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International Disaster Prevention & Climate Change - Trend and Approaches

by

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Abstract

Background: These days, Climate change is a matter of serious concern all over the world. Whereas the Earth is warming rapidly due to the emission of greenhouse gases (GHGs), mainly from industrialization, deforestation and increased use of fossil fuels for transport. The GHGs from human activities are among the major causes for global warming and climate change which have contributed to the variations in rainfall patterns. These have direct and indirect impacts on environment, water resources, agriculture, forests and biodiversity, health, infrastructure development, tourism and livelihoods. Several scenarios for climate change have been predicted for the Himalaya, but speculation is hazardous. Climate changes will interact with changes in plant communities and habitat.

The Problems: If we see the impact of climate change globally, in the last 100 years the world's average temperature has risen rapidly than in the last 10,000 years and the scale of temperature rise is in increasing trend. Out of the 10 recorded warmest years in history, nine were recorded during the last decade. Climate variability adds to the vulnerability, in particular to the resource poor. Climate change exacerbates the variability with increased frequency and intensity of dry spells, drought and other extreme events.

Examples: The consequences of melting of glaciers due to climate change are addressed for the Himalaya region. The global rise of seawater level and its consequences are addressed for the costal zones and islands. Potential increase in outspread of tropical diseases is considered. The engagement of Norway in climate change issues and climate change consequences for Norway are addressed as an example of a western rich and industrialized country. The same is considered for Taiwan. The REDD policy are described and positive and negative effects are considered.

Conclusions: It is high time to address the issues of climate change by formulating and implementing relevant policies and programs in certain countries. The performance can be greatly enhanced if the programs can be conducted in close collaboration among the countries that are conducting their activities in isolated manner. There is the opportunity of learning among the countries to develop regional climate change scenarios and basin-wide scenarios of water availability under the climate change situation. Therefore, the policy makers must ease the transition to a carbon-free energy industry by passing legislation that creates favorable market conditions, shaping new frameworks for change and ensuring that the Kyoto Protocol enters into force. Moreover, the provisions of United Nations Framework Convention on Climate Change (UNFCCC) should be implemented effectively.

Key words: *Impact, Emissions, Warming, Exposure, Vulnerability.*

1. An Overview

Climate change is one of the key factors for the occurrences of natural disasters in the world. Climate change is a natural phenomenon. Anthropogenic climate change has been accelerated by the emission of greenhouse gases (GHGs), primarily from industrialization, deforestation and increased use of fossil fuels for transport. Scientific evidence, as cited by the Inter-governmental Panel on Climate Change (IPCC), clearly indicates the wide scale of climate change. Therefore, the United Nations General Assembly adopted a resolution to develop an international legal instrument to address the issues of climate change. On the basis of this, the Inter-governmental Negotiation Committee met several times and the United Nations Framework Convention on Climate Change (UNFCCC) was adopted in May 1992. This Convention was opened for signature at the UN Conference on Environment and Development in Rio de Janeiro, Brazil in June 1992. A number of countries signed thereafter.

According to the report of the IPCC Fourth Assessment - anthropogenic activities have accelerated the process of global climate change. Increasing GHG emissions has contributed to the increase in the atmospheric temperature, resulting in location-specific impacts. Due to climate change, there have been changes in rainfall patterns and seasons. These have direct and indirect impacts on water resources, agriculture, forests and biodiversity, health, infrastructure development, tourism, and livelihoods. Recognizing this, the international community is actively engaged in minimizing the current effects and likely future adverse impacts through effective implementation of the UNFCCC provisions.

Generally, the least developed, landlocked, and mountainous countries are the most affected by climate change. Therefore, it has been an urgent necessity to address the issue of climate change by formulating proactive legislations and implementing relevant programmes to minimize the existing effects and likely impacts in different regions.

2. Pertinent Issues

Within the climate notions and extremities, water scarcity, land degradation, desertification, poverty and malnutrition make dry lands highly vulnerable to climate risks. Dry lands cover about 40 per cent of global land area and are home to over two billion people. Climate change and extreme weather variation brings in higher temperatures, drier conditions and erratic heavy rainfall affecting communities livelihood and their nourishment. As a matter of fact, most dry land communities depend on dwindling supplies of ground water, extracting it much more quickly than it can replenish itself. Typical responses to water scarcity involve digging more wells and/or bringing in water tankers. Both are unsustainable, short term answers. The problem is particularly acute in regions where large populations rely almost entirely on rain fed agriculture for sustenance, income and livelihoods. Moreover, insufficient or erratic rainfall and drought periods can lead to severe social and economic stresses resulting in hunger, migration and increased poverty.

Nowadays, increasing atmospheric temperature, changes in the annual rainfall cycle, intense rainfall and longer droughts have been observed. Similarly, both days and nights are presently warmer. The number of days with 100 mm of heavy rainfall is increasing. The timing and duration of rainfall is changing. As glaciers recede from rapid snow and ice melting, glacier lakes are expanding. The adverse impacts of climate change have been noticed in agriculture and food security, water resources, forests and biodiversity, health, tourism and infrastructures. Climate-induced disasters and other effects have caused damages and losses to life, property and livelihoods.

3. Repercussions of Climate Change

Several researches have shown that in the last 100 years the world's average temperature has risen rapidly. For the last 10,000 years we have been living in a remarkably stable climate that has allowed the whole of human development to take place, now we see the potential for sudden changes of between 2 and 6 degrees Celsius (by the end of this century). We just do not know what the world is like at those temperatures. We are climbing out of the safe zone (Corell 2007).

