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Global Warming

Everything You Want to Know...

Rayappa A. Kasi

Articles from His Best Seller

Earth - The Lost Paradise of Happiness

The Latest on Copenhagen, Denmark

Global Warming

Everything You Want to Know...



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NASA Photo: Picture of Gangetic Plain, India.
Satellite Image of Sunderbans - Victim of Global Warming
Courtesy of Google

Explanation of the satellite photo on the cover:

Sunderbans is one of the most ecologically vulnerable zones in India. Global warming is wrecking the delicate ecology of this estuarine region which stretches from West Bengal to neighboring Bangladesh. The Intergovernmental Panel on Climate Change (IPCC) has predicted that by the end of this century the sea level could rise by 0.8 meters could totally submerge the Sunderbans.

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Preface

According to an old saying *"If you do things you are not supposed to do, you will be faced with events which are not supposed to happen." Every little action there is reaction.* In effect of our actions, mass destruction is taking place all over the world. Water is polluted. Air in many places is almost unbreathable. Rain forests are being hacked down mercilessly, thus changing the weather pattern all over the globe. *Population growth is going out of control. No matter how we look at the state of affairs around the world, the earth seems to be a doomed planet.* Man, the natural enemy of all living things, has been destroying it systematically and no wonder that thousands of species of animals and insects are disappearing from the face of the Earth. We are squandering all the natural resources without foresight. Consequently ecological imbalances like Greenhouse Effect, Ozone Layer depletion, volcanic eruptions, earthquakes, floods and other calamities seem to be on the increase. Every one of us is responsible for the disaster threatening the very existence of life on Earth. The reason for the problems facing mankind today appears to be over-exploitation of all the resources around us far beyond our genuine immediate needs. The question that we have to ponder is whether it is possible even now, *although late,* to salvage this planet and make it a habitable place for all living things.

I thank Fr. Joseph for this publication, who is also a Catholic priest, younger to me by 20 years. However, he displays an incredible expertise, involving fully in ecology and environment, giving hope, in this process he guarantees a promise of vibrant future to thousands of people, especially poor. I would like to thank also to Mrs. Christina Samy and Mr. Sagayam for their remarkable contributions to ecology and environment through their dedicated life-styles. I thank them for publishing this timely book on *"Global Warming – Everything You Want to Know!"* This book has been bubbling and churning in my brain for nearly 5 years, and I am grateful that I have finally found time to write it. *This book is mainly intended to awaken the readers from their dream world to the frightful situation we are in. It is clear that we are inexorably moving towards a major catastrophe which we cannot stave off.* We seem to have taken this beautiful planet Earth for granted and assumed that it is there forever for us to exploit. As you go through this book, many of you will agree that this assumption is not valid any more.

After all, we are part of nature which has its own rhythm and we must admit to ourselves that any attempt to disturb it would be to force nature to retaliate with disastrous consequences for all of us. As we stand on the threshold of impending catastrophe and look back to see whether we have made any attempt to alter our way of living to prevent the imminent catastrophe, it is clear we have not made any attempt in that direction which is really unfortunate. On the contrary, we are destroying everything much faster than ever before as we can see from the rapid deterioration of environment all around us.

This is the matter of priority if we are intending to live on this planet for some more time. Hence, we must redirect our lives away from the ecological degradation of technology and development. *We attempt to undo the damage done to ecosystems, transforming and strengthening their relationships with the rest of nature. It is an attempt to bring back the dignity and the beauty of the Earth, which was lost, due to our irresponsibility.* Ethics points out that all organisms, plants, animals, have the right to exist and coexist with us and with other beings, since they have existed for millions of years before us on this beautiful land. All biotic and abiotic beings have right to present and future. *My appeal rather, should be, also to the logic: of saving this Planet Earth: not only to the sentiments.* I think the secular world need the logic, because sentimentality is not a winner in politics. *Sentiment joined with logic, there got to be a new approach, stressing the importance of stopping, thinking and changing the way we interact with nature. Besides destroying, man has entrusted with another powerful tool: creating.* Man can create, conserve, preserve, protect, prosper, renew, and relive with this beautiful and bountiful planet. Equipped with this awareness, a new species is rising on the planet. It is arising now in you. Whether humans have logic or sentiment, it is their ability that has enabled them to survive in the constant cultural changes and force them to dominate such vast areas of planet Earth and make humans the greatest of all.

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I dedicate this book in memory of the Victims of Bhopal Tragedy.

Bhopal, India is the site of the greatest industrial disaster in history. December 23, 2009, will mark the 25th anniversary of the catastrophe that took place on a chilly night in Bhopal, around 11.30 pm in 1984. An estimated 12,000 residents died immediately in their sleep from Methyl Isocyanate poisoning (MIC), leaked out from Union Carbide Factory (Fertilizer Company). About 40 tons of MIC poured out of the tank for nearly two hours and escaped into the air, spreading within 8 km downwind. Nearly 80,000 people, by some accounts, have died in the intervening years since the catastrophe. More than 250,000 people continue to suffer from permanent disabilities and chronic ailments as the result of exposure to the poisonous gases on that night. It is estimated that children born in Bhopal after the disaster face twice the risk of dying as do children elsewhere, due to the consequences of Bhopal Tragedy.

Copenhagen Accord, Denmark,

December - 2009

Before the Copenhagen Conference, the wish for clarity is expressed by Yvo de Boer, executive secretary of the United Nations Framework Convention on Climate Change (UNFCCC), in an interview with Environment and Energy Publishing (E&E). According to Yvo de Boer, the four essentials calling for an international agreement in Copenhagen are: *First:* How much are the industrialized countries willing to reduce their emissions of Greenhouse Gases? *Second:* How much are major developing countries such as China and India willing to do to limit the growth of their emissions? *Third:* How is the help needed by developing countries to engage in reducing their emissions and adapting to the impacts of Climate Change going to be financed? *Fourth:* How is that money going to be managed? He sees a need to get something signed and agreed in Copenhagen, but he thinks it will be very difficult to get every final, small detail of a whole new treaty done. The new climate treaty will be replacing the Kyoto Protocol which was adopted in Kyoto, Japan, in December 1997 and entered into force on 16th February 2005.

Failure in Copenhagen is not an option. If the world fails to deliver a political agreement at the UN Climate Conference in December, it will be a big disaster for humanity and other living organisms. If the whole world comes to Copenhagen and leaves without making the needed political agreement, then I think it's a failure that is not just about Climate Change. Then it's the whole global democratic system not being able to deliver results in one of the defining challenges of our century. And that is and should not be a possibility. It's not an option. These were the high hopes of humanity before the Copenhagen Conference. On the other hand, the UN Climate Conference narrowly escaped collapse at the end of the summit as bitterly divided delegates agreed after all-night talks to recognize a political compromise that US Preseident Barack Obama brokered with China, India, Brazil and South Africa. *The official name is the "Copenhagen Accord."* Depending on whom you ask, it's defined as anything from a "reference document" to the precursor of a "legally binding treaty." The Copenhagen Accord was bogged down for hours by protests from delegates who felt they were excluded from the process or said the deal didn't go far enough in cutting the Greenhouse Gas emissions that cause Global Warming.

After all that outcry and heat generated over saving the planet from Global Warming, Copenhagen ironically has done exactly the opposite. *The mammoth summit has itself turned out to be one of the highest polluting events of the year.* According to data with United Nations Framework Convention on Climate Change (UNFCC) and Deloitte Accounting, total carbon emission of the summit was around 46,200 tones. The numbers that make up that figure put into context mean the emission of this 12-day summit was more than what 6 lakh Ethiopians emit in a year. The numbers include emissions caused by air travel, accommodation, local transport, electricity, paper, security, transport of goods and services etc. according to data from international agencies, around 30,000 people flew into Copenhagen for the summit, 140 private jets were used to carry delegates, 1,200 limousines were hired; nearly 800 km of computer cables were laid and close to 1.5 million sheets of papers were used for a summit which ended without a result. *Environmental campaigners have branded the summit an abject failure, saying it made progress on financing the battle against Climate Change but little else.* By delaying action, rich countries have condemned millions of the world's poorest people to hunger, suffering and loss of life as Climate Change accelerates. The blame for this disastrous outcome is squarely on the developed nations. A major bloc of developing nations called the draft climate deal in Copenhagen the "worst in history" and hinted it may try to block it. The deal locks developing countries and the poor of developing countries into a cycle of poverty forever.

