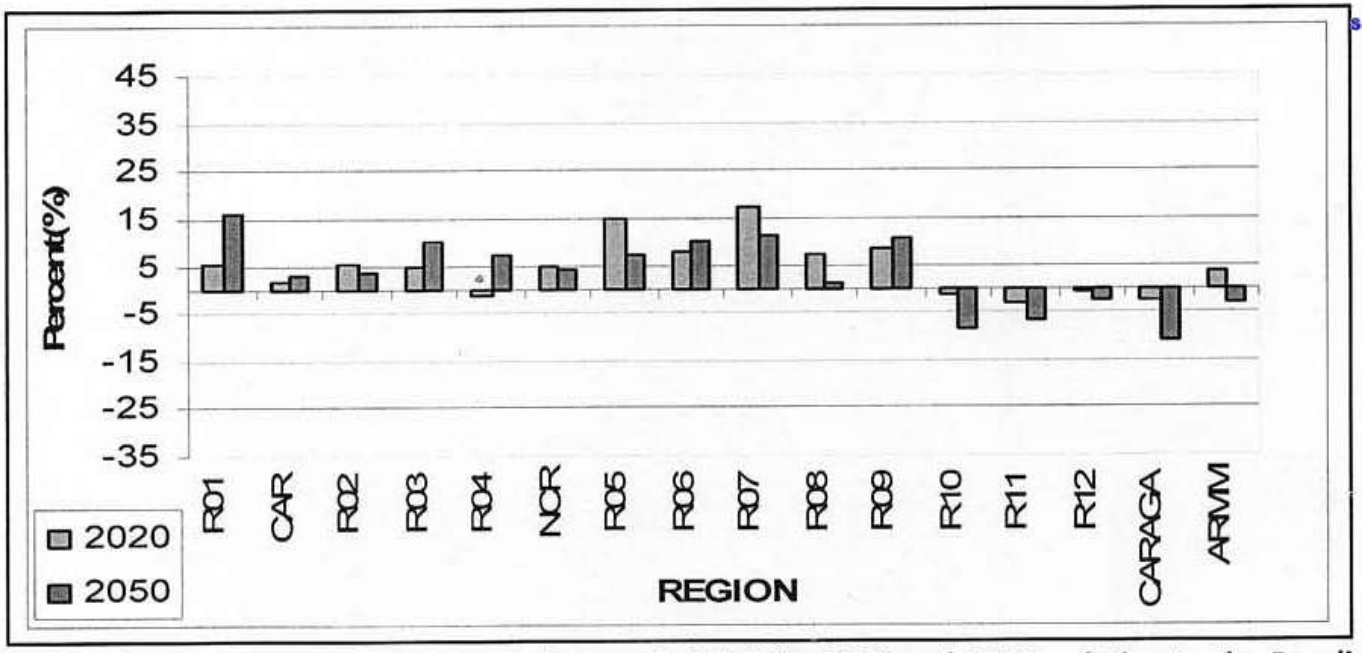


Figure 2: Projected Changes in Annual Mean Rainfall for 2020 and 2050, relative to the Baseline 1971-2000 by Region (PAGASA, 2010)

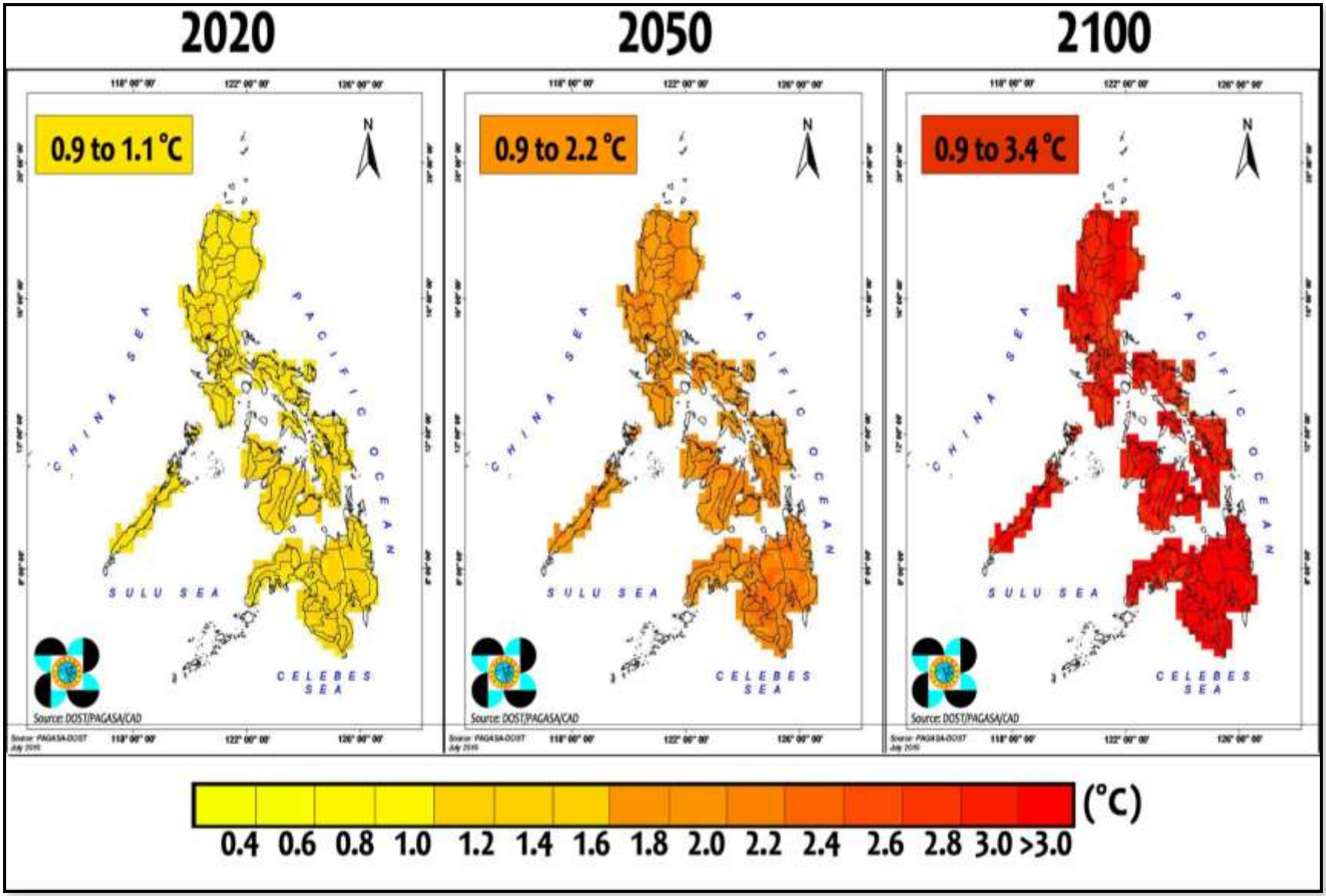
The PRECIS simulation exercise projects a change in annual precipitation from -0.5 to 17.4% in 2020 and -2.4 to 16.4% in 2050. Increases in rainfall are particularly evident in most areas of Luzon and Visayas, while Mindanao is projected to undergo a drying trend. Average rainfall of Luzon and Visayas is expected to be 2 to 17% by 2020 and 1 to 16% by 2050. In contrast, there is a general reduction in regional annual average rainfall in Mindanao (~0.5 to 11% by 2020; 2 to 11% in 2050).

Sea Level Rise

- Sea level rise will increase the risk of flooding and storm damage. Projected impacts of 1 meter seal level rise in many areas of the country show vast portions being inundated, affecting coastal settlements and livelihood.

