

# Climate Change: a sustainable development nightmare!

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## Abstract

Mitigation of the causes of climate change and adaptation to their effects are two closely related issues that considered recent and future global sustainable development challenges. The amount of adaptation and the success of mitigation touch all aspects of human lives and their conservations and relay mainly on communities' consorted efforts. Extensive studies suggest strong link between the climate change trends and trends of human anthropogenic activities. Scenarios of both future trends projected more extreme climate events, financial problems, increase in poverty, increase in energy prices and the increase health problems. All are obstacles for national development plans. This paper is trying to shed lights on current related climate change impact of major sectors. It also suggests general adaptation plan in which mainly depends on consorted international cooperation between the industrialized and developing and least developed countries to safeguard the shared environment and to ensure the livelihoods of the future generations.

## Introduction

The profile of climate change has risen from being an environmental issue to a major development issue that is considered as the 'biggest threat facing the world' [1]. It is believed that most of the observed increase in globally averaged temperatures since mid 20<sup>th</sup> century is very likely due to the observed increase in anthropogenic greenhouse gas (GHG) concentrations. The observed evidence from all continents and oceans shows that many natural systems are being affected by climate change. It is for that reason that most international efforts on climate change have centered on limiting GHG emissions associated with human activities, which reflect the attempts to tackle the cause of the problems. Today,

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such efforts are driven by several international agreements that address climate change with an ultimate objective: to stabilize the GHG concentrations in the atmosphere (see Figure 1) at a level that would prevent the serious anthropogenic interference with the climate system [2].

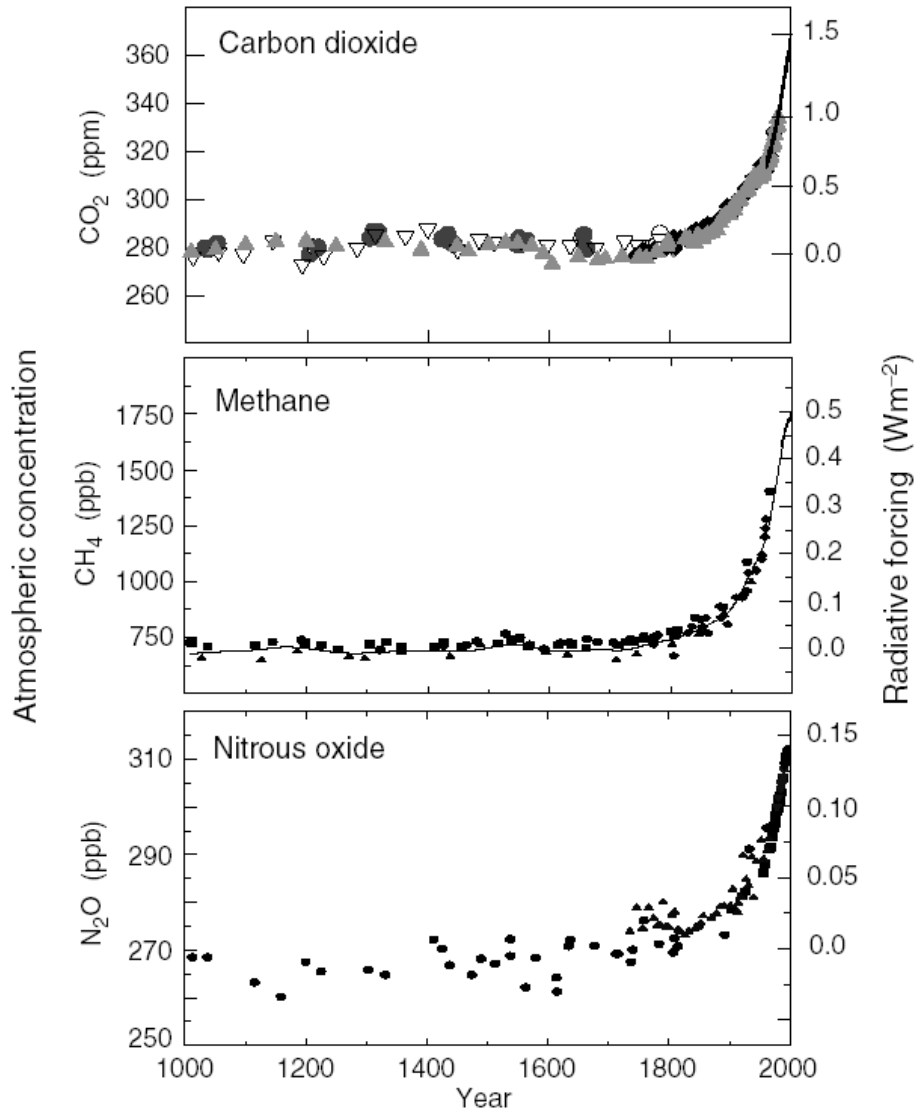


Fig. 1 Development of GHG concentrations in the atmosphere [3]