"We have a deal in Copenhagen, the Copenhagen Accord may not be everything everyone had hoped for," UN Secretary General Ban Ki-Moon said, adding "this is just the beginning" of a process to craft a binding pact to reduce emissions. Disputes between rich and poor countries and between the world's biggest carbon polluters, China and the US dominated the two-week conference in Copenhagen, the largest and most important UN meeting ever on fighting Global Warming. Obama met twice with Chinese Premier Wen Jiabao once privately and once with other leaders in hopes of sweeping aside some of the disputes that has blocked progress. The US President appeared to have salvaged the faltering talks during the summit when he declared a "breakthrough" with China, India, Brazil and South Africa. But the three page document they agreed upon ran into trouble in the plenary, where delegates from Bolivia, Cuba, Sudan and Venezuela denounced it. The Climate Conference went into an extra day of discussions in Copenhagen but failed to adopt a legally binding treaty or commitments, only *"taking note"* of an agreement. Obama's day of hectic diplomacy produced a document promising $30 billion in emergency climate aid to poor nations in the next three years and a goal of eventually channeling $100 billion a year by 2020 to developing countries.

What the Copenhagen Accord Outlines?

Global Warming: Global Warming "should be kept below two degrees Celsius." says the draft. Bit it does not identify a year by which carbon emissions should peak, a position vehemently resisted by emerging giants. Countries are asked to spell out by February 1 next year their pledges for curbing carbon emissions by 2020. The deal does not spell out penalties for any country that fails to meet its promise.

Funds: Rich countries are pledging 10 billion in the three years from 2010-2020 to help poor countries tackle Climate Change. They also set the goal of "mobilizing jointly" 100 billion a year by 2020, drawn from "a wide variety of sources, public and private, bilateral and multilateral, including alternative sources of finance."

Verification: in the contentious area of monitoring, verification and reporting (MVR), it provides that unsupported actions could be subject to assessment only by domestic institutions but adds a new provision for international consultations and analysis without impinging on national sovereignty.

Mid-Century Targets: The text does not endorse the goal of halving the global output of carbon pollution by mid-century, an objective many rich countries endorse. Emerging giants especially India and China have said they are willing to back such a target.

Legally-Binding Treaty: There is no deadline for transforming the objectives outlined in the accord into a legally-binding treaty. It had been widely expected that the text would call for a treaty to be finalized before the end of 2010.

In many reasonable reckoning, the outcome of the Copenhagen Climate Summit falls for short of what the nations of the world, particularly the industrialized countries, absolutely need to do to combat Global Warming. The Copenhagen Accord arrived at during the Climate Summit will instantly forgive the industrialized countries' historical responsibility for Climate Change, eliminate the distinction between developed and developing countries, and fatally undermine efforts to renew the Kyoto Protocol. *The Copenhagen Accord postpones any global quantitative commitment to climate mitigation, particularly any commitment to drastic emission reduction by the developed nations. It pays disproportionate attention to the responsibilities of developing countries.* It is very obvious that in the mitigation commitments currently made, the contribution of developing countries is greater than that of the developed countries. The cry of many

small developing countries, led by tiny Tuvalu, that the promise of $100 billion in annual climate finance by 2020 amounts to asking them to trade their future "for thirty pieces of silver today", is a call to conscience that must not be ignored.

Addressing the high-level segment of the summit, Indian Prime Minister Manmohan Singh said the Kyoto Protocol should continue to stand as a valid legal instrument. It would go against international public opinion if we acquiesce in its replacement by a new and weaker set of commitments." This will be disastrous for the climate, and for India's most vulnerable communities, says the Center for Science and Environment (CSE). Accusing India of buckling under pressure in Copenhagen, the CSE, in a statement, said the Copenhagen Accord (which has not been adopted by the Conference of Parties) agrees to weak and non-legally binding commitments from the developed world. *The agreement will be disastrous for the world, particularly the poor and the most vulnerable, as it will allow emissions to increase in the rich world.* The Copenhagen Accord agrees to a process which will ultimately kill the Kyoto Protocol and undermine the legitimacy of the United Nations Framework Convention on Climate Change (UNFCCC). It changes the framework based on equity and historical emissions.

Greenpeace, an international non-governmental organization working on environment issues, said global leaders had failed to act to event a catastrophic change. Reacting to the "deal" on Climate Change arrived at Copenhagen Greenpeace said a weak outcome had emerged from the talks. *The deal is not ambitious, is unfair, not legally binding and likely to put the world on a path to at least a 3 degrees Celsius temperature rise. World leaders had a once in a generation chance to change the world for good, to avert catastrophic Climate Change. In the end they produced a poor deal full of loopholes big enough to fly Air Force One through. We have seen a year of crises, but today it is clear that the biggest crisis facing humanity is a leadership crisis.* "Climate science says we have only a few years left to halt the rise in emissions before making the kind of rapid reductions that would give us the best chance of avoiding dangerous Climate Change. We cannot change that science, so instead we will have to change the politics, and we may well have to change the politicians," Greenpeace said.

The confusion over the nature of the agreement arises from the fact that it was not "adopted by consensus," due to strong objections by some countries. After an acrimonious debate and an adjournment filled with frantic bargaining, the chairman announced that the conference would instead "take note" of the accord, and swiftly brought his gavel down. Countries that approve of the accord are free to add their names to it.

Minister for environment and forests Jairam Ramesh said that after several hours of negotiations, that it was *"a good deal and satisfactory solution",* adding that in forging the deal Mr Obama had spoken to Prime Minister Manmohan Singh, Chinese Premier Wen Jiabao, Brazilian President Luis Inacio Lula da Silva and South African President Jacob Zuma together for over one hour. *Indian Prime Minister Manmohan Singh is bearing an offer to reduce India's carbon intensity by 20 to 25 percent by 2020 of the 2005 levels.* Assuming that no deal is inked in Copenhagen, parliamentarians have a great role to play in the climate scenario by enacting their own legislation in their respective countries and allocating the budget for the strict implementation of environmental laws. India must strengthen its scientific capacity to measure, monitor and model the impacts of Climate Change on different sectors of its economy and different regions. A difficult period lies ahead as governments have to sign up to making cuts and everyone will be watching to see who does something and who does nothing. I see defiance in the words expressed by Indian Environment Ministaer Jairam Ramesh, after the Copenhagen Accord, "I went to Copenhagen to protect India's right to development. For the West, Climate Change is an environmental issue, but for us it is a development issue." It is unfortunate to see there may not be any significant carbon reduction in India, leaving 125 crores of people and their future vulnerable.

An Indian Examination of Conscience

We are the worst polluters of our land, water and air. The pity is we don't care. When Queen Elizabeth II visited Delhi twelve years ago, she was so "disgusted" with "dirty Delhi" that she complained to the then Prime Minister, Mr Inder Kumar Gujral, at a sate banquet that India's capital was one of the dirtiest cities she had ever visited. Asked to explain what she had meant by "dirty", a senior officer from the British High Commission responded by explaining that the Queen was referring to "people easing themselves in public. An upset Mr Gujral, along with the then President K.R. Narayanan, were photographed the following morning, brooms in their hands, cleaning a street outside Rashtrapadi Bhawan. The gesture amounted to sheer tokenism. Little has changed ever since, or why would the environment minister, Mr Jairam Ramesh, have lashed out with his comment on India deserving a Nobel Prize for filth?