The scale of temperature rise is an increasing trend. Out of the 10 recorded warmest years in history, nine were recorded during the last decade. The global mean temperature is expected to increase between 1.4 to 5.8ºC over the next hundred years. The adverse effects of such change in global climate are seen in the Himalayas where glaciers and glacial lakes are posing catastrophic risks. Himalayan glaciers are retreating at rates ranging from 10 to 60m per year and many small glaciers (<0.2 sq.km) have vanished. The boundary of most of the high altitude valley glaciers in Bhutan, China and Nepal are diminishing quickly. Glaciers in the Himalaya are thinning faster than elsewhere in the world. If the current situation prevailed, the glaciers could disappear by the year 2305. Thus, climate change is shrinking the mountain glacier and directly affecting the landscape and threatening water supplies all over the world. In such a way, the Himalayan glaciers can be considered as a reliable indicator of climate change.

4. Effects of Climate Change on the Mountainous Regions

Mountain regions occupy about a quarter of the global terrestrial land surface and provide goods and services to more than half of the inhabitants. The rise of the Himalaya and Tibetan Plateau together that started about 50 million years ago caused a tremendous impact on the regional and global climate of the world. The Himalayan region has long been recognized as extremely rich in animal and especially plant diversity. Himalayan watersheds harbour more diverse ecosystems than the Amazon. The rise of the Himalaya and Tibetan Plateau together caused a tremendous impact on the regional and global climate of the world. During the summer season warm moist wind blows from ocean to land. While in winter time, cold dry wind blows from land to ocean. Monsoon circulation involves a change of approximately 180 degree in the direction of wind between the summer and winter (Upreti, 2008).

The intensity and duration of rainfall that can initiate a landslide depends on many factors. However, most landslides and debris flows reported in the Nepal Himalaya are either associated with intense or sustained monsoon precipitation (Dhital 2003, Adhikari and Koshimizu 2005).

Climate change data and predictions for the Himalayas are very sparse and uncertain, characterized by a "Himalayan data gap" and difficulties in predicting changes due to topographic complexity. A few reliable studies and climate change models for Nepal predict considerable changes: shorter monsoon seasons, more intensive rainfall patterns, higher temperatures, and drought. These predictions are confirmed by farmers who claim that temperatures have been increasing for the past decade and wonder why the rains have "gone mad." The number of hazard events, notably droughts, floods, and landslides are increasing and now account for approximately 100 deaths in Nepal annually. Other effects are drinking water shortages and shifting agricultural patterns, with many communities struggling to meet basic food security before climatic conditions started changing. (Sudmeier-Rieux 2012).

The recent floods and landslides occurred in June 2013 in western Nepal and North-West of India is also attributed to climate change. The flood and landslide disaster caused thousands of deaths and huge loss of physical properties.

5. Green House Gases (GHG) Effects

Global climate change –driven largely by human induced warming of greenhouse gases (GHG) – is a growing threat to humanity. The world experienced a surface temperature rise of 0.6°C on average during the 20th century, and the temperature by year 2100 is projected to go as high as 6.4°C relative to 1990 if GHG emissions are not reduced (IPCC 2007). But time has shown that given the dependence of global economic systems on fossil fuels, and the time required for new technologies that reduce or replace fossil fuels, to integrate into the global marketplace, significant reduction in GHG emissions is unlikely to occur soon enough to avoid climate impacts. Significant harm from observed climate change on the environment and on society is already occurring worldwide and more severe and widespread impacts lie ahead. Climate change impacts on the geo-environment of the Nepal Himalaya are significant (Meen Chhetri 2012).

6. Reducing Emissions from Deforestation and Forest Degradation - REDD

Reduced Emissions from Deforestation and Forest Degradation (REDD) is one of the most controversial subjects in the climate change issues. The understanding or agreement was that the governments, companies or forest owners in the South should be rewarded if they protect their forests. The Bali Action Plan-Conference of the Parties to the UNFCCC in Bali (COP-13) emphases REDD-plus as "Policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing

countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries". More-clearly, the importance given in BAP is referred to REDD+. In other words, REDD+ includes activities with extremely serious implication for indigenous people, local communities and forests: "Conservation" sounds good, but the history of the establishment of national parks includes large scale evictions and loss of rights for indigenous peoples and local communities; "Sustainable management of forests" could include subsidies to commercial logging operations in old-growth forests, indigenous people's territory or in villagers community forests; "enhancement of forest carbon stocks" could result in conversion of land (including forests) to industrial tree plantations[1], with serious implications for biodiversity, forests and local communities. Likewise the second plus (REDD++) refers all land uses.

But the main problem is that the payments are not for keeping forests, but for reducing emissions from deforestation and forest degradation. This might seem irrational; nonetheless it is important, because it opens up the possibility, for example, of logging an area of forest but compensating for the emissions by planting industrial tree plantations anywhere. More importantly, the notion of making payments is to discourage deforestation and this matter was discussed in the negotiations leading to the Kyoto Protocol, and it was ultimately rejected.

There are two basic mechanisms for funding the REDD. First, from the government funds like: the Norwegian government's International Forests and Climate Initiative or from private sources, which would involve treating REDD as a carbon mitigation 'offset' and getting polluters to pay have their continued emissions offset elsewhere through a REDD project. There are many variants and hybrids of these two basic mechanisms, such as generating government-government funds through a "tax" on the sale of carbon credits or other financial transactions.

Why trading the carbon stored in forests is controversial? The reasons are as following:

- Carbon trading does not reduce emissions because for every carbon credit sold, there is a buyer. Trading the carbon stored in tropical forests would encourage pollution in wealthy nations to continue. As a result, global warming will not stop.
- As there are already extremely complicated carbon derivatives on the market - carbon trading may create a new sparkle of carbon derivatives. Adding forest carbon credits to this mix would be disastrous, particularly in view of the difficulties in measuring the amount of carbon stored in forests.

