

Understanding Climate Change

Part 3

Impacts of Climate Change on Guyana and the World at large

Part 2: Impacts of Future Climate Change

In previous articles, we introduced the concept and scientific basis of climate change, and discussed the changes in climate that have been observed over the last century, and the impacts of these changes on Guyana and the rest of the world. This week we will discuss the climatic changes that are projected to occur over the next century if action is not taken, and the impacts that these changes will have on Guyana and the rest of the world.

Projecting climate change

We have learned that changes in climate have occurred and these have been linked to high levels of Green-House Gas (GHG) emissions. Scientific studies such the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 2007 (IPCC FAR) indicate that the continued GHG emissions at or above current rates, would cause further warming and induce many changes in the global climate system during the 21st century that would very likely be larger than those observed during the 20th century.

To understand how these changes will affect us in the future, climate change scientists use computer-based climate models to generate projections of future climate scenarios for coming centuries. Projections of future climate change are generated using Atmosphere-ocean general circulation models (AOGCMs), which are founded on accepted physical principles and can project aspects of climate, such as temperature and rainfall, for several decades or more into the future. There is considerable confidence in the accuracy of estimates provided by these models, based on their ability to reproduce observed features of current and past climate. AOGCMs can give different projections of future climate depending on which SRES scenario is used.

Projected climate changes for the world

The IPCC Special Report on Emissions Scenarios (SRES) develops a set of climate change scenarios that show various combinations of demographic, economic and technological driving forces could affect future greenhouse gas (GHG) emissions. The various emissions projections under different SRES scenarios are widely used in the assessments of future climate change.

For the next two decades a warming of about 0.2°C per decade is projected for a range of SRES emissions scenarios. Thereafter, temperature projections increasingly depend on specific emissions scenarios. The IPCC projects that the increase in global temperature by the end of this century is likely to be in the range of 1.1 to 6.4°C, depending on which SRES scenario is used.

According to The Economics of Climate Change: The Stern Review (2007), if annual emissions of GHGs remain at their present levels, the concentrations of GHGs in the atmosphere will reach about 550 parts per million CO₂ equivalent (ppm CO₂e), which is roughly double their pre-industrial levels, by the year 2050, and global temperatures would rise by 2-5°C, or more. Even if GHG concentrations were to remain at their current levels (approximately 430ppm CO₂e), mean

global temperatures would be likely to rise by up to a further 2°C, because the effect of past emissions has not yet been fully realized.

The projected effects of global warming include sea level rise (in the range of about 0.2 to 0.6 metres above 1990 levels by the end of the century), which will threaten low lying coastal areas, especially small islands and coastal cities, and melting glaciers, which will increase the risk of flooding and threaten water supply to parts of Asia and South America. Other effects include the contraction of snow cover, permafrost and sea ice, increased frequency of heat waves, and more intense tropical cyclones.

Precipitation is projected to increase in high latitude areas such as Northern Europe, Asia, and Canada, and decrease in subtropical land regions, with an increase in heavy precipitation events that will lead to an increased risk of flooding in many areas.

Impacts of projected climate change on ecosystems and human lives

It is estimated that a temperature increase greater than 1.5 to 2.5°C above pre-industrial levels is likely to cause major changes in ecosystem structure and function, and could place 20 to 30 percent of plant and animal species at increased risk of extinction. Changes in temperature and rainfall that increase the risk of flooding, drought, wildfire, and insect infestation will have a damaging effect on terrestrial ecosystems, such as forests and savannas. Ocean acidification and warming of oceans and rivers will affect marine and freshwater ecosystems, damaging habitats and altering species' distributions.

Climate change is projected to greatly reduce water resources which are already affected by population growth and land use change in many regions of the world. Many semi-arid and drought prone regions are projected to experience decreases in water availability, with severe implications for agriculture, energy production and human health. The frequency and severity of both drought and flooding is expected to increase, with associated risks to human settlements.

Declining crop yields due to higher temperatures will threaten food security and exacerbate malnutrition and starvation in many parts of the developing world, especially Africa. Human health would also be at risk due to an increase in vector-borne diseases such as malaria and dengue fever, and an increase in deaths due to heat stress as well as extreme cold in higher latitudes is predicted.

