CLIMATE CHANGE AND ITS IMPLICATIONS FOR SMALL FARMERS

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Cover photo: A woman leading her famished cow, looking for grass, India. Photo by Sunil Malhotra

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The threat of climate change on global survival systems has emerged as a critical, urgent issue. The earth's average temperature has increased, some weather phenomena have become more frequent and intense (for example, heat waves and heavy downpours of rains), while others have become less frequent and intense (for example, extreme cold events).**[1]** A warmer earth may lead to changes in rainfall patterns, a rise in sea level, and a wide range of impacts on plants, wildlife and humans.

An ecosystem consists of the biological community that occurs in some locale and the physical and chemical factors that make up its non-living (abiotic) environment. Rain forests and tundra, coral reefs and ponds, grasslands and deserts are examples of ecosystems. Climate differences from place to place largely determine the types of these ecosystems.**[2]**

Broad climate stability is critical to existing ecosystems adapted to a particular climate. A colder climate may wipe out species in a particular ecosystem adapted to a hot climate and *vice versa*. All of this is going to have its most adverse effect on the vulnerable sections of society in developing countries, like small food producers who primarily depend on

Moving to safety in flood, India; by Sunil Malhotra

farming and fishing (and gathering) for their livelihood and survival.

In fact, the impact of climate change on the human production systems is already evident and ominous - with increasing unpredictability of local weather conditions upsetting agricultural production patterns. Warmer weather or climate advances sowing and harvesting periods, affects yields, reduces water availability, increases incidences of pest attacks and exacerbates drought.

It is ironic that though climate change is largely caused by the unsustainable production and consumption patterns of industrialized Northern countries, it is the people of the South who are likely to suffer the most from its effects. This is because these people live in rural areas and are marginalized from the productive resources, which have already been plundered by global corporations and local elites through a history of colonialism and globalization. Their poverty, the product of colonialism and exacerbated by globalization policies, makes it difficult for them to adapt to extreme and rapid weather changes. Even the current global solutions to climate change problems, more focused on mitigation rather than on adaptation, remain inaccessible to the poor as these are market based solutions and not premised on genuine human development.

WHAT IS CLIMATE CHANGE?

Before we understand how climate change is impacting and threatening small farming systems, it is important to briefly discuss the phenomena itself.

We already understand that climate is the average weather pattern (usually taken over a 30-yr time period) for a particular region and time and includes average weather conditions, regular weather sequences (like winter, spring, summer or fall) and extreme weather events (like tornadoes and floods). **[1][3]** Accordingly, climate change represents changes in long-term weather patterns, which persist over an extended period, typically decades (10-30 years) or longer. These changes may be due to internal processes and/or external forces. Among the external forces, those like solar radiation and volcanic activities occur naturally and contribute to the overall natural variability of the atmosphere. However, other external forces such as changes in the composition of the atmosphere that began with the Industrial Revolution in the early 18th Century, are results of human activities.**[1]** In fact, it is these human driven external forces, which have speeded up climate change to make it an issue of grave consequences and urgent concern.

Scientists attribute recent climate changes to the increasing rate of global warming or increase in the Earth's temperature. According to them, for the last 10,000 years or so, the average temperature of the Earth has been about 15^0 Celsius (59^0 Farenheit). During this time, the Earth's average temperature did not change by more than 1^{0}C (1.8^{0}F). But since the mid-1800s, scientists have documented the average temperature of the Earth to have risen by about 0.5^{0}C (0.8^{0}F). The 1990s was the warmest decade ever recorded. **[4][5]**

Many factors contribute to the Earth's temperature, including the Earth's revolution around the Sun, its tilt on its axis, the way it moves on its axis, solar activity such as sunspots, and the chemical composition of the Earth's atmosphere, which is really a thin layer of gases that helps the Earth from becoming too hot or too cold. The composition of these gases is 78% nitrogen and 21% oxygen. The remainder includes less than 1% is carbon dioxide, water vapor, methane, nitrogen oxides and ozone – which are known as the greenhouse gases (GHGs). **[5]** *(See **Box 1** – Climate Change Related Terms)*. These GHGs act like the glass panes in a greenhouse. They allow incoming solar radiation to pass through the Earth's atmosphere but prevent some of the outgoing infrared radiation from the surface and lower atmosphere from escaping to the outer space and thereby keep the Earth's temperature warm enough for different life forms to exist. **[1] [4]** Until about 100 years ago, the concentration of greenhouse gases (GHG) in the Earth's atmosphere was stable. **[5]** Current life on Earth could not be sustained without this natural greenhouse effect. **[3] [4]** *(See **Figure 1**)*

Box 1. Climate Change Related Terms

Green·house Gas ['grEn-"haus 'gas]. Any gas that absorbs infra- red radiation in the atmosphere. Greenhouse gases include water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), halogenated fluorocarbons (HCFCs), ozone (O_3), perfluorinated carbons (PFCs), and hydrofluorocarbons (HFCs).

At·mo·sphere ['at-m&-"sfir] is the mixture of gases surrounding (covering) the Earth. The Earth's atmosphere consists of about 79. 1% nitrogen (by volume), 20. 9% oxygen, 0. 036% carbon dioxide and trace amounts of other gases. This thin layer of gases helps the Earth from becoming too hot or too cold. The atmosphere can be divided into a number of layers according to its mixing or chemical characteristics, generally determined by temperature. The layer nearest the Earth is the troposphere, which reaches up to an altitude of about 8 km (about 5 miles) in the polar regions and up to 17 km (nearly 11 miles) above the equator. The stratosphere reaches to an altitude of about 50 km (31 miles) and lies above the troposphere. The mesosphere extends up to 80- 90 km and is above the stratosphere, and finally, the thermosphere, or ionosphere, gradually diminishes and forms a fuzzy border with outer space. There is very little mixing of gases between layers.

Ozone layer is a layer in Earth's atmosphere which contains relatively high concentrations of ozone (O_3). This layer absorbs 97- 99% of the sun's high frequency ultraviolet light, which is potentially damaging to life on Earth. Ozone is a molecule composed of three oxygen atoms. Ozone as a greenhouse gas -- Although ozone was present at ground level before the industrial revolution, peak concentrations are far higher than the pre- industrial levels and even background concentrations well away from sources of pollution are substantially higher. This increase in ozone is of further concern as ozone present in the upper troposphere acts as a greenhouse gas, absorbing some of the infrared energy emitted by the earth. Quantifying the greenhouse gas potency of ozone is difficult as it is not present in uniform concentrations across the globe. However, the most recent scientific review on the climate change (the IPCC Third Assessment Report) suggests that the radiative forcing of tropospheric ozone is about 25% that of carbon dioxide.

Car·bon Di·ox·ide ['kär-b&n (")dI-'äk-"sId]. A heavy colorless gas (CO_2) that does not support combustion, dissolves in water to form carbonic acid, is formed especially in animal respiration and in the decay or combustion of animal and vegetable matter, is absorbed from the air by plants in photosynthesis, and is used in the carbonation of beverages. CO2 is one of the greenhouse gas chemical compounds.

Ni·trous ox·ide ['nI-tr&s äk-"sId]. A colorless gas (N_2O) that is an atmospheric pollutant produced by combustion. N_2O is one of the greenhouse gas chemical compounds. N_2O is also used in dental procedures and sometimes referred to as "laughing gas. "

Me·thane ['me-"thAn]. Colorless, odorless, flammable hydrocarbon (CH_4) that is a product of decomposition of organic matter and of the carbonization of coal. Methane is one of the greenhouse gas chemical compounds.

Biosphere is that part of Earth's atmosphere, land, oceans that supports any living plant, animal, or organism. It is the place where plants and animals, including humans, live. Large quantities of carbon dioxide are exchanged between the land- based biosphere and the atmosphere as plants take in carbon dioxide and give off oxygen, and animals inhale oxygen and exhale carbon dioxide.

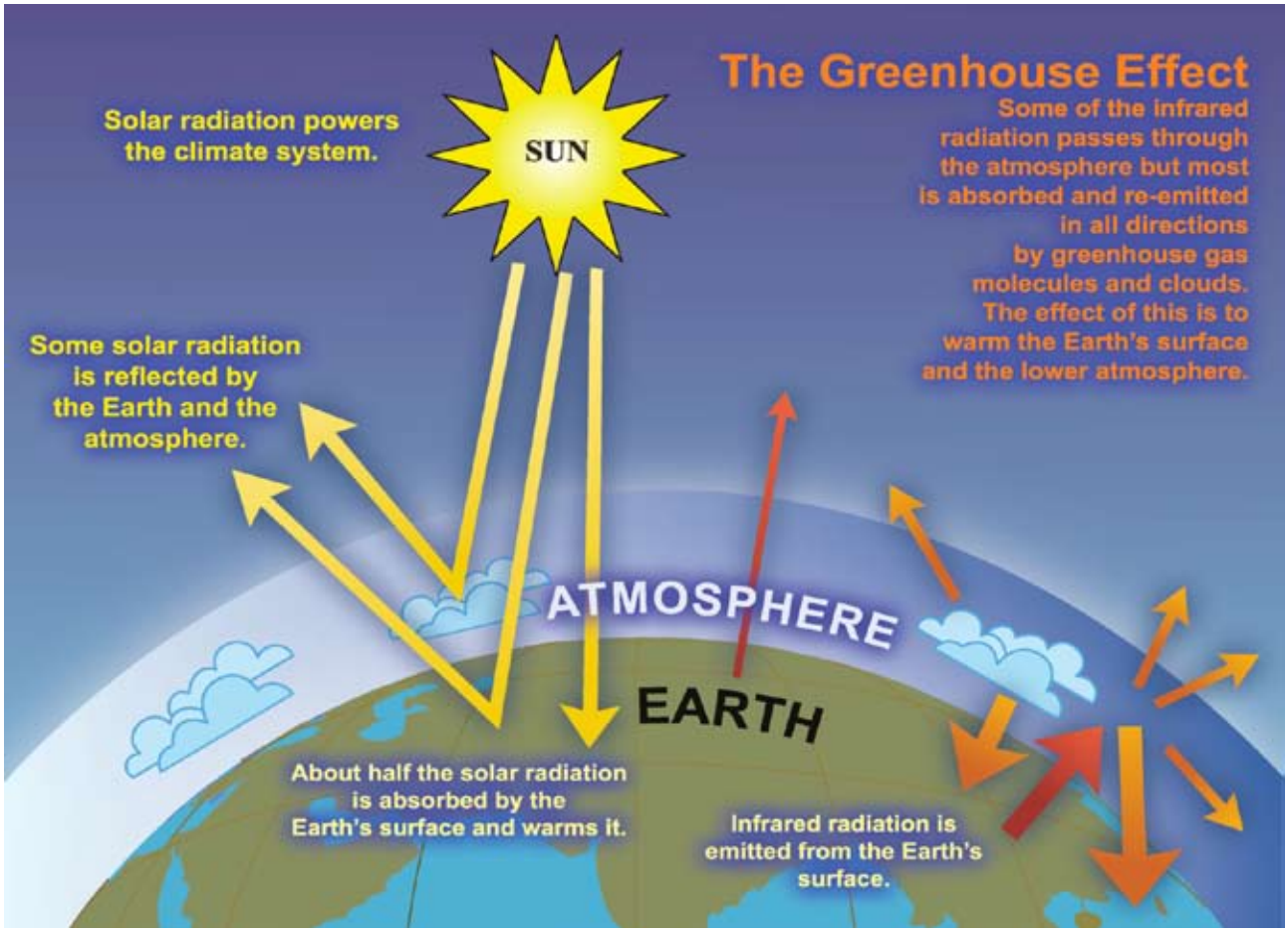
Oceans cover about 70 percent of Earth's surface. Their large mass and thermal properties, enable them to store vast quantities of heat. Oceans buffer and regulate temperature – energy absorbed or lost by the oceans results in a smaller surface temperature change than would occur over land. The atmosphere and ocean constantly exchange energy and matter. For example, water evaporates from the oceans into the atmosphere. This moisture then falls back to the Earth as precipitation – rain, snow, sleet, and even the morning dew on the grass.

