Global Warming & Climate Change

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23rd Session of the UNEP's Governing Council / Global Ministerial Environment Forum

■ Noor Hasimah A. Manaf

The UN General Assembly in 1972 which established United Nations Environment Programme (UNEP) in its resolution 2997 also established the UNEP Governing Council (GC) to provide a forum for the international community to address major and emerging environmental issues. The Global Ministerial Environment Forum (GMEF) is constituted by the UNEP GC for the purpose of constituting a process for ensuring policy coherence in the environment field.

In September 2000, at the United Nations Millennium Summit held in New York, 189 world leaders committed their countries to strengthen global efforts for peace, democracy, good governance, environmental sustainability and poverty eradication as well as promoting the principles of human rights, human dignity, equality and equity. The road map that was developed to guide these efforts resulted in the identification of the The Millennium Development Goals (MDG). The MDGs comprise 8 goals, 18 targets and 48 indicators (EPU, 2005) " to create an environment – at the national and global levels alike–which is conducive to development and the elimination of poverty".

The Meeting

The 23rd Session of the UNEP's Governing Council/Global Ministerial Forum was held on 21-25 February 2005 at the UN Office at Nairobi, Kenya. The Ministers and Heads of Delegations at the Meeting discussed the implementation of the internationally-agreed development goals contained in the Millennium Declaration (MDG) related to gender and environment, as well as policy issues related to water, sanitation and human settlements, and international environmental governance; and to put forward recommendations for accelerated and sustainable implementation of the goals to the Summit Level Meeting of the General Assembly in September 2005.

The Meeting discussed draft decisions on international environmental governance; environment fund budgets for 2006-2007; administrative and other budgetary matters; state of the environment and UNEP's contribution to addressing substantive environmental challenges; chemicals management and relevant water-related issues.

The meeting elected H.E Mr. Rachmat Witoelar, State Minister for the Environment of Indonesia as the President of the Council replacing the Hon. Mr. Arcado Ntagazwa.

Malaysian Delegation

The Malaysian Delegation was headed by the Minister of Natural Resources and Environment, the Honorable Dato' Sri Hj. Adenan b. Hj. Satem. Other members were Dr. Nadzri Yahaya, Undersecretary, Conservation and Environmental Management Division, Ministry of Natural Resources and Environment (NRE), Mr. Rizal Mansor, Press Secretary to the Minister of Natural Resources and Environment, Mr. S. Muthusamy, Economic Planning Unit, Mr. Wan Zaidi bin Wan Abdullah, Ministry of Foreign Affairs and Mrs. Noor Hasimah A. Manaf, Department of Environment.

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Inside this Issue

Weathering the Storm

Hurricanes Katrina and Rita have demonstrated to us the destructive fury of weather and climate gone berserk. The havoc it created was brought into our homes via the marvels of ICT, specifically digitalized satellite communications. It happened upon a distant shore and upon people bestowed with wealth. While the killer Tsunami of last year mostly affected poorer Asian countries, Katrina and Rita reserved their fury for the richest country in the world. Clearly when it comes to weather and climate we are all in it together–rich and poor, black and white, and all other shades of human pigmentation.

In the immediate aftermath of these hurricanes, the whispering and hissing voices of discord with regard to widespread flooding and destruction to property and persons in New Orleans claimed that rich America's response to poor Black America's plight bore the hallmark of indifference at best and racism at worse. This avalanche of disquiet sorely missed the point. The politics of managing climate change is being grossly overlooked for the politics of race and economics. There could never have been an adequate warning of Katrina's (or Rita's) impending furry for it is Katrina itself that is the Warning spelled with a big "W". It is a warning blowing in the wind that the global climate has been altered, by mankind's doing, to a degree that spells doom for all of us here, there and everywhere. Can we weather this storm of our own making?

Weather and climate have a profound influence on life on earth and essential for health, food production and well being of all organisms. This climate system that nurtures and protects us is a highly complex system consisting of five major components: the atmosphere, the hydrosphere, the cryosphere, the land surface, the biosphere and the interactions between them. Even taking each of these components without their interactions tells us that the 'state of health' of the weather and climate system is much imperiled. There is now little doubt among leading scientists and experts in their own fields that climate change is a reality. The severity of these changes may be debatable but evidence accumulates by the day that its impact on ecology and human health and wellbeing will be profound. Let us for a start briefly review the impact of global warning (it being only one manifestation of climate change) on human health.

Heat related deaths such as heat stroke and illnesses are associated with strong heat waves especially among the elderly, infants and people suffering from cardiovascular and respiratory diseases. The recent summer heat wave in France was recognized as a health disaster. The risk of air pollution to human health is obvious. The recent and annual appearance of haze over our shores makes us no stranger to this risk. Exposure to air pollutants can exacerbate respiratory and cardiovascular diseases and cause premature deaths. Elevated levels of CO_2 for instance promote growth and sporulation of soil fungi. The combinatory effects of such phenomenon can be deadly. These spores are potential aero allergens and can be transported by diesel particles into the alveoli of humans. The third category of risk are infectious diseases. Malaria and dengue, both mosquito borne, are sensitive to meteorological changes. Higher temperatures speed up the rate of reproduction and maturation of pathogens carried by these mosquito vectors. The fourth category of risks pertain to the alteration of the marine ecology which in turn affects our food chain. Fertilizers and sewage when combined with warm water can trigger toxic algal blooms which contaminate fish and shellfish. Certain such algae support the proliferation of various bacteria including the causative agent of cholera. We can add to this list of risks those arising form rising sea levels, extreme weather, droughts and storms which in the main displace human populations and destroy their means of livelihood. Given all this, we should be really afraid of the future, but are we? If enough is not done by peoples, countries and governments, we would in effect be exposed to the annual lottery of the weather.

Dato' Hajah Rosnani Ibarahim
Director-General
Department of Environment
Malaysia

We should by now be clear that with regard to weather and climate, everything is linked to everything else. If we do not rationalize anew our needs and wants to ensure sustainability, then surely Mother Nature and our planet Earth will not remain our home. In its place, we will live and fight for scarce resources in an increasingly hostile natural environment hopelessly defiant to the last. In other words, it could mean the end of civilization no less. It would indeed be inhuman of us all to let this come to pass. We must double up our efforts to weather this storm!

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A rich and interactive debate took place and the Ministers and Heads of Delegations then requested the President of the Governing Council/ Global Ministerial Environment Forum GC/GMEF to convey what has been transpired and decided at the Meeting (The Nairobi Communiqué) to the Secretary-General of the United Nations to be presented to the meeting of the General Assembly as the contribution of the Ministers of Environment assembled at the GC/GMEF. The goals under discussion were:

Discussion on Millennium Development Goals

Goal No.1 : Eradicate Extreme Poverty and Hunger – Environment and Poverty
Goal No.3 : Promote Gender Equality and Empower Women – Gender and Environment
Goal No.7 : Ensure Environmental Sustainability in Relation to Water, Sanitation and Human Settlements

Goal 1 : Eradicate Extreme Poverty and Hunger – Environment and Poverty

Natural ecosystems and services provided by watersheds and aquifers, coastal and marine ecosystem, forests, soils and the atmosphere are continuously being threatened by our current patterns of consumption and production that undermine the sustainability of the resource base upon which we depend. Extreme poverty, degradation of natural resources and global environmental changes are some of the factors that can undermine development efforts and heighten potential threats of conflicts and insecurity at all levels. The international community should take all possible actions to alleviate these problems including revitalizing commitment to improve governance and the rule of law.

Goal 3 : Promote Gender Equity and Empower Women – Gender and Environment

Sustainable development is not possible without the empowerment of women and gender equality. This means that gender equality is also instrumental and a precondition for economic empowerment, environmental management and also sustainable development. Women are most affected by environmental degradation, such as chemical contamination and indoor pollution and are also most vulnerable to natural disasters. Women are among the poorest but nonetheless are strong drivers of change.

Goal 7 : Ensure Environmental Sustainability in Relation to Water, Sanitation and Human Settlements

Water is perhaps the most fundamental of all environmental resources and key to the viability and long-term sustainability of the world's ecosystems. But damaging activities of humans such as environmentally damaging infrastructure development, modification of river flows, deforestation, unsustainable agriculture practices, overfishing, introduction of alien invasive species, disposing of toxic materials and chemicals and release of hazardous wastes and pollutants have degraded the quality of water. Appropriate measures and actions must be taken to address this problem and the link between sustainable water management and poverty reduction is therefore crucial and must be prioritized.

Recommendations for countries and the international community

- Involvement of the poor, particularly the rural poor, and women in the development of environment-sound MDG implementation strategies at the local and community level should be ensured, as a central component of the success of such strategies.
- Innovative mechanisms, including micro finance, equitable tax incentives, and the involvement of civil society should be further explored to enhance local ownership and commitment to such strategies. Partnerships with the private sector should be further explored.
- Trade and aid measures should be mutually supportive. Urgent measures should be taken to remove barriers to trade and agriculture subsidies in developed countries that impact negatively on developing countries' commodity exports to relieve pressure on natural resources.
- International financial institutions and development cooperation agencies should integrate principles of environmental sustainability into their policies and programmes.

