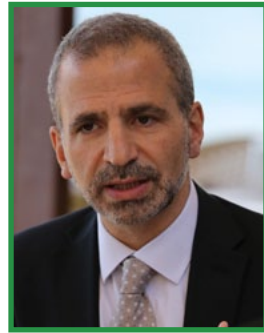


# Climate Change Overview



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## Introduction

Climate change is a term that is being tossed around quite frequently these days. This is especially the case when more flooding, droughts, extreme temperatures and other weather anomalies occur. Scientists and non-scientists have been discussing this phenomenon and its impacts from many perspectives. Many have discussed the effects of climate change on the abundance of natural resources such as forests and water and on the survival of ecosystems both terrestrial and marine. Some have looked at the economic impact associated with climate change while others have looked at its effects on human and environmental health. Within all discussions two terms stand out: adaptation and mitigation. A third term that is becoming equally common is vulnerability. All these indicate how complex the issues associated with climate change are and how important it is to better understand and face up to them.

What is climate change? Why does it occur? What are its impacts? What are adaptation and mitigation? These are questions that will be addressed in this overview paper on the topic of climate change.

## Climate Change and its Causes

The World Meteorological Organization (WMO) defines climate as the average and variability of measured variables (such as temperature, wind and precipitation) over a period of time that could vary from months to

thousands and millions of years (WMO 2016). In essence it is the average weather over extended periods of time. The Intergovernmental Panel on Climate Change (IPCC) defines climate change as the quantifiable changes of climate variables for extended periods of time, typically a decade or more (IPCC 2007). This is different from the definition of climate change that is put forward by the United Nations Framework Convention on Climate Change (UNFCCC) in that the IPCC does not distinguish between natural variability and human induced changes while the UNFCCC does. According to the UNFCCC climate variability is due to natural changes in the climate whereas climate change is due to anthropogenic activities (UNFCCC 2011).

The Earth's atmosphere and the greenhouse effect it supports make Earth a livable planet. The greenhouse effect is caused by the trapping of incoming energy from the sun by greenhouse gases (GHGs) like water vapor (H<sub>2</sub>O), carbon dioxide (CO<sub>2</sub>), and methane (CH<sub>4</sub>). According to the IPCC's Fifth Assessment Report (2014) anthropogenic greenhouse gas emissions together with other human drivers are extremely likely to have been the dominant reason for the warming of the earth since the middle of the last century. The US National Oceanic and Atmospheric Administration (NOAA) has determined that the concentration of carbon dioxide in the Earth's atmosphere has risen from pre-industrial levels of 280 parts per million by volume (ppmv) to about 396 ppmv in 2013 – nearly 40% of the increase in carbon dioxide emissions has occurred since 1958 (NOAA 2016). The US National Climate Assessment Report (Program 2014) shows that the increases in concentrations of GHGs since 1750 are due to human activities in the industrial era with methane reaching concentration levels more than two and a half times those of the pre-industrial period and nitrous oxide concentrations rising by more than 20% over the same period. The main reason for the increases in GHG emissions is an increase in population and economic (IPCC 2014)

As a result of these increases in GHG concentrations (along with other human drivers) the atmosphere and ocean have warmed leading to a reduction in the amounts of snow and ice and a rise in sea level. The IPCC (2014) indicates that the Earth's temperature has increased by 0.85°C between 1880 and 2012. And the upper 75 m of oceans have warmed over the period 1971 to 2010 by 0.11°C per decade. Thus if GHG emissions continue at the same rate this will cause further warming and increase the likelihood of severe, pervasive and irreversible impacts on people and ecosystems. Some of these impacts are (IPCC 2014, Program 2014, Sillman et al. 2013, Sun et al. 2007):

- Frequency of heat waves will be higher frequency and duration longer. Associated with these would be droughts and heat-related deaths and illnesses
- Increased temperatures will lead to an increase in the spread of vector borne infectious diseases, mainly because of the lack of colder temperatures that would have greatly

reduced the numbers of disease-carrying insects

- Changes in precipitation will vary across the Earth
  - Precipitation in areas closest to the poles is projected to increase
  - Areas such as the western U.S. and the Mediterranean which are presently dry are expected to become drier.
  - Precipitation is expected to become less frequent but more intense. The widespread trend of increasing heavy downpours continuing along with the associated flooding
- Extreme storms (such as hurricanes) will increase in frequency and intensity
- Vegetation will shift toward Polar Regions and up mountain slopes. These shifts might be blocked by urban development leading to loss of habitat for animals that are dependent on these vegetation.
- Food production would suffer from the decrease in water due to increase in frequency and duration of droughts. The





increase in disease spreading insects will further reduce agricultural productivity

As seen above, climate change will intensify existing risks and create new risks for natural and human systems. These risks are more onerous for poor and disadvantaged communities who are less likely to manage them than more affluent communities. The IPCC (2014) declared that “*climate change impacts are projected to slow down economic growth, make poverty reduction more difficult, further erode food security and prolong existing and create new poverty traps, the latter particularly in urban areas and emerging hotspots of hunger.*” This problem will be felt worldwide through increased migration and conflict over resources. As such the problems being faced are of interest to the entire world and should be dealt with at a global level; hence the various climate change negotiations that have been taking place for the past two decades and more. These negotiations have focused on developing means of reducing emissions and enabling communities to cope with the changes in climate – mitigation and adaptation.

### Mitigation and Adaptation

According to the United Nations Environment Programme (UNEP), mitigation may be defined as efforts that are geared towards reducing or preventing GHG emissions (UNEP 2016). These efforts span a wide range of activities such as use of technologies, behavior change, legislation and regulation, etc. Some of these activities would be:

- Reducing or even eliminating the burning of fossil fuels for electricity, heat or transport
- Enhancing the “sinks” (such as the oceans, forests and soil) that accumulate and store GHG
- Developing environment friendly building designs
- Increase reliance on alternative/renewable energy sources. Example, recovery of energy from waste

The IPCC (2016) defines adaptation as “adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.” Examples of adaptation are:

- Expanded rainwater harvesting; water storage and conservation techniques
- Shifting crop growing seasons and locations to more suitable times and locations
- Urban planning to reduce heat island effects

It must be understood that there are many limitations to the activities that could be undertaken in either adaptation or mitigation. These in addition to technical restrictions include financial, political, social and behavioral.

Effective decision-making in developing mitigation and adaptation measures to limit climate change and its impacts is required. This would entail a series of analytical approaches that:

- evaluate expected risks and benefits
- recognize the importance of governance
- have an ethical dimension that is anchored in equity and value judgments
- include economic and social assessment of risks and uncertainty

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