A recent *"Forbes"* magazine survey has rated Mumbai and Delhi among the 25 dirtiest cities in the world. Indians have traditionally prided themselves on keeping their homes clean even if their cities remain grubby. The Hygiene Council, a global initiative that brings together experts in the area of public health, has punctured India's self-pride. A survey across eight

nations had Indian homes being ranked amongst the dirtiest in the world. Also, 50% of Indian homes do not have toilets and people continue to defecate in the open, according to a United Nations survey. A dynamic district commissioner in Tikamgarh in Madhya Pradesh took it upon himself to build a series of toilets in several villages under his jurisdiction. On his next visit there, where this writer had accompanied him, the officer found the toilets being used as cattle sheds while the villagers continued to defecate in the open. Apart from Indian homes, India is projected to be losing 4.5 % of its annual GDP because of environmental problems. In Chennai, six of the top ten causes of death are related to respiratory diseases which are rising 30% per annum in the larger cities, said Dr. D. Ranganathan, director in charge of the Institute of Thoracic Medicine.

The effects of air pollution are being felt in many areas. Rice crop yields in Southern India are falling as brown clouds block out more and more sunlight. And the brilliant white of the Taj Mahal is fading to a sickly yellow. As a result of the rising filth, 80% of urban waste in India ends up in the country's rivers, and unchecked urban growth across the country combined with poor government oversight means the problem is only getting worse. India's holiest rivers, the Ganga and the Yamuna, are dying due to unchecked pollution. The center for Science and Environment which regularly monitors the quality of Yamuna water, maintains that between 75 to 80% of the river's pollution is the result of raw untreated sewage. Yamuna's frothy brew has become so glaring that it can be viewed on Google Earth and also captured scientists' attention from space. The Ganga's fate is no different. Between Kanauj and Varanasi, industrial runoffs, pollutants, garbage and untreated sewage has this lifeline end up being little more than a dirty drain.

Mr Jairam Ramesh admitted in the just-concluded session of Parliament that the Center has already spent Rs 817 crores on cleaning the Ganga and another Rs 1,306 crores on the Yamuna, but had little to show for it. The World Bank has agreed to provide multi-billion dollar assistance in conserving the Ganga River basin though activists feel there needs to be much greater accountability in the way the money is spent. What is the reaction of the "common man" to a life surrounded by pollution? He believes that the government needs to take firm steps and not allow itself to get mired in corruption as millions of rupees are being siphoned away in the name of cleaning up our cities and rivers. Environmentalists cite the example of how the citizens of Kanpur launched an agitation, insisting that the Kanpur State Pollution Welfare Board be allowed to file an FIR against the municipal corporation for dumping untreated sewage into the Ganges. No action has been taken on the ground.

This new paradigm for waste disposal must be a cradle-to grave approach with responsibility being shared by many stakeholders, including product manufacturers, consumers and communities, the recycling industry, trade, municipalities and the urban poor. It is now an established fact that consumption, linked to per capita income has a strong relationship with waste generation. As India's per capita income rises, more savings will be spent on goods and services, which in turn will generate more waste. Growing urbanization will see a parallel increase in the concentration of waste from which we will have no escape. Teri-Green Report (Growth with Resource Enhancement and Nature) India 2047: Looking back to think ahead puts several red lines around our worsening environmental situation.

Water Scarcity: water scarcity earlier felt in pockets, is now a country-wide phenomenon. The world's wettest place, Cherrapunji, is becoming a dry zone. Water availability has reached a scarcity benchmark of 1,000 m percent and 45 percent of the population is still denied access to safe drinking water. Water use efficiency is as low as 25-35 percent in irrigation which takes up over 80 percent of the water consumed. Abysmally low industrial water tariff and inadequate waste water treatment capacity further compound the problem of water quality and availability.

Air Pollution: Air Pollution has emerged as one of the biggest killers in urban areas. Almost 85% of Indian cities showed violation of Respirable Suspended Particulate Matter (RSPM) standards in 2007, exceeding the safe limits prescribed by the World Health Organization (WHO) and those of the Central Pollution Control Board. Despite recent measures at tackling air pollution about 57-71% of Indian cities were found to lie in the dangerous-bad-poor category during 1997-2007 measured by the ORAQI (Oak Ridge Air Quality Index) used to interpret air quality data based on three criteria pollutants. A large percentage of this pollution is being caused by vehicular exhaust with 80% of particulate matter (PM) emission from pre-2000 vintage.

Land Resources: Land resources have shown a decline and productivity levels for major grain crops are below the world average. Thirty seven percent of India's geographical area is degraded due to flawed agricultural policies and uncontrolled land fragmentation. Small and marginal landholdings constitute over 80% of current total but contribute only 30-35% of agricultural output. Similarly, the disproportionate focus on irrigated land, with an overdose of subsidized inputs, has caused a decline in land productivity.

Solid Waste Disposal: Disposal of solid waste management has proved completely inadequate with the blame being placed squarely on local

bodies. The average revenue from solid waste management services is Rs 10.12 as against the average expenditure of Rs 140,63 per capita per day (Raghupathy U. 2005) with the deficit being covered by general revenue of the local governments or through funding from state and central governments.

Forests: While the area under forests has stabilized at about 21% of the country's geographical area, over 40 % of forests are degraded. Micro-level studies suggest the situation on the ground may be worse.

Biological Diversity: Biological Diversity, which is the ecological stability and productivity, has had to make room for "development". India is recognized as a mega diverse country with about 8% of the world's biodiversity but this is being threatened from many sources. Experts state that almost 9% of world's total threatened species are found in India.

Global Warming – It's a Global Warning?



Earth is ill and it is in advanced stage of exhaustion. Man lost the connectedness with nature. Most leading climate scientists are convinced that the climate is warming rapidly. Strange terms like "Global Warming", "Greenhouse effect", and "Climate Change" have captured the attention of humanity. New words crept into the popular lexicon, smog, acid rain, toxic waste. *A new target is pollution*. For several decades, a number of meteorologists and climatologists have predicted that global warming would lead to greater incidence of severe or extreme weather on Earth. As a result, storms like cyclones, hurricanes could become more frequent and destructive, heat waves and droughts could become longer and worse, thunderstorms, tornadoes, rainfall, and floods could intensify.

In the 1970s and 1980s, scientific evidence was still not definitive. But by the early twenty-first century, evidence was mounting that human-released greenhouse gases were having an impact on rising global temperatures,

with the potential for consequences for weather and climate. *Atmospheric carbon dioxide has increased by 40 percent since the Industrial Revolution.* Average global temperature is now rising at a rate of one to three degrees Celsius per century. Glaciers are retreating. Global warming is melting ancient glaciers in the Polar Regions, resulting in rising sea levels worldwide. In the Arctic region, the iconic species, polar bear is imperiled by reduced hunting grounds, as global warming melts Polar Ice. All these catastrophes are the immediate consequences of "weather" and "climate."

Weather and Climate

Weather and Climate do not mean the same thing. Weather and climate are different concepts. Weather refers to atmospheric conditions for an individual event or time. For example, if someone asks you, "How's the weather?" you can simply go outside and answer this question easily. We are concerned with how meteorological conditions may affect us over the next week or so, and we refer to weather forecasts as a guide. Weather forecasting involves modeling the circulation of atmospheric conditions through time by employing a series of mathematical equations. *Weather is measured* in terms of wind, speed, temperature, humidity, atmospheric pressure, cloudiness, and precipitation. In most places, weather changes from hour to hour, day to day, and season to season. Although the accuracy of weather forecasts has improved over the past couple of decades because of advances in observation, analysis, and modeling, the current limit of weather forecast skill extends to about ten days.



Climate refers to an average of weather conditions over an extended period of time, months, years, or centuries. A place that doesn't get much rain over many years would have a dry climate. A place where it stays cold for most of the year would have a cold climate. Meteorological elements that characterize climate include temperature, precipitation, cloud cover, humidity, and wind patterns. *Climate ultimately influences human culture,* from the articles of clothing we wear and the recreational activities we engage in to more pressing issues such as our food, water, and energy basis, it truly dictates our way of life. Recorded climate variations have caused or contributed to ecological adaptations, migrations, catastrophes, and successes.