Land covers 27 percent of Earth's surface, and land topography influences weather patterns. For example, the weather in areas covered by mountains can be completely different than the weather in areas where the land is mostly flat.

Ice is the world's largest supply of freshwater. It covers the remaining 3 percent of Earth's surface including most of Antarctica and Greenland. Because ice is highly reflective and because of its insulating properties, ice plays an important role in regulating climate.

Sources: **[2], [5]**

Figure 1. The Greenhouse Effect



Source: [1]

Changes in atmospheric concentrations of GHGs and aerosols, land cover, and solar radiation alter the energy balance of the climate system. The global warming experienced by the Earth today is attributed to the amount of GHGs in the atmosphere, which today far exceeds the normal levels needed to warm the earth.

Climate change - scientific and natural or manmade?

While many factors influence climate, there is increasing evidence that much of the global warming that is causing extreme weather changes over the recent decades is brought about by human activities. The report by the

Inter-governmental Panel on Climate Change (IPCC)[1] in 2007 revealed that human activities are the major or dominant cause of climate change. Human activities are responsible for most of the global warming observed over the past 50 years.

Increasing and continuous emission (or releases) of GHGs especially carbon dioxide (CO_2) into the Earth's atmosphere has increasingly warmed the globe in the last five decades. This has been compounded by the warming effect caused by the depletion of the ozone layer. The IPCC report states, "GHG emissions due to human activities have grown since pre-industrial times, with an increase of 70% between 1970 and 2004."**[6]** Indeed, human activities are affecting the chemical composition of the Earth's atmosphere through the increasing emission of GHGs primarily from industrial activities like burning of fossil fuels (crude oil, coal) and clearing and burning of forests for logging, mining, agriculture and commercial uses.**[1][2]**

Of all the GHGs, CO_2 concentration in the Earth's atmosphere is the most dangerous. The CO_2 concentration in the atmosphere at 379 parts per million (ppm) in 2005 (and further increasing) was far higher than the natural range (180 to 300 ppm) over the last 650,000 years. CO_2 accounts for over 80% of global warming pollution, and has been growing faster than ever since 1960 when direct measurements began. Emissions of CO_2 from burning fossil fuels increased from 6.4 Gigatons per year in the 1990s to 7.2 Gigatons per year over the period 2000-2005. **[1]**

Around 97% of the CO_2 emitted by industrialised countries comes from burning coal, oil and gas, largely to feed the energy demand of industries producing consumer goods and catering to the needs of the developed countries as well as those of the rapidly urbanizing countries in the developing world particularly China and India. Such rapid production and consumption patterns are unsustainable and have put tremendous pressure on natural resources and the environment.

Today, the world burns 400 years' worth of this accumulated, compressed biological matter every year, three to four times more than in 1950. It has taken millions of years for plants to extract the carbon from the atmosphere that makes up today's coal, oil and gas deposits. With the present pace of production and consumption, its replacement as coal, oil or gas will be impossible for many, many thousands of years.[**7**] *(See **Box 2** – The Global Carbon Cycle)* The carbon accumulation has been made worse, especially over the last century, by unchecked land clearance and the spread of industrial agriculture using increasing amounts of chemical inputs and inorganic fertilizers.

Economy of Overproduction and Unsustainable Consumption

Clearly, human activities, or more specifically, corporate activities directed towards the exploitation and plunder of the Earth's natural resources for industrial consumption, are largely responsible for much of the environmental stress that has contributed to global warming. Globalization policies of liberalization, deregulation and privatization, have exacerbated the rate and degree of the plunder and exploitation. The irreversible environmental devastation and resulting unimaginable human suffering are borne by the more vulnerable countries and sectors of society.

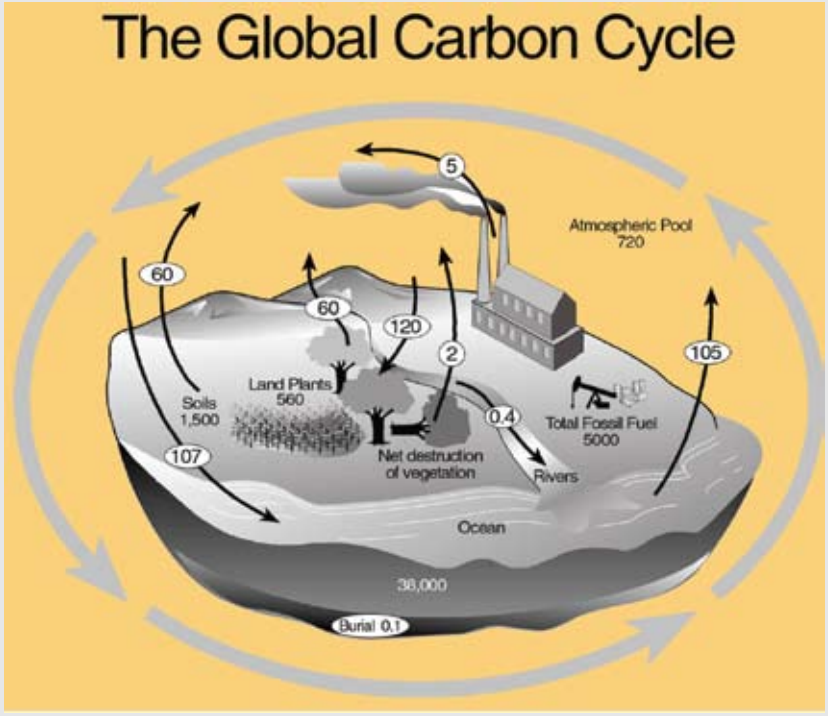
TNC Plunder

The main culprits for such devastation of the environment and the Earth's natural resources are the transnational corporations (TNCs), which continue the unbridled burning of fossil fuels to power up industries and energy consumption especially in the First World. It is these giant corporations which are also responsible for the uncontrolled logging and mineral extraction in the forests, especially in the Third World; the large-scale agricultural plantations using massive amounts of pesticides and non-organic fertilizers, again in the Third World, and large-scale commercial fishing, again, especially in the Third World.

According to the IPCC, the economies of developed countries (G8) are responsible for

1 The Intergovernmental Panel on Climate Change (IPCC) is a scientific inter- governmental body tasked to evaluate the risk of climate change caused by human activity. It was established in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP). It is composed of scientists, government bodies and individuals.

Box 2. Global Carbon Cycle



Carbon moves back and forth among these various pools. Nearly all of the carbon on earth is locked up in the lithosphere as sedimentary rock deposits and fossil fuels. And about 99. 999% of this carbon is fixed in place and essentially off the table as far as the carbon cycle is concerned. Only the amount stored as fossil fuels enters the carbon cycle, and only then through human activities. Currently, the atmospheric carbon pool is expanding by about 6. 1 gigatons per year, and the fossil fuel carbon pool is shrinking by about 4 to 5 gigatons per year. This is one aspect of the carbon cycle that can be readily manipulated by human activity. *Before the industrial revolution, the main source of fluctuation in atmospheric carbon was from changes in biomass and soil organic carbon. Now, fossil fuel burning is the greatest factor in atmospheric carbon fluctuations.* The basic carbon cycle of life is: (1) the conversion of atmospheric carbon dioxide to carbohydrates by photosynthesis in plants; (2) the consumption and oxidation of these carbohydrates by animals and microorganisms to produce carbon dioxide and other products; and (3) the return of carbon dioxide to the atmosphere. On a global level, the total carbon cycle is more complex, and involves carbon stored in fossil fuels, soils, oceans, and rocks. We can organize all the carbon on earth into five main pools, listed in order of the size of the pool: **(a)** Lithosphere (Earth's crust). This consists of fossil fuels and sedimentary rock deposits, such as limestone, dolomite, and chalk. This is far and away the largest carbon pool on earth. The amount of carbon in the lithosphere: 66 to 100 million gigatons (a gigaton is one million metric tons). Of this amount, only 4, 000 gigatons consists of fossil fuels; **(b)** Oceans. Ocean waters contain dissolved carbon dioxide, and calcium carbonate shells in marine organisms. Amount of carbon: 38, 000 to 40, 000 gigatons; **(c)** Soil organic matter. Amount of carbon: 1, 500 to 1, 600 gigatons. The soil organic matter pool is currently losing about 1 to 2 gigatons of carbon per year to the atmospheric pool. About 60 gigatons of carbon per year enters the soil organic carbon sink as decaying biomass remains in the soil. About 61 to 62 gigatons of carbon are lost from this pool as soil organic matter is oxidized by the atmosphere. This is the other main cycle that can be manipulated by human activity. Changes in land use patterns and agricultural practices can affect the amount of carbon released into the atmosphere from soil organic matter.