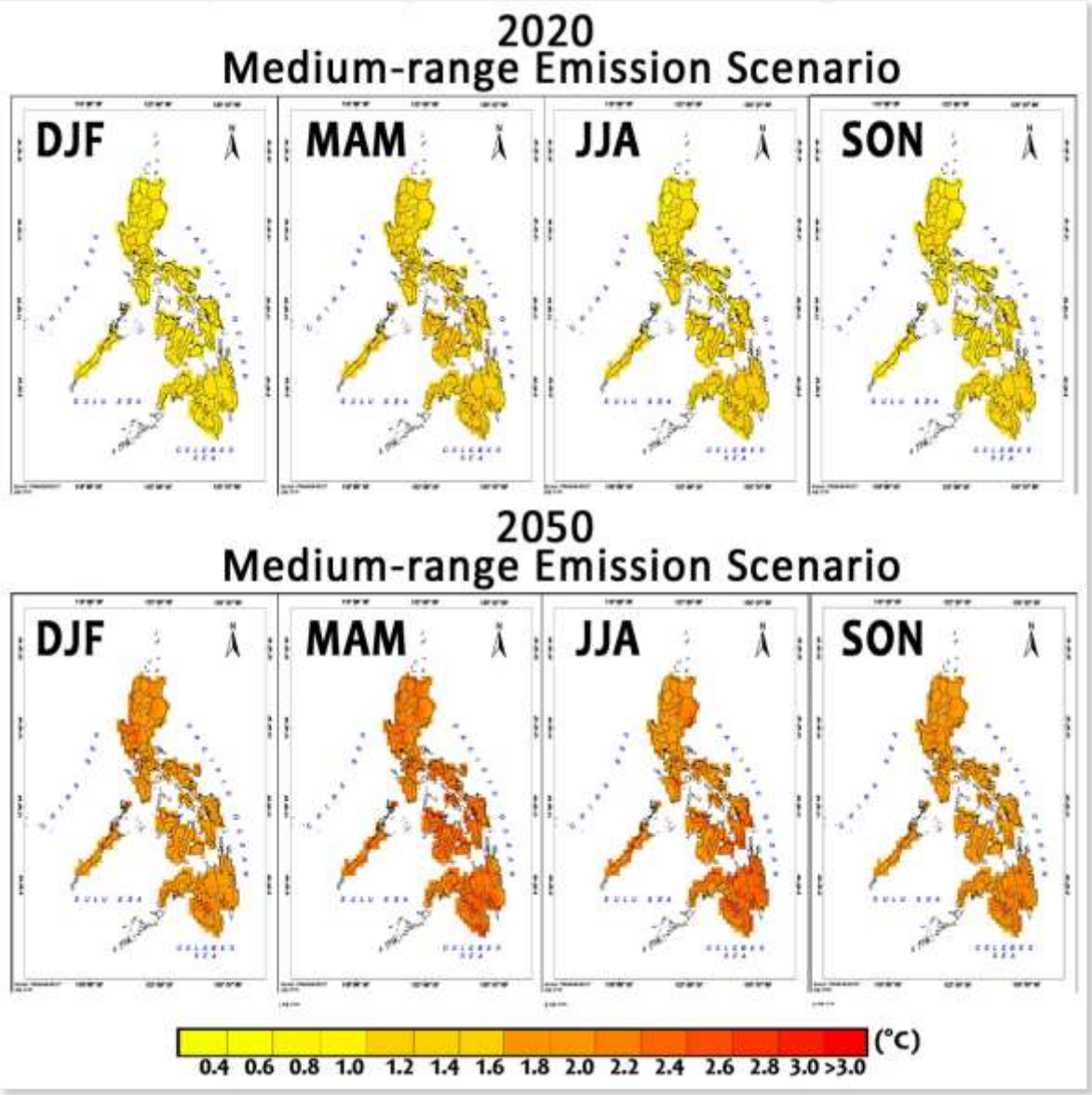
- According to estimates of the National Mapping and Resource Information Authority (NAMRIA), a 1 meter sea level rise can translate to an estimated land loss of 129,114 hectares.

Projected Change in annual mean temperature
Medium-range Emission A1B Scenario



Source: PAGASA

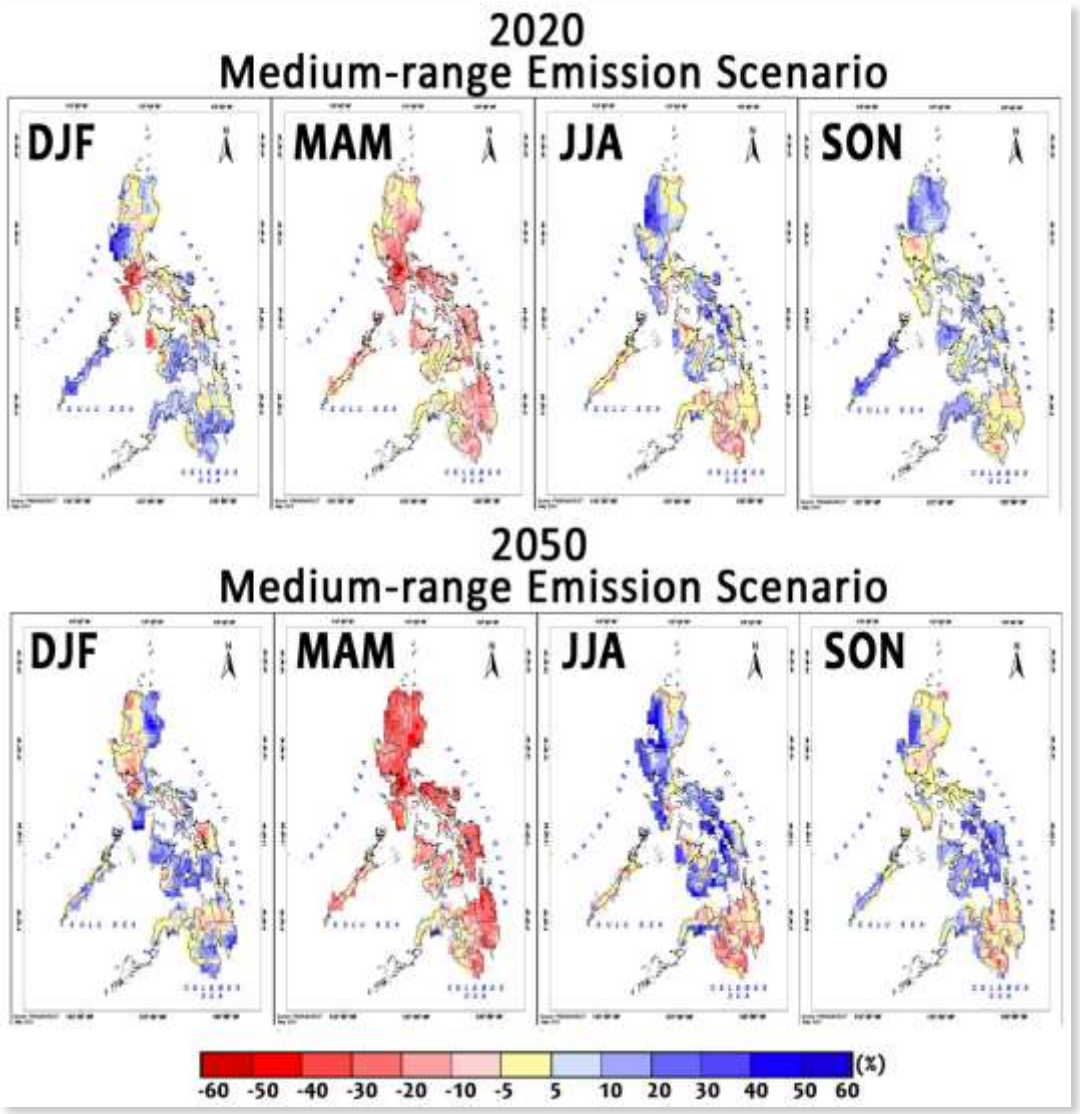
Projected Change in Seasonal Mean Temperature



SEASON	Medium-range Emission Scenario	
	2020	2050
Dec-Jan-Feb (DJF)	0.8 to 1.0	1.6 to 2.2
Mar-Apr-May (MAM)	0.9 to 1.3	2.0 to 2.5
Jun-Jul-Aug (JJA)	0.8 to 1.3	1.6 to 2.6
Sep-Oct-Nov (SON)	0.8 to 1.1	1.5 to 2.2

Source: PAGASA

Projected Change in Seasonal Mean Rainfall(%)



Dry seasons becoming drier.