In tropical regions of Latin America, increased temperatures are projected to drive the gradual replacement of tropical forest with savanna in eastern Amazonia, with severe loss of biodiversity due to species extinction. A decline in productivity in important crops and livestock is also predicted for Latin America.

Developing countries are particularly vulnerable to the negative effects of climate change due to their geographic location (often in areas that are prone to drought, flooding and tropical diseases), their reliance on climate sensitive primary sectors such as agriculture and fisheries, and their low income which limits their capacity to adapt. The poorest people are likely to be affected earliest and most severely, due to their dependence on subsistence agriculture, and their limited access to capital which restricts the possibilities for adaptation or insurance against possible losses.

Projected climate change in Guyana

Guyana's Initial National Communication to the UNFCCC (2002) reports climate model projections assuming a development path which results in a doubling of carbon dioxide concentrations by 2020-2040 and a tripling by 2080-2100. Under these assumptions, temperature is

projected to increase by about 1.2°C above 1995 levels by the first half of this century, with higher increases in southern regions of Guyana and during the second dry season (August to October). Towards the end of the century, temperature is projected to increase by about 4.2°C, with greater increases in the south and during the second dry season.

Rainfall is predicted to decrease by an average of 10mm per month by the first half of this century and 21mm per month by the end of the century, with greater decreases in the first rainy season (May to July) and the second dry season. The southern regions are expected to experience the greatest declines in rainfall, and significant reductions in rainfall are projected for the coastal regions by the end of the century. The increase in temperature and reductions in rainfall will exacerbate evaporation, especially by the end of the century, resulting in a reduction in overall water availability.

Model projections of sea level rise for Guyana indicate a rise of about 40cm by the end of this century, or closer to 60cm if the effect of melt water from land ice is considered.

Impacts on Guyana's people, ecosystems, and economy

With 90% of the population and 75% of the main economic activities concentrated on the low-lying coast, Guyana is particularly vulnerable to negative effects of climate change on its economy, human livelihoods and ecosystems.

Guyana already suffers high variability in rainfall, with acute droughts alternating with heavy precipitation and flooding. This phenomenon may be exacerbated by climate change. Decreasing rainfall and increasing evaporation can lead to lower water levels in the rivers, decreasing the availability of freshwater. Demand for water is expected to increase with increasing temperatures.

An increase in sea level can increase the intensity of storm surges, increasing risk of flooding along the coast. Sea level rise could also affect the supply of fresh water through salt water intrusions into aquifers, threatening domestic and industrial water supplies.

The predicted sea level rise coupled with extremes in rainfall events and storm surges and increased wave action will increase the level of flooding in Guyana significantly.

Guyana's population is expected to be seriously at risk from the adverse effects of climate change. The anticipated impacts include frequent flooding and prolonged inundation of settlement areas, spread of water-borne diseases and increased incidence of diseases in general, possible contamination of potable water and reduced food supply. This can eventually threaten human health and result in deaths.

Climate change is likely to cause flooding and inundation of valuable agricultural land, decreases in agricultural production due to loss of land, heat stress, decreased soil moisture and an increased incidence of pests, increased soil erosion and loss of crops caused by increased frequency of heavy rain and drought, and increased heat stress in livestock caused by higher temperatures. This change in agricultural production may have a negative impact on Guyana economically.

The energy sector is also likely to be affected by climate change, as higher temperatures increase electricity demand (predominantly for residential, commercial and industrial air conditioning).

Guyana is particularly vulnerable to climate change because it is a poor country, with limited financial capacity to adapt to or mitigate the worst impacts of climate change. This is compounded by the important role that agriculture, a sector likely to be severely affected by climate change, plays in Guyana's economy.

In order to avert the potential disaster that climate change poses to the world in general and developing countries in particular, a concerted international effort is required, with leadership and cooperation from developed and developing countries alike. In next week's article, we will discuss approaches to addressing climate change.

*Information used in this feature was extracted from the following reports: The Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 2007 (IPCC FAR), Guyana's Initial National Communication (INC) in Response to its Commitments to the UNFCCC (2002) and The Economics of Climate Change: The Stern Review (2007)

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