Weather is the day to day forecast and climate is the average over a long term. About ten thousand years ago, the most recent ice age ended, and the glaciers covering north of equator began to recede. Archaeologists note that the onset of this cooler and drier period coincided with the beginning of agriculture in northern Mesopotamia.* Fluctuations in the climate likely had an adverse impact on the food supply of hunter-gatherers, creating an incentive for developing agriculture as a more stable and reliable food source. A couple of relatively minor climate variations during the last millennia, the Medieval Warm Period and the Little Ice Age, had dramatic impacts on the population of Europe.

During the Medieval Warm Period in the tenth to fourteenth centuries, a small increase in temperature was concentrated primarily over North Atlantic basin and allowed the Vikings** to colonize Greenland. However, the onset of the Little Ice Age in the fifteenth to nineteenth centuries ushered in cooler temperatures, which resulted in the collapse of these colonies. In addition temperatures cooler than today across much of Europe significantly reduced agricultural productivity and led to increased rates of starvation and an overall deterioration in human health. Some believe that these changes exacerbated the plague that ravaged Europe during this period. On much shorter timescales, phenomena such as El Nino,*** Southern Oscillation and tropical volcanic eruptions have important but short-lived impacts on global climate.

El Nino, southern Oscillation is an atmosphere and ocean phenomena that channels inter-annual (year-to-year) fluctuations in ocean temperatures over the tropical east Pacific into global fluctuations in climate. For example, during winters when ocean surface temperatures off the coast of Peru are unusually warm, the Southern half of the U.S generally sees cooler and wetter than normal winters while the Northern half of the country from the great Lakes westward to the Pacific Northwest generally sees warmer than normal conditions. Volcanic eruptions have long been implicated with climate variations. Following an eruption, huge quantities of gases and aerosols are injected high into the atmosphere, where they form a cloud that effectively shields the Earth from the sun's rays and leads

**Mesopotamia means in Greek "between the rivers." It is one of the earliest centers of urban civilization, in the area of modern Iraq and Eastern Syria between the Tigris and Euphrates Rivers.*

***Vikings, Nordic peoples: Danes, Swedes, and Norwegians, who raided and settled in large areas of eastern and western Europe during a period of Scandinavian expansion from the 800 to1100.*

****El Nino, oceanic and atmospheric phenomenon in the Pacific Ocean, during which unusually warm ocean conditions appear along the western coast of Ecuador and Peru, causing climatic disturbances of varying severity.*

to a short-lived global cooling. For example, it has been suggested that the eruption of Mt. Etna on the island of Sicily in 44 BC cooled the planet and led to crop failures and eventual famine in Rome and Egypt.

Earth's Climate System

The main elements of the climate system include the Sun, the source of heat energy, atmosphere, providing a protective blanket, oceans, helping to distribute heat through its currents, water, as rain, snow, or ice, and land, reflecting or absorbing energy from the Sun. In short Earth's climate system can be thought of as an elaborate balancing act of energy, water, and chemistry involving the atmosphere, oceans, ice masses, biosphere, and land surface. Although generated nearly 150 million kilometers away, radiation from the sun provides our planet with the energy that forms the basis of climate and makes life possible.



The sun's energy propagates toward the Earth as solar radiation. Solar radiation directed toward the Earth carries energy amounting to 342 watts for every square meter of the surface of the Earth. This is equivalent to six 60-watt light bulbs shining year-round for every square meter and represents nearly ten thousand times the energy consumed by humankind. However, not all the energy emitted from the sun actually reaches the Earth's surface. *Roughly 30 percent of the incoming solar radiation is reflected back to space off of bright surfaces on the planet, including snow cover and sand, and bright surfaces in the atmosphere, including clouds.* This reflection to space happens through the same phenomenon that keeps a white car, which readily reflects solar radiation, much cooler on a hot day than a black car, which readily absorbs solar radiation. The remaining two thirds of solar radiation that penetrates the atmosphere, and reaches the Earth's surface, which heats the land and oceans.

Just as the sun emits energy, so does the Earth. Emitted energy, or radiation, from both the sun and the Earth travels in the form of waves that are similar to the waves moving across the surface of a pond. However, the energies emitted by the Sun and Earth are different due to the large differences in temperature between the two bodies. They emit radiation at distinctly different wavelengths. While the hot Sun emits energy at short

wavelengths (referred to as *shortwave radiation or solar radiation*), the much cooler Earth emits radiation at longer wavelengths (referred to as *long-wave or thermal radiation*). If the Earth is to maintain a constant temperature, the amount of radiation received by the Earth from the Sun must be balanced by an equal amount of radiation emitted from the Earth back to space. Without an atmosphere, the only means by which the Earth's temperature could change would be through changes in solar input. According to simple energy balance calculations, the average temperature of the Earth should be minus 18 degree Celsius or 0 degree Fahrenheit.

Fortunately, the Earth has an atmosphere that acts like a blanket that traps much of the outgoing thermal radiation emitted by the Earth's surface but allows most of the solar radiation to pass through. Certain trace gases in the Earth's atmosphere, called *"greenhouse gases," selectively absorb and trap these longer wavelengths of energy emitted by the Earth and then reemit them back to the Earth's surface. This allows for a significant warming of the Earth's surface and its lower atmosphere. Water vapor and clouds account for much of the natural greenhouse effect*. The warming effect of clouds can be observed during winter nights. A cloudy winter night is often much warmer than a clear winter night, since clouds and water vapor trap the heat radiating from the surface and keep surface temperatures from dropping as much as they would on a clear night. Overall, the greenhouse effect allows the average surface temperature of the Earth to warm from a frigid minus 18 degree Celsius (0 degree F) to a more comfortable 15 degree Celsius (18 degree F). Thus the chemical make up of the atmosphere is crucial in establishing a climate that is hospitable to life.

Although all locales on the face of the Earth receive the same duration of sunlight over the course of a year, solar radiation is much more intense near the equator than near the poles. Due to the curvature of the Earth's surface and the tilt of the Earth's axis, the Sun's rays are directly overhead in tropical locales throughout the year. In contrast, the Sun is much lower on the horizon over the polar-regions. However, the rate at which Earth emits energy (radiation) to space, which depends on temperature, does not differ dramatically from the equator to the poles. *To maintain a steady climate, the ocean and atmosphere must transport excess heat from the tropics to the heat deficient polar- regions. That heat is moved by the action of winds and ocean currents.* Without a dynamic atmosphere and ocean system, there would be a precipitous cooling of the poles and a dramatic warming of the tropics.

The circulation of our atmosphere and oceans redistribute this energy imbalance in setting the Earth's climate, thus making life more habitable on much of the globe. The warmer air over land becomes less dense and

begins to rise. As this air mass rises, the cooler air over the ocean flows inland to replace the rising warm air. As a result, the sea breeze cools inland locations in an attempt to offset temperature differences. Warm air in the tropics is forced to rise upward and eventually pole-ward. *This redistributes energy around the globe, bringing warm air to higher latitudes and cool air to lower latitudes and ultimately defining climate as we know it.* Oceans are a key component of the climate system. Oceans contain 97 percent of the planet's water and cover over 70 percent of the Earth's surface. Among the unique properties of water is its ability to store vast quantities of heat. As surface water in the tropics is heated, large-scale ocean currents, driven by atmospheric circulation patterns, transport heat pole-ward.

The northward-flowing Gulf Stream* transports warm water from the Gulf of Mexico toward northern Europe. It is believed that the Gulf Stream is partially responsible for the relatively mild climates of northwestern Europe, although the large-scale atmospheric circulation likely plays a dominant role. The ocean also plays a role in determining the chemical composition of the atmosphere because it absorbs and releases gases. The most recognized example is the evaporation and precipitation of water vapor through what is called the *"hydrologic cycle."*** However, the ocean also emits and absorbs large quantities of atmospheric carbon dioxide (CO2). *The Cryosphere comprises all frozen water, including Greenland and Antarctic ice sheets, sea ice in the Arctic and Southern Oceans, and all other snow-and ice- covered surfaces.* The Cryosphere represents only about 2 percent of the water on our planet, but it is important to the climate system because it reflects incoming solar radiation, allowing very little radiant energy to warm the surface. Unfortunately due to greenhouse effect, greater amount of energy reaches to the Earth's surface, accelerating the warming and the melting of the ice sheet.