Creating a market in REDD carbon credits opens the door to carbon cowboys, or would be carbon traders with little or no experience in forest conservation, who are exploiting local communities and indigenous peoples by persuading them to sign away the rights to the carbon stored in their forests. - http://www.redd-monitor.org

6.1 Explore and Develop REDD Policy

It is obvious that there are a number of key challenges and complexities in the policy of Reduced Emissions from Deforestation and Forest Degradation (REDD) mechanism. A study[1] highlights some challenges in implementing REDD. The challenges are: addressing international issues in the national context to Nepal where governance and institutional capacity is weak mainly due to the ongoing process of state restructuring; international REDD debates where Nepal has not still been developed a strong point for the negotiation. Eligibility criteria to participate, verify methods and data, national baseline of forest carbon and other services, principles and methodological guidelines for assessing carbon and gains/losses, cost effectiveness and monitoring mechanism of carbon stocks and flows, corruption control in the payment system, issues regarding property right be defined in the upcoming constitution are key challenges to adopt REDD policy in national context and local contexts.

Yet many REDD supporters claim that carbon markets are needed to make REDD work. Environmental Defense Fund, for example, on its website has mentioned as following:

"Reducing emissions from deforestation and forest degradation (REDD), which EDF (Environment Defense Fund of US and related institutions in Europe) helped pioneer, is based on establishing economic incentives for people who care for the forest so forests are worth money standing, not just cleared and burned for timber and charcoal. The best way to do this is to allow forest communities and tropical forest nations to sell carbon credits when they can prove they have lowered deforestation below a baseline."

It can be concluded that in the absence of strong monitoring system and strict controls and regulation, REDD may deepen the woes of developing countries – providing a vast pool of unaccountable money which corrupt interests will prey upon and political elites will use to extend and deepen their power, becoming non-accountable to their country. Similarly, the revenues from oil, gold, diamond and other mineral reserves have fuelled pervasive corruption and bad governance in many tropical countries, REDD could prove to be another 'resources curse'. Finally, it may fail to protect forests and also fail to reduce carbon emissions.

7. Sea Level Rise as a Consequence of Climate Change

Impact of climate change will be affecting sea level rise as compounded impacts with great implications on earth life system.

The projected sea level rise of 5 millimeters per year for the next 100 years would cause enhanced soil erosion, loss of land including wetlands, loss of fresh water supplies, poverty, dislocation of people, increased risk from storm surges, reduced resilience of coastal

[1] Dahal, N.,Banskota, K.,& Ojha, H.R.(p.e.),2009. Cultivating REDD in Nepal's Community Forestry: Discourse for Capitalizing Potentail? Forest Action Nepal, Lalitpur

ecosystems, saltwater intrusion into freshwater resources, and high resource costs to respond to and adapt to changes. Similarly, some projection of sea level rise: a few inches to a few feet, would have the following effects:

- 2 ft: U.S. would lose 10,000 square miles
- 3 ft: Would inundate Miami
- Half of the world's population lives along coasts will adversely affect their livelihoods.

7.1 Impacts of Climate Change on Small Island States in Pacific Islands

The Pacific Islands are becoming increasingly vulnerable to extreme weather events as growing urbanization and squatter settlements, degradation of coastal ecosystems, and rapidly developing infrastructure on coastal areas intensify the islands' natural exposure to climate events. In the 1990s alone, the cost of cyclones and typhoons exceeded US$ 800 million, while the 1997 drought cost upwards of US$175 million even before nutrition-related deficiencies were taken into account. During the 1997–98 drought in Fiji US$ 18 million in food and water rations had to be distributed.

Source: IPCC 2001b; IFRC-RCS 2002; World Bank 2000.

8. How much will sea levels rise in the 21st Century?

Sea levels are rising due to thermal expansion and melting of land-based ice. Global warming is causing the oceans to absorb a lot of extra heat (up to 90%). This makes the volume of water expand, and sea levels rise. The Greenland and Antarctic ice caps, and many of the world's glaciers, are all slowly melting. The runoff feeds into rivers and directly into the oceans. This too adds to sea levels.

Prior to the use of satellite systems, measurements were taken using tide-gauges, devices that measure the height of a water level relative to a fixed point on land. Global estimates of sea level rise were subject to substantial differences in measurement from different parts of the world. Sea levels change all the time. They are affected by seasons, astronomical tides, storm surges, currents and density, among other influences. Tidal gauges reflect these short term influences, introducing a large margin of error. The IPCC Fourth Assessment Report described studies that estimated sea level rise for the 20th century between 0.5 and 3.0 mm a year. The most likely range, according to the IPCC, was between 1.0 and 2.0 mm a year.

Satellite altimetry since 1993 provides a more accurate measure of global sea level rise. Three different satellites take measurements: TOPEX/Poseidon (launched 1992), Jason-1 (launched 2001) and Jason-2 (launched 2008).