Wet seasons becoming wetter.

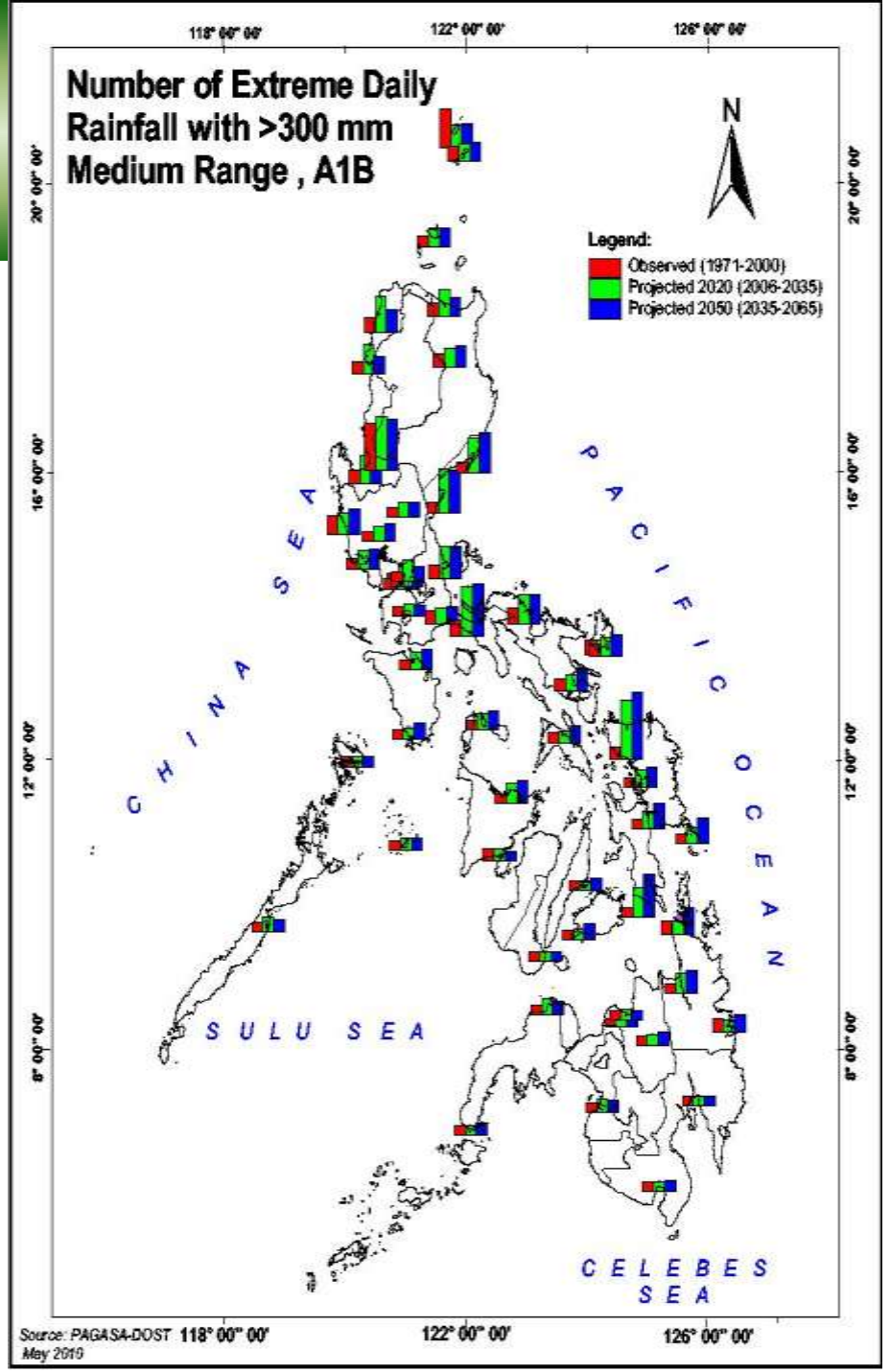
	Medium-range Emission Scenario	
	2020	**2050**
Dec-Jan-Feb (DJF)	**-0.4 to 54.3 %**	**-0.1 to-25.1-%**
Mar-Apr-May (MAM)	**-0.2 to -33.3%**	**-1.4 to -39.8%**
Jun-Jul-Aug (JJA)	**-0.4 to 43.1%**	**-0.7 to 72.5%**
Sep-Oct-Nov (SON)	**-0.4 to 30.0%**	**-0.5 to 39.0%**

Source: PAGASA

Frequency of Extreme Rainfall

Heavy daily rainfall (exceeding 300mm) events will continue to increase in number in Luzon, Visayas & eastern sections of the country.