(d) Atmosphere. This consists primarily of carbon dioxide, carbon monoxide, and methane. The amount of carbon in the atmosphere has increased from 578 gigatons in 1700 to about 766 gigatons in 1999, and continues to increase at the rate of about 6. 1 gigatons per year; **(e)** Biosphere. This consists of all living and dead organisms not yet converted into soil organic matter. Amount of carbon: 540 to 610 gigatons.

Source: **[8]**

65% of the historical global emissions, with the USA alone accounting for 25% in 2003**[9]** and the highest global per capita GHG emissions at 20 tons per person. The USA houses 162 TNCs among the global 500, which have huge investments in fossil fuel extraction and are expanding their operations in new oil and gas fields across continents. For example, in Africa where many TNCs like Exxon, Royal Dutch Shell, BP and BHP Billiton are engaged in fossil fuel and minerals extraction, GHG emissions are concentrated in 15 countries including OPEC member countries Nigeria and Angola. **[10]** In 2006, for example, Exxon Mobil still had underdeveloped holdings totalling 105 million acres in 31 countries, 24 million acres of which is located in deep water areas offshore of the African continent.**[6]**

The TNCs account for 50 percent of all oil extraction and refining, and a similar proportion of the extraction, refining and marketing of gas and coal. They control 80 percent of land worldwide which is cultivated for cash crops. Only 20 TNCs account for about 90 percent of the sales of hazardous pesticides and other agricultural chemicals.

These TNCs based in the US and Europe are now leading the lobbying to water down solutions in major international conventions aiming to address environmental issues towards achieving sustainable development.

Colonialism and Globalization

TNC dominance in the global economy is rooted out in the historical process of colonial and neo-colonial subjugation of the poor countries by the developed countries. Colonies were important to the industrialized countries as sources of raw materials for their industries, cheap supply of labour-power, ready markets for their consumer goods, as well as geo-political bases. The primary sector, especially the mining of minerals, oil and gas were the main targets of TNCs until the first half of the 20th Century. **[11]**

In the 21st Century, the neo-liberal policies of liberalization, privatization and deregulation have increased TNC domination. Through international financial institutions (IFIs) such as the International Monetary Fund (IMF) and the World Bank, multilateral organizations such as the World Trade Organization (WTO), and through regional and bilateral agreements that countries in the Third World are pushed to open up and allow TNC access to their natural resources to the detriment of the local populations. This form of neo-colonialism is matde possible through legislation and government regulations favouring wider access by TNC to the natural resources of the Third World countries. It often leads to conflicts especially where these TNCs encroach on the ancestral lands of indigenous peoples, violate human rights and deploy military personnel to suppress people's opposition, and cause further impoverishment of the already poor populations.

War

War and the use of high powered weapons, bombs, chemical and biological weapons claim lives and inflict massive environmental damage, the impact of which extends over generations in terms of health problems and danger to human lives. These include poisoning of water systems, planting of land mines, and fallout from nuclear and atomic bombs.

A research report by Oil Change International entitled "A Climate of War: The War in Iraq and Global Warming" released in March 2008 states that the war in Iraq is responsible for *at least* 141 million metric tons of carbon dioxide released in the Earth's atmosphere since March 2003. According to the report, CO_2 released by the war to date equals the emissions of 25 million cars on the road in the USA in 2008. Further, according to Oil Change International, if the war was ranked as a country in terms of emissions, it would emit more CO_2 each year than 139 nations do annually.**[12]**

Estimates of emissions come from fuel-intensive combat, oil well fires, increased gas flaring, the boom in cement consumption due to reconstruction efforts and security needs, and heavy use of explosives and chemicals. Not included in the calculation are military consumption of halons or other greenhouse gas intensive chemicals and the use of bunker fuels for the transportation of troops and equipment to Iraq.**[12]**

In the Gulf War of 1991, where more than 600 Kuwaiti oil wells were set ablaze, some burning for nine straight months, the smoke blocked the sun and temperature fell by 10°C, resulting in

approximately 1000 deaths due to acrid smoke, and 300 million tonnes CO_2 released.**[13]**

Computer models tracked the oil fire smoke from Kuwait eastward. According to a World Health Organization (WHO) report, in Iran alone, 4 billion cubic meters of rainfall were contaminated with hazardous materials. The soot from the fires capped the Himalayas with soot and dust and caused the normally reflective area of this huge range of mountains to absorb heat. The release of soot and hydrocarbons from the burning oil-fields changed the albedo (reflective capacity) of the Himalayas and other affected mountain ranges, which kept the heat from solar radiation within the atmosphere, melted glaciers, exposed the underlying rock to absorb solar radiation, and thereby exacerbated weather pattern shifts. There are changes that appear now to be an ongoing process, which are clearly visible from space; during the past decade almost 67 percent of the glaciers in the Himalayan and Tienshan mountain ranges have retreated. [**14]**

While the reasons for going to war may often have political factors involved, the main factor is still economic and is rooted in access to resources. Just as the First and Second World Wars were fought over access to raw materials and markets, conflicts and wars in recent history have been fought for the same reasons.

IMPLICATIONS FOR SMALL FARMERS AND FISHERFOLK

According to the IPCC, climate change is likely to lead to some irreversible impacts. The rural poor, which account for a large percentage of the world's poor, are the ones to be adversely affected because of their high dependence on natural resources for their livelihood and their limited capacity to adapt to a changing climate.

Around 60 to 80 percent of the population in poor countries engage in small-scale agriculture. The Food and Agriculture Organization (FAO) estimates that over 90 percent of the 15 million people working in coastal waters are small-scale fishers, apart from the tens of millions of the poor who fish inland rivers, lakes, ponds, and even rice paddies. The World Bank estimates that 90 percent of the world's 1.1 billion poor derive a portion of their income from forests while over 600 million keep livestock which is a critical cash asset for many. According to the UN Hunger Task Force, half of the world's hungry are smallholders, a fifth do not have their own land, a tenth are agro-pastoralists, fisherfolk and forest users, while only a fifth live in urban areas. **[6]** *(See **Table 1**)*

According to the IPCC, adverse environmental impacts from climate change include:

1. The destruction of natural systems such as glaciers, alpine systems, forests, grasslands, wetlands, mangroves, sea-coasts, and backwaters
2. Increasing air and water temperatures leading to a change in weather conditions and extreme weather conditions
3. Rise in sea levels
4. Change in rainfall patterns or decrease in its volume

Table 1. Number of People Dependent on Ecosystems

Dependent on forests in some way	1.6 billion
■ Smallholder farmers who grow farm trees or manage remnant forests for subsistence and income	500 million – 1 billion
■ Indigenous people wholly dependent on forests	60 million
Poor dependent on agriculture in Sub-Saharan Africa	>500 million
Rural poor who keep livestock	600 million
■ Landless rural poor who keep livestock	150 million
Fishers and fish-farmers in the Lower Mekong River basin	40 million

*Source: Angelsen and Wunder 2003; IFAD, et.al, 2004; Kura et.al., 2004; Haggblade, 2004; as cited in World Resources Report 2005, used in **[6]***

5. Floods and water retention
6. Droughts and salinity.

The destruction of natural systems has adverse effects on the Earth's temperature and leads to extinction of species of plants and animals, especially those utilized by people for sustenance.**[6]** Approximately 20 to 30 percent of species assessed so far are likely to be at increased risk of extinction if increases in global average warming exceed 1.5-2.5°C (relative to 1980-1999). As increase in the global average temperature exceeds about 3.5°C, model projections suggest significant extinctions at around 40 to 70 percent of species assessed all over the globe.**[1]**

As stated earlier, as the average temperature increases, some weather phenomena will become more frequent and intense while others will be less frequent and intense. Higher water surface temperatures could lead to an increased probability of torrential rain. Climate change will therefore result in greater risks of deaths due to severe weather events.**[1]**

According to data released in 2005 by the United Nations Development Programme (UNDP), over the past four decades, the number of great catastrophes has increased about four times while economic losses have increased over 10 times. *(See **Table 2**)*

The UNDP also found that natural disasters affected twice as many people in the 1990s as in the 1980s and the annual average losses for all disasters over the 1990s were 62,000 deaths, 200 million affected, and $69 billion in economic losses. Asia was disproportionately affected, accounting for more than 43% of all natural disasters in the last decade of the 20th Century. During the same period, Asia accounted for almost 70% of all lives lost due to natural hazards. In China alone, floods affected more than 100 million people on average each year. In Africa, average rainfall dropped in the Sahel and droughts occurred in the 1970s and 1980s that resulted in more than 100,000 deaths. Africa has had one major drought in each of the last three decades. Ethiopia's 1984 drought affected 8.7 million people — one million died and millions more faced malnourishment and famine. The 1991-1992 drought in South Africa reduced cereal harvests and exposed more than 17 million people to the risk of starvation.**[6]**

Changes to sea levels also have drastic impacts. Rises of five meters or more are expected in the centuries to come because substantial amounts of ice in Greenland and the Antarctic are likely to melt. For farmers and fisher people living in coastal areas, a rise in sea level by one meter would be a heavy blow as this would cause inundation of their dwellings, farm areas and marine resources. If sea levels rise by seven to twelve meters, most cities in the world would definitely be affected. Massive migration would be inevitable and scarcer settlement options could trigger conflicts leading to military intervention.

A warmer Earth would lead to the spread of tropical diseases borne by insects and other anthropods[2]; and common diseases such as malaria, diarrhoea, tuberculosis and dengue fever. Exceptional weather events can also cause clusters of diseases that are transmitted by water, mosquitoes or rodents. Moreover,

Table 2. Great Natural Catastrophes and Economic Losses, 1950 to 1999

Catastrophes & Losses	1950-59	1960-69	1970-79	1980-89	1990-99
Incidence	20.0	27.0	47.0	63.0	82.0
Economic Losses *	38.5	69.0	124.2	192.9	535.8
Insured Losses *	Unknown	6.6	11.3	23.9	98.9

* in billion US$ - 1998 (note: natural catastrophes are classified as great if the ability of the region to help itself is distinctly over-taxed, making interregional or international assistance necessary.)