Climate change has generated its own glossary of terms and definitions that mostly based on the accumulated scientific background. Hence, in climate change terminology, tackling climate change by limiting greenhouse gas emissions is known as **mitigation**. In addition there are growing effort to better understand the **vulnerability** of human societies to the impacts of both current climate and future climate change. Such vulnerability describes the ability of the

impacted communities to cope with a situation of being exposed to external shocks (e.g. a flood or draught) and stresses (e.g. a gradual temperature increase, or increases in extreme weather events) that are linked directly with the climate. The last fifty years have witnessed the occurrence of shocks and stresses that have exceeded the ability of communities to cope with. Communities require to strengthening their capacities to cope with the possible consequences of climate change and at the same time to reducing the possible exposures. It is very much crucial to understand how communities and natural systems can prepare to changes in climate, or **adaptation** in climate change terminology. In this respect a planned effective adaptation by individuals, communities or institutions may reduce the possible risks associated with external shocks and stresses in addition to reducing vulnerability. Developing adaptation measures is crucial for tackling issues linked with climate change especially those that may derail sustainable development, such as the environment and nature, public health, biodiversity and agriculture, food security, energy security, and socio-economic growth. Adaptation measures should be integrated in ways that represent and tackle issues of concern, e.g. planting trees for sustainable agricultural systems, soil and water conservation measures, which involve reducing major GHG in the atmosphere.

Integrated adaptation measures require relevant information and may fall into two approaches:

1. **Top-down** adaptation approach, which relies on climatic and applied modeling to predict secondary impacts from a projected change in climate.
2. **Bottom-up** adaptation approach, which assess vulnerability and adaptive capacity to current climate variations and future climate trends at the local level.

The global climate change threatens all communities; however, poorest nations in developing and least developed countries are expected to be more vulnerable to climate change and the associated external shocks and stresses. This is because such countries depend to large extent on agriculture and fisheries that are both highly vulnerable to climate change, in addition to the fact that such countries have already instable and shaky socio-economic conditions.

Emphases on major sectors that are vulnerable to climate change are presented below with recommended adaptation measure. It is worth mentioning that although several measures

could be considered as proposed standards, each community has its own settings, culture and uniqueness that should be taken into account by national governments that bear responsibility for planning national policies.

## **Climate change possible impacts on different sectors**

### **1. Climate change impacts on public health, poverty and social disruptions**

Predicting the impact of climate change on public health is a complicated task, however, the potential impacts of climate change's associated external shocks and stresses on human health are likely to increase vulnerability and reduce opportunities by interfering with education and the ability to work. The Prolonged intense heat waves coupled with humidity may increase mortality and morbidity rates, particularly among the urban poor and the elderly. In addition the increase in extreme weather events and their intensity, i.e. floods, landslides, and storms, are considered major cause of recent disaster-related deaths [4].

Changes in temperature and rainfall may change the geographic range of vector-borne diseases such as malaria and dengue fever, exposing other populations to these diseases. Young children as well as pregnant women and their unborn children are especially vulnerable to malaria. Malaria contributes to mortality, low birth weight, and maternal anemia [5]; e.g. the frequency and severity of malaria epidemics in East Africa already appear to have increased in correspondence with the increased frequency, magnitude, and persistence of the El Niño phenomenon over the past 20 to 30 years [6].

In addition to its adverse effect on public health, climate change consequence shocks and stresses impacts will particularly affect the poor in many countries, in particular Africa, Asia, and Latin America. It is unfortunate that currently over one billion people; of them two thirds are women, live in extreme poverty, a figure that is expected to rise to 2.8 billion in the coming ten years [7]. Climate change will compound existing poverty. Its adverse impacts will be most striking in the developing and least developed communities because of their geographical and climatic conditions, their high dependence on natural resources, and their limited capacity to adapt to a changing climate. Within these communities, the poorest, who have the least resources and the least capacity to adapt, are the most vulnerable [8]. Further, the consequence of climate change associated shocks and stresses may threaten the livelihoods of the developing

and least developed nations and increase inequities between them and the developed nations. Current development strategies in developing and least developed countries tend to overlook climate change risks and compromise the use of both mitigation and adaptation.