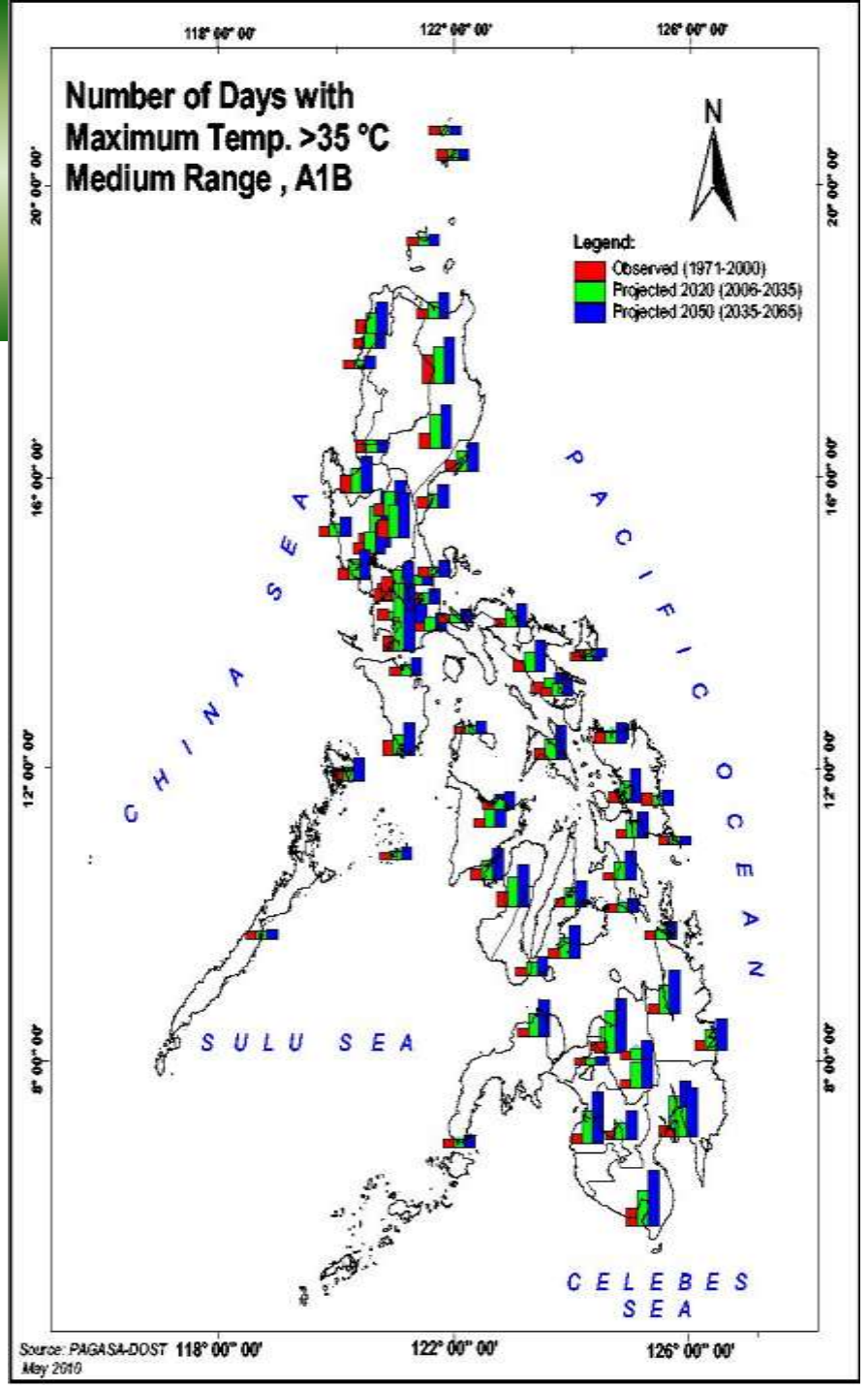
Source: PAGASA



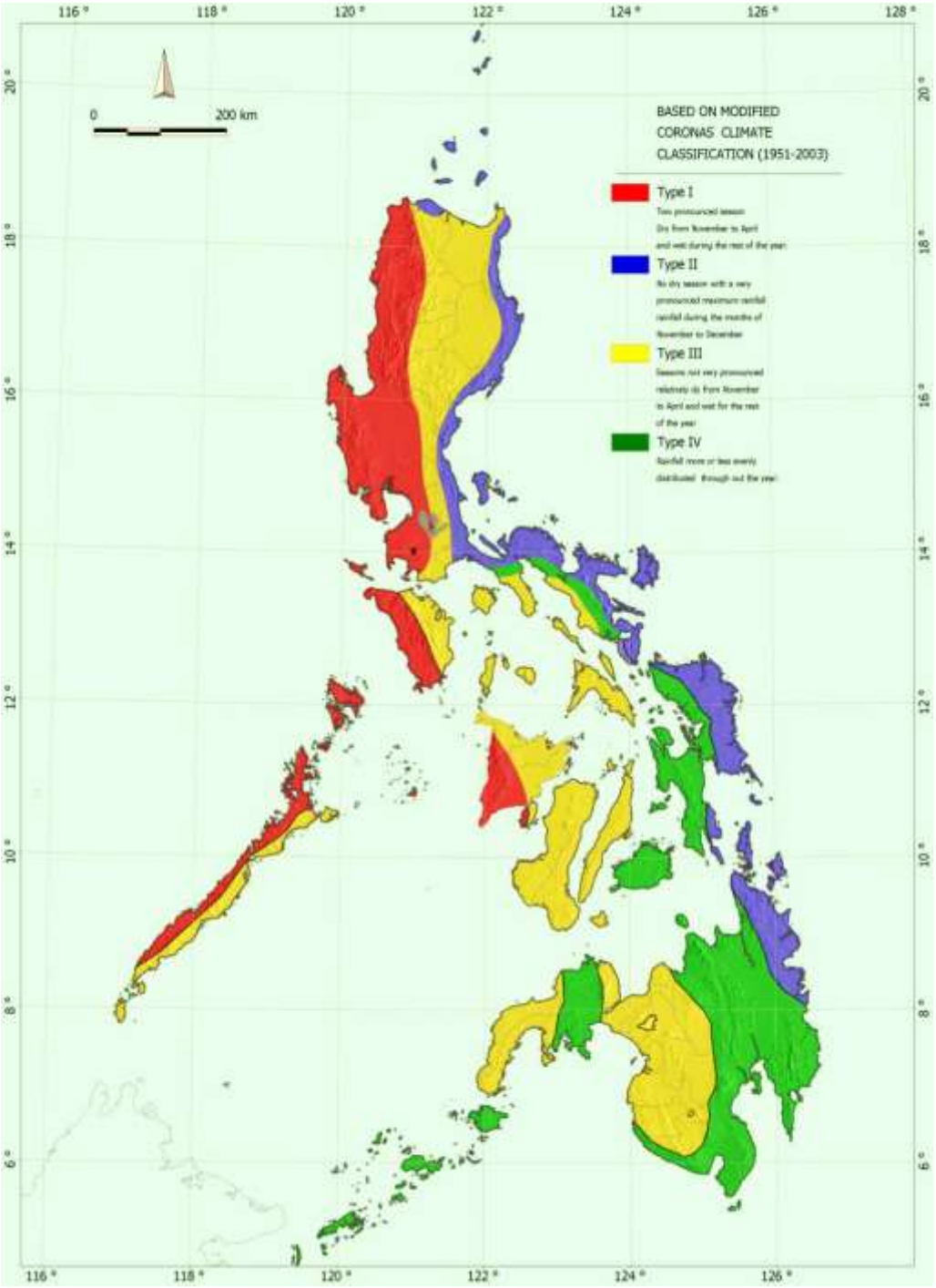
Frequency of Extreme Temperature

hot temperatures (indicated by the number of days with maximum temperature exceeding 35 °C) will continue to become more frequent.

Source: PAGASA



Climate Map of the Philippines



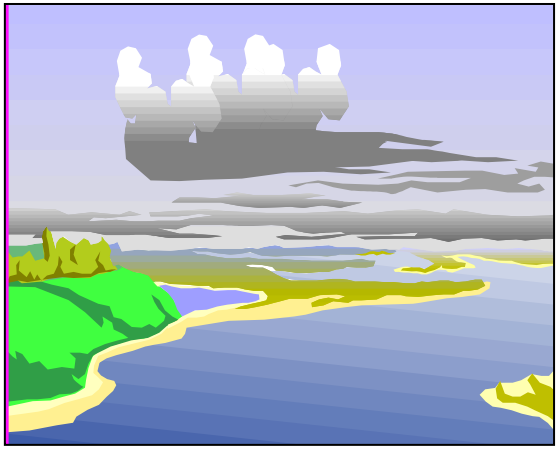
Source: Climate Change of the Philippines, NEDA – MDGF, Adapt Tayo

Climate Change and Environmental Impacts

Changes in temperature, weather patterns and sea level rise

Coastal/Marine Ecosystem

- Coastal erosion
- Storm surges
- Coastal flooding
- Saltwater intrusion
- Coral bleaching
- Ocean acidification



Agriculture

- Added heat stress, shifting monsoons, drier soils, water shortages/ irrigation demands
- Decreased rice/crop production
- Impact on livestock production
- Occurrence of weed infestation & diseases

Human Health

- Increase in vector-borne diseases
- Increase in cardio-vascular illnesses
- Increase in upper respiratory illnesses
- Occurrence of infectious diseases

Water Resources

- Impact on hydrological cycle, changing evaporation, precipitation and runoff patterns which could affect water resources (freshwater quantity and quality)
- Impact on power generation

Forests/ Biodiversity

- Shift in feeding point and disruption in flight patterns for migratory birds.
- Extinction of some mountain plants and animals
- Changes in species distribution, composition
- Invasion of weeds and alien species
- Loss and migration of plant and animal species