*Source: World Resources Report 2005, UNDP used in **[6]** (does not include the December 2004 Tsunami that claimed more than 300,000 lives across Asia nor the 2005 flash flood disaster in Quezon and Aurora Provinces in the Philippines)*

2 Anthropods make up 90% of the animal kingdom and are classified in the phylum anthropoda. Other than insects, arachnids are spiders, ticks; crustaceans are crabs, isopods; chilopods are centipedes; diplopods are millipedes. (http://insected.arizona.edu)

extreme torrential rains and droughts can also trigger diarrhoea due to the pollution of drinking water sources by overflowing sewage facilities and water shortages making it difficult to prepare food hygienically. The WHO estimates that changes in climate over the past decades are responsible for approximately 2.4% of all diarrhoea cases today.**[6]**

Inadequate water, sanitation and hygiene claims 1.7 million deaths and results in the loss of at least 54 million healthy life years annually. The economic cost of polluted coastal waters is estimated to be $16 billion annually, mainly due to impacts on human health. **[6]**

The more vulnerable sectors of society, particularly the world's rural poor, are the ones mostly affected by these diseases.**[11]** In agriculture, adverse changes in biodiversity that translate to imbalances in the food chain, further decrease resources available for the poor both for livelihood and nutrition. There may be increases in disease epidemics for both livestock and crops and rise of fungal and bacterial diseases for vegetables like tomatoes, potatoes and beans. The resulting mud and stagnant water due to heavy rains may favour development of foot rot, foot and mouth disease and liver flukes. Leaching, water run-off and flash floods will most likely render soils less fertile for agriculture. In the highland areas, the intensity and frequency of the rains are most likely to cause landslides.**[15]**

The impacts of climate change (and even natural disasters) are aggravated by man-made or man-instigated disasters such as flash floods coming from denuded forests, which claim hundreds to thousands of lives, or collapsed mine tailings dams that pollute rivers and oceans, kill marine life, and cause lifelong debilitating diseases among the rural poor. The vulnerability of the world's poor is further manifested in the uneven distribution of affected population from the damaging effects of climate change. The WHO reports that 96% of all deaths from natural disasters occur in poor countries. While the economic losses per catastrophe are much larger in industrial countries, the greater losses

Devastated houses after a flash flood, Nepal; by Manoj Aryal, courtesy ICIMOD

still occur in poor nations in absolute number of lives as well as in relation to the gross domestic production (GDP).**[6]**

Temperature increases will cause inundation and flooding in some regions while in others it will cause desertification and bring about shortages in water supply. In Africa, for instance, by 2080 there is a projected increase of 5 to 8 percent of arid and semi-arid land. In Latin America, by mid-century, increases in temperature and associated decreases in soil water are projected to lead to gradual replacement of tropical forests by savannahs in eastern Amazonian, and semi-arid vegetation will tend to be replaced by arid-land vegetation. By 2030, production from agriculture and forestry is projected to decline over much of southern and eastern Australia and over parts of eastern New Zealand due to increased drought and fire. The same is true in southern Europe where high temperatures and droughts are projected to increase with climate change.**[1]**

In contrast, flooding and inundation will be experienced by countries in the South, East and South-East Asia. Coastal areas, especially heavily populated mega-delta regions, will be at the greatest risk due to increased flooding from the sea and in some mega-deltas, flooding from the rivers. By 2050, ongoing coastal development and population growth in some areas of Australia and New Zealand are projected to exacerbate risks from sea level rise and increases in the severity and frequency of storms and coastal flooding.

In Europe, climate change is expected to magnify regional differences in Europe's natural resources and assets. Negative impacts will include increased risk of inland flash floods and more frequent coastal flooding and increased erosion due to storminess and sea level rise. Mountainous areas will face glacier retreat, reduced snow cover and winter tourism, and extensive species losses – in some areas up to 60 percent under high emissions scenarios by 2080.

Small Pacific Island countries will experience sea level rises which are expected to exacerbate inundation, storm surge, erosion and other coastal hazards, thus threatening vital infrastructure, settlements and facilities that support the livelihood of island communities. Deterioration in coastal conditions, for example through erosion of beaches and coral bleaching, is expected to affect local resources.**[1]**

Meanwhile, water shortages are expected in countries in the Asian region, the Small Islands, the Caribbean and the Pacific to the point where they become insufficient to meet demand during low-rainfall periods. By the 2050s, freshwater availability in Central, South, East and South-East Asia, particularly in large river basins, is projected to decrease. In Latin America, changes in precipitation patterns and the disappearance of glaciers are projected to significantly affect water availability for human consumption, agriculture and energy generation. Warming in the western mountains of North Americas is projected to cause decreased snowpack, more winter flooding and reduced summer flows, exacerbating competition for over-allocated water resources. **[1]**

In the face of growing population demands, crop yields are predicted to decrease by up to 20 percent in large parts of Africa, Asia and Latin America. The geographical boundaries of agro-ecosystems as well as species composition and performance will change markedly. Marine ecosystems are a primary source of protein for millions of the poor in coastal communities, and Small Island states and migratory patterns of fish stocks are changing. Coral reefs have and will continue to experience major bleaching and mortality events in response to rising temperatures. **[1]**

More adversely, the increase in the number of undernourished population from 5 to 170 million in 2080, projected by the FAO, is expected to increase further. Even small rises in temperature will increase the risk of hunger in poor countries due to negative impacts on food production and availability. The impact of climate change on food security, will likely reduce access to and utilization of food in many regions that are already vulnerable. While this is expected, it has not yet been quantified. In particular, stability of the food supply is likely to be disrupted by more frequent and severe climate extremes. Utilization of food may be affected negatively by increases in crop, livestock and human pests and diseases as well as by reduced water availability and water quality. **[16]**

THE KYOTO PROTOCOL AND AGRICULTURE

Several international treaties have been adopted in the last three decades to mitigate the projected impact of climate change. Of note is the **UN Framework Convention on Climate Change (UNFCCC)** signed by 154 countries during the United Nations Conference on Environment and Development (UNCED) – otherwise known as the Earth Summit – in June 1992 in Rio de Janeiro, Brazil.

The UNFCCC encouraged developed countries to stabilize GHG emissions to 1990 levels by the year 2000. Alongside UNFCCC, Agenda 21 was agreed upon and signed by 179 countries during the Earth Summit. Agenda 21 is a programme of action for sustainable development in the 21st century, aimed at providing a high quality environment and healthy economy for all.**[6] [17]**

Five years later, the **Kyoto Protocol** (hereinafter referred to as the Protocol) was adopted at the Third Conference of the Parties to the UNFCCC (COP 3) in Kyoto, Japan on 11 December 1997. The Protocol shares the objective and institutions of the UNFCCC but commits countries listed in Annex B of the Protocol to implement cuts to their GHGs emissions especially CO_2 by an average of 5% (against the baseline of 1990) below levels specified for each country between 2008 and 2012.

The Protocol places a heavier burden on developed nations under the principle of "common but differentiated responsibilities." This has two main reasons. Firstly, developed countries can more easily pay the cost of cutting emissions. Secondly and more importantly, developed countries have historically contributed more to the problem by emitting larger amounts of GHGs per person than the developing countries. Following the ratification by Russia in 2004, the Protocol entered into force only on 16 February 2005, eight years after it was adopted. [6] It required 55 nations to ratify it before it could be implemented. *(See **Table 3** for the list of Annex B Countries)*

In December 2007, two years after the Protocol was enforced and nine months after the IPCC released its 2007 report pointing to humans as the main culprits for climate change, world leaders and members of civil society organizations (CSOs) convened at a high level UN conference in Bali, Indonesia to tackle critical issues related to climate change. The main focus of the Bali Conference on Climate Change was the launching of a long-term

Drought affected Jhikhu Khola, Nepal; by Ingrid Jaegar, courtesy ICIMOD

cooperation agreement under the UNFCCC negotiation track and the post-2012 period when the Protocol's first commitment period expires. The most significant result of the Conference was the creation of an ad hoc working group on long-term cooperative action to discuss a wide range of issues under the four "building blocks" of mitigation, adaptation, finance and investment, and technology transfer.**[18]**

Of particular concern among world leaders is the impact of climate change on agriculture and the direct implications for world food production and food security especially in Third World countries. Various conferences led by the UNFCCC seek to find ways to mitigate the impact of climate change on food security. Mitigation and adaptation measures to meet ecological, economic and socially sustainable goals towards achieving food security and poverty reduction have been identified by the World Food Summit, the Millennium Development Goals, and the UNFCCC. Mitigation refers to action to reduce emissions or the causes of climate change. Adaptation refers to efforts to lessen the vulnerabilities of the Earth and the people to the negative effects of climate change.

The UNFCCC has given space for agriculture in several articles of the Protocol. The goal of Article 2 is to ensure stabilization of GHG concentrations in the atmosphere at a level that would prevent "dangerous anthropogenic (human) interference with the climate system". Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner.**[16]**

While understanding is progressing, many procedures and methodologies are not yet developed. The UNFCCC for instance explicitly mentions the possibilities for agricultural projects that reduce emissions of non-carbon dioxide (CO_2) GHG. Examples are reduced methane (CH_4) emissions through improved manure management, different diets for livestock, adapted irrigation of rice, and reduced laughing gas (N_2O – nitrous oxide) emissions from reduced chemical fertiliser use – or simply, organic agriculture.**[19]**

The Bali roadmap on the other hand notes that actions aimed at safeguarding food security and rural livelihoods in the coming decades must focus on synergies between adaptation and mitigation strategies in the agricultural and forestry sectors in order to address climate, environmental, social and economic concerns expressed within both the UNFCCC and the MDGs.**[16]**

Concerns have been raised by the Third World led by the Group of 77 or G77[3] at the Bali Conference on Climate Change, among which is the non-fulfilment by the developed countries of their commitments to channel financing for mitigation and adaptation measures for developing countries. Also, the commitment to develop and transfer of technology remains unfulfilled and complicated by issues of intellectual property rights (IPRs), market incentives, and so-called enabling environment. On top of this, reductions in GHG emissions of Annex B countries (participants to the Protocol) remain unfulfilled. Emissions even increased by 21% between 1997 and 2004. **[20][21][22]**

The G77 has listed the following as the most formidable challenges in addressing climate change:

- Lack of fulfilment of commitments during the Kyoto Protocol's first commitment period by Annex B (developed) countries in reducing emissions.
- Provision of finance and technology transfer to developing countries
- Inadequacy of financial resources for adaptation and mitigation efforts
- Insufficient national institutional capacity in developing countries to participate in carbon market mechanisms.

