

The Impact of Global Warming on Sustainable Developments Mitigating the Impact: Natural Hazard Mitigation

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Global Warming

New, international climate data reveal that 2005 is the hottest year on record, setting forth a 25-year trend of rising global temperatures.

This climatic development has raised considerable concern among meteorologists who believe that a rise in global air and sea temperatures could give rise to more frequent, durable and powerful hurricanes. This would have a negative impact on sustainable developments of coastal communities.

There is now convincing, scientific evidence that the rapid rise in temperatures over the past 50 years is attributed to the excessive burning of fossil fuels and deforestation, all of which are responsible for a rise in heat-trapping greenhouse gas emissions, such as carbon dioxide, the major heat-trapping greenhouse gas. Tropical deforestation alone is responsible for approximately twenty percent of anthropogenic carbon dioxide emissions each year.

Unfortunately, the consumption of fossil fuels will continue to rise as developed countries are still very much dependant on fossil fuel-generated electricity for their economies, and developing countries strive to achieve better living standards, and hope to achieve this by increasing their demand for fossil fuel-generated electricity.

Greenhouse gases in the atmosphere behave somewhat like the glass panes in a greenhouse: Solar radiation enters the earth's atmosphere and passes through a blanket of greenhouse gases; as the solar radiation reaches the earth's surface, land, water and biosphere absorb its energy. The earth reacts to the solar radiation by emitting infrared radiation. A portion of the infrared radiation passes through the blanket of greenhouse gases into space; a large portion of it though, remains trapped in the atmosphere by greenhouse gases, causing global warming.

Actually, the greenhouse effect is vital for humans and the biodiversity. Without the greenhouse gases provided by nature, the earth would not be warm enough for humans to live, and the biodiversity to develop; it would be -18°C, a temperature at which the earth would be frozen and could not sustain life.

It is the tens of millions of tons of greenhouse gas emissions forced upon nature annually by human activities that is responsible for a continual rise in global temperatures. Even a slight rise in global temperatures can cause a change in climate, and problems for humans, animals, natural resources, and also a change in the behaviour of natural processes, such as floods, coastal storms and tornados etc.

The main components of a hurricane are heat, moisture and spiral winds relating to the earth's rotation; its precondition is atmospheric disturbances (i.e. warm air collides with cold air). If winds at high levels in the atmosphere remain light and constant, moisture condenses over warm waters forming bands of thunderstorms. During the development of thunderstorms, energy in the form of heat is released. The released energy fuels spiral winds which draw the bands of thunderstorms into a formation at an increasing wind speed, strengthening the now developing hurricane.

There is strong scientific evidence that the duration and intensity of coastal storm events are influenced by global warming.

Those who are least responsible for global warming are now suffering some of its impact: the poor. According to Mr. Osman Benchikh, a UNESCO representative, who held a speech on the benefits of renewable energy for developing countries at the *World Renewable Energy Assembly, WREA*, in Bonn, Germany, on 30th November, 2005, and who I had the pleasure of talking to after his impressive speech about the plight of the poor, many communities in developing countries were actually experiencing severe coastal storm events similar to those experienced in the USA in 2005. He explained that such severe weather conditions were occurring monthly in some regions.

Defining Sustainable Development

While the literature is replete with definitions of sustainable development, the one that is generally universally accepted today derives from the report published in 1987 by the United Nations' World Commission on Environmental and Development entitled *Our Common Future: Sustainable development is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs"*.

How does global warming affect sustainable development?

In natural hazard-prone regions in the world, community's vulnerability to recurrent disasters incurred by natural hazards poses considerable constraints for the achievement of sustainable development, as structures, critical facilities, infrastructure and natural resources are vulnerable to potential natural hazard events.

Over the last decade, a change in the behaviour of coastal storms, such as hurricanes, has been observed. The duration, intensity and frequency of coastal storms have increased, developing higher wind speeds, causing greater flood depths and vast destruction to coastal and some inland communities, reversing long years of achievements in community developments.

Humans put themselves in arm's way by encroaching upon areas of earth reserved by nature for natural processes; all the more as rising temperatures enhance the duration, intensity and frequency of some of these natural processes.

Since the dawn of time, riverine systems of the world have coped quite capably with water flows that exceed the capacity of their channels by allowing the excess water to spread out over the adjacent floodplain. Such processes are an integral aspect of the life cycle of a river, and occur as a result of rainfall, snowmelt, and other intrinsic components of earth's hydrological cycle.

The floodplain is designed by nature to absorb the overflow of its rivers, dissipating the impact of flooding over a wider area. This process has resulted in riparian soils that are rich in alluvial deposits, highly beneficial for vegetation, and quite appealing for human settlements on riverbanks.

Flood becomes a disaster when it is deprived of its floodplain, owing to human activities in the floodplain. It is only when the constructed environment intersects with extreme processes of the natural environment that disasters occur. Such disasters occur when human activity, such as structures and agriculture, take place in the path of the forces of nature.

