CMFRI

Winter School on
Impact of Climate Change on Indian Marine Fisheries

Lecture Notes

Part 2

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CLIMATE CHANGE: GLOBAL ISSUES

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Introduction

Climate change is a complex, long-term crisis about two centuries in the making. It has come to be recognised as one of the most critical challenges ever to the humankind. The world has now recognized that climate change is no longer solely an environmental problem. Rather, it has become an economic, trade and security issue that will increasingly dominate global and national policies as its impacts become more apparent. There are few human activities that do not contribute to it and as such, the scale of response needed is so large and widespread.

Scientists believe that a temperature rise of above 2 - 2.5ºC risks serious and intolerable impacts. Along with impacts such as sea level rise, melting of ice caps/glaciers with rising temperatures, it is predicted that frequency of heat waves, droughts, heavy rainfall events etc. will very likely increase, thus affecting agriculture, forests, water resources, industry, human health and settlements. Developing countries, where greater poverty and vulnerability limit the capacity to act, will be the most seriously harmed, particularly the poorer segments. The situation is known to be one of the worst human-made environmental crises of the century.

Several key features distinguish climate change from other environmental issues and thus it is profoundly different from most other environmental problems that humanity faces. It is one of the first truly global environmental challenges. In the last few decades, the earth has been warming at a rate that is faster than at any point in human history and studies invariably established that human activities resulting into the emission of greenhouse gases is responsible to this alarming situation.

The Greenhouse effect

The greenhouse effect is very simple. We are increasing emissions of greenhouse gases and thus their concentrations in the atmosphere are going up. As these concentrations increase, the temperature of the earth rises. This, in turn, leads to changes in the patterns of precipitation and to sea level rise. And as temperatures, precipitation and sea level change, there is reason to worry about adverse effects on ecological, socio-economic systems and human health.

The world's climate has always varied naturally but compelling evidence from around the globe indicates that there is now a discernible human influence on the earth's climate system, foreshadowing drastic impacts on people, economies and ecosystems. If there is no global agreement to try and limit greenhouse gas emissions, the temperature of the earth is expected to increase between 1.0 and 3.5ºC over the next century. Such a rate of change has not been experienced at any time during the past 10,000 years.

Greenhouse gases last for a long time in the atmosphere. Their long life means that, if effective measures are not taken, the world's climate will inevitably change. It will take not years, not even decades, but centuries to reverse the damage. The full ramifications of those changes will primarily be felt by future generations.

The IPCC Report

The Intergovernmental Panel on Climate Change (IPCC) has been in existence since 1988 having established by the World Meteorological Organisation and the United Nations Environment Programme.

During this period, the panel has not only brought out four assessment reports, which present a comprehensive assessment of knowledge on all aspects climate change, but has also produced several special reports dealing with specific issues related to climate change. As part of the Fourth Assessment Report (AR4), three volumes representing the contributions of Working Group I, II, and III have been completed and released. The Synthesis Report bringing together the major findings of the three working groups too is published. The AR4 has incorporated several advances in scientific knowledge related to climate change. This has had a major impact on public opinion and awareness among world leaders on knowledge related to observed climate change in recent dates as well as projections fro the future. Overall, the IPCC's AR4 has had a major impact on awareness and knowledge on various aspects of climate change across the globe.

Observed Impacts

One major finding of the AR4 has been the fact that climate change is now unequivocal and the human influence on the earth's climate is now very well established. The average temperature increase across the globe during the 20th century was around 0.74ºC and sea level rise around 17 cm. These changes have been accompanied by changes in precipitation as well, including an increase in precipitation in the higher latitudes and a decline in the lower latitudes. However, these changes have also been accompanied by an increase in the frequency and intensity of extreme precipitation events. While any single event that occurs cannot be linked to human induced climate change, the pattern observed across the globe provides abundant evidence of this trend. It is also observed that floods and droughts are increasing in frequency and intensity and this trend is likely to increase.

Future Trends

Projections of temperature rise in the 21st century have been made on the basis of established and plausible scenarios of the future. At the lower end of these scenarios, the best estimate of temperature increase by the end of the 21st century is placed at 1.8ºC and at the upper end of the scenarios, the best estimate is approximately 4 ºC. These projections are of course based on the assumption of no specific action towards mitigation of emissions of greenhouse gases.

Unequal Impacts

The impacts of climate change vary across regions and communities. In general, these are most severe in those regions, which display high vulnerability on account of a number of factors including poverty. For instance, during the 20th century, glaciers and ice caps have experienced widespread mass losses, which are likely to have major consequences for water supply in several areas of the world. Data confirm that losses from the ice sheets have contributed to sea level rise over the period 1993-2003.