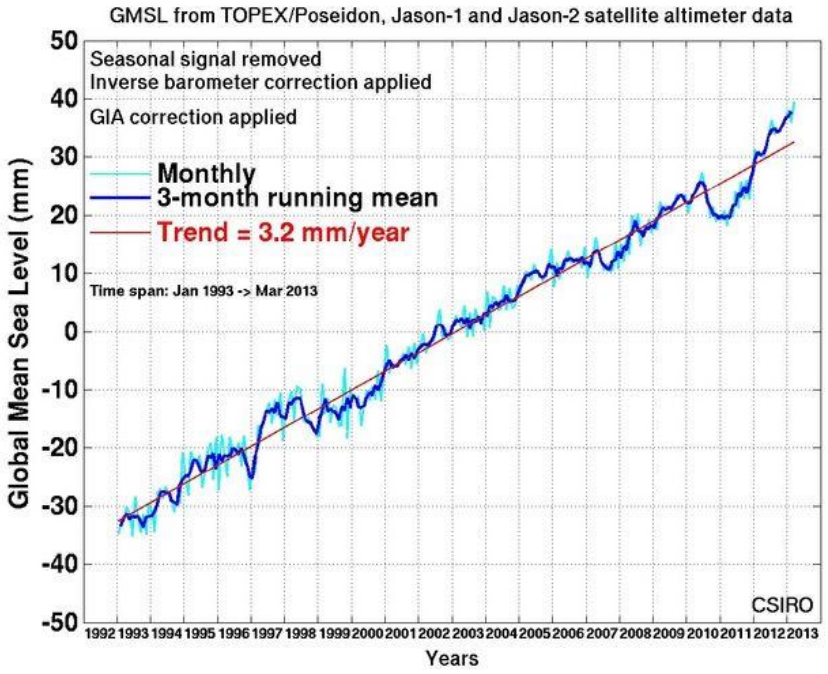

Figure 1: Source - CSIRO

The IPCC projections are derived from climate models. Using both tide gauge and satellite data, we can see that sea levels are rising. Unfortunately, sea level rise is already tracking the worst-case projections, as this graph shows:

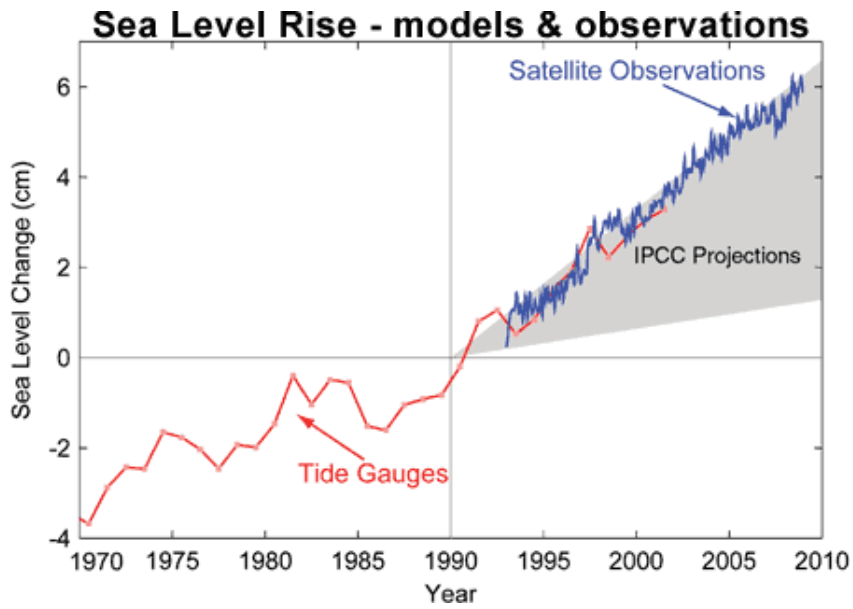

Figure 2: Sea level change. Tide gauge data are indicated in red and satellite data in blue. The grey band shows the projections of the IPCC Third Assessment report (Allison et al 2009).

In fact, the climate models underestimated the rate of sea level rise because the rapid melting of the ice sheets and glaciers was not incorporated in the last IPCC report. (It was left out because the data were not considered sufficiently robust).

8. 1 Damaging Potential

Rising sea levels are widely considered to be the greatest threat posed by climate change. They threaten low-lying countries with inundation, forcing inhabitants to migrate. Coastal cities and ports could be flooded, as could cities sited near tidal estuaries, like London. Many nuclear installations are built by the sea so they can use sea water for cooling.

The potential for sea level rise is enormous. This is because the ice caps - Greenland and Antarctic - contain huge amounts of fresh water - around 70 % of all the freshwater on Earth. Estimates suggest that if the Greenland ice sheet was to melt away to nothing, sea levels would rise around 6 meters. To put that a different way, a loss of just one per cent of the Greenland ice cap would result in a sea level rise of 6 cm. If the West Antarctic Ice Sheet (WAIS) were to melt, this would add around 6 meters to sea levels. If the East Antarctic Ice Sheet (EAIS) were to melt as well, seas would rise by around 70 meters.

In a process that is accelerating, all three ice caps are losing mass. While nobody is suggesting any of the ice caps will melt away to nothing, only a small amount of melting would cause great problems.

A 1 % loss of ice from these three sources would produce a likely increase in sea levels of around 76 cm. With the thermal expansion implied by such melting, and contributions from melting glaciers, the oceans would actually rise far more.

8. 2 Predictions for future sea levels

Future sea level rises depend on a number of factors. The amount of CO2 emitted will determine how much global warming takes place. The amount of ice that melts will vary according to the amount of global warming. The same is true of thermal expansion.

Previous estimates of sea level rise have been based on a set of possible outcomes called emissions scenarios. These theoretical scenarios range from emissions which fall very quickly, to emissions that continue to rise even faster than they have already. Scientists then calculate possible outcomes for each scenario.

In the next IPCC report (AR5), due in 2014, a new method has been used. Emission scenarios have been replaced by Representative Concentration Pathways (RCP). Four trajectories were chosen, based not on emissions, but possible greenhouse gas concentrations in the year 2100. From the concentrations, the RCPs project a 'forcing' for each pathway (the amount of warming); 2.6, 4.5, 6.0, and 8.5 Watts per meter squared. Each pathway is named after it's forcing e.g. RCP4.5. The lowest emission scenario is also referred to as RPC3PD, because it posits a peak warming of 3 w/m^2 by 2070 (~490 ppm CO2 and equivalents), and a reduction to 2.6 w/m^2 by 2100. (PD stands for Peak/Decline).

A draft version of the next report from the IPCC (AR5), due for publication in 2014, was recently leaked. Although the information is subject to change, the draft report says sea levels are likely to rise by between 29 and 82 centimeters by the end of the century, (compared to 18-59 centimeters in the 2007 report).

