Climate Change: An environmental, development and security issue

Bob Watson
Chief Scientific Advisor, Defra, Nobel House, 17 Smith Square, London SW1P 3JR
Email: elisabeth.campbell@defra.gsi.gov.uk
Web: www.defra.gov.uk

Climate Change

Human activities are changing the Earth's climate and further human-induced climate change is inevitable. The question is not whether the Earth's climate will change in response to human activities, but rather where, when and by how much. The Earth's climate has warmed, on average by about 0.7°C, over the past 100 years, with the decades of the 1990s and 2000s being the warmest in the instrumental record, the temporal and spatial patterns of precipitation have changed, sea levels have risen by up to 25 cm, most non-polar glaciers are retreating, and the extent and thickness of Arctic sea ice in summer are decreasing. It is very likely that most of the observed warming (globally and regionally) of the past 50 years can be attributed to human activities increasing the atmospheric concentrations of greenhouse gases resulting from the combustion of fossil fuels and tropical deforestation, rather than changes in solar radiation or other natural factors. Observed changes in sea level, snow cover, ice extent and precipitation are consistent with a warmer climate. Projected changes in the atmospheric concentrations of greenhouse gases and aerosols are projected to result in increases in global mean surface temperatures between 1990 and 2100 of 1.1 to 6.4°C, with land areas warming more than the oceans, and high latitudes warming more than the tropics. Globally averaged precipitation is projected to increase, but with increases and decreases in particular regions, accompanied by more intense precipitation events over most regions of the world, and global mean sea-level is projected to rise by up to 0.5 meters, between 1990 and 2100, even without considering a contribution from melting of the Greenland ice sheets. The incidence of extreme weather events is projected to increase, e.g., hot days, floods and droughts.

Impacts of Climate Change

Observed changes in climate, especially warmer regional temperatures, have already affected biological systems in many parts of the world. There have been changes in species distributions, population sizes, the timing of reproduction or migration events, and an increase in the frequency of pest and disease outbreaks, especially in forested systems. Many coral reefs have undergone major, although often partially reversible, bleaching episodes, when sea surface temperatures have increased by 1°C during a single season, with extensive mortality occurring with observed increases in temperature of 3°C. While the growing season in Europe has lengthened over the last 30 years, in some regions of Africa the combination of regional climate changes and anthropogenic stresses has led to decreased cereal crop production since 1970. Changes in fish populations have been linked to large scale climate oscillations, e.g., El-Nino events have impacted fisheries off the coasts of South America and Africa, and decadal oscillations in the Pacific have impacted fisheries off of the west coast of North America. There is emerging evidence that the oceans are becoming more acidic, thus reducing their capacity to absorb carbon dioxide and affect the entire food chain. In addition, livestock will be affected in a number of ways including, a likely increase in diseases.

Projected changes in climate during the 21st century will occur faster than in at least the past 10,000 years with predominantly adverse consequences for developing countries and poor people within them. Low-lying Small Island States and deltaic regions of developing countries in South Asia, the South Pacific, and the Indian Ocean, could eventually disappear under water, displacing tens of millions of people in the process; peoples' exposure to malaria and dengue fever, already rampant in the tropics and sub-tropics, could become even more severe in some regions; crop production could significantly decrease in Africa, Latin America and in other developing countries, areas where hunger and child malnutrition are already prevalent; hydro-power could become less reliable in areas already energy insecure, and fresh water could become even more scarce in many areas of the world already facing shortages. Climate change will also exacerbate the loss of biodiversity, increase the risk of extinction for many species, especially those that are already at risk due to factors such as low population numbers, restricted or patchy habitats and limited climatic ranges, and adversely impact ecosystem services essential for sustainable development. For the 850 million people who go to bed hungry every night, and the 2 billion others exposed to insect-borne diseases and water scarcity, climate change threatens to bring more suffering in its wake. In this way, climate change may undermine long-term development and the ability of many poor people to escape poverty.

The Challenge

The challenge is simultaneously limit the magnitude and rate of human-induced climate change, by reducing emissions of greenhouse gases from all sectors, including agriculture, and to reduce the vulnerability of socio-economic sectors, ecological systems and human health to climate variability and change by integrating climate concerns into sectoral and national economic planning.

Based on the current understanding of the climate system, and the response of different ecological and socio-economic systems, significant adverse global changes are likely to occur if the global mean surface temperature exceeds 2°C above pre-industrial levels and the rate of change exceeds 0.2°C per decade. Stabilization of the equivalent concentration of carbon dioxide at 450ppm would imply a medium likelihood of limiting changes in the global mean surface temperature to below 2°C above pre-industrial levels.

Reducing emissions of greenhouse gases, which cannot be achieved with continued reliance on today's technologies and policies, must be achieved while improving access to affordable energy in developing countries, which is critical for poverty alleviation and economic growth. Reduced emissions of greenhouse gases will require energy sector reform, appropriate pricing policies, and a technological evolution in both the production and use of energy. However, technological options for significantly reducing greenhouse gas emissions over the long term already exist and large reductions can be attained using a

portfolio of options and costs are likely to be lower than previously considered. Priority should be afforded to identifying and implementing policies and technologies that can simultaneously address local and regional air pollution and global climate change. In addition to reducing emissions from the energy sector it will crucial to reduce the rate of deforestation, reduce emissions of methane from livestock and rice, and nitrous oxide from the use of fertilizers.

Political Situation

The long-term challenge is to meet the goal of Article 2 of the UN Framework Convention on Climate Change (UNFCCC), i.e., "stabilization of greenhouse concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system, and in a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner." The UNFCCC also specifies several principles to guide this process: equity, common but differentiated responsibilities, precaution, cost-effective measures, right to sustainable development, and support for an open economic system.

Most industrialized countries have ratified the Kyoto Protocol, which mandates industrialized countries to reduce their emissions on an average by 5.2% between 2008 and 2012 relative to emissions in 1990, with individual industrialized country targets varying. There are no emissions targets for developing countries.

Given that many industrialized countries will not meet their reduction targets with domestic actions alone, this provides significant opportunities for carbon trading, which are likely to provide sustainable development benefits for many developing countries.

The challenge now is to negotiate a long-term global equitable regulatory framework with intermediate targets that can limit greenhouse emissions at a level that limits the increase in global mean surface temperature to 2oC above pre-industrial levels.