3 The Group of 77 (G-77) was established on 15 June 1964 by seventy-seven developing countries signatories of the "Joint Declaration of the Seventy-Seven Countries" issued at the end of the first session of the United Nations Conference on Trade and Development (UNCTAD) in Geneva. Beginning with the first "Ministerial Meeting of the Group of 77 in Algiers (Algeria) on 10 – 25 October 1967, which adopted the Charter of Algiers", a permanent institutional structure gradually developed which led to the creation of Chapters of the Group of 77 with Liaison offices in Geneva (UNCTAD), Nairobi (UNEP), Paris (UNESCO), Rome (FAO/IFAD), Vienna (UNIDO), and the Group of 24 (G-24) in Washington, D.C. (IMF and World Bank). Although the members of the G-77 have increased to 130 countries, the original name was retained because of its historic significance.

According to the G77, which includes China, technology transfer is an enormous challenge, keeping in view the issue of incremental costs and capacity building. Addressing the climate system depends on early development, deployment, transfer and diffusion of environmentally sound technology. A key question is the treatment of IPRs over climate-friendly technologies. Developing countries must be helped on affordable, preferential and concessional terms, through technology transfer, directed R&D and other assistance, to acquire and build capacity for applying technologies.**[21]**

On the issue of IPRs, a research by the UNFCCC that surveyed R&D funding of environmentally sound technologies (ESTs) in the US, Canada, the United Kingdom (UK) and Korea found that in most countries, governments allocated a significant portion of their rights (patents, copyrights, trademarks *etc*) to the recipient research institutions. As a result, the diffusion of climate-friendly technologies would "typically be along a pathway of licensing or royalty payments rather than use without restriction in the public domain."**[23]**

Worst of all is the attempt the Protocol makes to link climate change to trade measures that have been proven to be detrimental to developing countries. Such countries not only have poor technologies, lack financial resources and have debt burdens, but are already bound to unfair trade and investment agreements.

For example, there was a proposal at the Bali Conference to introduce the WTO concept of "level playing field for competitiveness" (suggested by Japan) based on the argument that countries that are more energy efficient or with lower carbon intensity in production can slap a tariff on products from countries with inferior efficiency. The "level playing field for competitiveness" argument is that eco-efficient countries have had to incur costs to upgrade their technology to be energy-efficient, and this affects their "competitiveness". Thus the less efficient countries are subsidizing or "dumping" eco-unfriendly products, and the eco-efficient countries should be allowed to place higher duties (like countervailing duties) on these products. This argument and the suggested measure penalize poorer countries that do not have the funds or technology to become more eco-efficient, if their products are blocked, the victims of climate change will also be victims of unfair trade measures.**[24]**

The developed countries have also suggested that additional import duties on products from countries that do not fulfil obligations under the UNFCCC, or on products on the basis of their carbon or carbon-dioxide content be imposed. A variant of this is for taxes or penalties to be placed on domestically-based companies for the carbon content of the products they import. This will prompt the companies to purchase from sources with lower carbon content in their products. Such schemes are biased against developing countries because they do not have the same access to more environmentally-sound technology as developed countries, and thus their products are likely to be adversely affected. Such schemes do not respect the equity principle.**[24]**

Table 3. ANNEX B COUNTRIES IN THE KYOTO PROTOCOL

COUNTRY (& date of Kyoto Protocol ratification)	Change in Greenhouse Gas Emissions 1990-2002 (in %)	Target for Greenhouse 2008-2012 Percent Base Year
Australia (2007)	22.2	8
Austria (2002)	8.8	-13
Belarus	-44.4	
Belgium (2002)	2.9	-7.5
Bulgaria* (2002)	-56	-8
Canada (2002)	20.1	-6
Croatia	-11.5	-5
Czech Republic* (2001)	-25.6	-8

Table 3. ANNEX B COUNTRIES IN THE KYOTO PROTOCOL

COUNTRY (& date of Kyoto Protocol ratification)	Change in Greenhouse Gas Emissions 1990-2002 (in %)	Target for Greenhouse 2008-2012 Percent Base Year
Denmark (2002)	-0.4	-21
Estonia*	-55.2	-8
Finland (2002)	6.8	0
France (2002)	-1.9	0
Germany (2002)	-18.6	-21
Greece (2002)	26	25
Hungary* (2002)	-31	-6
Iceland (2002)	-4.2	10
Ireland (2002)	28.9	13
Italy (2002)	8.8	-6.5
Japan (2002)	12.1	-6
Latvia* (2002)	-62.8	-8
Liechtenstein	-0.1	-8
Lithuania* (2003)	-65.7	-8
Luxembourg	-19.5	-28
Monaco	31.7	-8
Netherlands (2002)	1.1	-6
New Zealand	21.6	0
Norway (2002)	6.1	1
Poland*	-32	-6
Portugal (2002)	40.5	27
Romania* (2002)	-48	-8
Russia* (2004)	-38.5	0
Slovakia*(2002)	-28.4	-8
Slovenia* (2002)	-38.5	0
Spain (2002)	-1.1	-8
Sweden (2002)	40.5	15
Switzerland (2003)	-3.5	4
Ukraine* (2004)	-1.7	-8
UK (2002)	-47.7	-12.5
US**	13.1	-7

Source: The Framework Conventionon Climate Change (FCCC); uk/dsgpollock/public_html/courses/environs/KPprog.pdf]; Earth Trends Climate Tables

** countries in transition to market economies;*
*** refused to ratify the Kyoto Protocol*

PROPOSED ADAPTATION AND MITIGATION MEASURES FOR AGRICULTURE

A number of mitigation strategies in the agriculture and forestry sectors have been identified as useful in achieving the goal of stabilizing atmospheric concentrations of CO2. In the forestry sector, these include reduced deforestation and degradation of tropical forests (REDD), sustainable forest management (SFM), and forest restoration (FR), including afforestation and reforestation (A/R). In agriculture, these involve reduction of non-CO2 gases through improved crop and livestock management and agro-forestry practices, enhanced soil carbon sequestration in agricultural soils via reduced tillage, and soil biomass restoration.**[16]**

The FAO in its High Level Conference on World Food Security on June 2-5, 2008 presented certain adaptation and mitigation strategies for agriculture. Adaptation strategies include the promotion of organic farming as an alternative to the current agricultural methods applied in most farms across the world. *(See **Box 3** - Possible Adaptation Strategies in Agriculture, and **Box 4** - Possible Mitigation Measures.)*

Box 3. Possible Adaptation Strategies in Agriculture

- Altering inputs, varieties and species for increased resistance to heat shock and drought, flooding and salinization; altering fertilizer rates to maintain grain or fruit quality; altering amounts and timing of irrigation and other water management; altering the timing or location of cropping activities.
- Managing river basins for more efficient delivery of irrigation services and prevent water logging, erosion and nutrient leaching; making wider use of technologies to "harvest" water and conserve soil moisture; use and transport water more effectively.
- Diversifying income through the integration of activities such as livestock raising, fish production in rice paddies, etc.
- Making wider use of integrated pest and pathogen management, developing and using varieties and species resistant to pests and diseases; improving quarantine capabilities and monitoring programmes.
- Increasing use of climate forecasting to reduce production risk.
- Matching livestock stocking rates with pasture production, altered pasture rotation, modification of grazing times, alteration of forage and animal species/ breeds, integration within livestock/ crop systems including the use of adapted forage crops, re- assessing fertilizer applications and the use of supplementary feeds and concentrates.
- Undertaking changes in forest management, including hardwood/ softwood species mix, timber growth and harvesting patterns, rotation periods; shifting to species or areas more productive under new climatic conditions, planning landscapes to minimize fire and insect damage, adjusting fire management systems; initiating prescribed burning that reduces forest vulnerability to increased insect outbreaks as a non- chemical insect control; and adjusting harvesting schedules.
- Introducing forest conservation, agro- forestry and forest- based enterprises for diversification of rural incomes.
- Altering catch size and effort and improving the environment where breeding occurs; reducing the level of fishing in order to sustain yields of fish stocks.

(Howden, et al. , 2007) *Source:* **[16]**

Box 4. Possible Mitigation

Reducing methane emissions via integrated rice and livestock systems traditionally found in West Africa, India, Indonesia and Vietnam, is a mitigation strategy that also results in better irrigation water efficiency. It can also provide new sources of income while improving performance of cultivated agro- ecosystems and enhancing human well- being.

Reducing N_2O emissions – can lead to improved groundwater quality and reduced loss of biodiversity.

Integrating animal manure waste management systems, including biogas capture and utilization, for reductions of CH_4 and N_2O – could result in greater demand for farmyard manure and create income for the animal husbandry sector where many poor are engaged.

Restoring land by controlled grazing – can lead to soil carbon sequestration, have positive impacts on livestock productivity, can reduce desertification and also provide social security to the poor during extreme events such as drought (especially in sub- Saharan Africa).

Practicing agro-forestry – can promote soil carbon sequestration while also improving agro-ecosystem function and resilience to climate extremes by enriching soil fertility and soil water retention.

(Smith, et al., 2007) *Source:* **[16]**

Short-term, medium-term and long-term policy proposals for adaptation and mitigation were also identified, but the major issue since then has been funding. The sources of financing for possible adaptation and mitigation measures in the developing countries have yet to be identified as well as the mechanisms for access to these funds and the organizations that shall manage the funds.