The land surface and the biosphere also contribute to the climate system. The large-scale configuration of the continents including altitude, proximity to the ocean, and prominent mountain ranges, alters atmospheric and oceanic circulation patterns. In addition, variations in land surface alter the exchange of both heat and water, thus affecting local and regional climates. *The land surface and the biosphere both affect and are affected by atmospheric temperature and humidity and can alter the amount of solar radiation reflected*

**Gulf Stream, warm current of the North Atlantic Ocean, flowing in a generally northeastern direction from the Straits of Florida to the Grand Banks in Canada, east and south of Newfoundland and Labrador.*

***Water Cycle or Hydrologic Cycle, is a series of movements of water above, on, and below the surface of the Earth. The water cycle consists of four distinct stages: storage, evaporation, precipitation, and runoff.*

back to space. Vegetation also plays a key role in the *"carbon Cycle,"* which is the exchange of carbon among atmosphere, ocean, and land. Plants are active participants in the carbon cycle as they absorb CO2 through photosynthesis and expel oxygen through respiration. Changes in land use, such as deforestation and subsequent burning or decomposition of forest material, release an abundance of stored carbon into the atmosphere and obstruct processes that remove greenhouse gases and aerosols. Scientists call these removal processes *"sinks".*

History of Catastrophes

Killer storms tear through the skies! Violent winds shower the earth! Glaciers crumble! Flood waters ravage the coast! Mass extinctions wipe out all species! This is a carnage brought by extreme climate change. But this is not the description of the present. This is the climate of the ancient past. A past that is about to repeat itself. *Now scientists are racing to understand, weather of the past, in the hope of preventing the climate catastrophe in the future. The world is getting hotter. Our weather is getting wilder. Freak weather is becoming the norm.* May 2003, 400 tornadoes tear through the American Midwest and rip up the record. 2007 summer sea ice cover at the North Pole recedes to its lowest levels since the records began. And today in Darfur, Africa relentless drought has affected millions of people, leading to widespread hunger. Most scientists believe that we are to be blamed and human activity is pushing earth towards climate catastrophe as we pump ever great volumes of greenhouse gases into the atmosphere. It traps heat and raises the global temperature. Now climate scientists are sounding the alarm. Threat to our climate is being recognized right now. This is the right



moment for action. *The Intergovernmental Panel on Climate Change (IPCC)* is made up of the leading climate scientists, since 1990, it issued serious of warnings on climate change. Time is running out, if the predictions are right. To understand what might happen in the future, scientists are turning back the clock. They believe earth's past can offer a tantalizing view of what our future might hold.

Today most scientists believe that global warming is reality. And one of its potential side effects: warming oceans. It could have far reaching, alarming consequences. Corals are clear evidence to reveal the mystery. Corals are made up millions of tiny sea creatures. They secrete a substance called calcium carbonate. Over time, layer upon layer, corals build up. *Sea temperature affects the rate of build up. Sea Corals can grow faster when sea is hot. Warmer the oceans temperature faster the calcium carbonate is being produced.* Analyzing sea corals taken from last 3 centuries, from different reefs around the world reveal the same pattern of truth: corals are growing faster in the past 50 years, revealing a faster growth rate. Our planet from the last 600 million years of its climate history has been from the frozen extreme "snow ball earth" through the scorching temperatures that wiped out entire species, and a flooded earth of 125,000 years ago. The *Earth's volatile climatic past shows the global warming and the cooling is nothing new to the planet. Our climate is unstable and swings between extreme cold and heat. Through the millennia, one truth emerges, the awesome power of greenhouse gases.* It's a lesson we should heed, because today's global warming is again thought to be caused by greenhouse gases, including carbon dioxide. The huge amount of CO2 what we see in the history of our planet, more CO2 warmer and less CO2 colder. Scientists are using the lessons from the past climate change to discover whether CO2 is responsible for the global warming today.

Scientists are imputing into super computers, the data collected: data on present CO2 levels, volcanic eruptions, methane measurements, and even the sun's activity. They use this data to computer simulations of weather disasters, known to have occurred in the past. These simulations have been nearly accurate. *Evidence points out clearly to the human fingerprint. Climatologists are using them to predict the future.* They add in the current carbon dioxide levels. Oil and coal emissions from factories, power stations, gases from car exhaust, as well as logging and burning of forests, all the effects of human activity. And the results are chilling. The simulations predict, that we keep releasing greenhouse gases at the same rate, levels of carbon dioxide in the atmosphere could double in the end of this century. Temperatures could rise by 5 degrees Celsius by the end of this century.

The Intergovernmental Panel on Climate Change predicts at the current rate of warming, our world will change significantly. The ice sheets will melt and many of the coastal cities under water. India, England, Bengladesh will be the hard hits. Tens and thousands of people will become refugees, fleeing to higher grounds. And this could be just the beginning. If we continue to release the greenhouse gases at the current rate, temperatures could increase to high level, hot enough to evaporate the seas, just as they did 35 million years ago. *That could release million tones of methane, buried beneath the ocean floor and catapult the earth in a deadly cycle of escalating global warming. Just as it in the past, survival would depend on our ability to adapt*. Wealthy nations would develop an arsenal of technology designed to hold back the oceans and tackle the rising temperatures. While the technology could be shared with the less developed nations, however, climate change has predicted that the poor nations would be hit the hardest. Millions would starve. Entire populations would migrate to cooler regions. Many fear the Mass Exodus would trigger wars with nations battling, for the little land and resources which are left. But this is not the worse case scenario.

In the past sudden climate change had wiped out 95 percent of species on earth. And some scientists *believe that another mass extinction is already underway: an apocalypse caused by human activity*. We are living and witnessing this happening. We are also witnessing the mass extinctions taking place right now. The 5000 living species of animals and plants, which were present last year, they are not here today. They *are lost to the planet forever*. Year before last year, almost 5000 species became extinct and the year before the same. But there is hope. Today's climate crisis is in a large part caused by humans. We are finally waking up to the dangers and consequences of our actions. Political leaders are setting newer emission limits. But developing nations like India, China, fossil fuel consumption is rapidly increasing. Twenty years back there were only bicycles, but today cars and motorbikes. Where does energy going to come for this people in the future? We need one more planet for natural resources.

Eighty percent of India's electricity comes from burning fossil fuels. There are new coal-based factories on increase to meet the insatiable demand for energy and consumption. Many scientists believe India with their counter part China, would overtake US carbon output by 2012. Today the nations of the world stand at the cross roads and they need to act together, or face the climate even worse than that of our past. It is possible that the consorted world wide action could change the situation. So far our technology doesn't allow us to create same amount of energy without polluting. But we'll get

there some day. We'll learn to live by what is coming with the new inventions and new adjustments. I think we have little time. The clock is ticking fast. But it may take a major catastrophe, before we finally take the necessary action on our changing climate. What would it take to get us all in the same page?

Unlike us, plants and trees need carbon dioxide to survive, absorbing through their leaves. Under the microscope, scientists investigate fossilized remains of plants from 250 million years ago. They zero in on the lungs of the plant, tiny breathing pores that covering the back of the leaf. In most plants the number of breathing pores is a very sensitive barometer to the amount of CO2 in the atmosphere. *As CO 2 goes up the number of these breathing pores tend to go down and vice versa, when CO2 is low the plant has to expand, increasing the breathing pores in order to take up enough carbon. The higher the CO2 levels, the fewer breathable pores the plant needs.* So scientists account the pores and estimate the amount of CO2 that choked the atmosphere. Carbon breathing pores dating back 250 million years ago have suggested that CO2 was rising and rose just after the mass extinction to 10 times the present level. The Siberian traps blasted out so much green house gas that it blanketed the planet, trapping the sun's warmth. Carbon dioxide increased to the maximum of 700 percent. Global temperatures rose to 18 degrees Celsius. The result is the super heated planet, a scotched wasteland, where plants perished, herbivore that depended on them starved: carnivore that depended on herbivore consequently disappeared. Their disappearing food supply meant death.