Industry and Energy

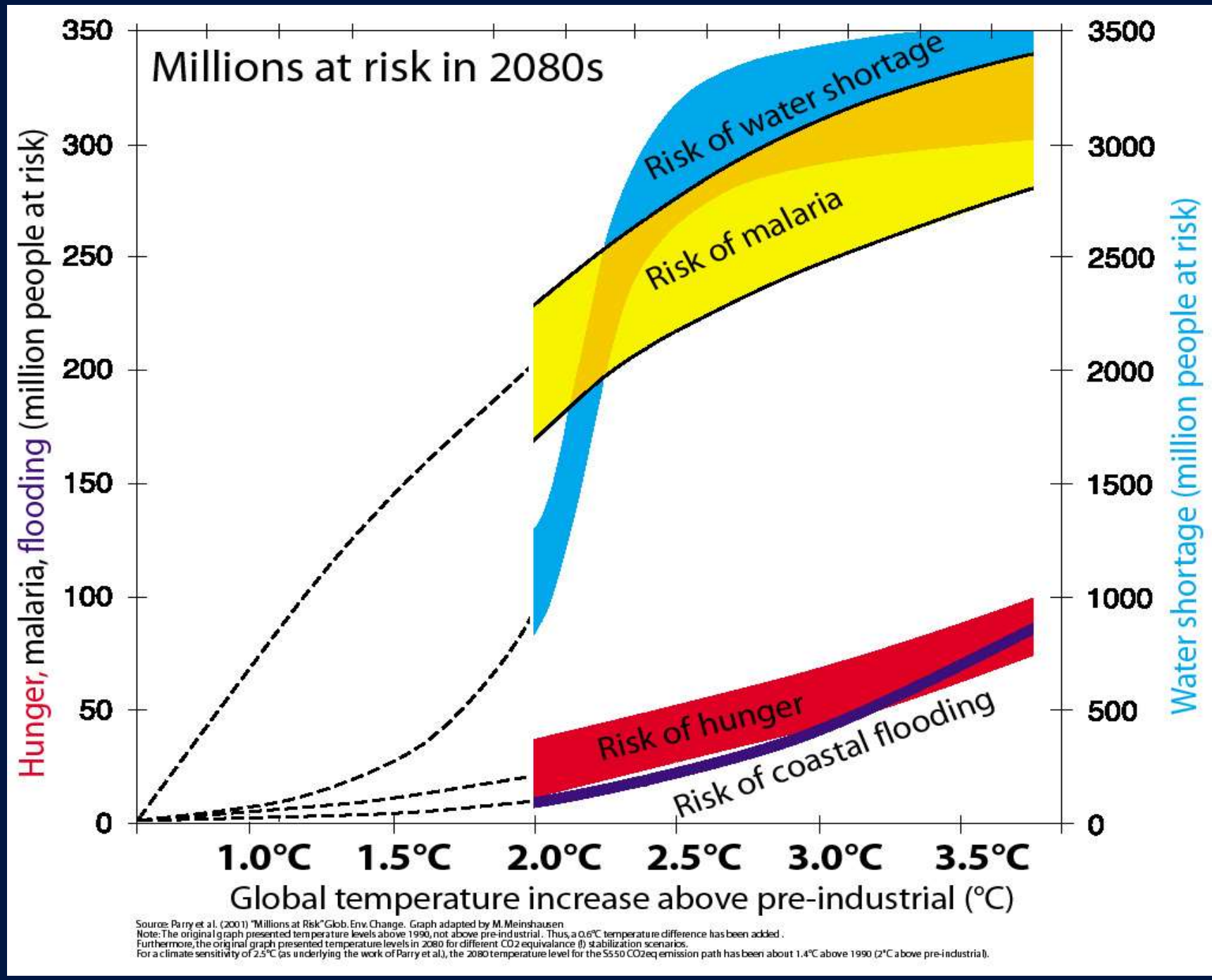
- Changes in energy supply and demand
- Impact on energy infrastructure
- Impact on industries such as wine, tourism, livestock, fishing, insurance, holiday resorts, mining, and others

The starting point

for WWF's analysis was
the strong scientific consensus that
any human-induced warming
greater than two degrees Celsius
above pre-industrial levels
would have a dangerous
and highly damaging impact
on both human societies
and their economies
and the global environment
as a whole.

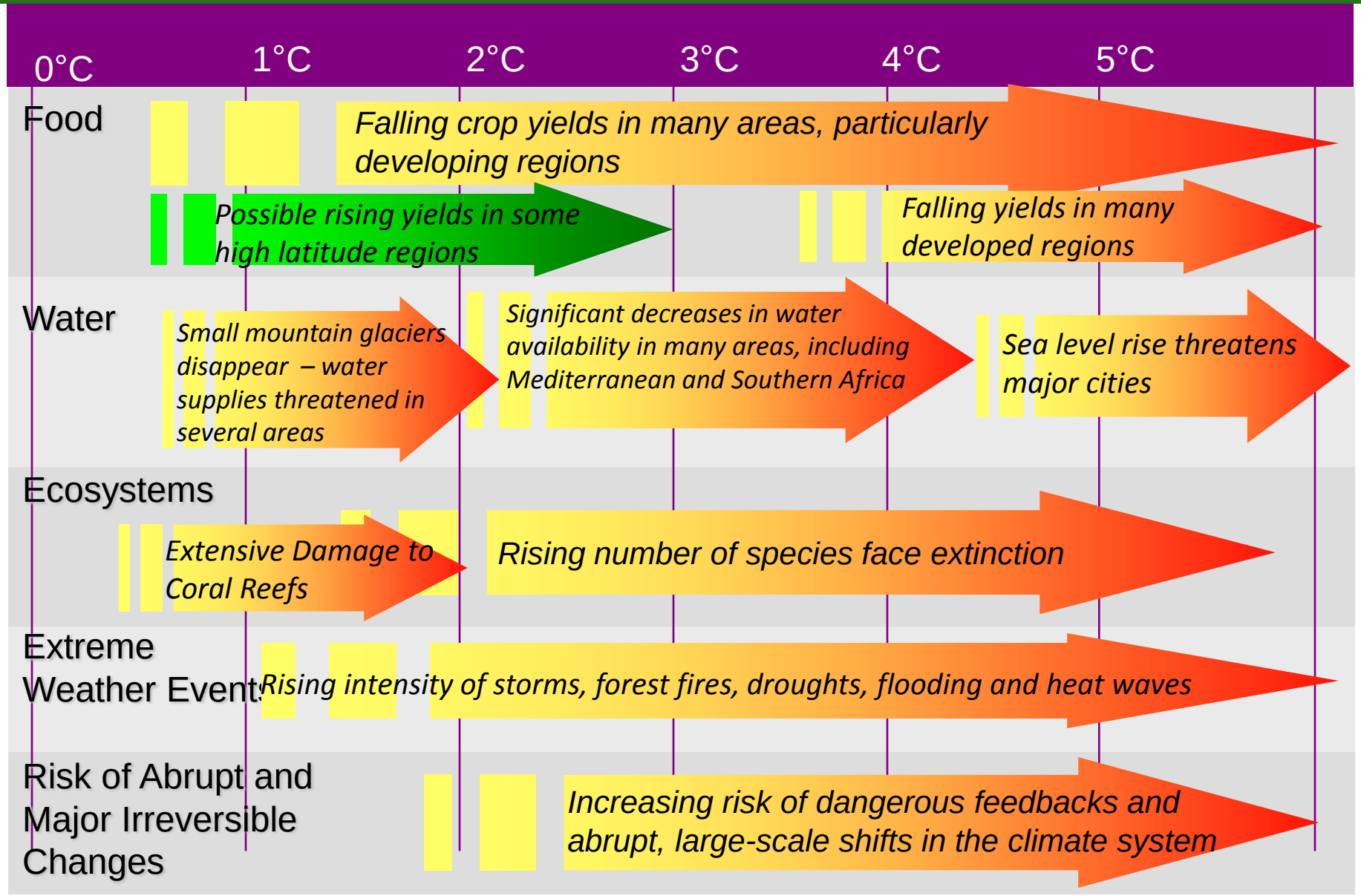
2°C

Peak 475 ppm



Source: Parry et al. (2001) "Millions at Risk" Glob. Env. Change. Graph adapted by M. Meinshausen
Note: The original graph presented temperature levels above 1990, not above pre-industrial. Thus, a 0.6°C temperature difference has been added.
Furthermore, the original graph presented temperature levels in 2080 for different CO_2 equivalance (!) stabilization scenarios.
For a climate sensitivity of 2.5°C (as underlying the work of Parry et al.), the 2080 temperature level for the S550 CO_2eq emission path has been about 1.4°C above 1990 (2°C above pre-industrial).