According to the FAO, adaptation and mitigation activities require investment and financial flows that are additional to those normally carried out. It is estimated that the global annual cost of climate change mitigation in 2030 would be US$250-380 billion. About half of this amount would be needed for developing countries. More specifically, about one-half of the expected mitigation costs and almost all of the adaptation costs in developing countries are expected in economic sectors relevant to the rural poor.**[25]**

The total bill necessary in 2030 to protect the livelihoods of the rural poor in developing countries under climate change is estimated to be in the order of US$83-127 billion per year, or about one-third of global costs. Specifically, US$55-65 billion will be needed for mitigation options in the agriculture, land use, land use change and forestry sectors. This includes costs for achieving emission reductions from avoided deforestation, forest management and afforestation/reforestation (A/R) as well as from enhanced agro-forestry and grassland/ rangeland management, and improved methane and N_2O management (fertilizer and livestock management). Adaptation costs needed to cushion the rural poor from the impacts of climate change are between US$28-67 billion per year. These are likely to be underestimates since these include only a limited set of possible response actions, such as adapting some production and processing activities, research and development, improving water supply, fighting diarrhoeal disease, malnutrition and malaria, safeguarding low-lying coastal areas, and upgrading infrastructure.**[25]**

One funding source is the Global Environment Facility (GEF) proposed to be managed by the World Bank. This was adamantly opposed by the G77 countries during the Bangkok Climate Change Talks in March 2008, as they said that the UNFCCC and no other body should be the one to manage funds relating to climate change.

Another option is to tap the carbon market through which carbon credits are made available to developed countries and their TNCs at a certain price. This is made possible through the market-based mechanisms provided by the Protocol as mandated by the UNFCCC. These include the clean development mechanism (CDM), joint implementation (JI), and emissions trading.

Under the CDM, developed countries fund projects that cut or avoid GHG emissions in developing countries, and are awarded so-called carbon credits which they can use to offset their GHG emissions that exceed their targets. The recipient countries are supposed to benefit from free infusions of advanced technology from the developed countries. JI allows developed countries to fund projects that cut GHG emissions in other developed countries. Lastly, emissions trading allows countries to buy and sell GHG emissions "units" and "credits." The Protocol allows countries that have emissions units to spare, *i.e.* emissions permitted them but not "used", to sell to countries that are over their targets.

This so-called carbon market – so named because CO_2 is the most widely produced GHG, and because emissions of other GHGs will be recorded and counted in terms of their "CO_2 equivalents" – has been widely criticized because it encourages developed countries and their TNCs to continue with "business as usual", a practice that has been largely responsible for global warming. Carbon trading enables developed countries and their TNCs to *buy and sell* the right to pollute and to escape even the "insignificant" commitments laid down in the Kyoto Protocol. What carbon trading has achieved so far is major profits for TNCs engaged in banking and finance business with the commodification of carbon in the speculative futures and commodities market while sanctioning TNCs to go on with their dangerous carbon emissions by continuously burning fossil fuels.

In fact, carbon trading was proven to be profitable even before the Protocol evolved. According to the World Bank, the carbon market grew in value to an estimated US$30 billion in 2006 (€23 billion), three times greater than in 2005. The market was dominated by the sale and re-sale of European Union Allowances (EUAs) at a value of nearly $25 billion under the EU ETS (€19 billion).

Project-based activities primarily through the CDM and JI grew sharply to a value of about US$5 billion in 2006 (€3.8 billion). The voluntary market for reductions by corporations and individuals also grew strongly to an estimated US$100 million in 2006 (€80 million). Both, the Chicago Climate Exchange (CCX) and the New South Wales Market (NSW) saw record volumes and values traded in 2006.**[26]**

About 920 million tons of emission reduction credits were transacted under the CDM between 2002 and 2006, corresponding to a cumulative value of $7.8 billion and leveraging an estimated $21.6 billion in investment (74% for clean energy related projects).**[27]** It is estimated that the total value of carbon emission permits could reach $13 trillion by 2050, thus the explosive emergence of a global market for emissions. **[28]**

Furthermore, in a number of already documented cases of CDM projects in developing countries, aimed at offsetting carbon emissions of power projects in developed countries, the actual amount of carbon emission reduction per metric ton is short of the projected output. For example, the first forestry project funded explicitly to offset GHG emissions set up in 1989 by Applied Energy Service, Inc. (AES) – US-based independent power producer in Guatemala – fell short of its target carbon emissions reduction 10 years after its implementation.

The forestry project in Guatemala's Western Highlands, one of the country's few remaining highland areas with existing forest and the potential to offset significant quantities of carbon, involved establishing 12,000 hectares of community woodlots, 60,000 hectares of agro-forestry and 2,880 kilometres of live fences. Some 2,000 hectares of vulnerable slopes in local watersheds would be protected. Training was provided for forest fire brigades to reduce the threat of fire and potential CO_2 release from the 183-megawatt coal-fired power plant in Connecticut, USA. AES offered to pay US$2 million for the 10-year forestry project in Guatemala to serve as carbon offset for its power plant in Connecticut. At the same time the purpose was to make the plant more acceptable

to state regulators. In all, AES finance would make possible the sequestration of 15.5 to 16.3 million tonnes of carbon in Guatemala offsets – the fossil economy's new arena of conflict – more than enough, it was claimed, to cover the 14.1 million tonnes the Connecticut plant would emit over its 40-year lifetime. Ten years later in 1999, an external evaluation of the project showed that, even by its own carbon-accounting standards, it was falling far short of the 1 million tonnes of carbon it was supposed to have offset to date.**[7]**

A mechanism that would exactly measure carbon emission reductions is yet to be developed. All of the carbon emissions reductions reported by corporations are mere estimates. There is no clear formula or any existing technology to measure and monitor actual carbon emissions reductions or actual carbon emissions. Corporations are left to monitor, measure and report their carbon emissions reductions. There are doubts that corporations may have been underreporting their actual carbon emissions and even over projecting potential emissions reduction of CDM projects to gain larger margins of profit at the carbon market.**[7]**

Encroaching on Sovereign Lands

One critical issue against the Protocol is the tendency of CDM projects to marginalize the communities in the decision making process or even from benefiting fully from the CDM projects. Worse, communities are disenfranchised especially when CDM projects involve forestry-related activities. Forests are considered to be carbon sinks and one tree has the capacity of absorbing one tonne of carbon. As forests increase in value, (as experienced by many upland communities in the past from privatization of public lands including forests), they will be declared off limits to communities that live in them or depend on them for their livelihoods.**[7][29][30]**

Cases documented in several countries across Asia, Africa and Latin America provide a trail of evidences on the adverse impact of CDM projects on the local communities in the host countries. A number of these projects cannot be considered 'clean' at all and contribute nary a dent in the carbon emission reduction targets the Protocol hopes to achieve. As the cases show, communities are not aware of the details of the CDM projects, how these will benefit the environment, or how much money is involved. Communities are made to perform tasks that are not duly compensated and end up indebted to the project proponents. Worse, they are denied their rights to benefit from their own lands for a long time depending on the lease rights granted to the investors.

Like the so-called development projects funded by the World Bank and other IFIs, and projects financed by foreign capital from TNCs, these documented cases of CDM projects have marginalized communities and displaced them from their sources of livelihood. *(**Table 4** provides a matrix of these documented cases.)*

Even in the application of organic farming as in the pilot project in Tanzania, once farmers decide to return to their old ways of farming, the sequestered soil carbon will be lost. The agricultural system in Tanzania consists of a rotation of several years of cultivation and several years fallow. This fallow of grass, shrubs and trees could be considered as 'forest'. Taking fallow land into cultivation is considered as deforestation and farmers are bound to take financial risks for the carbon released into the atmosphere. Formally, the seller of carbon credits is responsible to keep the carbon sequestered and is obliged to buy replacement carbon credits if the sold carbon is 'lost'. This can be very expensive for farmers and may lead to their indebtedness. The UNFCCC suggests that a system needs to be set up that motivates farmers to continue the improved practices but does not push farmers to debt when they return to old practices.**[31]**

This condition is clearly unjust for small farmers. Whilst the traditional slash-and-burn practice by small upland farmers and indigenous peoples may be contributing to GHG emissions, the resulting carbon released into the atmosphere is miniscule compared to the carbon released by the burning of fossil fuels and mining activities of TNCs.

Bias for large, industrial investments

It has also been observed that there seems to be a bias for large, industrial investments. This bias overlooks the primary need to help developing countries, which are more vulnerable to the impact of climate change, adapt. For example,

Table 4. Matrix of Documented CDM Projects & Impact on Communities

Annex B Country / Corporation Involved/ Project to benefit from Carbon Offsets	Project/Host Country & Area Involved/Affected Population	Impact of the Project
Norway; Tree Farms (Fjordglott); conventional gas-fired power plants by German Naturkraft and Industrikraft Midt-Norge corporations (project started in 1995)	> Bukaleba, Uganda – Five fishing and farming villages were inside the Tree Farms area in the Bukaleba forest reserve, and people from at least eight villages outside the reserve were cultivating the earth on Tree Farms' lease. > Tree Farms' original management plan called for their plantations in the Bukaleba reserve to cover some 4,260 hectares of the company's total area of 5,160 hectares by 2005. The firm anticipated being able to sell 500 tonnes of CO2 credits per hectare, or 2.13 million tonnes of carbon dioxide in all > Tanzania. Between 1996 and 2000, some 1,900 hectares of trees were planted in Mufindi and Kilombero districts at about 2,000 metres above sea level. The land had been leased from the government at US$1.90 per hectare per year for a 99-year period on condition that it be used solely for forestry. Industrikraft Midt-Norge, meanwhile signed an options contract to pay Tree Farms nearly US$ 4.50 per tonne of carbon dioxide supposedly sequestered or US$27million in 25 years for one plantation complex, Uchindile. Compared to US$565,000 paid to the Tanzanian government in compensation for losing the chance to do anything else with the land.	> Acquired low-cost 50-year lease on 5,160 hectares east of the town of Jinja in the Bukaleba forest reserve on Lake Victoria, to plant mainly eucalyptus and fast-growing pines. By 2000, Tree Farms controlled at least 20,000 hectares of land in the region with Industrikraft Midt-Norge securing a first option on the associated carbon credits. Tree Farms did allow farmers to grow maize, beans, and other products between the rows of planted trees during the first few years, until the trees grew too high for other plant life to grow beneath them. Local farmers clear, plough, weed and manage the plantation areas, providing free labour for ground clearing and weeding.30 Many farmers reported having to pay the firm cash or a share of their crop to be allowed to farm on the company's lands. Conflicts over land and unpaid labour were seen by several locals as threatening the project's future as a provider of both wood and carbon credits.
Carbon sinks -forest plantations for US and Norway	Costa Rica; project initiated by Costa Rican Government to collect carbon credits for sale to Annex B countries. Overall, Costa Rica is today putting US$1.5 million annually into financing 4,000-6,000 hectares per year of new plantations. A UN Food and Agriculture Organization consultant's study has suggested that the country set up even more plantations, up to 15,000 hectares per year, using carbon money. Another study estimates that, during the period 2003-2012, some 61,000 hectares of monoculture plantations, or 7,600 a year, could be established in so-called 'Kyoto areas'.	Half of a 3.5 percent fuel tax went into an 'environmental service program' designed largely to give incentives to private landowners to be 'green' in a country in which 20 per cent of the land is national parks, a few per cent indigenous territories and the rest private land. Under the program, a landowner might get, for example, US$ 90 per hectare per year to conserve forest, or US$500 per hectare over five years to establish a plantation. In return, the state gets rights to the carbon in the plantation, which it can use to bargain with in international negotiations. This implies that plantations could start competing aggressively for land that might otherwise be given over to secondary regeneration and conservation of native forest. In addition, because CDM forestry projects, for economic reasons, would probably have to cover 1000 hectares and upwards, they could well threaten the land tenure of people carrying out other forest projects in Costa Rica. The average landholding in the country is less than 50 hectares, with most parcels belonging to families.