Other recent studies have projected comparable sea level increases. Jevrejeva 2011 for example, modeled sea level rise using RPC scenarios. This table shows best and worst cases (RPC3PD and RCP8.5), with two in between. The figures for each projection are listed in this table:

RCP scenarios	Sea level rise (m)		
	5%	50%	95%
RCP8.5	0.81	1.10	1.65
RCP6	0.60	0.84	1.26
RCP4.5	0.52	0.74	1.10
RCP3PD	0.36	0.57	0.83

Table 1: Projected sea level rise (m) by 2100 for the RCP scenarios. Results presented as median, upper (95% confidence interval) and lower (5% confidence interval) limits, calculated from 2,000,000 model runs. Sea level rise is given relative the period 1980–2000; (Jevrejeva 2011)

Another study (Rahmstorf 2011) obtained much the same results:

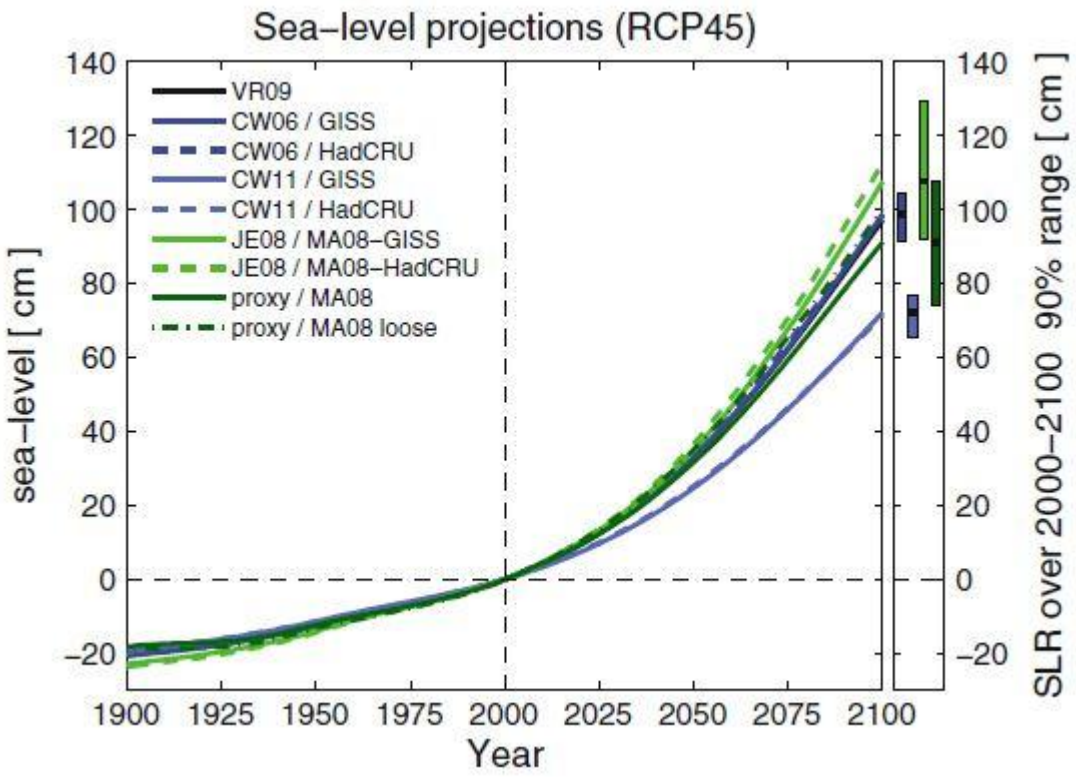

Figure 4: Sea level hindcasts and projections for different models calibrated with different temperature and sea level data. The error bars on the right indicate 90% confidence intervals (5–95 percentile, using the GISS temperature dataset); for the proxy-based projection the uncertainty is as presented in Kemp et al., 2011. (Rahmstorf 2011).

8.3 What's in the pipeline?

The 'pipeline' is a term used to describe the slow reaction of the oceans to heating (inertia). Even if we were to stop emitting greenhouse gases tomorrow, the oceans would continue to rise, driven by the heat already stored. (90% of all the sun's energy falling on the surface of Earth is absorbed by the oceans as heat). This sea level rise is said to be 'in the pipeline'.

A paper published in PNAS - Levermann 2013 - has found that greenhouse gases emitted today will cause sea levels to rise for several centuries. For every degree of warming, sea levels will rise by more than 2 meters in the next few centuries. The Earth's temperature has already risen 0.8 degrees C over pre-industrial temperatures.

Jevrejeva 2011 also found increased rates of sea level rise, even if emissions were to stabilize at 490 ppm by 2070 following the scenario in RPC3PD (RPC2.6):

RCP scenarios	Sea level rise (m)		
	5%	50%	95%
RCP8.5	2.26	5.48	11.51
RCP6	1.03	2.62	5.79
RCP4.5	0.72	1.84	4.30
RCP3PD	0.13	0.53	1.74

Table 2: Projected sea level rise (m) by 2500 for the RCP scenarios. Results presented as median, upper (95% confidence interval) and lower (5% confidence interval) limits, calculated from 2,000,000 runs of the model. Values of sea level rise are given relative the period 1980–2000.

8.4 Implications

Based on the new mid-range IPCC RCP4.5 scenario - around 650 ppm CO2 and equivalents producing a forcing of approximately 4.5 watts/metre^2 - the most likely sea level rise by 2100 is between 80cm and 1 meter. Longer term, sea levels will continue to rise even after emissions have been reduced or eliminated.