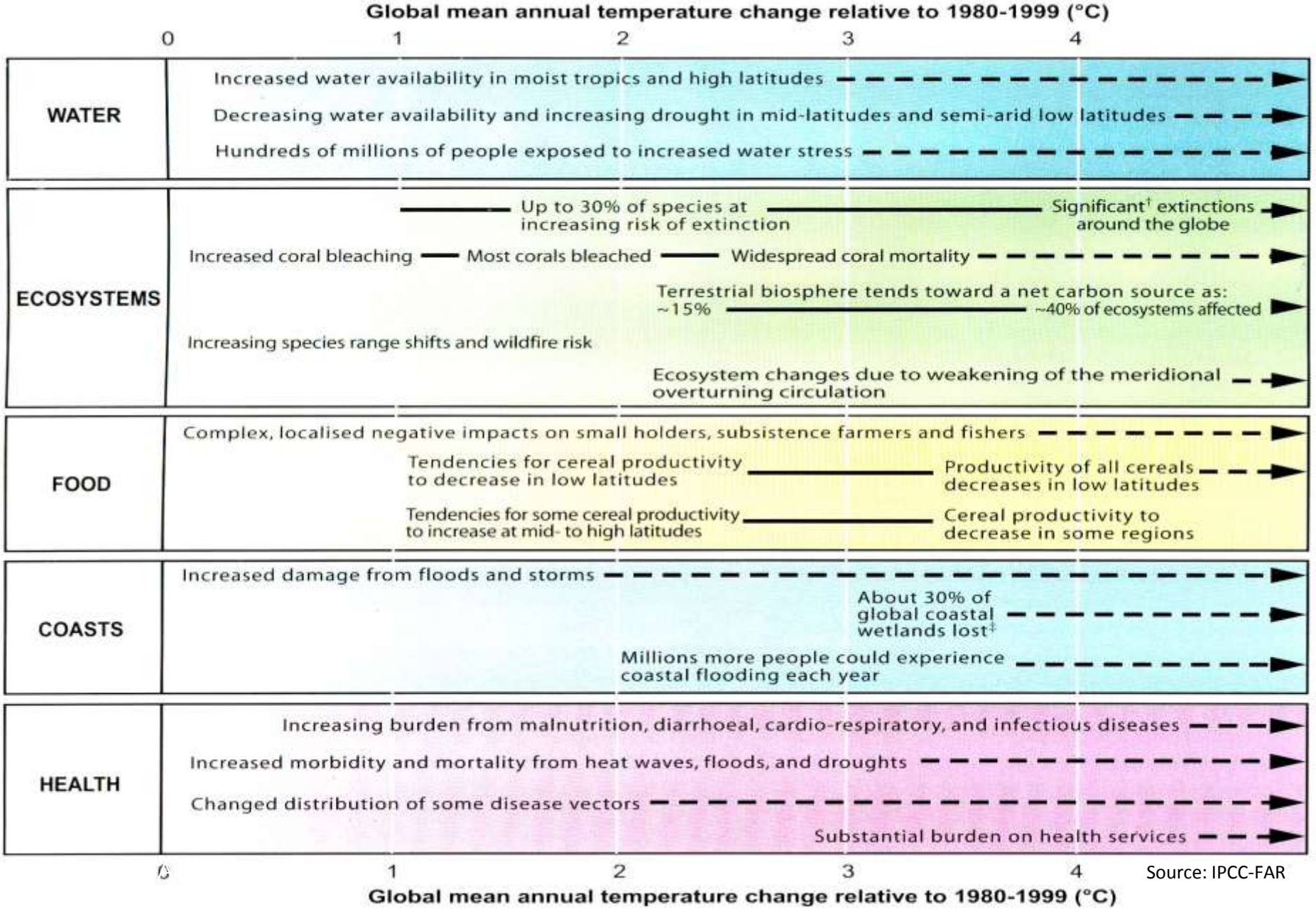
Above +2ºC impacts will be large



Source: PAGASA

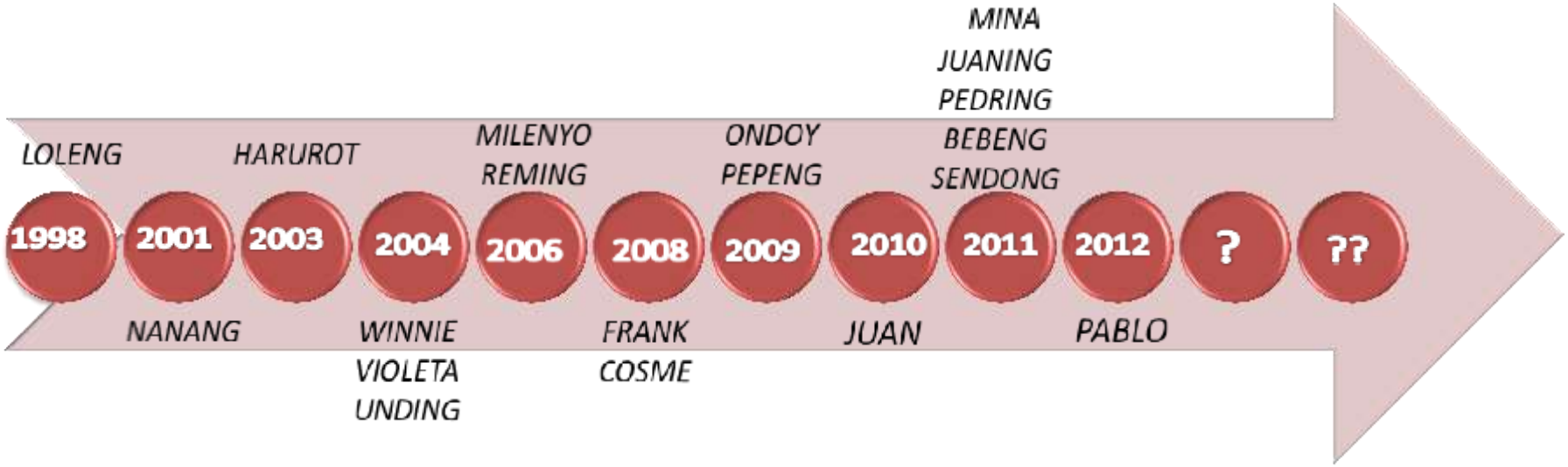
Key Impacts as a function of increasing global average temperature change

(Impacts will vary by extent of adaptation, rate of temperature change and socio-economic pathway)



Source: IPCC-FAR

Adverse Effects of Climate-Related Disasters , 1998-2012



	1998	2001	2003	2004	2006	2008	2009	2010	2011	2012	TOTAL
Damages (in pesos)	36.9 B	25.79 B	11.50 B	38.25 B	18.19 B	12.05 B	8.02 B	3.23 B	3.24 B	12.78 B	169.95 B
Casualties	303	236	64	995	947	618	929	31	1,490	1,067	6,680

Disasters and Assistance to Affected Persons

Type of Disaster	Number of Persons Affected (annual average)		Number of Persons Assisted (annual average)		Assistance per Affected Person (pesos)		As Percent of Income of Poor Person	
	1994–2096	2004–2006	1994–1996	2004–2006	1994–1996	2004–2006	1994–1996	2004–2006
Typhoon	4,092,023	5,928,979	2,221,036	2,992,873	7	16	0.14	0.18
Flooding	829,560	1,864,245	326,826	1,039,266	6	20	0.12	0.22
Strong Wind/Monsoon Waves	2,877	14,381	1,936	10,304	21	83	0.41	0.92
Sea Tragedy	515	906	271	411	2,083	170	39.56	1.88
Tremors/Landslides	6,761	7,778	289	7,109	11	977	0.21	10.78
Volcanic Activity	35,872	15,811	28,210	15,811	117	630	2.23	6.95
Others	71,386	1,332	14,748	1,182	0	260	0.00	2.87
Total	5,038,994	7,833,432	2,593,316	4,066,955	8	19	0.15	0.21

Note: The average income of a poor person is the average of the poorest 30% of the population.

Sources: Data from Department of Social Welfare and Development and Family Income and Expenditure Surveys (NSO, various years).