Another possible associated impact on communities, particularly the developing and least developed nations, is the mass migration resulted in crucial reduction in resources that threatens the communities' livelihoods. The loss of land mass in coastal areas due to sea level rise is, for example, likely to lead to greater permanent or semi-permanent displacement of populations, which may have considerable social and political ramifications. Areas most vulnerable to sea level rise located in the tropics: the west coast of Africa; the north and eastern coast of South America; South and Southeast Asia; and Small Island states in the Caribbean, Pacific and Indian Oceans [8]. Of the world's 19 Mega-Cities<sup>2</sup>, 16 are on coastlines and all but 4 are in the developing world. To this should be added the risk for potential conflicts, including social insecurity, political instability, and wars over scarce fresh water or other natural resources.

## **2. Energy security and climate change**

Energy plays a vital role in our society, underpinning all areas of economic activity. The economic impact of energy supply disruptions can, therefore, adversely impact development. Thus the role of national governments is to ensure that secure and reliable energy sources are readily available. A country's energy security refers to planned measures taken to minimize the risks of supply disruptions below a certain tolerable level. Such measures ensure that a supply of energy is readily available and affordable to meet domestic demand and involves quantity and price parameters. The main energy source streams come from the fossil fuel which has been exploited and used heavily over almost a century. The consequences of burning fossil fuel over a long time span are the increase of anthropogenic GHG emissions and concentrations in the atmosphere.

The forty years accumulation of scientific evidence pointing towards the risks of enhanced climate change due to increasing anthropogenic GHG emissions led to a first international

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energy policy response in 1992 with the adoption of the United Nations Framework Convention on Climate Change (UNFCCC). The UNFCCC's ultimate objective is to stabilize "GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system". This was subsequently endorsed in 1997 by the Kyoto Protocol, which sets a timeframe for emission reductions in industrialized countries. It is suggested that to stabilize CO<sub>2</sub> concentration in the atmosphere at any given level, emissions will ultimately have to be reduced to the level of persistent natural sinks [9]. Although countries are active trying to reduce energy-related emissions, achieving the goals of the UNFCCC will require more actions, with growing repercussions on communities' energy systems and their reliability. E.g. due to the nature of electrical energy as a commodity, that cannot be stored in meaningful volumes, maintain the balance between the supply and the continuous increasing demand is a huge and complex challenge. The contribution of alternative energy sources in ensuring supply is still low, but promising. In addition energy efficiency and life style change terms are both actively used to ensure the future energy security.

### **3. The economics and climate change**

The degree of local environmental consequence degradation may influence the vulnerability of ecosystems to climate change. Habitat fragmentation is already a leading cause of biodiversity loss, and changes in temperature and moisture regimes further limit habitats necessary for the survival of species. Degradation of forested mountain slopes in conjunction with intensified rainfall may increase erosion and loss of fertile soil and affect the quality of watersheds. Climate change is likely to lead to changes in species distribution and abundance, and increase the risk of extinction and loss of biodiversity [10]. Since some ecosystems are highly sensitive, even small changes can have large effects. Minor increases in water temperature can, for example, damage coral reefs, exacerbating other stresses such as pollution and over-fishing and thereby cause a reduction in fish stocks, badly impact fish and tourism dependent livelihoods. Changes in ecosystem composition and provision of goods and services may also have wider economic effects. Essential ecosystem services include breaking down wastes and pollutants, purifying water, and maintaining soil fertility. Climate change will alter the quality and functioning of ecosystems, reducing their capacity to perform their role as important life support systems. This will have important impacts on key economic sectors such as agriculture, water supply, and

others. The overall effect is expected to hampering economic growth, in particular in developing and least developed countries. The absence of adaptation plans and mitigation measures is expected to increase the costs of rehabilitation of affected areas from external shocks' consequences thus diverting funds from the sustainable development purposes. Current extreme weather events are already taking their toll on developing countries' economies, leading to loss of human and economic capital. Regions where climate change exacerbates climatic extremes and which have limited adaptive capacity will be further constrained in their development prospects due to additional loss of life, private assets, reduced productivity of important economic sectors, and destruction of infrastructure.