- Gender equality should be mainstreamed at all levels in strategies, policies, and programmes including in poverty reduction strategies.
- Women including girls should be empowered through education and capacity building, not just in environment but in all fields. Gender skills should be included in school curricula for women and men alike.
- Barriers to the education of women and girls should be identified and removed.
- Women should be equally represented and fully involved in environmental decision making at all levels. They should be involved from the onset of the planning process and have access to environmental information. Men should be actively involved in the empowerment of women.
- Women should enjoy equal access to economic activities, market opportunities, land tenure and natural resources.
- Government and international organizations should strengthen or establish mechanisms at the national, regional and international levels to assess the impact of development and environmental policies on women.

- It is vital to achieve environmentally sustainable water use, and the application of integrated water resources management (IWRM), including ecosystem approaches, for doing so.
- Environmental valuation of ecosystem goods and services should become a core component of water strategies.
- While increased investment in infrastructure at the national level is vital, there should be a clear recognition of the need for more affordable, smaller scale and environmentally sustainable infrastructure that targets the needs of the poor as the highest priority.
- Ecosystem approaches increase the availability of clean water and should be an integral part of actions to supply the poor with clean water and adequate sanitation.
- Improved water governance is important in mobilizing funds but substantive increases in donor assistance are required.

Recommendations for UNEP

- The environment and poverty initiative of UNEP and UNDP should be the primary mechanism to assist developing countries to fully integrate environmental sustainability into poverty reduction and developing strategies. The initiative will require long-term commitment and adequate financing.
- The UNEP/UNDP MOU should be implemented as a matter of priority and UNEP's capacity to support and provide technical advice to governments at the national level should be enhanced.

- UNEP, in collaboration with UNESCO, UNICEF and other UN agencies and national governments, should play a stronger role in the field of gender and environment, inter alia, in the areas of education, participation and assessment.

- UNEP should increase its support for the implementation of the JPOI target of Integrated Water Resources Management and Efficiency Plans by 2005, with the support of developing countries, including through capacity building and with partners such as UNDP and the Global Water Partnership (GWP).
- Progress in the implementation of the Convention on Biological Diversity and the marine and freshwater biodiversity targets of the JPOI should be monitored by UNEP / WCMC and regularly reported to relevant intergovernmental bodies.
- UNEP should support the establishment of regional Ministerial bodies on water, e.g. AMCOW and work with UNDP to ensure that environmentally sustainable water use is integrated into PRS and national development plans.
- UNEP should be more active in international forums to drive home the vital contribution of environmental sustainability in meeting water targets.

The Nairobi Communiqué

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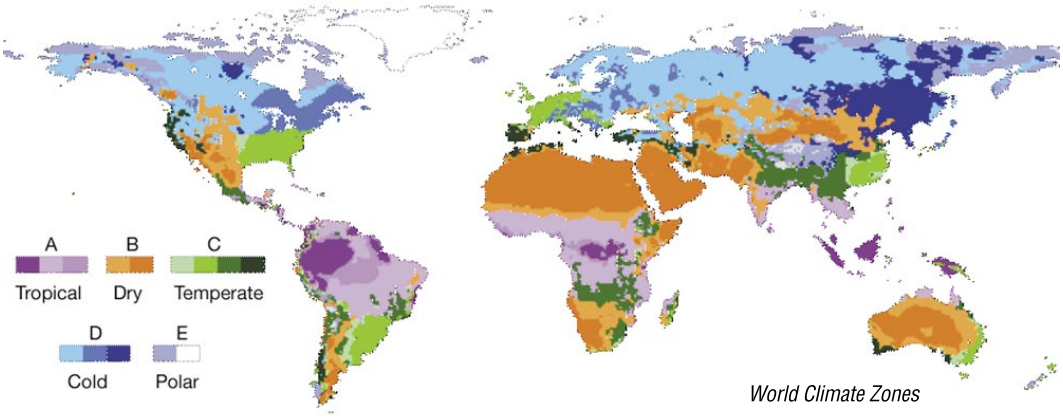
Concept of Climate Change

Dr Sanjoy Banerjee and Prof Dr Fatimah Md. Yusoff, Universiti Putra Malaysia



World Climate Zones

Climate classification encompasses the averages, extremes, and frequencies of all meteorological elements such as temperature, atmospheric pressure, precipitation, wind, humidity, photo-period and sunshine, together with factors that influence them. In simple terms, climate is the average pattern of weather over a long term.

There are many definitions of climate. According to the Intergovernmental Panel on Climate Change (IPCC 2001), climate has been defined as the statistical description in terms of the mean and variability of relevant quantities (such as temperature, precipitation and wind) over a period of time, ranging from months to thousands or millions of years. However, the World Meteorological Organization puts 30 years as the classical period for defining climate.

The climate system is a highly complex system consisting of five major components: the atmosphere, the hydrosphere, the cryosphere, the land surface, the biosphere and the interactions between them (IPCC, 2001). The system evolves in time under the influence of its own internal dynamics and other external forces such as volcanic eruptions and solar variations. The oceans, which cover more than 70% of the earth's surface, play a fundamental and complex role in regulating climate. In addition, human-induced forces such as the changing composition of the atmosphere and landuse changes can also affect the climate.

When a given region experiences a change in the "average weather", it is called climate change. According to IPCC (2001), climate change can be defined as "statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period". The United Nations Framework Convention on Climate (UNFCC) states that climate change is variation in the climate, which can be attributed to human activity, either directly or indirectly and stresses that it must be in addition to natural variation being experienced during the same time period.

The causes of climate change can be divided into two categories (1) natural causes, and (2) anthropogenic origins. Continental drifts, volcanoes, ocean currents, the earth's tilt, comets and meteorites are some of the natural factors responsible for climate change. Man-made activities such as land clearing and industrial development are some of the main causes of climate change. A common example of man-made cause is the production of greenhouse gases. The Industrial Revolution in the 19th century saw the large-scale use of fossil fuels for industrial activities, causing a rise in greenhouse gases in the atmosphere. This man-made climate change is known as global warming. Global warming has become an environmental threat as more energy is being absorbed from the sun than is emitted back to the space leading to warming of the planet.

Weather and climate have a profound influence on life on the earth and are essential for health, food production, and well-being of all organisms. It is therefore critical for human societies to develop ways for a sustainable life support system that will cause minimal impacts on climate change and global warming.

Conclusion

Over the last century, the earth's climate has changed. It is a serious global, long-term problem, involving complex interactions. Evidence suggests that most of the warming observed over the last 50 years is attributed to human activities. Computer models have predicted that because of greenhouse gas emissions, temperatures would continue to rise over the next decades, unless concrete and effective steps are immediately taken to remedy the problem. Failure to introduce some form of global greenhouse gas emission reduction strategy will merely extend the time frame of anthropogenic global warming effects that humanity may already be witnessing.

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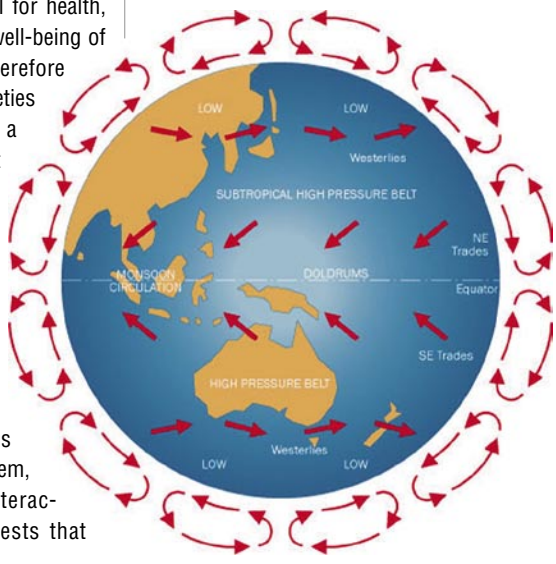

Global Air Circulation

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Malaysia's Achievement of the Millennium Development Goals

Difficulties in the form of ethnic and geographic inequalities in income and access to health and education services have been addressed. Advantages that Malaysia possesses such as steady per capita income and stable and strong physical and administrative structure have substantiated the process of development. Malaysia has successfully implemented the MDGs with full commitment including the three goals discussed in the 25th UNEP GC Meeting in Nairobi (EPU, 2005).

Goal 1: Eradicate Poverty and Hunger

The MDG 1 targets to halve the proportion of population living below the poverty line by 50% between 1990 and 2015. Malaysia's poverty rate has declined dramatically over the past three and a half decades. (EPU, 2005). In 1970 about half of Malaysian households lived below the poverty line, while this figure fell to 16.5% in 1990 and to just 5.1% in 2002. Thus Malaysia has successfully achieved the target.