The terrifying event of this prehistoric disaster offers scientists a glimpse, Carbon dioxide's awesome power. By comparing past levels of CO2 and temperature they can build a picture on the role of CO2 in warming events. They can use this data to predict how hot the future might become. So, could human activity today push CO2 to the same disastrous levels that choke the atmosphere at the time of mass extinctions? Many scientists believe that we might if we continue to do businesses as usual. If we do what we do now, we'll double it in the future. If you double the present levels of CO2 you end up expecting 5 degrees Celsius rise in the atmosphere. If we continue to pump the CO2 level without stopping, we can rise temperatures to that of 250 million years ago. We could expect unimaginable consequences.

After super hot conditions of 250 million years ago the planet slowly cools. New life forms flourish. The dinosaurs come and go. *Then 55 millions years ago temperatures sore, a staggering 20 degrees higher than today. But*

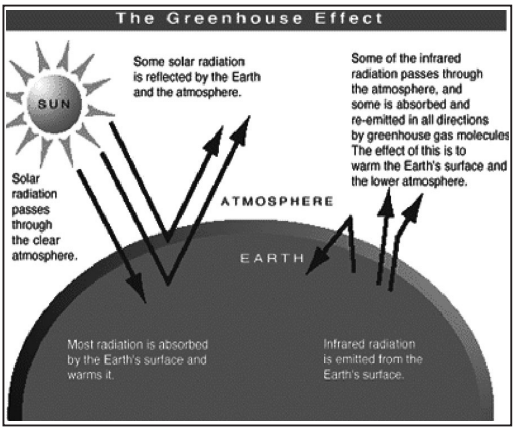
this time carbon dioxide was not the culprit. What triggered the extreme climate change? It's a question that led the scientists to one of the coldest places on the planet: the Arctic. In 2004, a team made up of best climate scientists on the planet, set sail on board ice breaker on an ambitious expedition to the frozen Arctic North. Let us wind the clock back to 55 million years. The scientists look hard under the Arctic oceans' floor. The team drilled 1000 feet into the oceans' sediment, hunting for clues trapped in the layers. Deeper the core, deeper we go further back in time. *These deeper sediments are like the "History book of the Earth."* By using the radio active dating of the sediment, they zoom in on the 55 million year mark and make an extraordinary breakthrough. Hidden in the core, the team finds the fossilized remains of a tiny fern, a plant that can thrive only in warm waters. *It is a shocking discovery. The fern reveals that 55 million years ago, Arctic was a warm tropical ocean.* It was covered with greenish and reddish ferns or slime and imagine thousands and thousands of kilometers covered with this stuff. The discovery of the fossilized fern allows the climatologists to piece together an extraordinary picture of the Arctic, 55 million years ago. *It was a kind of temperate rain forest scenario in Arctic, where animals like crocodiles swimming, like in the warm lakes in India or Florida, kind of everglades situation.* Climatologist calculate that high temperatures rocketed to a staggering 23 degrees Celsius higher than today. So, what turned up the temperature? What had the power to transform the Arctic into the everglades?

Earth 55 million years ago, much of the surface is a fiery hell, alive with volcanic eruptions that blast unimaginable levels of greenhouse gases into the atmosphere. Temperatures rise, but this alone is not enough to produce hot Arctic. But scientists try to look into the missing link into the prehistoric puzzle. The ocean off the coast of Santa Barbara, California offers a clue. *They are methane bubbles escaping from the deep crack of the oceans' floor. It's a gas with potent greenhouse properties that scientists believe could responsible for sending the earth climate into overdrive to heat, 55 million years ago.* Oceans release methane hydrates, in the form of bubbles. Bacteria produce methane from dead plankton. Some freezes into methane hydrates. Millions of tones of methane lay buried under the oceans' floor, kept in check by the high pressure and cold seas. It's solid like ice. If the ocean warms up, the methane hydrate goes from solid to gas and releases the trapped methane. *Methane is a powerful greenhouse gas, it is 23 times more powerful than CO2 and if we generate lots of methane into atmosphere that can spike the temperature up.* Volcanic activity under the oceans warmed up the seas 55 million years ago, melting the frozen methane ice and blasting it into the atmosphere. Today the planet is heating up once

more. Scientists fear the devastating global warming of the past could be repeated in the future. Estimates of how much methane hydrates there are is the 3000 times more that of methane in the atmosphere is locked up in the hydrates under the seafloor, safe and secure lay buried. But with the oceans warming, frozen gas could melt, unleashing vast reserves of methane and pushing the earth's temperatures sky high once again.

What is a Greenhouse Effect?

The notion of global warming as an enhanced greenhouse effect is best understood by using the following analogy. You try to stay warm at night by using a blanket to trap the heat that the Earth's greenhouse gases do by reradiating heat back to the body of interest, to you in the former and to the earth's surface in the latter. Just as a blanket must be the right thickness to keep you comfortable, the Earth's greenhouse gases must be of the right type to keep the planet comfortable. And just as too many blankets may make you too warm, too many greenhouse gases may lead to a warming of the globe. In an ordinary greenhouse, sunlight passes through the glass walls and warms up the inside. This heat then gets trapped within the walls. The greenhouse effect in the atmosphere works a little bit like an ordinary greenhouse. Greenhouse gases trap the heat brought by light passing through the atmosphere of the Earth. *Greenhouse gases are components of the atmosphere that contribute to the greenhouse effect. Without the greenhouse effect the Earth would be uninhabitable.* Greenhouse gases come from natural sources and human activity. In 1824, the French scientist Joseph Fourier hypothesized that the average temperature of the planet is warmer because of the existence of the Earth's atmosphere. He claimed that the warming effect of the atmosphere on the Earth's surface was similar to how a plant warms when it is encased in a house of glass. Fourier called this phenomenon the *"greenhouse effect."*



The composition of the Earth's atmosphere governs the climate of the planet and establishes conditions vital for life. Although the atmosphere is primarily composed of nitrogen (78 percent) and oxygen (21 percent), these gases do not interact with the long-wave thermal radiation emitted by the Earth. *This task is left to the greenhouse gases, which account for less than 3 percent of the atmosphere. Greenhouse gases, including CO2, methane CH4, nitrous oxide N2O, halocarbons, ozone O3, and water vapor H2O, are very effective at absorbing thermal radiation expelled from the Earth's surface.* The energy from the sun that reaches Earth's surface is mostly "shortwave" radiation, mostly visible light. This energy passes freely through the atmosphere and is absorbed by Earth's surface. The surface warms from the energy input, and some of its heat projects back to the atmosphere absorb 95% of the energy in infrared radiation, allowing only 5% to pass into space. After greenhouse gases absorb thermal radiation emitted from the Earth's surface, they reradiate this energy back to the surface of the Earth, which warms the Earth in the same way that a blanket traps body heat on a cold night. While greenhouse gases absorb and emit thermal radiation, they are essentially transparent to solar radiation and allow additional heat into Earth's atmosphere, where it is trapped by the greenhouse gases. This system permits hospitable conditions for life on the Earth's surface. However, small changes in the concentrations of these gases can drastically alter the heat-trapping capabilities of our atmosphere, resulting in acute changes in climate with serious consequences for life on Earth.

The four planets that are closest to the sun are Mercury, Venus, Earth, and Mars. Earth's two neighboring planets, Venus and Mars, offer good examples of how changes in atmospheric composition can lead to changes in surface temperatures. Although Venus is closer than the Earth is to the Sun and thus receives a greater amount of incoming solar radiation, thick clouds engulf the planet and reflect nearly 75 percent of this radiation (compared to 30 percent for Earth). *Venus is a searing desert. Its waterless surface crushed under a thick atmosphere almost 100 times the pressure of Earth's. The clouds that shroud the planet contain droplets of deadly sulfuric acid (the acid rain in Venus is known as Virga), not life-sustaining water.* The atmosphere of Venus is rich in greenhouse gases, with carbon dioxide accounting for 97 percent of it. As a result, the thick Venusian atmosphere is highly effective at trapping thermal radiation from escaping to space. The large amounts of greenhouse gases in the atmosphere reradiate the trapped heat back to the surface of the planet, *resulting in average surface temperatures of 470 degrees Celsius (878 degrees F), hot enough to melt lead.* All known forms of life would be broiled alive. Yet, both Venus and Earth may have had similar climates shortly after they formed. The big mystery

Venus will help answer is how these two similar worlds ended up with such different outcomes. Understanding the atmosphere of Venus will help scientists learn how a world that might have been a tropical Eden became instead a close approximation of Hell.