Table 4. Matrix of Documented CDM Projects & Impact on Communities

Annex B Country / Corporation Involved/ Project to benefit from Carbon Offsets	Project/Host Country & Area Involved/Affected Population	Impact of the Project
PacificCorp / SELCO / Neeyamakola rural solar electrification – for carbon offsets for the 500-mgw, natural-gas fired power station in Klamath Falls, in Oregon USA. 103 In 1999, Pacific Corp Power and the City of Klamath Falls signed the necessary finance agreement with a US solar-energy company called the Solar Electric Light Company, or SELCO. Sri Lanka, India	Pacific Corp Power Marketing, proposed a diversified US$ 4.3 million dollar carbon-off set portfolio, allocating US$ 3.1 million to finance off-site carbon mitigation projects. In particular, the firm put US$500,000 into a revolving fund to buy photovoltaic (solar-home) systems and install them in 'remote households without electricity in India, China and Sri Lanka'. In all, SELCO agreed to install 182,000 solar-home systems in these three Asian countries, 120,000 in Sri Lanka alone. The idea was that the solar systems would reduce the carbon dioxide emissions given off by the kerosene lamps commonly used in households that are 'off -grid', or without grid-connected electricity. On average, SELCO calculated, each such household generates 0.3 tons of carbon dioxide per year.106 SELCO argued that the installation of a 20- or 35-watt solar home system would displace three smoky kerosene lamps and a 50-watt system would displace four. Over the next 30 years, it claimed, these systems would prevent the release of 1.34 million tons of carbon into the atmosphere, entitling the Klamath Falls power plant to emit the same amount.	SELCO negotiated with the local tea plantation owner in Sri Lanka - Neeyamakola Plantations – one of the minority estates comprised of Tamil communities. The 200 families in this Estate live and work in conditions of debt dependence on tea and rubber plantations established by the British during the colonial period. Unfair labour practices in the sector have continued to keep estate society separate from and unequal to the rest of Sri Lankan society. Daily wages average US$1.58 and the literacy rate is approximately 66 per cent, compared to 92 per cent for the country as a whole. Neeyamakola accepted the project in order to drive its workers to work more. The project created a new form of indebtedness for the plantation workers. Neeyamakola used access to loans for solar-home systems to entice estate labourers into working additional days. The Neeyamakola accounting department would deduct a 500-rupee loan repayment every month and send it to SELCO. In effect, the solar power CDM project earned for the plantation owner additional profits from the extra days the workers worked in the plantation, further tightening its hold on the workers. It earned for SELCO interest profits from the loan it provided to the local plantation.
WB's Prototype Carbon Fund (PCF) to benefit PCF investors who get pro rata shares of PFC project credits. Investors include British Petroleum, Mitsubishi, Deutsche Bank, Tokyo Electric Power, Gaz de France and RaboBank, as well as the governments of the Netherlands, Norway, Finland, Canada, Sweden and Japan.	Bisasar Road Dump, South Africa managed by the Durban Solid Waste (DSW). WB signed an agreement with DSW to promote a prospective CDM project to extract methane from the Bisasar landfill and burn it to generate up to 45 megawatts of electricity for supply to the national grid. The idea is that the electricity generated by the project would 'replace' electricity that otherwise would have been generated by burning coal. It's claimed that the project would generate enough power to light up 20,000 informal houses or 10,000 formal-sector houses. Because burning methane is less climatically damaging than simply releasing it, and better than burning coal (the dirtier fuel usually used) the project is better than the alternative. The PCF's life is for seven years renewable for another two terms or equivalent to 21 years.	The open dumpsite has for years been subject to controversy as people/ communities living within the vicinity of the dump has suffered various illnesses including cancer from the foul odor it releases. Opened in the 1980s, the dump is a primary source of livelihood for the mainly African, and poorer, Kennedy Road settlement, established in the late 1980s and now numbering nearly 1,000, who recycle materials from the dump while struggling with officials and business to gain more secure rights to the land their houses occupy. Although the site is licensed only to receive domestic waste, medical waste, sewage sludge, private corporate waste and large shipments of rotten eggs have also wound up there. Cadmium and lead emissions are over legal limits, and limits for suspended particulate matter also often exceeded. Concentrations of methane, hydrogen chloride, and other organic and inorganic compounds including formaldehyde, benzene, toluene and trichloroethylene are high. The Kennedy Road Settlement who eke out livelihood from the dump are caught in the middle as they have no tenurial security to the land. Prior to the WB's PCF, the dump site was being eyed for conversion into a commercial area. Extending the life of the dump site means they have more time to use the dump for their livelihood; and at the same time buying time for securing their tenurial rights to the land.

Table 4. Matrix of Documented CDM Projects & Impact on Communities

Annex B Country / Corporation Involved/ Project to benefit from Carbon Offsets	Project/Host Country & Area Involved/Affected Population	Impact of the Project
Credits first sold to the EU.	Local government initiative in Kuyasa - Kuyasa low-cost housing energy upgrade project in South Africa. Certified by the CDM Executive Board on 27 August 2005, Kuyasa is the first Gold Standard project in the world to generate certified emissions reductions credits and has been widely applauded both nationally and internationally.	The project involved retrofitting eight Reconstruction and Development Programme (RDP) homes and two crèches with insulated ceilings (where there would normally just be a corrugated steel roof), replacing regular lighting with low watt compact fluorescent bulbs, and installing solar water heaters on the roofs. Partly because residents would have used grid electricity to heat their water in the absence of the solar heaters, the project is held to reduce demand for coal-fired electricity. The claim is that in total, 2.85 tonnes less CO2 are generated per household per year as a result of the project. The project's next phase will see the target group expand from 10 to 2,309 RDP homes throughout Kuyasa. Project proponents estimate that carbon money can cover no more than 20 per cent of the scheme's costs, depending on the spot market price of the Certified Emissions Reductions (CERs) it sells.The first 10,000 CERs from the project were sold at 15 euros each to the UK to 'off set' jet flights and other emissions associated with the 2005 G8 summit meeting at Gleneagles, Scotland.166 But 'very few CER purchasers will pay upfront'.
WB's first PCF project to benefit PCF investors who get pro rata shares of PFC project credits. Investors include British Petroleum, Mitsubishi, Deutsche Bank, Tokyo Electric Power, Gaz de France and RaboBank, as well as the governments of the Netherlands, Norway, Finland, Canada, Sweden and Japan.	Plantar S.A. Carbon project in Minas Gerais, Eastern Brazil. Plantar is a pig-iron producing and plantation management company. The project involved financing 23,000 hectares eucalyptus plantation out of the 180,000 eucalyptus plantation mainly devoted for charcoal Plantar already manages. The project is supported / endorsed by the Forest Stewardship Council (FSC). Plantar has also looked to get carbon credits for afforestation; improvements in charcoal production that minimize methane releases; rehabilitating cerrado (savannah), the biome it itself has had such a hand in depleting; and improving grasslands.	Locals accused Plantar as having illegally dispossessed many people of their land, destroyed jobs and livelihoods, dried up and polluted local water supplies, depleted soils and the biodiversity of the native cerrado biome, threatened the health of local people, and exploited labour under appalling conditions.

Table 4. Matrix of Documented CDM Projects & Impact on Communities

Annex B Country / Corporation Involved/ Project to benefit from Carbon Offsets	Project/Host Country & Area Involved/Affected Population	Impact of the Project
Not specified...	Raigarh City, India where Jindal Steel and Power Ltd. (JSPL) was given four CDM projects. JSPL's plans include a 20-billion-rupee expansion over three surrounding villages which, with a population of close to 3000, are located on fringe of mixed deciduous, sal, bamboo, and teak forests. Agriculture is a major occupation, and villagers are also engaged in the collection of non-timber forest produce. Reducing CO2 emissions in Sponge iron production: in conventional sponge iron plants, using rotary kilns, the waste heat in exhaust gases is either discharged or partially used for power /steam generation. In the CDM project developed, waste heat is used for preheating the charge (mix of iron ore and dolomite) by installing a rotary pre-heater. This has resulted in reducing coal consumption significantly, while also increasing the capacity of the kilns.	In 2005, about 10,000 people mobilised in Chhattisgarh, India to protest the proposed expansion of Jindal Steel and Power Limited (JSPL) sponge iron plants in the district. The production of sponge iron (an impure form of the metal) is notoriously dirty, causing intensive air, soil and water pollution. Having already lost 240 hectares of their revenue land to JSPL, farmers in Khairpur village in Raigarh are meanwhile refusing to surrender any more, and complain about musclemen and touts sent by JSPL to pressure them to capitulate. They are also concerned about a new reservoir JSPL is constructing that would inundate their entire agricultural area (which is irrigated and yields two crops a year) and force them to migrate in search of other work. JSPL runs the largest sponge iron plant in the world, which is spread over 320 hectares on what used to be the thriving, agricultural village of Patrapali. In this case, the CDM is not only providing financial assistance to JSPL in making the expansion, but also providing them with "green" credibility by putting them at the forefront of the emerging carbon market.