Goal 3: Promote Gender Equity and Empower Women

The target is to eliminate gender disparity in primary and secondary education preferably by 2005 and in all levels of education by 2015. Educating girls is the key. In Malaysia, enrolment rates of girls are equal to, or exceed, those of boys at all levels of schooling. A key challenge now is to increase enrolment and retention rates of boys (EPU, 2005).

Goal 7: Ensure Environmental Sustainability

Environmental sustainability is necessary to achieve and sustain economic growth, poverty eradication and social development (EPU, 2005). MDG 7, on ensuring environmental sustainability, sets three targets namely to (i) integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources; (ii) halve by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation; and (iii) by 2020 have achieved a significant improvement in the lives of at least 100 million slum dwellers.

Malaysia uses six key indicators to monitor the progress of the MDGs. These are: (i) proportion of land areas covered by forest; (ii) ratio of area protected to maintain biological diversity to surface area; (iii) energy use (kg. oil equivalent) per $ GDP; (iv) carbon dioxide emissions (per capita) and consumption of ozone depleting CFCs (ODP tons); (v) proportion of population with sustainable access to an improved water source, urban and rural; (vi) proportion of urban and rural population with access to improved sanitation.

In Malaysia, nearly 60% or about 19.5 million hectares of the total land area of Malaysia is under forest and a further 3.3 million hectares are protected as wildlife sanctuaries, national parks, state parks and wildlife reserves.

In the energy sector, currently over two-thirds of Malaysia's electricity is produced by turbines. Malaysia's largest energy resources are oil and natural gases. For clean water supply, in 2000, 98% of Malaysia's urban population and 87% were served with clean piped water (EPU, 2005). Sanitation is an important element of the infrastructure for human health and environmental protection. By 2000, sanitary latrines had been provided for 99% of the population (EPU, 2005).

Conclusively, Malaysia has fulfilled the three MDG targets discussed in the 25th UNEP Governing Council in Nairobi. The challenge now is to maintain momentum for the remaining goals and to set priorities that will keep the nation moving ahead in an exemplary way.

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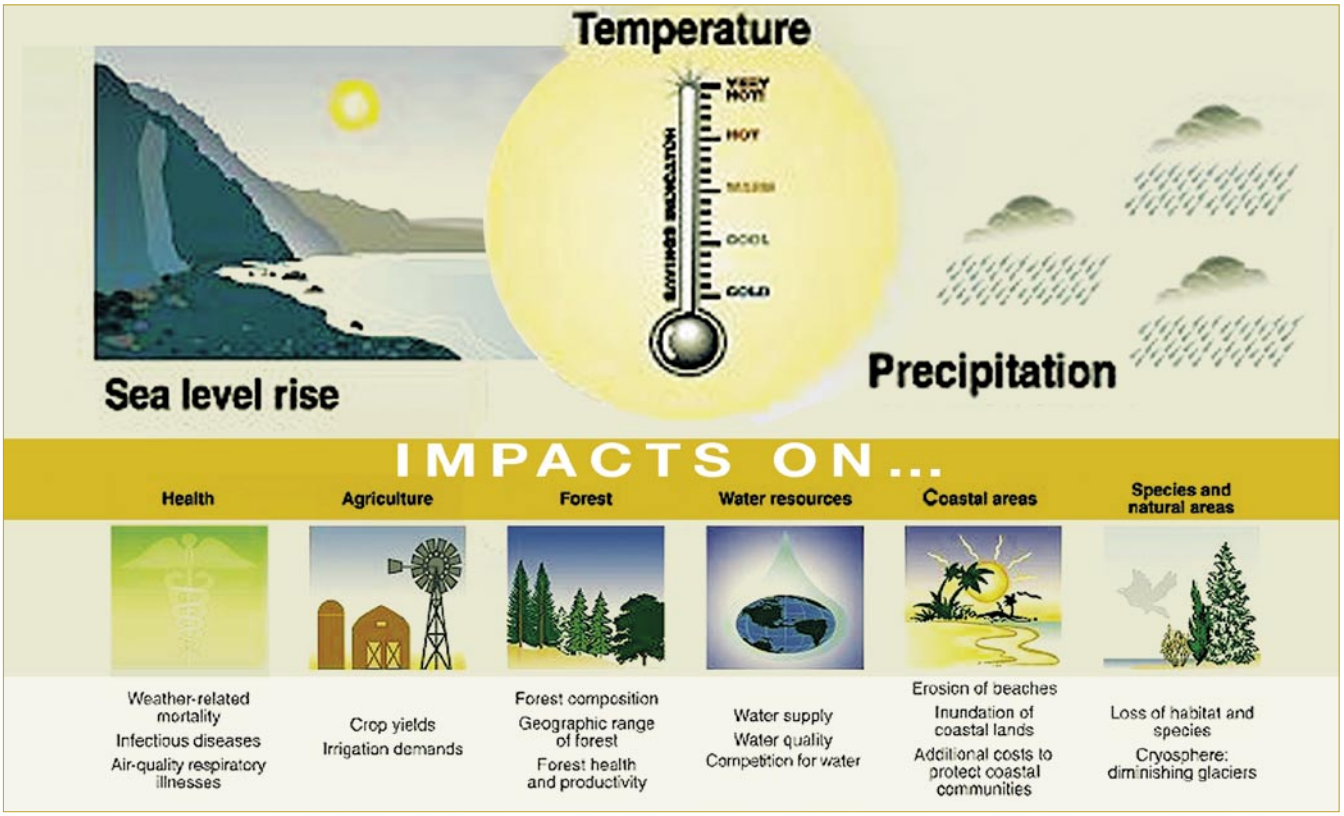
Potential Impact of Climate Changes



Global Warming: Causes & Consequences

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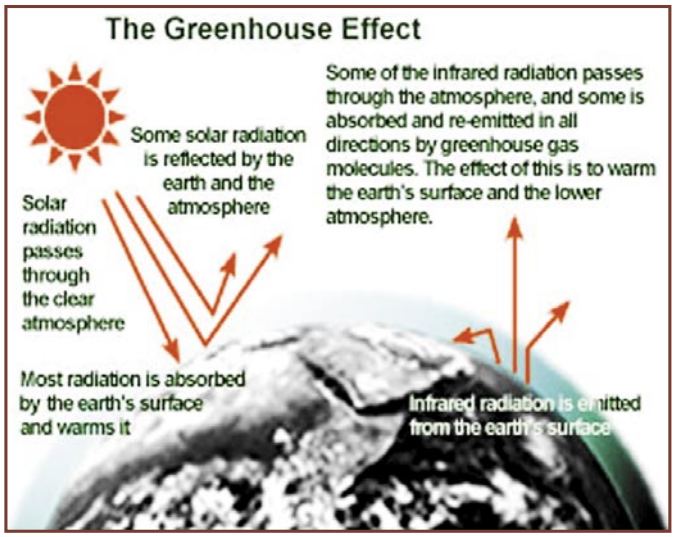
The earth's surface temperature has risen by about 0.6 °C in the past century (National Academy of Sciences). There is a strong evidence that most of the warming is caused by human activities, that have altered the chemical composition of the atmosphere through the buildup of greenhouse gases. The warmest year ever recorded was 1998, with 2002, 2003 and 2004 close behind it.



Man-made activities such as land clearing, urbanization, economic growth and industrial development are some of the main causes of climate change. The Industrial Revolution in the 19th century saw the large-scale use of fossil fuels for industrial activities, causing a rise in greenhouse gases in the atmosphere, a trend that remains until the present day. These greenhouse gases emitted by human activities remain in the atmosphere for long periods and contribute to global warming. The main greenhouse gases that are generated from a variety of industrial processes include carbon dioxide (CO2), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF6).

Causes of Global Warming

The earth has a natural greenhouse effect which keeps it warmer than it would be without an atmosphere. However, mankind has been releasing extra greenhouse gases to the atmosphere by burning fossil fuels and through deforestation during the last 200 years. More heat is trapped in the atmosphere by these gases, and it is now suspected that the observed warming of the earth is due to this man-made enhancement of the natural greenhouse effect.

Global warming has become an environmental threat as more energy is being absorbed from the sun than is emitted back to the space. This has caused the imbalance of the earth's energy and warming of the planet. Scientists from the National Aeronautics and Space Administration (NASA) (Washington, D.C.), The Earth Institute at Columbia University (New York), and Lawrence Berkeley National Laboratory (California) have confirmed the energy imbalance by measuring ocean heat content occurring over the past decade.