Source: http://www.skepticalscience.com/sea-level-rise-predictions.htm

9. Will Climate Change Impact the Spread of Tropical Diseases?

Tropical diseases transmitted by vectors like mosquitoes, flies, ticks or snails are directly affected by conditions in the ecosystems they inhabitant. The conditions include humidity, water levels, temperature and rainfall. Dengue fever (DF) is an emerging mosquito borne viral disease and important public health problem in low land Terai region which is also moving towards hilly region Nepal. Serum samples were collected from 289 patients. The anti-dengue IgM positivity was found to be 8.99%. (Sah et al 2012)

An increase in temperature would create many new tropical diseases, temperature related illnesses and deaths. Prolonged intense heat waves coupled with humidity may increase

mortality and morbidity rates, particularly among the urban poor and the elderly. Another direct effect will be increased death and injury from extreme weather events such as flooding, landslides, and storms (World Bank 2001) which have potentiality of spreading the epidemics during the disaster and inundation.

It is not much studied on what will actually happen to many tropical diseases like malaria and dengue. Many factors are involved in inducing diseases. The logical analysis shows the likelihood of these diseases extending to new areas with establishment of favorable environment for them due to temp rise. It cannot be declared without more evidences. IPCC 4th assessment report could be good reference to follow unless there are evidences. Only climate change is not root cause or driving factor in dengue and other disease extension.

Changes in temperature and rainfall may change the geographic range of vector-borne diseases such as malaria and dengue fever, exposing new populations to these diseases. The frequency and severity of malaria epidemics in East Africa already appear to have increased in correspondence with the increased frequency, magnitude, and persistence of the El Niño phenomenon over the past 20 to 30 years (McMichael et al. 1996). Basically, young children as well as pregnant women and their unborn children are especially vulnerable to malaria.

It will adversely impact in the household and national economy due to increased types and frequency of new tropical and vector-borne diseases.

Due to limited human, institutional, and financial capacity of developing and poor countries, their vulnerability is highest to anticipate and respond such impacts in terms of loss of life and relative effect on investment and the economy (IPCC 2001b). More cost which needs to respond on treatment and prevention of such diseases can have unprecedented impacts in the global economy. The developed country should invest more to the developing country from the humanitarian ground as well.

9.1 Climate Change Impacts on Malaria

Modeling based on IPCC (2001b) scenarios suggests that temperature rise by 2100 could lead to significant increases in potential breeding grounds for malaria in parts of Brazil, Southern Africa, and the Horn of Africa. In a few areas – such as parts of Namibia and the West African Sahel – malaria risk may fall due to excessive heat. In Africa, cities that currently are not at risk of malaria because of their high altitudes, such as Nairobi and Harare, may be newly at risk if the range in which the mosquito can live and breed increases.

Source: Gallup and Sachs 2000.

10. Norway and Climate Change

Norway has been an active resource and "driver" on international climate change issues, and as a western, rich, modern and industrialized country, the eventual effects of Norway is outlined in the following, based on predictions described by Norway Ministry of Foreign Affairs.

Since the whole world is being affected by climate change, Norway can not be an exception. There are direct and indirect effects of climate change in Norway. The direct effects can be outlined as following:

(i) Increased temperatures (2.5-3.5 C by 2100)
(ii) Increases in the amount and timing of precipitation
(iii) Changes in seasonal characteristics (milder winters, earlier springs, wetter autumns)
(iv) Changes in the magnitude and frequency of extreme weather events
(v) Melting of sea ice in the Arctic
(vi) Temperature changes and melting of continental ice will lead to rising sea levels

In the context of Norway, changes in the magnitude and frequency of extreme weather events can be expected to create the most serious impacts. Although there are uncertainties associated with these scenarios, observational records suggest that many projected changes may have been underestimated, rather than overestimated. In some cases, observed changes are surpassing projections, suggesting that climate changes may be faster and more dramatic than projected by model scenarios. Hence it is important that climate policies are flexible and able to respond to new scientific research and scenarios.

Nevertheless, understanding how Norway will be affected by these changes in 2020/2050 requires looking beyond scenarios generated by climate models. It involves attention how potential changes in the climate interact with many other types of changes taking place within Norway. For example, changes in social and health policies, changes in trade policies, changes in investment strategies, and changes in values will to determine the consequences of changes in natural systems.

Indirect effects of climate change in Norway can be outlined as the following:

(i) Foreign investments and trade: Norwegian companies have investments in many countries, and international trade is important to the Norwegian economy. Norway plays a key role in international shipping and recreational cruise ships.
(ii) Immigrant communities in Norway: Vulnerability of "others" to climate change is increasingly shared. Norway's immigrant population is growing, and many of these people come from countries that are considered to be highly vulnerable to climate change. The emotional and financial impacts of climate-related disasters in other countries will be shared through responsibility for families and remittances.

(iii) Norwegians travelling/living abroad: Many Norwegians work or live abroad, and many vacation in increasingly distant and "exotic" locations. Many travel for work or study purposes, or have second homes in other countries.

The impacts in other places may thus affect Norwegian interests and the well-being of Norwegians.

9.1 International implications

Above mentioned direct and indirect effects of climate change will not limit to Norway alone, and thus they will have the following international implications for Norway:

(i) Geopolitics: International relations will be influenced by changing interests in the Arctic, including competition for oil, gas and mineral resources in the Arctic, and changes in local and global fisheries. The management of shipping and implications for environment and northern cultures are likely to become increasingly important issues.

(ii) Migration: Disruptions due to climate change may lead to a greater movement of people in search of more secure conditions. However, media-driven images of millions of climate refugees storming across borders must be questioned. Despite the globalization of markets, communication technology, and cultures, the mobility of people is constrained, including through the construction of physical barriers (e.g. a wall between the United States and Mexico), advanced surveillance systems in travel hubs, and increased monitoring of populations. "Climate refugees" are likely to be people with resources, connections, and adaptive capacity – and not the most vulnerable people. The issue of human mobility and "the right to move" is likely to rise on international agendas within the context of climate change.