What can we do?

- Limit the cause of climate change through measures that could slow down the build up of atmospheric GHGs concentrations by reducing current and future emissions and by increasing GHG sinks (**Mitigation**)

- Adjustment in natural or ***human systems*** in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (**Adaptation**)

Increase the resilience and coping capacity of the sector with the current and future changes






What is adaptation?

- Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (IPCC-FAR)
- Practical steps to protect countries and communities from the likely disruption and damage that will result from effects of climate change. For example, flood walls should be built and in numerous cases it is probably advisable to move human settlements out of flood plains and other low-lying areas…" (Website of the UNFCCC Secretariat)
- Is a process by which strategies to moderate, cope with and take advantage of the consequences of climatic events are enhanced, developed, and implemented. (UNDP, 2005)
- The process or outcome of a process that leads to a reduction in harm or risk of harm, or realisation of benefits associated with climate variability and climate change. (UK Climate Impact Programme (UKCIP, 2003)

Source: OECD, Adaptation to Climate Change: Key Terms, 2006

Why do we need to adapt?

- Climate change has the potential to push developing countries back into the poverty trap and to undo many achievements that have been made to date with regard to the Millennium Development Goals (MDGs).
- Even an immediate and dramatic cut in global greenhouse gas emissions would not fully prevent climate change impacts.
- The most vulnerable ecological and socio-economic systems are those with the greatest sensitivity to climate change and the least ability to adapt.
- Ecosystems that are already under stress are particularly vulnerable.
- Social and economic systems tend to be more vulnerable in developing countries with weaker economies and institutions.

Types of Adaptation

- Various types of adaptation exist, e.g. anticipatory and reactive, private and public, and autonomous and planned.
  - Anticipatory adaptation (proactive) – takes places before impacts of climate change are observed.
  - Autonomous adaptation (spontaneous) – does not constitute a conscious response to climate stimuli but is triggered by ecological changes in natural systems and by market or welfare changes in human systems.
  - Planned adaptation – is a result of a deliberate policy decision, based on awareness that conditions have changed or are about to change and that action is required to return to, maintain, or achieve a desired state.

Current and Potential Options for Adapting to Climate Change in Vulnerable Sectors (IPCC-FAR)

Examples of current and potential options for adapting to climate change for vulnerable sectors

	Food, fibre and forestry	Water resources	Human health	Industry, settlement and society
Drying/ Drought	*Crops*: development of new drought-resistant varieties; intercropping; crop residue retention; weed management; irrigation and hydroponic farming; water harvesting *Livestock*: supplementary feeding; change in stocking rate; altered grazing and rotation of pasture *Social*: Improved extension services; debt relief; diversification of income	Leak reduction Water demand management through metering and pricing Soil moisture conservation e.g., through mulching Desalination of sea water Conservation of groundwater through artificial recharge Education for sustainable water use	Grain storage and provision of emergency feeding stations Provision of safe drinking water and sanitation Strengthening of public institutions and health systems Access to international food markets	Improve adaptation capacities, especially for livelihoods Incorporate climate change in development programmes Improved water supply systems and co-ordination between jurisdictions
Increased rainfall/ Flooding	*Crops*: Polders and improved drainage; development and promotion of alternative crops; adjustment of plantation and harvesting schedule; floating agricultural systems *Social*: Improved extension services	Enhanced implementation of protection measures including flood forecasting and warning, regulation through planning legislation and zoning; promotion of insurance; and relocation of vulnerable assets	Structural and non-structural measures. Early-warning systems; disaster preparedness planning; effective post-event emergency relief	Improved flood protection infrastructure "Flood-proof" buildings Change land use in high-risk areas Managed realignment and "Making Space for Water" Flood hazard mapping; flood warnings Empower community institutions

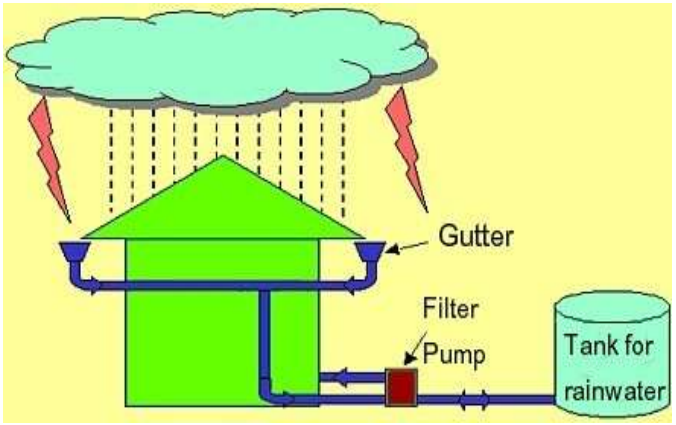
Examples of current and potential options for adapting to climate change for vulnerable sectors

Warming/ Heatwaves	*Crops*: Development of new heat-resistant varieties; altered timing of cropping activities; pest control and surveillance of crops *Livestock*: Housing and shade provision; change to heat-tolerant breeds *Forestry*: Fire management through altered stand layout, landscape planning, dead timber salvaging, clearing undergrowth. Insect control through prescribed burning, non-chemical pest control *Social*: Diversification of income	Water demand management through metering and pricing Education for sustainable water use	International surveillance systems for disease emergence Strengthening of public institutions and health systems National and regional heat warning systems Measures to reduce urban heat island effects through creating green spaces Adjusting clothing and activity levels; increasing fluid intake	Assistance programmes for especially vulnerable groups Improve adaptive capacities Technological change
Wind speed/ Storminess	*Crops*: Development of wind-resistant crops (e.g., vanilla)	Coastal defence design and implementation to protect water supply against contamination	Early-warning systems; disaster preparedness planning; effective post-event emergency relief	Emergency preparedness, including early-warning systems More resilient infrastructure Financial risk management options for both developed and developing regions

Adaptation Measures

Water Sector

- Expanded rainwater harvesting
- water storage and conservation techniques
- water re-use desalination;
- water-use and irrigation efficiency



Biodiversity/Forestry Sector

- Maintaining and restoring native ecosystems
- Protecting and enhancing ecosystem services
- Managing habitats for endangered species
- Creating refuges and buffer zones
- Establishing networks of terrestrial, freshwater and marine protected areas that take into account projected changes in climate.

Source: UNEP, Convention on Biological Diversity. Biodiversity and Climate Change

Energy

- Strengthening of overhead transmission and distribution infrastructure
- energy efficiency;
- use of renewable sources;
- reduced dependence on single sources of energy

Agriculture

- Adjustment of planting dates and crop variety;
- crop relocation;
- improved land management, e.g. erosion control and soil protection through tree planting

Coastal Areas

- Relocate residents living along low lying areas
- Set up marine reserve networks to replenish coral/fish larvae
- Mangrove reforestation to serve as buffer for strong waves and storm surge

Health Sector

- Sanitary practices
- Preventive care(e.g., vaccines)
- Information and awareness
- Health surveillance and monitoring

Disaster Risk Reduction

Panic room added in a house in Provident Village, Marikina after Ondoy

Awareness and Information Dissemination as Adaptation Strategies to Climate Change

- ✓ Promote awareness on climate change in your office, school, community, or in your home
- ✓ Update yourself on the latest information on climate change
- ✓ Be prepared for disasters