Consequences of Global Warming

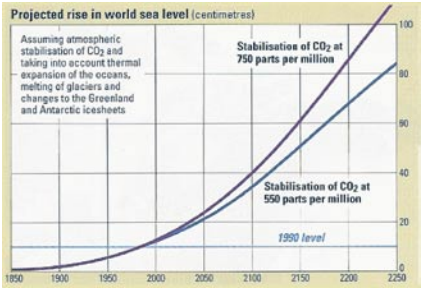
There are many disasters that can be related to global warming. These include oxone depletion, sea-level rise, El Niño and La Niña, hurricanes/tornadoes, changes in ocean circulation and perhaps tsunami. Long term impacts of climate change in coastal areas, such as sea level rise or storm surges, could result in the increased erosion of shores and associated habitat, increased salinity of estuaries and freshwater aquifers, altered tidal ranges in rivers and bays, changes in sediment and nutrient transport and increased coastal flooding (NOAA, 1998). Rising global temperatures are also expected to change precipitation and other local climate conditions. A changing regional climate could alter forests, crop yields and water supplies. In addition, it could also affect human health, animals and many types of ecosystems.

Ozone Depletion

The ozone layer, or ozonosphere, discovered in 1913 by the French physicists Charles Fabry and Henri Buisson, is that part of the earth's stratosphere which contains relatively high concentrations of ozone. The ozone layer is crucially important to life because it absorbs biologically harmful ultraviolet (UV) radiation from the sun. Ozone depletion causes sunburn, skin cancer, cataract and excessive exposure can also cause genetic damage. It also causes immune suppression in both animals and humans making them more susceptible to infectious diseases and also damages plants including hardwood forests and phytoplanktons. Some scientists have predicted that continued global warming can hasten ozone destruction and increase stratospheric ozone depletion especially when the stratosphere gets colder. Global warming traps heat in the troposphere causing less heat to reach the stratosphere. This makes the stratosphere cold. This has been the case for the past two years causing extensive ozone depletion. Thus global warming due to greenhouse gas emissions will enhance ozone depletion.

Sea-level Rise

Climate warming will lead to the thermal expansion of water and melting of glacial and polar ice, causing a rise in sea level (Kennedy *et al.*,2002). A study team led by Ruth Curry of Woods Hole Oceanographic Institution in Connecticut has established that 20,000 sq km of freshwater ice melted in the Arctic between 1965 and 1995 (Henderson, 2005). One of the most significant potential impacts of sea level rise may include inundation of coastal areas and islands, shoreline erosion and destruction of important ecosystems such as wetlands and mangroves (Church *et al.*, 2001; Woodworth,1999). In 1982-1983, sea level at Christmas Island in the mid-Pacific rose several inches. While sea level rose in the east, it simultaneously dropped in the western Pacific, exposing and destroying the upper layers of the fragile coral reefs



surrounding many islands. Following the sea-level rise at Christmas Island, sea birds abandoned their young and scattered over a wide expanse of the ocean in search for food. By the time conditions along the coast of Peru returned to normal in mid-1983, 25% of the year's fur seal and sea lion adults and all of the pups had died.

McLean *et al.* (2001) have identified a range of potential socio-economic impacts due to the impacts of sea-level rise on natural systems:

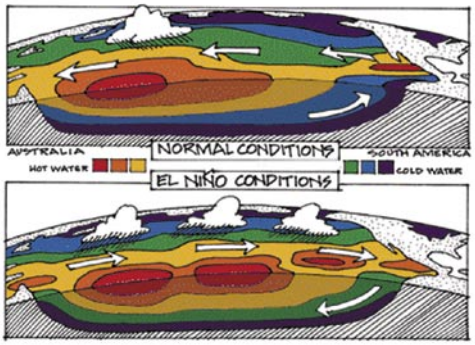
- Loss of coastal habitats and biodiversity
- Increased loss of property
- Increased flood risk and potential loss of life
- Damage to coastal protection works and other infrastructure
- Loss of renewable and subsistence resources
- Loss of tourism, recreation and transportation functions
- Loss of non-monetary cultural resources and values
- Impacts on agriculture and aquaculture through decline in soil and water quality

El Niño and La Niña

El Niño is a disruption of the ocean-atmosphere system, characterized by unusually warm ocean temperatures in the equatorial Pacific. According to scientists, the accumulation of greenhouse gases could inject enough heat into Pacific waters making El Niño events more frequent and fierce. It was in 1972-1973 that the El Niño event attracted global attention. El Niño was originally recognized by fishermen off the coast of South America as the appearance of unusually warm water in the Pacific Ocean, occurring near the beginning of the year.

The 1982-83 El Niño was the strongest so far. Sea surface temperatures at the Galapagos Islands and along the coast of Ecuador rose from 70°F to 80°F, with unprecedented impacts on marine life, such as coral bleaching. Along the Pacific coastline stretching from Chile to British Columbia, water temperatures were above normal and fish that normally live in the tropical and subtropical waters either migrated or were displaced poleward (Wallace and Vogel, 1994). Many species of fish disappeared from their normal habitats. The fishing industries in Ecuador and Peru suffered when their anchovy harvest failed and sardines unexpectedly moved south into Chilean waters (Wallace and Vogel, 1994).

Researchers from Scripps Oceanographic Society after a seven-year study of the deep eastern North Pacific revealed that marine organisms that live on the ocean bottom suffered from a long-term food shortage between 1989 and 1996. One of the reasons given for the decline in food supply was an increase in ocean surface temperatures. Studies by the Californian Cooperative Oceanic Fisheries Investigations showed that zooplankton, microscopic floating animals on which sardines feed, declined from the 1950s through early 1998, especially during El Niño events, leading to the collapse of the Californian sardine fishery.



La Niña, on the other hand, is characterized by unusually cold ocean temperatures in the equatorial Pacific. La Niña means `the little girl' and is sometimes called El Viejo, anti-El Niño, or simply "a cold event" or "a cold episode". Only at the end of the 20th century did La Niña events become of serious interest to the El Niño research and forecasting communities.

Hurricanes

A hurricane is a heat engine that derives its energy from ocean water. When water vapor evaporates, it absorbs energy in the form of heat. As the vapor rises, it cools within the tropical depression, condenses, and releases heat which sustains the system. Possibilities are there that a warmer world could lead to more frequent storms and make them stronger and more dangerous. Because the ocean is getting warmer, tropical storms can pick up more energy and become more powerful. In fact, scientists have found that the destructive potential of hurricanes has greatly increased along with ocean temperature over the past 35 years. There is evidence that human activities helped to fuel the monster hurricanes such as Katrina and Rita in the Gulf Coast, which set a trend of increasingly powerful and deadly storms in the last 10 years (Kluger, 2005). Scientists believe that carbon dioxide and other green house gases raise the temperature of the earth's atmosphere, translating into warmer oceans. Warm oceans are the jet fuels that drive the hurricane's turbines. When Katrina hit at the end of August 2005, the water at the Gulf of Mexico was 3˚C higher than normal.

Recently this year, hurricanes Katrina (Aug 2005), Rita (September 2005) and Wilma (October 2005) caused billions of damages and untold misery to thousands of people in the Southern States of USA and Mexico. According to the *Financial Times,* current estimates of "total economic losses" from hurricane Katrina is close to USD100 billion.

Hurricanes have devastating effects on coral reefs. Kramer and Kramer (2000) have presented evidence that Hurricane Mitch increased the prevalence of coral disease in the Bay Islands. He reported losses in coral cover of 15-20% across the Central American region and damage to 50-70% of corals in parts of Honduras.

Changes in Ocean Circulation

Oceans play a crucial role in the regulation of the global climate system due to the immense amount of heat energy stored in them. Changes in ocean circulation can disrupt the hydrological cycle on a global scale and can cause flooding and long-term droughts in various regions. Abrupt climate change caused rapid changes in ocean circulation 8,200 years ago that had global effects. Some regions turned significantly colder while others experienced widespread drought (Alley *et al.*, 1997). Researchers had found that the rate of ocean circulation varied remarkably following the last ice age, with strong reductions and abrupt reinvigorations closely tied to regional climate changes. Most ocean-atmosphere models suggest a weakening of the convective overturning of the ocean in the North Atlantic and around Antarctica affecting ocean circulation that could have significant regional impacts on climate. (Pittock, 2003)

Tsunami

There are speculations that global warming can trigger disasters like the Asian tsunami of 26 December 2004 that swept well over 150,000 victims to their deaths and has made many more homeless. Sri Lanka, India, Indonesia and Thailand had been seriously affected, accounting for the bulk of the casualties. Deaths were also reported from Africa, Bangladesh, Malaysia and the Maldives. Munich Re, the world's largest reinsurer, estimates tentative losses to hover around USD13.6 billion.