(iii) Disaster management, relief, and prevention: The international donor community is likely to face an increasing number and intensity of climate-related disasters that result from vulnerable populations exposed to more extreme events. The cost of responding to disasters on an ad hoc basis may be much higher than preventing disasters in the first place. However, disasters will rarely be attributed to climate change alone, and efforts to prevent disasters should be prioritized if extreme climate events are expected to increase.

10.2 Repercussions for Norway's Climate Policy Response

Climate policy response of Norway will have to take into account both the direct and indirect effects, and pay close attention to the social consequences, rather than just the biophysical impacts. Norway will have to respond to climate changes that are occurring, not just in Norway, but elsewhere in the world as well. For example, by 2050 Norway's shipping sector may have to adapt to changes in ocean conditions, changes in port access, and changes in

markets. Under worst case scenarios of climate change, by 2050 more people may be on the move than resources and material goods. Therefore, to respond to direct and indirect effects of climate change, Norway's climate policy response needs to be comprehensive rather than piecemeal.

11. Taiwan and Climate Change

In the past 100 years, Taiwan experienced an island-wide warming trend (1.0–1.4 °C/100 years). Both the annual and daily temperature ranges have also increased. The warming in Taiwan is closely connected to a large-scale circulation and SAT (Surface Air Temperature - the temp of lower troposphere) fluctuations, such as the "cool ocean warm land" phenomenon. The water vapor pressure has increased significantly and could have resulted in a larger temperature increase in summer. The probability for the occurrence of high temperatures has increased and the result suggests that both the mean and variance in the SAT in Taiwan have changed significantly since the beginning of the 20th century. Although, as a whole, the precipitation in Taiwan has shown a tendency to increase in northern Taiwan and to decrease in southern Taiwan in the past 100 years, it exhibits a more complicated spatial pattern. The changes occur mainly in either the dry or rainy season and result in an enhanced seasonal cycle. The changes in temperature and precipitation are consistent with the weakening of the East Asian monsoon (H.H. Hsu and C.T. Chen).

Under consideration of both the warming effect from greenhouse gases and the cooling effect from aerosols, all projections from climate models indicated a warmer climate near Taiwan in the future. The projected increase in the area-mean temperature near Taiwan ranged from 0.9–2.7 °C relative to the 1961–1990 averaged temperature, when the CO_2 concentration increased to 1.9 times the 1961–1990 level. These simulated temperature increases were statistically significant and can be attributed to the radiative forcing associated with the increased concentration of greenhouse gases and aerosols. The projected changes in precipitation were within the range of natural variability for all five models. There is no evidence supporting the possibility of precipitation changes near Taiwan based on the simulations from five IPCC climate models (H.H. Hsu and C.T. Chen).

12. TIEMS and Climate Change

TIEMS was founded in 1993 in Washington, USA, and is today registered as an international, independent, non-profit NGO in Belgium. TIEMS is an International Network of Users, Planners, Researchers, Industry, Managers, Response Personnel, Practitioners, Social Scientists, and other Interested Parties and individuals concerned with Emergency and Disaster Management.

TIEMS stimulates the exchange of information regarding the use of innovative methods and technologies within emergency and disaster management to improve society's ability to avoid, mitigate, respond to, and speedily recover from natural and technological disasters.

TIEMS is building a network of experts through local TIEMS Chapters all over the world, with the aim of "think globally and act locally".

TIEMS believes in a global dialogue to learn from exchange of expert information and experience between all stakeholders involved in emergency and disaster management. Last year TIEMS arranged 13 conferences and workshops around the world, in Norway, Japan, Italy, Russia, Romania, Korea, China and Iraq, focusing on different topics within emergency and disaster management. This year TIEMS has so far 9 conferences and workshop on the program in USA, Japan, Iraq, France, Germany, China and Finland.

TIEMS also initiates and takes part in research & development projects which aim at developing and/or improving methods and technologies within emergency and disaster management. TIEMS also is developing an International Education Training and Certification Program in Emergency and Disaster Management. The International Education Program comprises TIEMS Chapter Training and TIEMS QIEDM (Qualifications in International Emergency and Disaster Management) Certification. More details are found on TIEMS web-site: www.tiems.org.

TIEMS network constitutes a large international multidisciplinary group of experts, with different educational backgrounds and various experiences in the field of emergency and disaster management, representing a unique source of expertise and ideas, which are important assets in creating resilient societies and also contribute to REDD and other measures to reduce the consequences of climate change.

TIEMS contribution as an NGO can be within the organization's focus, namely in Education and Research, which in my opinion are the keys to a better understanding and spreading the information on climate change. Our belief is that, the more we repeat the message with more and more accurate information, in more and more fora, the global understanding will increase, and improve the willingness to make the necessary changes in our society to seriously deal with the climate change issue.

13. Way Forward

Global warming has become a serious concern due to its adverse effects in livelihood and environment. Experts firmly believe that most glaciers worldwide are retreating inevitably to their final demise. Global warming is a scientific fact and ice melting is the indicator of disastrous consequences. Yet most gloom-and-doom climate scenarios exaggerate trends of the agents that drive global warming. However, study of these factors has revealed that global warming can be slowed and stopped, with practical actions that yield a cleaner, healthier atmosphere. Therefore, while designing strategies to cope with changing climatic conditions, it is necessary to identify the hot spots of climate vulnerability. The sensitivity of communities, their adaptive capacity, current and future exposure needs to be addressed. Various socio-economic and biophysical parameters should be taken into account while assessing the vulnerability of regions.

It is imperative for the governments to have good climate change policies with strong focus on impact adaptation. To avoid negative impacts on the socio-economy - planning for adaptation measures is essential. For adaptation planning, it is essential to understand how the climate of the region might change in the future and how the change might impact the hydrological regime of the river basins. Climate modeling has been an important tool to understand how the climate might evolve in the future while hydrological modeling can provide insights on how the projected climate might impact the hydrological regime of the river basins (Meen Chhetri 2012).