#### **4. Climate change implications on water resources, agriculture and food security**

Water scarcity is already a major problem in several parts of the world. The number of people impacted by water scarcity is projected to increase to around five billion people by 2025, independent of climate change [10]. Projections for the coming decades show that fresh water unavailability is likely to increase considerably in many water scarce regions due to increased frequency of droughts, increased evaporation, and changes in rainfall patterns and run-off. Precipitation is expected to increase in equatorial, middle, and high latitude regions [10]. As rainfall events are expected to become more intense, the incidence of floods may increase, adversely impacting communities and their infrastructures. Increases in temperature and changes in precipitation are projected to accelerate the retreat and loss of glaciers [10].

Agriculture is the other important sector that is believed to be strongly vulnerable to climate change. It is considered the most important sector for most countries, especially developing and least developed ones. In such countries the impact of agricultural growth on poverty reduction tends to exceed the impact of growth in other sectors. Food security is a function of several interacting factors, including food production as well as food purchasing power. Climate change could worsen the prevalence of hunger through direct negative effects on production and indirect impacts on purchasing powers. Land degradation, price shocks, and population growth are already a major concern for sustaining agricultural productivity. Changes in temperature, precipitation, and climatic extremes will add to the stress on agricultural resources in many regions, especially of developing and least developed countries, and reduce the quality of land areas for agricultural production. Areas of severe drought, land degradation and desertification

will particularly suffer more. Such areas; in Africa, Asia and South America are currently suffering from the climate change consequences with regard to land productivity. In addition, problems are expected to intensify in affected coastal areas where the consequence rise of sea level may lead to salinization and render agriculture areas unproductive. In areas where fish constitute a significant source of protein for people, declining and migration of fish stocks due to climate change and associated changes in the marine environment will further need to be considered in their impact on the local food security.

The impact of climate change on food supply varies significantly by region. In general, crop yields are projected to decrease in most tropical and subtropical regions due to changes in temperature and rainfall [10]. Consequently, there is a serious risk that climate change will worsen food security and exacerbate hunger in some regions, mainly developing and least developed. In the short term, however, the greater impact on food security could come from the projected increases and severity of extreme weather events rather than from gradual changes in the climate [7].

### **Cooperation in climate change mitigation and adaptation**

While national governments bear the responsibilities to develop and implement integrated policies and programs that build the resilience and reduce the vulnerability of their populations to climate change, international communities should act in consorted way to minimize the threat of global changing by complying with the agreements and conventions initiated to balance the anthropogenic emissions to the agreed on figures. National government should prepare national policies anchored in countries' economic growth and sustainable development, and integrated with its social security strategies. In that sense policies should encourage and propose preventive local actions, to manage the risks associated with the impacts of climate change. In this regard, the international cooperation should ensure the availability of relevant information that considered crucial to national polices and planning for adaptation to climate change. Countries need the capacity and resources to track meteorological patterns, forecast impacts, and assess risk in order to make good decisions and provide timely information to their citizens. Capacity for monitoring and forecasting climate change can significantly affect livelihoods. For farmers, for example, having access to technologies for adaptation and knowing early about abrupt changes in rainfall patterns or temperature can make the difference between



a bountiful harvest and crop failure. Developed countries should have the moral to provide support for several developing and least developed countries that have high degree of physical exposure to climate change and limited capacity to respond to the challenge of adaptation. Other developing countries, with less immediate exposure to impacts from climate change and with greater institutional and financial capacity to plan for adaptation, could work jointly with developed countries to mobilize financial assistance and to enhance their technical capacities to address challenges of adaptation. There are several international initiatives that need countries active response and to seriously cooperate among each others to put them in actions. In 2007, the Global Leadership for Climate Action (GLCA) published “Framework for a Post-2012 Agreement on Climate Change” [11], which called for four negotiating pathways focused on mitigation, adaptation, technology and finance that required international consorted efforts to jointly support mitigation and adaptation measures and plans and their implementations. Mitigation and adaptation requires financial funds that should be mostly secured from the industrialized countries to meeting the cost of adaptation in developing and least developed countries.

## **Conclusions**

Climate change is likely to adversely impact developing and least developed countries that are more vulnerable to serious climate change external shocks and stresses. The livelihoods of nations in such countries are expected to suffer from the consequence increases in poverty, health problems, social insecurity, resources scarcity and bad quality, and political instability. Although national governments bear the responsibilities for encountering the possible future climate change impacts on their nations, international communities and in particular developed nations have a moral obligations to help and assist adversely impacted nations to mitigate any associated serious threat by providing the proper information and the financial help.

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