Natural Hazard Mitigation

Natural hazard mitigation is measures taken to reduce community's vulnerability and increase its resilience to natural hazards so as to protect humans, structures, critical facilities, infrastructures and natural resources; its long-term goal and proactive nature distinguish natural hazard mitigation from the more immediate and reactive measures taken during disaster preparedness, response, and recovery. Natural hazard mitigation is the only phase of emergency management dedicated to breaking the cycle of damage, reconstruction, and reoccurred damage from disasters incurred by natural hazards. Hazard mitigation includes measures ranging from structural engineering and building code standards to land use planning, property acquisition and elevation.

Disasters generally leave a profound imprint on communities impacted by such disasters. In many hazard-prone communities, a combination of factors have changed the way citizens view natural hazards: The personal experience of social and economical disruption from such disasters; the recognition that disasters impair significantly the quality of life of a community; the recognition that communities can intervene to break the cycle of disaster damage, and in the process, assume responsibility for making their structures, infrastructures, critical facilities and natural resources less vulnerable and more resilient to the forces of nature.

The concept of sustainable development is increasingly under discussion, which recognises the limits of the earth's resources, and importance of managing development in a manner that does not compromise the ability of future generation to meet their own needs. Hazard mitigation must be integrated into the concept of sustainable development as a fundamental component.

Cities can enhance sustainability by locating structures, critical facilities and infrastructures in areas that are identified as not hazard-prone, using design and construction techniques that strengthen structures and infrastructure against the forces of wind, water, and ground shaking; promoting sustainable housing, and businesses that are able to function following a disaster event;

promoting sustainable agriculture that incorporates the principles of hazard mitigation into all aspects of agricultural production; conserving natural resources, including forests, wetlands, beaches, dunes, floodplain, and riparian areas, all of which play important, stabilising roles in ecosystems and serve as natural buffers.

A resilient city is a sustainable network of physical and social systems. Physical systems are the constructed and natural environmental components of the city. They include its structures, infrastructures, and its natural resources. The physical systems act as the body of the city, its bones, arteries, and muscles. During a disaster, the physical systems must be able to survive and function under extreme stresses. If too many of them suffer breakdowns that cannot be repaired on a reasonable timescale, losses escalate and recovery slows down. A city without resilient physical systems will be extremely vulnerable to disasters. The social systems of the city are the communities. They include the public and private associations: agencies, institutions, organisations, neighbourhoods, businesses, and critical facilities, such as hospitals, clinics, police and fire stations, schools, and community shelters. The social systems act as the brain of the city, directing its activities, responding to its needs, and learning from its experience. During a disaster, the social systems must be able to survive and function under extreme and unique conditions. If they break down, decision-making falters, and response comes to a halt. A city without resilient social systems will be extremely vulnerable to natural disasters.

It is very important that natural hazard mitigation policies include the education of the social systems to be aware of hazard risks, their vulnerability to such risks, and to reduce risks by responding effectively to natural disasters, as it is these social systems that will be responsible for the planning for natural hazard mitigation, identifying and analysing natural hazards, assessing their risks to the identified natural hazards, and implementing appropriate natural hazard mitigation measures to minimise or eliminate these risks, thus making their city less vulnerable and more resilient to natural hazards, enhancing sustainable developments.

Natural hazard mitigation merely mitigates, to some extent, the impact of global warming on sustainable development; it does not, however, mitigate global warming.

According to the Intergovernmental Panel on Climate Change (IPCC), the average surface temperature will increase between 1.4°C to 5.8°C by year 2100, if no significant efforts are undertaken to reduce greenhouse gas emissions.

Because CO₂ (the primary global warming gas) remains in the atmosphere for a century or even longer, the energy choices we make today greatly influence the climate our children and grandchildren inherit. We have the technology to increase energy efficiency, significantly mitigate greenhouse gas emissions from energy and land-use activities, and secure a high quality of life for future generations. Renewable energy will need to play a major role in the energy choices of the future. Another common sense solution is to protect natural resources, such as threatened forests.

Protecting vulnerable Communities

Considering the lives at risk and the enormous costs for community relief and rebuilding efforts after hurricanes, such as Andrew, Ivan, and Katrina, make landfall and sweep through coastal communities, at exceptionally high wind speeds and with heavy rainfall, incurring great flood depths, it is very important to do whatever is necessary to mitigate global warming, and to preserve healthy and prosperous coastal communities for future generations. As CO₂ remains in the atmosphere generally for a century, even decisive political measures to use energy more efficiently and reduce emissions from power facilities, transportation, and to protect forests will not bring global warming to a halt, unfortunately. Therefore, it is essential that we combine decisive greenhouse gas emission reduction efforts with natural hazard mitigation efforts to protect coastal and neighbouring communities from the catastrophic consequences of global warming. These measures must be designed to cope with increasing sea level rise, coastal storm duration, intensity and frequency. Such mitigation measures must be implemented in accordance with a comprehensive natural hazard mitigation plan, which must be tailored to individual community needs, and integrated into existing community policies so as to enhance sustainable development efficiently. This approach would contribute very sensibly to a sustainable development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Reference

United Nations, 1987. World Commission on Environmental and Development. Our Common Future.