Researchers are just beginning to assess damage to marine life, mangroves and coral reef communities, vital to fishing industries and tourism. In 2005, the United Nations has assigned USD1 million to fund a task force to survey environmental damage associated with tsunami. Tom Hourigan, a coral reef expert with the National Marine Fisheries Service headquarters in Silver Spring, Maryland said "As the tidal waves came in, they brought a lot of force and probably broke a lot of the corals. Then as they went out again,

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Global Climate Change & Human Health

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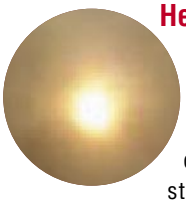
The risk of death and illnesses due to global warming in humans is difficult to quantify. Despite the uncertainty of whether it will happen, one thing for sure is that health professionals should be aware of the potential danger. Scientific evidence shows that the rate of heating is accelerating and signs of predicted troubles have slowly emerged. Among the climate-triggered health threats are:

Health Threats

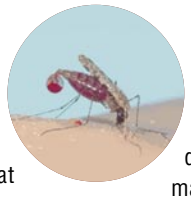


Heat waves

Heat related deaths such as heat stroke and illnesses are often associated with strong heat waves, especially among the elderly, infants and people suffering from cardiovascular and respiratory diseases. Urban dwellers who live in inadequate housing where heat is retained by concrete buildings and pavements and no air conditioning units to relieve heat stress, are also vulnerable. For example, the 1995 Chicago heat wave killed 465 people (USEPA, 1997).

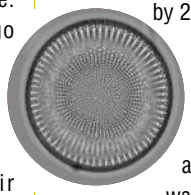
Air Pollution

Exposure to air pollutants can exacerbate respiratory and cardiovascular diseases and cause premature deaths. Ragweed when exposed to twice the ambient level of CO_2 sprouted 10% taller and produced 60% more pollen. Elevated CO_2 promotes growth and sporulation of soil fungi. These aeroallergens can be transported by diesel particles and deposited into the alveoli of humans (Epstein, 2005).



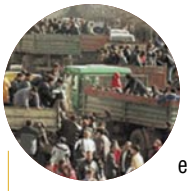
Infectious Diseases

Mosquito-borne diseases such as malaria and dengue are sensitive to meteorological changes. Heat speeds the rate of reproduction and maturation of pathogens (carried by mosquitoes). Since the life cycle is shortened, the chance of these vectors carrying matured and infectious pathogens is high. It has been projected that the risk of malarial transmission will increase in many parts of the world by 2020 if the temperature increases by 2°F (Epstein, 2000).



Altered Marine Ecology

Fertilizer and sewage, combined with warm water can trigger algal blooms ("red tide"). They create hypoxic "dead zones" in gulf and bay areas. They contaminate the fish and shellfish, and when consumed, may cause illness. As the algae grew bigger, they support the proliferation of various bacteria, e.g. *Vibrio cholerae*, the causative agent of cholera. The World Health Report 2002 estimated that climate change is responsible for 2.4% of worldwide diarrhoea (McMicheal *et al.*, 2003).

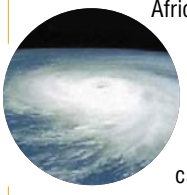


Population Displacement

Rising sea levels, extreme weather, or agriculture collapse forces people to move to other areas, creating refugee camps. Starvation, over crowding, and unsanitary conditions increase the risk of contracting infectious diseases and promotes social unrest.

Droughts

Prolonged drought may bring about a rise in malnutrition and diseases associated with it in certain countries. Droughts also cause the desert boundary to expand affecting not only locals but people living far away. For example, the people of Caribbean Island suffered respiratory illnesses when they were exposed to irritants carried by the dust clouds that originated from the African desert.



Storms

Flooding created by hurricanes causes deaths, injuries and displaces thousands from their homes. Its aftermath sets off waterborne outbreaks such as cholera, and mosquito borne infections. Hurricane Ivan brought to the US shore, soybean rust (fungal disease). The aftermath of hurricanes Katrina and Rita hauled up an estimated one million pounds of hazardous household wastes in Louisiana.

Possible Solutions

Epstein (2000) suggests three defensive strategies to prepare for the dangers.

1. Improved surveillance system that would promptly spot the emergence and resurgence of infectious diseases or vectors that carry them.

2. Focus on predicting when climatologically and other environmental conditions could become conducive to disease outbreaks so that the risks could be minimized.

3. Attack global warming itself. Human activities that contribute to the heating or that exacerbate its effects must be limited. Gains in energy efficiency of 10-30% above present levels are feasible with minimal cost through conservation measures, use of available technologies, new energy technologies and better land management practices.

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The Kyoto Protocol

Reducing Greenhouse Gas Emissions

Ramesh Nadarajah

1971 was an epochal year for environment watchers. In that year, an international treaty was drafted in response to growing concerns about global warming and its disasterous effects that were already beginning to be felt. The Kyoto Protocol adopted at the third Conference of Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) in Kyoto, Japan, that would commit industrialized nations to specifically legal-binding greenhouse gas emission reductions.

To become a legally binding article in international law, the Protocol need to be ratified by 55 countries representing 55% of global GHG emissions. After the pull out of USA (representing approximately 36% of world GHG emissions), the Protocol hung in balance. Russia, representing approximately 17% of world GHG emissions, effectively controlled the coming into force of the Protocol. After substantial deliberations with the EU, one of the main proponents of the Protocol, Russia finally ratified it in November 2004. The Protocol became legally binding in international law on 16 February 2005.

The Protocol consists of 28 Articles centered on five main elements that aim to reduce world greenhouse gas (GHG) emissions by 5.2% relative to 1990 levels during the first commitment period of 2008 – 2012. The five main elements are:

1 Commitments

The Protocol sets specific GHG emission targets for Annex 1 parties. Other parties (Non–Annex 1) are obliged to report on their emission levels. The Protocol targets the six main greenhouse gases, namely, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6).

2 Implementation

The Protocol provides for domestic and international measures through which GHG emission reductions can be achieved. These measures are namely the clean development mechanism (CDM), emissions trading and joint implementation (JI).

3 Joint Implementation

The Joint Implementation allows Annex 1 parties to implement projects that reduce emissions, or increase GHG removals by Carbon Sinks, in the territories of other Annex 1 parties, in return for Emission Reduction Units (ERUs)

4 Clean Development Mechanism

The Clean Development Mechanism allows Annex 1 parties to implement projects that reduce emissions through the implementation of projects, or through afforestation or reforestation projects in the territories of non Annex 1 parties. The emission reductions generated are termed Certified Emission Reductions (CERs). The CDM is the only mechanism of the Protocol that allows for the participation of developing countries.

5 Emissions Trading

Emissions Trading allows Annex 1 Parties to acquire carbon credits from other Annex 1 parties to meet their emission targets.

- **Minimizing Impacts on Developing Countries** – The Protocol addresses specific needs of developing countries especially those vulnerable to the adverse effects of climate change.
- **Accounting, Reporting and Review** - There are rigorous monitoring procedures to safeguard the integrity of the Protocol including an accounting system, regular reporting and scientific reviews.
- **Compliance** – The Protocol specifies a compliance committee to deal with facilitating and enforcing the Protocol

Ultimately the Protocol aims to enhance energy efficiency and encourage reforms in the relevant economic sectors so as to facilitate a less carbon intensive future. The main worldwide sectors intensively contributing to GHG emissions are the energy and transport sectors. Measures such as the protection and enhancement of GHG sinks, carbon sequestrian, renewable energy research, transport sector emission reductions and sustainable agriculture will now be more viable options as there are added financial incentives through the Protocol trading mechanisms. Subsidies for environmentally unfriendly industries will also be under threat, as these industries will face growing pressure to be more efficient and less carbon intensive.

The Kyoto Protocol is the only international treaty in place for climate change mitigation, and it must be seen as the justified first step towards a global initiative to create a more sustainable and energy efficient future. It is an extraordinary piece of work but its outcomes remain to be seen.

Total carbon dioxide emissions of Annex I Parties in 1990, for the purposes of Article 25 of the Kyoto Protocol *

Party	Emissions (Gg)	Percentage
Austria	59,200	0.4
Belgium	113,405	0.8
Bulgaria	82,990	0.6
Canada	457,441	3.3
Czech Republic	169,514	1.2
Denmark	52,100	0.4
Australia	288,965	2.1
Estonia	37,797	0.3
Finland	53,900	0.4
France	366,536	2.7
Germany	1,012,443	7.4
Greece	82,100	0.6
Hungary	71,673	0.5
Iceland	2,172	0.0
Ireland	30,719	0.2
Italy	428,941	3.1
Japan	1,173,360	8.5
Latvia	22,976	0.2
Liechtenstein	208	0.0
Luxembourg	11,343	0.1
Monaco	71	0.0
Netherlands	167,600	1.2
New Zealand	25,530	0.2
Norway	35,533	0.3
Poland	414,930	3.0
Portugal	42,148	0.3
Romania	171,103	1.2
Russian Federation	2,388,720	17.4
Slovakia	58,278	0.4
Spain	260,654	1.9
Sweden	61,256	0.4
Switzerland	43,600	0.3
United Kingdom of Great Britain and Northern Ireland	584,078	4.3
United States of America	4,957,022	36.1
Total	**13,728,306**	**100.0**

* Data based on the information from the 34 Annex I Parties that submitted their first national communications on or before 11 December 1997, as compiled by the secretariat in several documents (A/AC.237/81; FCC/CP/1996/12/Add.2 and FCCC/SB/1997/6). Some of the communications included data on CO_2 emissions by sources and removals by sinks from land-use change and forestry, but since different ways of reporting were used, these data are not included.

