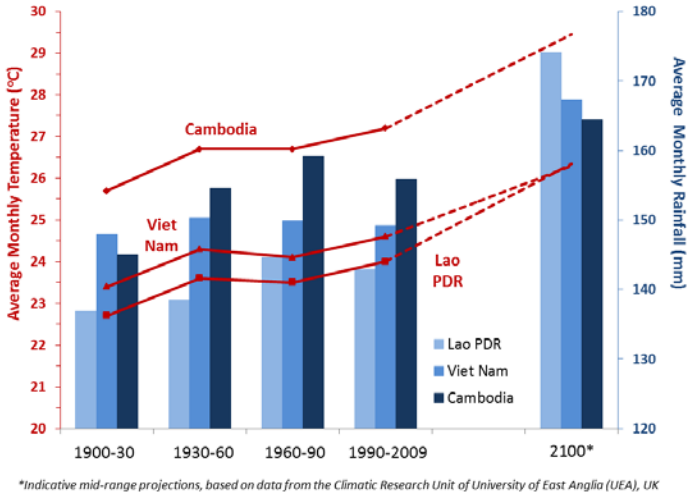

Bio-Brief#2: Climate Change

November 2013

What is Climate Change?

The air, water and land of our planet Earth are all linked to its atmosphere through the exchange of gases. These exchange processes are a big factor in determining Earth's climate or '*average weather*'.

Over Earth's history, the climate has changed considerably due to natural processes, but in the last 50-100 years these changes - a general warming - have been much bigger and happened much faster than any such changes the planet has seen in the recorded history of humans.

The consensus of the United Nations Inter-governmental Panel on Climate Change (IPCC), made up expert scientists from among 195 countries, is that:[i]

"Warming of the climate system is in no doubt, and since the 1950s, many of the observed changes are unprecedented over decades to millennia ['000 years]."

The IPCC finds that it is *"extremely likely"* that human activity has been the dominant cause of the rapid warming seen during this time and that climate change poses significant challenges for our way of life on Earth.

Natural and human activities foster exchange of many types of gases between the earth and its atmosphere, including clouds / water vapor (H_2O), oxygen (O_2) and *carbon dioxide (CO_2)*.

Some of these are called *Greenhouse Gases (GHG)* due to the similar heat-trapping effect they have to the 'greenhouses' used to manage growing conditions of plants. These gases - especially CO_2, *nitrous oxide (N_2O)* and *methane (CH_4)* - absorb radiation from the Earth's surface, clouds and gas molecules and trap it as heat within the lower levels of the atmosphere.

Although natural levels of GHGs are essential for the atmosphere to function properly and support life on Earth (without them the planet would be scorched during the day, freeze at night and we would have no water!), the proportion of gases is finely balanced by a complex relationship of chemical, physical and biological processes in nature.

The relatively recent expansion of human populations and activities through industrialization, agricultural development, deforestation and the burning of fossil fuels such as oil, gas and coal, have released much higher quantities of GHGs and at a much faster rate than natural processes alone.

This has the impact of disrupting the natural balance of atmospheric gases, creating a general trend of increased heat-trapping and warming of the Earth's surface (land and sea). Because gases are easily distributed through large-scale atmospheric circulation, the heat-trapping affects the whole planet and is called *'global warming'* - the major driving factor in man-made climate change.

Sources: i) IPCC, Fifth Assessment Report, 2013. ii) World Resources Institute, 2013. Data excludes land-use change and forestry. iii) Mekong River Commission, 2010; iv) 2011, Climatic Research Unit, University of East Anglia, Great Britain; v) McSweeney et al., 2008. UNDP; vi) World Bank, 2013. Climate Change Knowledge Portal; vii) OFDA/CRED, 2013. International Disaster Database; viii) Yusuf and Francisco, 2009: Climate Vulnerability Mapping of South-East Asia

Changing Climate & the Greater Mekong Subregion

Considering worldwide emissions in 2010 totaled over 44,500 million *tons of equivalent carbon dioxide (tCO2e)* - 6.46 per person - GMS countries' contributions to climate change have been relatively small so far. However, the Subregion's ongoing industrialization and rapid economic growth is already leading to steady emissions increases (*Table 1*).

Table 1: GMS GHG emissions / tons of equivalent carbon dioxide (tCO_2e)[ii]

	Total (millions)			per person		
	1995	2005	2010	1995	2005	2010
Viet Nam	102.6	197.4	256.8	1.43	2.40	2.95
Cambodia	16.5	23.8	26.0	1.48	1.78	1.84
Lao PDR	14.9	20.5	21.4	3.11	3.57	3.45

Climate science continues to refine our understanding of past and projected global changes, though significant uncertainty still exists due to the complexity of natural systems. Indications are that global warming may be causing profound changes around the world:

- *Sea-level rise, due to the increased input of freshwater from melting snow and ice into the ocean and expanding volume of warmer water;*
- *More variability in rainfall, leading to more and stronger floods, droughts and reduced predictability of seasons;*
- *Higher temperatures at Earth's land/sea surfaces;*
- *Greater potential for stronger, more frequent storms due to warmer sea-surface temperatures;*
- *More acidic oceans as increased CO_2 in the atmosphere dissolves more easily in warmer water.*

Climate modeling at the sub-regional scale is even more complex and has a high degree of uncertainty, making local projections difficult.

However, conservative estimates by the IPCC project average temperatures in South East Asia increasing by 4.8°C and sea levels rising by up to 0.7 meters by 2100, compared to 1990. Estimates indicate that by 2030, average annual rainfall in the Mekong River basin will increase by 13.5% from the 1951-2000 average, mostly from more intense, longer duration, less predictable wet seasons.[iii] The Mekong River delta is a highly vulnerable area for sea-level rise.

Climate Change & Lao PDR

The average monthly temperature in Lao PDR increased from 22.7°C between 1900 and 1930, to 24.0°C between 1990 and 2009.[iv] Projections suggest between 1.4°C and 4.3°C of additional warming by 2100.[v]

Average monthly rainfall across Lao PDR has increased from an average of 137mm (1900-1930) to an average of 143mm per month (1990-2009). Projections suggest that average monthly rainfall will surpass 170mm by 2100, depending on location. Higher rainfall would fall predominantly in the wet season whilst dry season rainfall is projected to decrease.[vi]

SPOTLIGHT IPCC, 2013

"Atmospheric concentrations of CO_2, CH_4 and N_20 increased to levels unprecedented in at least the last 800,000 years. CO_2 concentrations have increased by 40% since pre-industrial times, primarily from fossil fuel emissions and net land use change emissions."

Whilst single weather events cannot be directly attributed to human-induced climate change, the number and severity of droughts and floods increased between 1960 and 2001, affecting almost 9 million people and causing economic damages of over US$400 million.[vii] Phongsali, Houaphan and Louang Namtha are considered to be significant 'weak points' for excessive impacts from floods, droughts and landslides.[viii]

MORE INFORMATION: CLIMATE CHANGE & LAO PDR

- IPCC (www.climatechange2013.org)
- ADB (www.gms-eoc.org/climate-change)
- Government of Lao PDR (www.monre.gov.la/wrea)
- World Bank (http://goo.gl/70mev)

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