Before concluding, it would also be pertinent to consider if there are any positive effects of climate change? This will not be dealt with here comprehensively, but just to mention that one special positive effect we have already seen and being used is the opening of the North East and North West passage for shipping trade, giving shorter transport distances between the Far East and Europe and East USA. This has a positive effect of less use of fuel.

The less use of fossil fuel will have positive contribution in reducing GHG thereafter mitigation in climate change. There are benefits of the warming for different people in different regions for short or longer term. It is already conceptualized that impacts of climate change are unequivocal. While some areas are likely becoming unfit to life, others may be opening for opportunities.

14. Conclusions

We should realize that global warming is occurring and the Earth is warming rapidly due to human induced emissions of carbon dioxide and other heat-trapping gases. However, hopefully we can keep global warming within tolerable limits by taking necessary measures. As stated earlier, the major causes of global warming are the Greenhouse gases from human activities. Various studies show pressing need to calculate carbon appropriation, the basis for calculating the impact of ecological imbalance particularly - deforestation. Stopping deforestation and building healthy environment should be the key issues in climate change policy of every government. It will then provide a way for millions of poor people in developing countries to benefit directly. This kind of policy will help to reduce deforestation, maintain ecological balance and allow the nations to sell credits for successful programs combating carbon dioxide. More importantly, the developed countries which pollute more than the allowed limits under the existing Kyoto Protocol would be able to buy the carbon credits to increase their emission levels and help to fund forest protection plan and programs.

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16. Authors Brief Bio

K. Harald Drager

K. Harald Drager, Oslo, Norway, is the Managing Director of QUASAR Invest AS in Norway, a consultancy in global safety, emergency and disaster management. He has a Master's degree in control engineering from the Norwegian Technical University in 1966 and a Master's degree from Purdue University in USA in industrial engineering in 1973. His specializations are international organizational development, emergency, disaster and risk management, and project management. He has done consultancy work for numerous clients internationally amongst others the World Bank/International Finance Corporation, NATO and the European Commission, and he has been project manager of several international research and development projects for methods and software development in risk, emergency and disaster management.

He was employed by Det norske Veritas, http://www.dnv.com in 1967 and a member of the Board of Directors of the company for 5 years until he left the company in 1983 and founded his own consultancy. He took the initiative to establish TIEMS (The International Emergency Management Society; www.tiems.org) in 1993, and was the International Vice President of TIEMS since its inauguration until 2002, when he took over as TIEMS President. TIEMS has under his leadership developed to a global well known organization with local chapters in many regions/countries, and TIEMS arranges each year workshops and conferences all over the world with focus on disaster risk reduction. Recently TIEMS has initiated development of a global education, training and certification program and a research coordination service for its members. He has published numerous papers internationally on emergency, risk and disaster management.

He was TIEMS representative in the EU funded NARTUS project with the responsibility for consensus building and establishing the PSC Europe Forum, www.psc-europe.eu, an all stakeholder forum for public safety communication. PSC Europe Forum is now a sustainable organization after it was launched at the end of the NARTUS project in 2009, and arranges two assembly conferences each year and is a leading global advocate for standardization and research initiatives in public safety communication. He was a member of the advisory board of the EU project, ACRIMAS, http://www.acrimas.eu/, and is now a member of the advisory boards of Opti-Alert, http://www.opti-alert.eu/ and CRISMA, http://www.crismaproject.eu. He was an European Commission appointed evaluator for EU Security Calls for FP7 2013, see: http://ec.europa.eu/research/index.cfm

Meen Poudyal Chhetri

Meen Poudyal Chhetri is the Chairperson of Disaster Preparedness Network-Nepal and the President of Nepal Center for Disaster Management. He has been appointed as the Adjunct Professor at the Queensland University of Technology, Brisbane, Australia from 1 March 2009. He served as the Director of the Department of Disaster Management of the

Government of Nepal from 2001 to 2003. In 2004 He worked as the Deputy Regional Administrator in Hetauda, Nepal. From 1995 to 1996, he was the Chief District Officer and Chairman of District Disaster Relief Committee in Dhading district of Nepal. Prof. Chhetri also held positions of Under Secretary, Investigation Officer and Special Officer in various government agencies of Nepal including the Commission for the Investigation of Abuse of Authority, Ministry of Home Affairs, Ministry of Finance, Ministry of Agriculture and Ministry of Education. He was the member of the Drafting Committee of the Disaster Management Bill of Nepal in 2007.

Prof. Chhetri is the Chairman of The International Emergency Management Society (TIEMS)'s Paper Review Committee. He authored two books namely; "Mitigation and Management of Floods in Nepal" and "Analysis of Nepalese Agriculture." He has also published a number of articles in national and international journals.

Prof. Chhetri completed Post Doctorate (Post Doc.) Research Study on "Disaster Risk Reduction: Policy Implications for Nepal, Australia and Beyond" from the Queensland University of Technology (QUT), Brisbane, Australia in 2011. Prof. Chhetri earned his doctorate degree in Economics from the University of Vienna, Austria in 1995. He also holds an MA and Law degree. He carried out 14 months Drug Abuse Research Study at the Johns Hopkins University, Baltimore, U.S.A. from 2002 to 2003. He attended the Pandemic Disaster Preparedness Training Course at the Queensland University of Technology, Brisbane, Australia from August 24 to November 29, 2008. Apart from the above, he has carried out a number of research works in various fields in Nepal and beyond.

In addition to the above, Prof. Chhetri worked as the consultant and resource person in a number of projects and programs related to disaster risk reduction in Nepal. He has significantly contributed in formulating and implementing disaster management policy and legislation in Nepal.