Source: ***[7]***

all of Africa (including South Africa and the countries of North Africa) remain at 3% of the market, and all the other countries of Sub-Saharan Africa account for just about one-third of that number. This clearly demonstrates the difficulty of expanding carbon business in much of Africa where electricity access is a major challenge and therefore mitigation opportunities are also limited. For instance, in Uganda or Zambia, just around 10% of the population have access to the grid for electricity. Yet, a clean, grid-connected electricity project in these countries has to demonstrate (under CDM rules) that it displaces "carbon-intensive" electricity on its grid; the fact that it derives mainly power from clean hydro sources is seen as a reason for it not to receive credits for proposed new clean energy sources. This unnecessarily punishes the poorest people who can least afford to use expensive diesel, kerosene or fuel-wood for their basic needs. The poorest usually forego even the most basic benefits of modern energy services that so many others take for granted. **[26]**

Biofuels and food security

Aside from carbon capture and sequestration projects, there is also this seemingly mad rush for biofuels production to replace fossil fuel dependence especially in the transport sector. There is also a push towards the use of nuclear power and other technological fixes.

Biofuels is a fast-growing industry and a growing number of governments are lauding biofuels as the solution to the world's fossil fuel problems and the danger posed by global warming. Biofuels are being held up as ecologically-friendly substitutes to fossil fuels because they are renewable, absorb CO_2 from the atmosphere when produced (as the plants grow), emit less GHGs when burned, save on foreign exchange by lowering oil imports, and generate jobs to boot.

Yet the rapid increase in demand for biofuels and the widespread cultivation of biofuel crops such as palm oil, sugarcane and corn, is triggering new competition for agricultural resources, mainly land and water. Biofuel production is now threatening food security in many developing countries and even in Europe and the US. It is undermining food security not just because biofuel crops take land away from food production but also because they drive up food prices. Maize prices in the US have already doubled since the start of 2006, partly fuelling food riots in Mexico. The price of wheat has also reached a 10-year high while global stockpiles of both grains have reached 25-year lows.**[11]**

PEOPLES' ALTERNATIVE

Prospects for developing countries and their population – the majority of which comprises small farmers and fisherfolk in the rural areas – on adapting to the climate change and applying mitigation measures are uncertain. While developed countries led by the EU have been supportive of the Protocol and the UNFCCC as well as the market mechanisms introduced to meet GHGs emission targets and provide financial assistance to developing countries, these are primarily driven by incentives to profit from climate change through the carbon market. There has been no meaningful transfer of technology nor has there been substantial financial assistance to assist developing countries in the implementation of adaptation and mitigation measures. While a number of mitigation measures have been proposed, they are yet to be proven effective.

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The US and other developed countries which have refused to be party to the Protocol, remain reluctant to implement their obligations to curb GHG emissions. There is a glaring lack of altruism in assisting poor countries despite the clear and resounding fact that their plunder of the Earth's resources is the main culprit behind global warming. Indeed, it is the developed countries that have contributed most to the environmental catastrophes wrought by climate change; incidences that have increased poverty and human suffering to the world's poor.

As exemplified in the matrix of case studies, the terms and conditions tied to mitigation measures are in conflict with sovereign control by the communities over their natural resources. This ends up limiting peoples' livelihood options and pushing them to indebtedness. Conversely, developed countries and their TNCs are provided

with new opportunities to encroach in and profit from the natural resources of poor countries.

Developed countries and their TNCs have so far refused to provide financing to developing countries without getting anything in return. However, developing countries have in their possession what most developed countries are lacking, and that is whatever remains of the Earth's natural resources. Greater, freer access to these resources is what developed countries are aiming for in order to extract more profits at minimal costs. This profit-seeking has been a clear act of irresponsibility to the environment and disrespect and disregard for human rights. Existing local policies aimed at protecting the prior and sovereign rights of local populations over their natural resources for their own development are replaced with policies that are biased for foreign interests. These policies also end up removing effective government control and development aspirations of domestic resources.

There is an urgent need for small farmers and the poor population of developing countries to organize and assert their sovereign rights over their natural resources. Developing countries must unite and demand that developed countries – especially the US – be accountable for the environmental plunder their TNCs have wrought by fulfilling their obligations as articulated in the Protocol and without conditions. Every option – financial and technological including research and development – should be provided to developing countries without corresponding obligations to developed countries. Market-based solutions driven by capitalist profit motives will not resolve climate change. The issue requires genuine reforms that entail sustainable practices of natural resources utilization, adopting appropriate technologies as determined by the actual development needs of the people. *(See **Box 5** – Climate Change Discussion: Justice or Trade)*

Peoples' Protocol on Climate Change [32]

There was a draft *Peoples' Protocol on Climate Change,* which is to be finalized and ratified through a People's Assembly spearheaded by People's Movement on Climate Change, as a parallel activity during the Poznon (Poland) 2008 climate change meetings. It presents specific alternatives for the peoples of the Third World to address the implications of climate change. It articulates the values and principles that should guide international action and people's struggles against climate change and its associated ecological and socio-economic destruction. These principles are social justice, sovereignty, respect for the environment, and social responsibility.

As stated in the *Peoples' Protocol*, social justice must be guaranteed, acknowledging the systemic roots of the climate crisis, the disproportionate responsibility of a narrow elite, the disproportionate vulnerability of the majority to the adverse effects, the grossly uneven capacity to confront and respond, and the legitimate aspirations to development of the people apart from the crisis. Sovereignty means asserting the power of the people through their social movements and genuinely participatory structures as the foundation of the global response to the climate change issue. Respect for the environment means a rejection of market mechanisms that impose the cash nexus on ecological priorities. The needs of the planet and its people must take precedence over the push for growth and profits. Lastly, responsibility, expressed in the principle of common but differentiated responsibilities, requires a mechanism for globally-inclusive equity. Northern countries share a disproportionate responsibility for historic emissions.

The *Peoples' Protocol* asserts that the climate change crisis is not simply about adaptation and mitigation, but changing the whole economic framework into one of eco-sufficiency and sustainability. Further, it rejects market-based mechanisms to address climate change as diversionary and designed to perpetuate current levels of economic activity and profits, if not brazen manoeuvring by corporations to pass on the burden of dealing with the negative effects of their GHG emissions to the people of the South. While it acknowledges that technological developments can play a role in addressing the climate change issue, it is conscious that technological fixes in themselves are not just grossly insufficient but even used to divert from the need to address root causes. Human progress and the defence of the livelihoods, well-being and welfare of the people ultimately require an economic system that is socially just, democratic and ecologically sustainable.

Box 5. Climate Change Discussion – Justice or Trade

The Intergovernmental Panel on Climate Change (IPCC) of the UN recognizes that in the past one and a half century and so since the era of industrialization began, the rich, industrialised countries have contributed overwhelmingly to GHG emissions, as compared to the developing and poor countries. As such, they should be the first to take on the responsibility of bringing down their emissions. The Kyoto Protocol, which was drafted during the 3rd Conference of the Parties (COP3) of the UN Framework Convention on Climate Change (UNFCCC) in Tokyo in 1997, set binding targets for 37 industrialized countries and the European community for reducing these emissions by an average of five per cent against 1990 levels over the five-year period 2008-2012.

The first commitment period of the Kyoto Protocol ends in 2012. The negotiations among governments regarding the second or post-2012 commitment period of the Protocol must be completed by and decided at the forthcoming COP15 to be held in Copenhagen, Denmark scheduled to take place in December 2009. The COP13 held in Bali, Indonesia in December 2007 launched a long-term cooperation under the UNFCCC and drafted the timeline post-2012. The most significant result of the Bali conference was the creation of an ad hoc working group to discuss a wide range of issues under four so-called building blocks – mitigation, adaptation, finance and investment, and technology transfer. The explicit point of discussion of course would be the responsibility of industrialized countries to take on the lead in these building blocks.

The Bali Action Plan was then tackled in Poznan, Poland in December 2008 (COP14) as the penultimate meeting before COP15 where the post-2012 agreements would be finalized. But the Poznan conference barely moved the Bali Action Plan forward and even took some backward steps from what civil society has already achieved. The Poznan conference, aside from being a waste of time and resources, watered down highly political issues such as land rights and indigenous people's rights; continued to support trade-based mechanisms such as carbon trading and the creation of a carbon market as solutions to the climate crisis; and more dangerously, moved to reverse the principle of 'common but differentiated responsibilities' that has placed the heavier burden on industrialized countries.

While remaining quiet on the more substantive issue of binding targets of emissions reduction post-2012, the Poznan conference had even allowed advanced capitalist countries and international financial institutions particularly the World Bank to drag the debate into the aid issue. The creation of a so-called climate funding to be loaned to underdeveloped countries for them to adapt to climate change was being seriously mulled over during the Poznan conference. Such climate funding would be attached with conditionalities for underdeveloped countries to implement – some of which would even be policies on economic liberalization.

The advanced capitalist countries have stalled the Bali Action plan process. It is obvious that the governments of the North have not been fulfilling their convention and protocol obligations nor displaying any keen desire to do so in future. Instead, the emphasis at the Poznan conference was on trade and neoliberalisation, 'business-as-usual' solutions combined with free-market environmentalism, and not on social justice. And this could be clearly seen from the fact of less space provided for people's organizations and overwhelmingly more space captured by the corporations, with open access to government officials and ministers.

The upcoming COP15 in Copenhagen thus is a critical engagement for civil society organizations, peoples' movements and the world at large, when their voices need to ring even louder, demanding climate justice, moving away from fossil fuels use to renewables use, rejecting carbon trade and stopping the World Bank from promoting its market-based climate funding. COP 15 will be a watershed in the way how our future is going to unfold thereafter.

This includes people-oriented agricultural and industrial development. In order to address the climate crisis, the people must have real stewardship, access and control over the natural resources on which they depend rather than TNCs, international financial institutions or even governments which represent the narrow private interests of the global elite and their local collaborators.

Government leaders involved in the ad-hoc working group on long-term cooperative action (AWG-LCA) under the UNFCCC should do well to consider the *Peoples' Protocol on Climate Change* in coming up with the concrete and meaningful adaptation and mitigation measures and mechanisms to address climate change. After years of negotiations, nothing really substantial has been achieved by the world's governments as developed countries continue in their refusal to take full responsibility over their role in climate change. As such, decisive action from the peoples of the Third World is the only alternative option.

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