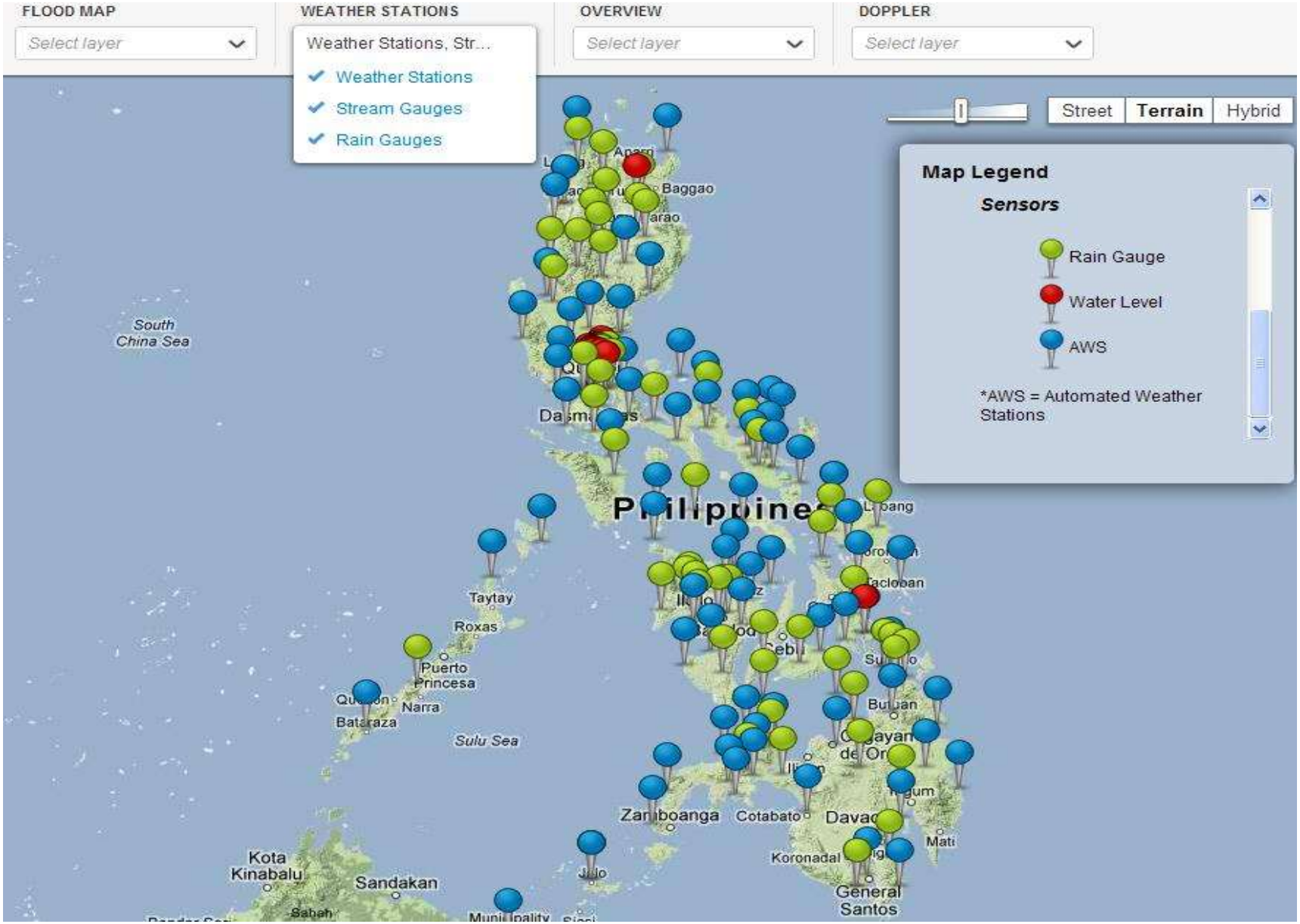
Coastal Flooding Risk Map of Albay Province, Philippines

Climate Check for Local Platforms 18-19 August, Legazpi, Albay

Source: GIZ

Project NOAH, DOST

(Nationwide Operation Assessments of Hazards)



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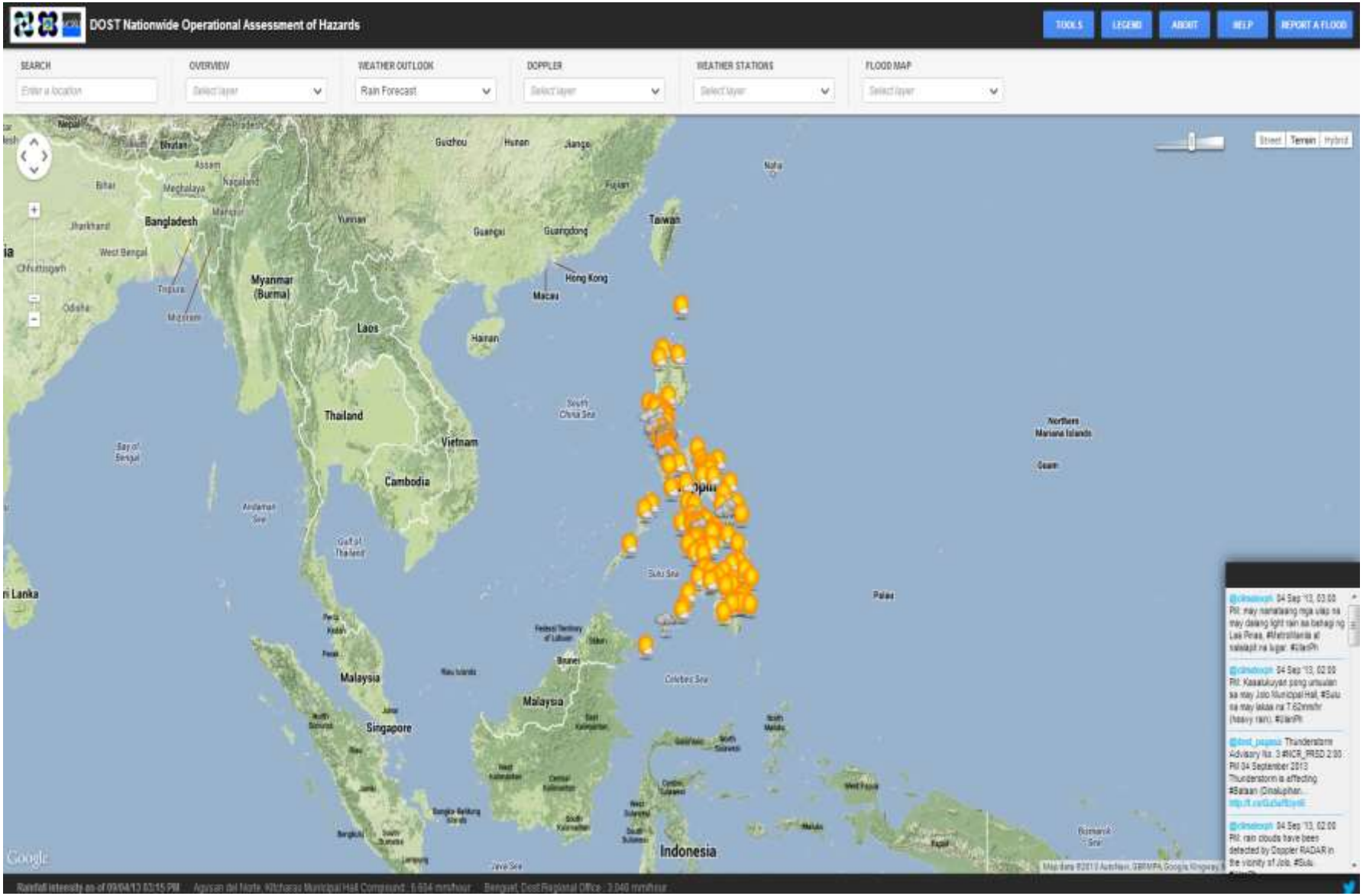

Best Practices on Climate Change Adaptation

1. **Paradigm Shift from Livelihood to Entrepreneurship**

   – change of practice of producing only raw materials to producing products with longer shelf and using small packages and focused marketing.

2. **Maximizing Sustainable Use of Natural Resources to Create Business Opportunities**

   – to create climate-proof tourism and develop business plans

3. **Clustering of Services to Minimize Infrastructure**

   – to manage resources effectively

"Climate change will not be effectively managed until individuals and communities recognise that their behaviour can make a difference."

-The Royal Society, Climate Change: what we know and what we need to know. (2002)

Thank you

For your questions / queries:

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