In contrast, Mars has a very thin atmosphere with a minimal greenhouse effect. As a result, most of the heat radiated from the surface of Mars is about minus 60 degrees Celsius (minus 76 degrees F).The ability of greenhouse gases to warm the surface of the planet depends on three main factors: their efficiency in absorbing heat, their total atmospheric quantities, and their atmospheric lifetimes or the amount of time they remain in the atmosphere. By looking at the clouds of Mars, we learn about the seasonal and daily weather pattern of Mars. Scientists want to understand how water vapor is transported around the planet. For example, on the extremely cold red planet, surface ice warmed by sunlight can briefly turn to vapor that rises into the atmosphere and then quickly cools to form ice crystals again, either in clouds or back on the ground. Scientists also estimate wind speed and direction based on the movement of the clouds. It definitely gives you the sense of what it might feel like to sit back and watch clouds on Mars.

Efficiency, Quantity, Lifetime of Greenhouse Gases

The main greenhouse gases

Greenhouse gases	Chemical formula	Pre-industrial concentration	Concentration in 1994	Atmospheric lifetime (years)***	Anthropogenic sources	Global warming potential (GWP)*
Carbon-dioxide	CO_2	278 000 ppbv	358 000 ppbv	Variable	Fossil fuel combustion Land use conversion Cement production	1
Methane	CH_4	700 ppbv	1721 ppbv	12,2 +/- 3	Fossil fuels Rice paddies Waste dumps Livestock	21 **
Nitrous oxide	N_2O	275 ppbv	311 ppbv	120	Fertilizer industrial processes combustion	310
CFC-12	CCl_2F_2	0	0,503 ppbv	102	Liquid coolants. Foams	6200-7100 ****
HCFC-22	$CHClF_2$	0	0,105 ppbv	12,1	Liquid coolants	1300-1400 ****
Perfluoromethane	CF_4	0	0,070 ppbv	50 000	Production of aluminium	6 500
Sulphur hexa-fluoride	SF_6	0	0,032 ppbv	3 200	Dielectric fluid	23 900

Note : pptv= 1 part per trillion by volume; ppbv= 1 part per billion by volume, ppm v= 1 part per million by volume

Greenhouse gases are defined by their ability to absorb thermal radiation emitted by the Earth. Different molecular structure of the gases, lead to differences in their ability to absorb radiation. Scientists estimate the

heat-trapping efficiency of the different greenhouse gases using an index called the *"high global warming potential" (HGWP).* It is important that we discuss what is meant by HGWP? Global Warming Potentials (GWPs) are used to compare the abilities of different greenhouse gases to trap heat in the atmosphere. *Carbon dioxide (CO2) is used as the base for all the calculations, so its global warming potential is 1.* The higher the GWP, the more heat the specific gas can keep in the atmosphere. So the more HGWP gases enter the atmosphere, the faster our climate will change. This represents the ratio of energy reemitted to the Earth's surface during a year for a given gas compared to that of the same mass of CO2. As time passes the GWP of a greenhouse gas usually decreases, but as is the case with fluorinated gases since their global warming potential is already very high it takes a very long time for them to break down and lose their ability to trap heat.

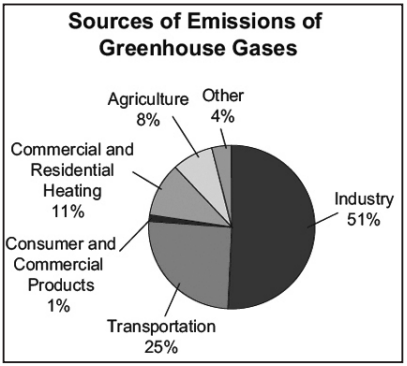
What's worse is that since these fluorinated gases are created exclusively by humans and are not normally found in nature, there *is no natural process or "sink"* to remove these gases from the atmosphere slowly over time. *That small volume of fluorinated gases is responsible for 87% of the extra heat trapped on Earth, which has a huge impact on climate change. By comparison, methane has a GWP of 21, meaning that a given mass of methane can heat the planet twenty-one times as much as the same mass of CO2.* Other greenhouse gases have even larger GWPs. *Nitrous oxide and halocarbons have GWPs of 300 and over 5,000, respectively.* So although carbon dioxide is notorious for its role in global warming, other less well-known greenhouse gases also play potent roles in the process. Carbon dioxide is a naturally occurring greenhouse gas which cycles through reservoirs in the land, ocean, atmosphere, and vegetation. Atmospheric CO2 has been maintained between 180 and 280 ppm (lower during glacial periods and higher during interglacial periods) over the last 650,000 years. Anthropogenic, or human made, CO2 began to be emitted to the atmosphere when people started to burn wood and fossil fuels.

Methane is produced naturally, but its atmospheric concentrations have been augmented by agricultural processes, such as, *rice cultivation, use of fertilizers, and cattle farming and industrial activities. Similarly, the amount of nitrous oxide in the atmosphere has increased as a result of agricultural soil management, fossil-fuel burning, and biomass burning.* Halocarbons are potent greenhouse gases that do not exist in nature. They are gases that are manufactured for use in refrigeration units and foaming agents. Alternative halocarbon compounds, such as hydro fluorocarbons were introduced as substitutes for chlorofluorocarbons (CFCs), which are potent greenhouse

gases that also destroy the ozone layer. CFCs act in a series of chemical reactions to destroy the natural shield of ozone high in the atmosphere, which protects life from the infiltration of dangerous ultraviolet rays. Those rays can harm human health, by leading to cataracts, suppressed immune systems, and some forms of skin cancer and destroy plant species, and oceanic plankton.

Because of the overwhelming worldwide effort to curtail the usage of CFCs since the Montreal Protocol of 1987, the Earth's ozone layer is slowly recovering. The success with CFCs provides hope that we are able to alter behavioral patterns to repair the damage we cause to Earth's atmosphere. *Most greenhouse gases have lifetimes of decades to centuries. This means that a gaseous molecule may remain in the atmosphere for as long as two hundred years, mixing throughout the atmosphere.* Lifetime of the gas is the primary factor in determining the overall warming effect of the gas. *Carbon dioxide, for instance, which has an atmospheric lifetime of about 120 years,* continues to contribute to radiative forcing, although with decreasing impact, for many decades. Like some CFCs that have long lifetimes, may contribute to global warming for many years. Water vapor with a short lifetime of a few days to the weeks is not well mixed in the atmosphere, and many locations have high humidity, cloud cover, and rainfall while other locales are dry and cloud free. Most other greenhouse gases have long lifetimes and continually accumulate in the atmosphere, leading to important long-term implications for future climate changes.

Industry and Greenhouse Gases



Until a few centuries ago, the Earth's radiation equilibrium and climate were maintained by the natural greenhouse effect. Atmospheric levels of carbon dioxide were balanced by the carbon cycle, and there was equality between sources and sinks. Carbon cycled through photosynthesis and respiration by land and sea flora, through air-sea exchanges (fluxes), and through "slow-turnover" geologic processes. Over millions of years, oceanic carbon is buried, and deep-sea sediments are recycled into the Earth. Eventually, this carbon is

reintroduced to the atmosphere, either violently by volcanic eruptions or mildly by the breakdown of exposed rocks. *Earth's largest reservoir for carbon is rock*. While important for the evolution of the atmosphere, the relatively slow pace of the geologic carbon cycle (millions of years) is important only in controlling long-term variations in levels of atmospheric carbon dioxide. Scientists can quantify the composition of the atmosphere prior to the historical record by examining ice cores.