Impact of Climate Change on Agriculture

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Our Earth is warming! And our skin is 'burning'. At least that is what we have been facing of late. The world records too do not deny the claim as the world's 20 warmest years have all been since 1983. The heating up of the earth has been at an unprecedented rate especially in the last 50 years. This phenomenon is generally attributed to the steep increase in the greenhouse gases resulting mainly from human activities.

It is evident that global warming is affecting weather patterns and climatic conditions altering the earth's climate extremes and variability! Increasing variability in rainfall will cause continents of large land areas to suffer from increased risk of droughts. It seems obvious that any significant change in the climate and its anomalies on a global scale would likely exert climate and weather variabilities, and impact local agriculture, therefore affecting the world's food supply. Discussion on the impact of climate change on agriculture in this article will focus only on the aspects of crop production.

Climate and Crop Performance

Climate plays a major role in determining crop performance. This includes the year-to-year variability of crop production within a climatic zone. The more frequent and rampant the incidence of abnormal weather variation, the more serious the implications are on the agricultural sector, land use pattern and rural socio-economy. Climate or weather variability therefore exerts an important impact on crop productivity, with potential for both benefits and drawbacks. To address the potential impact of climate change on agriculture, it would be better to look at it from the angle of plant and crop growth responses to both the potential direct effect of increasing carbon dioxide (CO_2) and to the potential effect of the change in major climatic factors such as temperature, precipitation and humidity.

Effects of increased CO_2 on Crop Growth

Plants grow through the well-known process of photosynthesis where CO_2 is absorbed and converted to carbohydrates. Principally, the growth stimulation by CO_2 enrichment is derived partly from stimulation of photosynthesis and partly from partial closure of stomatas, which improves water use efficiency. Plant response to elevated CO_2, however, varies with species, developmental stage, temperature, mineral nutrition and the rooting container. Wheat, rice, and soyabeans belong to a physiological class of plants called the C3 plants that respond readily to elevated CO_2 resulting in a substantial increase in growth and yield (10 to 50%). The C4 plants such as corn, sorghum, sugarcane, and millet, though more efficient photosynthetically than C3 crops, tend to be less responsive to enriched CO_2 (10%). Thus, the benefits of elevated CO_2 are likely to be more pronounced in the C3 than in C4 plants.

The complex series of physiological, metabolic and morphological changes of plants in response to the impact of increasing CO_2 levels are summarized in Table 1.

Table 1. Response of crop plants to an increase in CO2 concentrations above current ambient levels.

Process	Effects on Plants
Leaf photosynthetic rates	Increase in all plants on first exposure. C_3 plants respond more than C_4. Little response above 1000, and levels above 2000 may be toxic.
Inhibition of photosynthesis by source-sink imbalance	Response occurs in many species.
Leaf transpiration rate	Decrease in all plants. C_4 plants respond more than C_3.
Leaf anatomical and biochemical adaptation	Leaf area, weight per unit area, thickness, and number of mesophyll cell layers increase in many species.
Canopy leaf area	Usually increases.
Carbon partitioning among organs	Proportion of carbon going to roots and stems is increased in many, but not in all species.
Branching, flowering and fruiting	Initiation and/or retention of these organs is increased in many species.
Fruit and seed	Increases in number and/or size of fruits and seeds.
Canopy water-use efficiency	Increase in C_3 and C_4 plants. Increase in photosynthesis or yield contributes more than a reduction in transpiration.
Yield	Increases 32% on average between 300 and 600 µmol mol^{-1} for plants in favorable conditions.

Effects of Higher Temperature

Global warming will see higher mean maximum and minimum temperatures, more hot days and heat waves, and fewer cold spells. Temperature has a profound influence on plant growth. Basically, crop growth is enhanced when temperature is increased. With increasing temperatures in the middle and higher latitudes, the length of the potential growing season will extend, allowing earlier planting of crops in the spring, earlier maturation and harvesting. It will also allow two or more cropping cycles to be completed. Gradually, a shift is expected in the types of crops grown and the agriculture system used from temperate to sub-tropical or tropical system. Crop-producing areas may expand polewards in countries such as Canada and Russia.

Warmer temperatures are likely to cause lower crop yields in the tropical and subtropical countries. In warmer, lower latitude regions such as Malaysia, increased temperatures may pose more hazards to crop growth. Heat stress induced by increased temperatures and compounded by drought is very detrimental to plant growth and development. Respiration rate is expected to accelerate resulting in less than optimal conditions for net growth. Crop development is accelerated resulting in hastened maturation and reduced yield. Rice, a major food crop in the world, may face shortened vegetative and grain filling periods, thus lowering grain yields. For each 1˚C rise in temperature, grain yields may decline by 9 to 10%. If drought conditions are prolonged, the current flooded rice ecosystem cannot be sustained, and this spells serious implications on world food security. If the night time minimum temperature rises more than the daytime maximum, the daytime heat stress experienced by the crop may be less severe than otherwise. Increased temperature may also affect perennial tree crop. At higher than 31˚C, fruit bunch production is affected. Prolonged high temperatures can lead to drought conditions, and convert 12% of present oil palm areas estimated at more than 200,000 ha of land into marginal-to-unsuitable for oil palm cultivation, thus affecting the national economies of countries where oil palm is a major contributors to the GDP.

Available Water

Water is the most important compound for plant growth and development, and water availability has a strong influence on crop production and agriculture. On a global basis, water is a paramount factor in determining distribution of plant species. Climate change will modify rainfall, evaporation, runoff and soil moisture storage, and alter total and seasonal precipitation pattern and variability. A continuous reduction in rainfall is likely to cause drought which results in additional stress on food production in the subtropics.

The occurrence of moisture/drought stress at the onset of flowering, fruit setting and grain-filling is injurious to most crops, particularly rice, corn, soyabeans, and wheat.

As substantial yield loss is likely to occur, the demand for irrigation is projected to rise in warmer climates to combat this grave situation. The competition for water resources between agriculture and urban as well as industrial users will become steeper and costlier, particularly when drier conditions become more extensive and falling water tables result in the need for increased energy to pump the water needed. Peak irrigation demands are predicted to rise due to more severe heat waves. Intensive agriculture carried out in the marginal lands of drier regions further destroys the soils, extending the size of deprived lands through desertification.

Soil Fertility and Erosion

Higher air temperatures are likely to affect soil fertility. The use of fertilizers may increase due to increased atmospheric CO_2, and enhanced natural decomposition of organic matter and rates of other soil processes under higher air temperatures. Continual recycling of plant nutrients in the soil-plant-atmosphere system is also likely to accelerate, enhancing greenhouse gas emissions. Additional application of fertilizers will come at the cost of environmental risk, as additional chemicals may impact water and air quality. At the same time, it adds cost to the nation.

In the case of poor countries, agriculture may suffer badly, as the nutrient depleted soils cannot be replenished; thus the soils will not be able to support or sustain crop growth. If this continues, the depleted soil may eventually go through a desertification process and agriculture will disappear leading to famine.

Higher soil temperatures also put a check on microbial activities depending on soil moisture availability. Where soil conditions are drier, root growth is suppressed and crop vulnerability to wind erosion is increased. On the other hand, extreme precipitation events can cause increased soil erosion and loss of agricultural land.

Pests and Diseases

Pest and disease infestation seems to be enhanced under a climate change situation leading to greater use of chemical pesticides. Under warmer climates, proliferation of insect pests is expected to increase because longer growing seasons enable insects such as grasshoppers to complete a greater number of reproductive cycles. The crop-pest interaction may also shift as the timing of development stages in both hosts and pests is altered. In cold climates, warmer winter temperatures may also allow larvae which are otherwise limited by the winter condition to cause greater infestation during the following crop season. The spread of wind-borne pests and crop disease microbes may be changed with the altered wind patterns, causing serious infections to new areas. An integrated pest management technique has to be further developed to combat the problem.

Climate Variability Induced Haze

Prolonged drought and increased temperature may often causes hazardous forest fires, especially in the peat and forest areas, giving rise to a haze condition. Haze, which comprises five major pollutants (particulate matter, sulfur dioxide, carbon monoxide, nitrogen dioxide and ozone) reduces both light intensity and light duration, which is vital for plant growth and development. During a haze episode, solar radiation is reduced by 40-80% and sunlight hours by 40-70%, hence directly reducing photosynthesis and biomass production. The presence of suspended particulates may impact individual plants by damaging the tissues, interfering with physiological processes, clogging the stomata or increasing susceptibility to other forms of stress. These effects can involve direct reduction in growth or productivity resulting in a competitive disadvantage and eventual death of the individual or it may affect plant population indirectly through ecosystem alteration.