Ecosystem Disruption

Other observed impacts of climate change include more intense and longer droughts, wide spread change in extreme temperatures as well as changes in biodiversity. In general, it was assessed that climate change will reduce biodiversity and perturb the functioning of most ecosystems and therefore compromise on the services that they currently provide. On the species that were assessed it was found that 20 to 30 percent of plant and animal species would be at risk of extinction if increases in global annual temperatures exceed 1.5 to 2.5ºC. Some ecosystems such as coral reefs and marine shell organisms are particularly vulnerable. As genetic and species diversity is lost, and the types of ecosystems are changed, the goods and ecological services, which are so important to sustainable development, would be threatened. For example, the bio-geochemical cycling of the earth will alter. This in turn will change inputs of CO_2, methane and nitrous oxide and hence have a feedback effect on the earth's climate system

Food Insecurity

Another major area of serious impacts is in the field of agricultural production. Malnutrition, for instance would be further exacerbated by the reduced length of the growth seasons. In some countries,

yields from agriculture could be reduced by up to 50 percent by 2020. With the growing scarcity of water in different regions of the world, it was also assessed that 75 to 250 million people would be exposed to increased water stress in 2020 in Africa alone. In the case of sub-tropical and tropical regions, a temperature increase above 1.5 to 2.5ºC is expected to lead to a decline in agricultural productivity of crops such as maize and wheat. In fact, there is growing evidence in South Asia, for instance, that the wheat crop is already being affected adversely by climate change.

Coastal Flooding

Another serious impact of climate change is seen most prominently in the Asian region where the mega deltas such as Kolkatta, Dhaka and Shanghai are at risk of coastal flooding and negative impacts. There are other cities in the world, also located in coastal seas, with high density populations at the risk of coastal flooding and other impacts with the prospect of high sea levels. Once the sea level rise process is set into motion, it cannot be slowed down in anything less than a few millennia. A sea level rise of up to 1 meter will displace tens of millions of people in the low-lying deltaic areas of Bangladesh, Egypt and China. Bangladesh could lose as much as 18 per cent of its land surface and suffer a significant decrease in agricultural productivity. Small-island states would be wiped out. India too has good reason to be concerned about.

Who is responsible? Who is affected?

Major components of our biosphere have been altered by the intensity of human exploitation of the earth's resources in the twentieth century. Responsibility is with the developed as well as developing countries and must be understood in terms of two major global trends that lead to increased greenhouse gas emissions and reduced 'sinks' for carbon dioxide: population growth and increasing consumption (especially of fossil fuels).

World population has doubled over the past fifty years, where as, total energy consumption has increased fivefold during the same period of time. We depend mainly on fossil fuels for the energy generation and the growth in consumption has brought on parallel increases in greenhouse gas emissions. Carbon dioxide concentrations increased several times since the industrial revolution. The United States alone accounts for as much as twenty-one percent of the total world emissions while being home to only five percent of the world's population. In contrast, 136 developing countries are collectively responsible for twenty-four percent of global emissions.

Studies conclusively established that those countries have 'common but differentiated responsibilities' with regard to environmental degradation. The comparative susceptibility to adverse climate impacts lies also along a developing country-developed country axis, but in an inverse relation to historical responsibility. Though most of the emissions of greenhouse gases have been put into the atmosphere by the developed world, it is the developing countries that are particularly vulnerable to climate change. The costs would be extremely significant for some parts of the world.

Development challenges

The economy of the future will be low carbon. The sustainable solution to several of the problems is to replace fossil fuels with renewable energy sources (RES). It will need new technologies and new solutions. Leading edge developments are important for driving the development of low-carbon technology and providing confidence that new products will deliver the benefits. But technology alone cannot solve the global climate challenge and we cannot afford to do nothing as we wait for the next generation of climate friendly technology advances.

Sharing the Responsibility- Kyoto to Bali and Beyond

The divergence between the countries most responsible for, and the countries most affected by climate change creates a profound ethical dilemma. Developed countries have the capacity to act. Yet some of them are unwilling to do so without the assurance of substantial emission reductions on the part of developing

nations. However, countries in the South resent the imposition of high economic costs for the amelioration of what they perceive that the developed nations have caused environmental problem.

In the last 10 years since the parties to the United Nations Framework Convention on Climate Change reached their last major agreement to reduce greenhouse emissions, the Kyoto Protocol, progress toward a truly global accord to combat the mounting threat has been held hostage by a stand off between some of the world's largest greenhouse gas emitters. Mounting scientific evidence demands that we pursue all of the emissions reductions opportunities we can find, and without delay. All these demands for a truly global agreement in time to avoid a temperature rise of 2ºC. Further, these existing emissions commitments expire after 2012. The 'Bali Summit' was the largest such meeting ever held to form a binding post-2012 climate framework. The critical issue is whether the new road map sets governments on a course towards establishing binding multilateral commitments.

Global climate change requires a response encompassing the North and the South, local communities and the local community of nations. Ranging from global negotiations to individual choices, a diverse set of actors with different resource endowments and diverging values and aspirations would need to be involved. Concerns for equity and justice, however, are central to effective response to global climate change. Differences in the perceptions of developed and developing countries as to what is fair and equitable have presented enormous difficulties in constructing governance mechanisms for addressing climate change. The challenge of climate change demands unprecedented national and international coordination and cooperation.

Despite all the debate, the confrontations and the frustration, we have begun to move in the right direction. The issue now is the pace at which we are moving. The longer we wait before taking serious action, the more difficult and costly will it be to mitigate climate change. Although it is too early to predict the future nature and scope of the climate regime, adaptation and technology transfer are certain to be the central themes. In addition, emerging technologies will expand the options for reducing greenhouse gas emissions and thus for international cooperation.

Further Reading

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