Conclusion

Global warming and climate change are real phenomena that are likely to bring about serious consequences. Strong evidence has shown the potential negative impact of climate and weather change on agriculture and crop production to outweigh the benefits. Adaptation measures may be necessary to reduce these impacts. However, in all areas of the world, the necessary adjustments may be too costly to implement. Such changes may entail painful social dislocations and costly capital investments. Could serious mitigation strategies and awareness campaigns be the answers to check the impact of climate change?

Effects of Climate Change on the Marine Ecosystem

Prof Dr Fatimah Md. Yusoff, Dr Sanjoy Banerjee and Dr Aziz Arshad
Universiti Putra Malaysia

Global climate change has far reaching effects on the world's oceans. Marine ecosystems may collapse leading to extinction and loss of habitats as well as species diversity. Not only are marine animals, plants and invertebrates in danger, but people too have much to lose because of climate change.

Table 1. Ecosystem and species sensitive to climate change

Coast Areas	Open Ocean
Coral Reefs	Whales
Beaches and bluffs	Sea turtles
Arctic and Antarctic sea ice and ice shelves	Marine mammals
Mangroves and marshes	Salmon (and other fish)
Tide pools	Penguins (and other birds)
River deltas	Polar bears

Harmful Algal Blooms

Algae which forms the base of the marine food web in the marine environment is consumed by fish, shellfish and sea mammals. A reduction in these phytoplankton feeders as a result of overfishing or diseases may thus contribute to blooms of harmful algae. Plankton blooms can also harbor cholera and other bacteria and threaten the health of swimmers, or those who consume affected fish and shellfish. (Epstein, 1997). Off the east coast of Canada, the deaths of humpback whales and dolphins have been attributed to harmful algal blooms and viruses (Breslin, 1994).

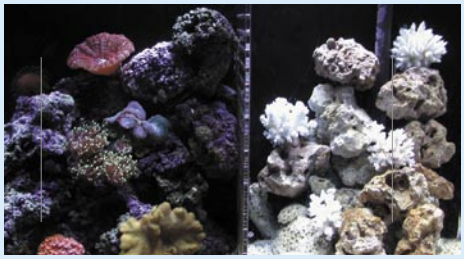
Extreme weather events associated with El Niño/La Niña events have been accompanied by new appearances of harmful algal blooms in Asia and North America; and in Latin America and Asia by outbreaks of malaria and various water-borne diseases, such as typhoid, hepatitis A, bacillary dysentery and cholera. (Epstein, 1997). Increased growth and dominance of fast growing filamentous macroalgae is yet another effect of nutrient overload which will change the coastal ecosystem, increase the risk of local oxygen depletion and reduce biodiversity and nurseries for fish.

Phytoplankton bloom due to rapid growth of one or more microalgal species may lead to production of toxins in sufficient concentrations to elicit effects obvious to the public at large (Yusoff, 2003). Harmful phytoplankton may contain potent neurotoxins. Red tide is a common phytoplankton bloom due to rapid growth of dinoflagellates. In Sabah, Malaysia, the occurrence of red tides has become an annual event resulting in problems related to paralytic shellfish poison (PSP).

Coral Reefs

Coral reefs cover some 600 thousand square kilometers of the earth's surface (0.17% of ocean surface) (Crossland *et al.,* 1991). The impact of climate change on coral reefs of the Western Indian Ocean (WIO) as well as other parts of the world is related primarily to rising seawater temperatures and associated intensification of the El Nino Southern Oscillation (ENSO) phenomenon. During the 1997-1998 ENSO event, the most significant coral bleaching ever recorded in the WIO resulted in 90-95% mortality of corals at the most heavily impacted sites, with 30% mortality on a regional scale.

Coral bleaching occurs as a stress response by symbiotic corals to a variety of environmental stressors that cause internal physiological imbalance (Brown 1990). In East Africa, bleaching occurred when sea surface temperature rose in February-May by 1-2°C above normal for over two months, causing expulsion of symbiotic dinoflagellates known as zooxanthellae from coral polyp tissue, with subsequent mortality of corals.

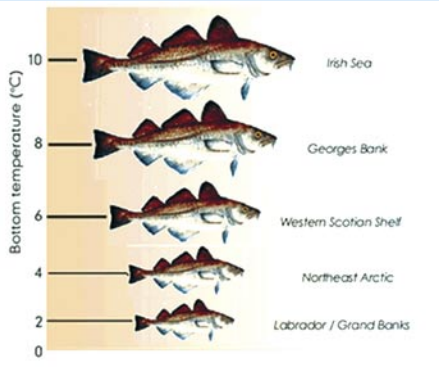


Fish

The annual average catch of Pacific saury in Korean waters used to amount to 25,000 metric tonnes (mt), but dropped to less than 5,000 tonnes in the late 1980s. Since then, the annual catches have fluctuated from 2,000 mt to 18,000 mt.

Great waves and erosion may also contribute to a decrease in fishery production. Rusty Brainard, a fisheries expert with the National Marine Fisheries Service in Honolulu said "The nursery habitats for fish stocks and young fishes were probably wiped out," due to the Asian tsunami of 26 December 2004. "That could mean the next couple of years, we could have low fish levels, which could lead to lower fish levels for the next couple of decades."

The growth rate of fish is sensitive to water temperature. The relative size of 4-year-old cods from different areas around the North Atlantic including off eastern Canada differ from each other. The diagram below shows that the larger size cods are found in areas with higher bottom temperature.



Plankton

Roemmich and McGowan (1995) demonstrated the link between a moderate surface warming of approximately 1.5°C since 1951 and a major decline (80%) in zooplankton biomass in the Californian Current. In El Niño years, reduced zooplankton abundance led to a major reduction in the abundance of young-of-the-year rock-fish species. Dickson *et al.* (1988) has demonstrated how a 30-year increase in northerly winds is associated with the decline of phytoplankton and zooplankton near the British Isles.

Scientists at Scripps Oceanographic Society reported that over the last 45 years,

zooplankton populations in southern California waters declined by more than half. The observed decline may have a link to a warming of the ocean surface in the region over the same period. Zooplankton forms a vital link near the base of the food web, and a decline in their numbers could pose a threat to other marine life.

Benthos and other Marine Invertebrates

Benthic animals are directly or indirectly involved in most physical and chemical processes that occur in the surrounding habitat. All benthic heterotrophs regenerate nutrients that can stimulate primary production, and nearly all serve as food for birds and for large numbers of demersal nekton that characterize the shallow water systems. Humans also feed avidly on certain benthic organisms, as demonstrated by the large harvests and economic value of oyster, mussel, cockle and clam. Climate changes could bring some forms of alteration to the habitat through typhoon, hurricane and storms. As most benthic sediments show intimate association with bottom sediments, one can predict that any changes to the bottom sediments brought about by events caused by climate changes can contribute to the habitat destruction and may result in temporary colonization and inhibition of benthic communities.

Mangroves and Seagrass

The shallow environments of mangroves and seagrass are also likely to have been damaged by the Asian tsunami of 26 December 2004. Brainard, a fisheries expert with the National Marine Fisheries Service in Honolulu explains these areas are partially enclosed bodies of water around the coastline that often host the most delicate forms of marine life, such as young fish.

Seabirds

Seabirds are prominent and highly visible components of marine ecosystems that will be affected by global climate change (Meehan et al., 1998). Because seabirds feed primarily on marine organisms, they are good indicators of change in different parts of the marine food web (Montevecchi, 1993). Furthermore, changes in sea level or increases in the frequency and intensity of storms could directly impact birds at nesting sites (Byrd & Tobish 1978) or contribute to die-offs in winter (Bailey & Davenport 1972). Scientists have already observed a wide range of changes in the migration patterns of birds apparently in response to warming which has already taken place. Wading birds such as the ringed plover are now spending the winter in the east of Britain rather than on the West coast, and chiff-chaffs are remaining in the UK throughout the year rather than migrating south (Hirsch, 2005). Increased storms are known to have damaged the breeding colonies of albatross (Hirsch, 2005).

Marine Mammals

Climate change is thought to affect the composition and structure of ecological communities (Genner et al., 2004). New species may join communities while others may disappear from them or change in their relative and absolute abundance as local conditions change. Such changes in megafauna in turn could lead to changes in species diversity, patterns of energy flow and in most extreme cases alterations to entire ecosystems. In north-west Scotland, between 1992 to 2003, the relative frequency of stranding of white-beaked dolphin, a cold water species, has declined while strandings of common dolphin, a warm water species, have increased. (MacLeod et al., 2005). They suggest that warming of local waters has led to changes in the cetacean community with a decline in occurrence of cold water species and increase in the occurrence of existing warm water species.

Conclusion

The impacts of climatic change on marine life and ecosystems are difficult to estimate, due to complicated interactions within and amongst different ecosystems and associated human activities. In fact, climate change does not only affect the biodiversity and production of marine organisms, but also affects the socio-economy of the associated human communities. Overall, the loss to the world economy as a result of climate changes has run into billions of US dollars, and this has not accounted for the sufferings and miseries experienced by millions of people worldwide.

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The Changing Climate Around the World

Kamsiah Md Ali

Amazon Basin Experiencing Extreme Drought

The government of Brazil has declared a state of emergency in the Amazon as a result of an unusual drought condition, which some believe is being caused by unusually high temperatures in the Atlantic Ocean. Studies by the Amazon Environmental Research Institute, a WWF-partner organization, suggest that the warming of the Atlantic near the Africa coast and the Gulf of Mexico may have altered the circulation pattern of air currents and moved dry air masses over the Amazon Region.

Freshwater, forest, species and local people are being heavily impacted by this drought. One of the main threats of the drought is reduced freshwater habitat for many non-migratory fish species, such as the pirarucu, the largest freshwater fish in the world and already a threatened species due to overfishing and destructive fishing practices. With the significant decrease in the water level in the Amazon River and its 1,000 tributaries, other aquatic species are also becoming more vulnerable.

The Brazilian Amazon is home to one-third of all the species in the world. Thousands of plant species, over one million insect species, more than 700 fish species, 1,000 bird species and over 300 mammal species 'not including those unknown to science' are found within the Amazon rainforest.

Source: http://www.panda.org/about_wwf/what_we_do/climate_change/news/index.cfm?uNewsID=24029

Heating Up

Specialist researchers at Britain's University of East Anglia have put together all the available data to produce a temperature chart for the last millennium. The warmest year on record was 1998, while the ten warmest years globally have all occurred in the last decade and half. The Intergovernmental Panel on Climate Change (IPCC) has also said that most of the observed warming over the last 50 years "is likely to have been due to the increase in greenhouse gas concentrations."

The most significant of these gases is carbon dioxide (CO_2). And the single biggest source of it – 37% of all emissions worldwide – is the carbon-rich coal burnt in power plants. The IPCC has predicted that temperatures will rise by up to 5.8˚C globally and up to 6.3˚C in Europe by the end of this century. These, clearly, are temperature changes that can be felt. And way too much for safety.

Early Warning Signs of Global Warming

Compelling new evidence demonstrates that global warming is already underway with consequences that must be faced today as well as tomorrow. The evidence is of two kinds:

Fingerprints of global warming are indicators of the global, long-term warming trend observed in the historical record. They include heat waves, sea-level rise, melting glaciers and warming of the poles.

Harbingers are events that foreshadow the impacts likely to become more frequent and widespread with continued warming. They include spreading disease, earlier spring arrival, plant and animal range shifts, coral reef bleaching, downpours, and droughts and fires.

The Union of Concerned Scientists (UCS) is taking steps to bring this evidence to the public's attention, with the goal of building support for action to reduce the heat-trapping gas emissions that cause global warming. Working with other environmental organizations, UCS has developed and recently updated a world map, viewable online and also available as a poster, that shows where the fingerprints and harbingers of global warming have occurred in recent years. By showing the local consequences of climate change, it brings the message home effectively.

Since its release in 1999, the map has been featured in several news stories, hand-delivered to every member of Congress, accessed by students across the country, and been visited online by people throughout the world.

Source: http://www.ucsusa.org/global_warming/science/early-warning-signs-of-global-warming.html

from page 7

they probably dragged a lot of debris back in and along the coral reefs," Rusty Brainard, a fisheries expert with the National Marine Fisheries Service in Honolulu said that the Asian tsunami of 26 December 2004 wiped nursery habitats for fish stocks and young fishes and mangroves and seagrass are also likely to have been damaged.

In Thailand, for instance, dolphins were swept 500 yards inland. Many dead and injured sea turtles were left high and dry, a three-foot shark ended up in a hotel swimming pool and beaches were littered with dead fish (Owen, 2005).

Conclusion

Global warming poses serious risks that will affect our health, agriculture, water resources, forests, wildlife and coastal areas. Complex systems like the atmosphere and the climate are known to move from one state to another, as response to changes in the environment. With uncontrolled climate change as a result of human activities, we face the possibility of more intense and frequent disasters that are economically and socially frightening. The Montreal Summit to be held on 28 Nov to 9 Dec 2005 will provide more positive steps towards minimizing the alarming effects of global warming.

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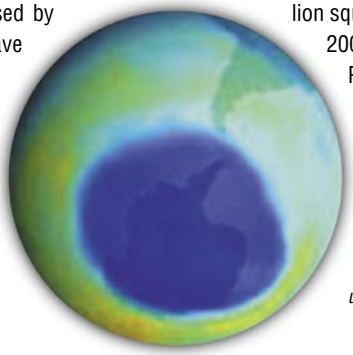
UN: Ozone Layer Depletion Seems to Have Peaked

Depletion of the ozone layer over Antarctica caused by emissions of industrial chemicals seems to have peaked indicating that global environmental pacts are working according to United Nations scientists.

"The current hole above the South Pole and Antarctica is now shrinking after falling short of the record years of 2003 and 2000", the United Nations' World Meteorological Organization reported in its latest bulletin.

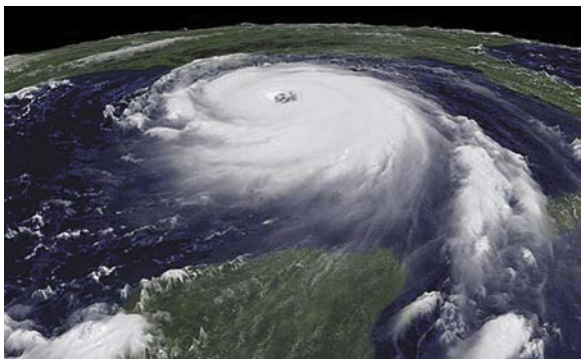


Last 19 September, the ozone hole peaked 26,9 million square kilometres compared to the 29 million of September 2003 which most scientists consider has been the record. Products containing chlorine and bromine are blamed for thinning the globe's protective ozone layer which filters ultraviolet radiation. But uncertainties remain because of the climate change that is leading to higher temperatures on the ground,while decreasing in the stratosphere.

Source : http://environment.about.com/gi/dynamic/offsite.htm?zi=1/XJ&sdn=environment&zu=http%3A%2F%2Fwww.unep.org%2Fozone%2FPublic_Information%2Findex.asp

Increasing Destructiveness of Tropical Cyclones over the Last 30 Years

Scientist Kerry Emanuel's latest research shows a startling global increase in hurricane strength and duration, which he correlates to rising sea temperatures linked to global warming. His paper provides substantial evidence for increase in the number and the proportion of hurricanes reaching the highest intensities (category 4 or 5) in both the Pacific and Atlantic oceans over the past 30 or 35 years – in an environment of tropical sea surface temperatures that have increased by about 0.5˚C (1˚F) on average. His research clearly points to the possibility of this trend becoming more apparent and severe as tropical temperatures continue to rise with increasing greenhouse gases in the atmosphere.



Satellite image of Hurricane Katrina on Aug. 28, 2005, when the storm was a Category Five hurricane. Hurricanes don't get much stronger than this.
Photo Source: NOAA Kerry Emanuel (4 Aug 2005). Nature 436: 686-688

Activity Highlights (Year 2005) Department of Environment, Malaysia

DATE	PLACE	EVENT
OCTOBER		
3–5	Geneva, Switzerland	2nd Meeting of the Steering Group UNEP/GEF: 12-Countries Pilot Project for the Development of National Implementing Plans (NIPs) for the Management of Persistent Organic Pollutants (POPs)
3–6	Chennai, India	Regional Measures to Collect, Handle, Treat and Dispose of Waste Generated in Applying the International Convention on the Control of Harmful Anti-Fouling Systems on Ships
11–13	Tokyo, Japan	3rd Workshop on Environmental Monitoring of Persistent Organic Pollutants (POPs) in the East Asian Countries
19–21	Wellington, New Zealand	4th Negotiation Session on the Free Trade Agreements (FTA) between Malaysia – New Zealand
25	Japan	International Symposium on Waste and Recycling Management
26–29	Osaka, Japan	Global Environment Technology Show and International Symposium
NOVEMBER		
10–11	Manila, Phillipines	3rd ASEAN Oil-Spill Preparedness and Response (OSPAR) Meeting
14	Bandar Seri Begawan, Brunei	17th Joint Meeting of ASEAN Working Group on Sub-Regional Fire Fighting Arrangements (SRFA) for Sumatera and Borneo
14–15	Thailand	UNEP-GEF South China Sea Projects 2nd Regional Scientific Conference
21–25	Tokyo, Japan	Asia Pacific Regional Inception Workshop on the Environment Sound Management of Electric and Electrical Trans-boundary Movement of Hazardous Wastes
28	Kuantan, Pahang	Launching of Malaysia Environment Week (MASM) 2005
28–9/12	Canada	11th Convention of Parties of United Nations Framework for Climate Change

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