Bubbles of air embedded within the ice cores that have been extracted from the Greenland and Antarctic ice sheets reveal a substantial amount of information on changes in climate. *The cores tell us that from about 420,000 years ago until the beginning of the industrial revolution in the late 1700s, CO2 varied from about 180 parts per million (ppm) to about 280 ppm. As of March 2009, there were about 393 ppm of CO2 in the atmosphere, with levels of CO2 rising about 1.6 ppm per year since 1980.* Measurements confirm a high correlation between fluctuations in atmosphere CO2 levels and global temperature. These observations are consistent with the radiative impact on surface temperatures from changes in the greenhouse effect. The question is: How will these high levels of CO2 affect our climate?

The industrial revolution marked a turning point in the balance of energy in the Earth's climate system. *The rise of industry and technology throughout the 1800s saw a massive increase in the burning of wood and coal, which released the greenhouse gases carbon dioxide, nitrous oxide, methane, and other halocarbons into the atmosphere.* The industrial activity thus altered the carbon cycle and the natural equilibrium of the Earth's climate system. At the same time, deforestation further exacerbated the balance by removing a potential sink for carbon. *Today, human activity is responsible for releasing approximately 7 billion metric tons of carbon per year into the atmosphere, and the oceans and land biosphere absorb approximately 3 billion metric tons of that carbon.* Since CO2 has a lifetime of over one hundred years, these emissions have been collecting for many years in the atmosphere. The atmospheric concentration of CO2 has increased 36 percent from pre-industrial times and is expected to continue rising in the foreseeable future. Electricity generated by the burning of fossil fuels accounts for most of the more than 5.5 billion tons of human made carbon dioxide released each year by the U.S. in contrast, other energy sources, including nuclear, solar, wind, hydroelectric, biomass, and geothermal energy sources, emit minimal, if any, greenhouse gases.

The transportation sector is the second biggest source of carbon dioxide emissions in the U.S. and around the world*, every gallon of gasoline*

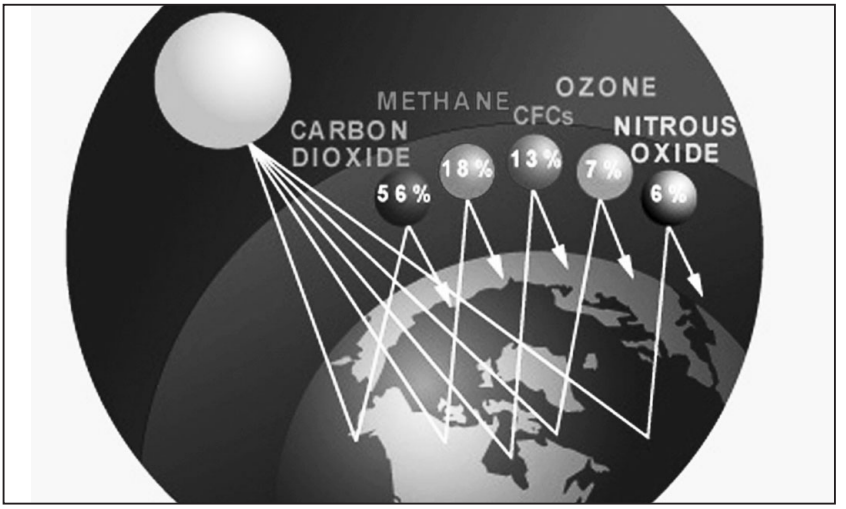
consumed releases about 9 kilograms (20 pounds) of CO2 into the atmosphere. Fuel economics of many automobiles have improved dramatically over the past few decades because of technological improvements, but the carbon dioxide emitted from vehicles in the U.S exceeds the total carbon dioxide emitted from India, even though the population of India is over four times that of U.S.A. *But now in 2009, India is overtaking its carbon emissions with that of U.S.A.* In addition to CO2 emissions in the electricity and transportation sectors, emissions of less notorious yet equally dangerous greenhouse gases are linked to climate change. About two thirds of present methane emissions are attributable to human activities, such as burning biomass, cultivating rice, creating landfills, and managing livestock. These methane releases from agricultural and natural sources are expected to be accelerated by changes in global mean temperature and moisture. *For example, recent studies indicate that climate warming may melt high-latitude permafrost** The switch from CFCs to other halocarbons has limited the destruction of the ozone layer, but these halocarbons remain active in enhancing the greenhouse effect and potentially harmful climate change.

Present Level of greenhouse gases

Non-energy-related sources of greenhouse gases include manufactured halocarbons, methane and nitrous oxide from agriculture, and methane from animal farms and landfills. Halocarbons is the general label applied to chemicals such as chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFC's), hydrofluorocarbons (HFCs), halons, and chlorocarbons (CCs). Halocarbons have the largest radiative impact per molecule of any of the greenhouse gases. However, halocarbon emission volumes are much lower than CO2 emission volumes, so that the total halocarbon contribution to global warming is less than that of CO2 from the sources. The CFCs also threaten the stratospheric ozone layer. Emissions of CFCs are scheduled to be eliminated under the Montreal Protocol, an international treaty signed in 1987 and strengthened in 1990 that commits nations to act to preserve the ozone layer. Positive action under the Protocol, including bringing additional nations under its umbrella, continues to be a visible demonstration of the possibility of global action on environmental questions. The present levels of

**Permafrost, is perennially frozen ground that maintains a temperature at or below the freezing point for at least two years. Vast tracts of permafrost lie across Alaska, Canada, northern Europe and Asia, and Greenland is almost totally covered with permafrost. Pockets of permafrost are found as far south as the 50th parallel in Canada and the 45th parallel in Siberia. Permafrost can extend to depths of more than 500 m (1,600 ft). and thus accelerate releases of methane from peat bogs.*

greenhouse gases present in the atmosphere is shown in this picture below and it is steadily rising. The Carbon Footprint of the world leaders in Copenhagen 2009, with their jumbo jets, cars and five star hotels, CO2 rocketed high and now after the U.N. Summit you add 2 percent hike of all the greenhouse gases in the present atmosphere. This shows the irresponsibility on the part of humanity, lacking in action, leaving planet earth in more vulnerable situation.



Global Warming - Causes and Effects

It was not that man's inability to understand the problem of Global Warming: on the other hand he did not want to understand. Like so many other cultural shifts, it gathered long and then broke quickly. At last the world, including a majority of people in the Unites States has acknowledged that Global Warming is real. Changing the public's opinion was not easy. It took the work of thousands of scientists, painstakingly accumulated over more than three decades. Their findings were then steadily communicated to the world through massive synthesis reports in 1990, 1995, 2001, and 2007 by the Intergovernmental Panel on Climate Change (IPCC), displaying a level of organization unprecedented in science. These reports document the evidence, now overwhelming of our new man-made climate. Questions like "Is it real?" and "Is it our fault?" have morphed into "What will happen?" "Where?" "How fast?" and "What are we going to do about it?" Science may have led us to these questions, but our answers will reverberate far beyond science. So, what will happen?

Here is what we know currently: *First,* the warming is just revving up. It is 90 percent certain that continued greenhouse gas emissions at or above the current rates will induce far greater climate change in the twenty-first century than we've yet experienced. In every plausible population-growth or greenhouse-gas-emission scenario for the next century, basic physics dictates that Earth's climate must continue to warm, with global average *temperatures rising between 1.8 degrees Celsius and 5.0 degree Celsius by the end of this century.* How high we go depends on how much carbon we choose to load into the atmosphere; the lower value is the IPCC's optimistic estimate, which assumes a stabilized global population and the adoption of clean-energy technology. The high value is the estimate based on unabated dependence on fossil fuels.



Global warming, the past 50 years of warming has been attributed to human activity. Earth's temperature has risen about 1 degree Celsius in the last century. The atmosphere is increasingly becoming hot, oceans are getting warm and the landmasses are smoking. *Global warming is an increase in the average temperature of the atmosphere, oceans, and landmasses of Earth.* The planet has warmed and cooled many times during the 4.5 billion years of its history. At present Earth appears to be facing a rapid warming, which most scientists believe results, at least in part, from human activities. Burning fuels such as coal, natural gas and oil produces greenhouse gases in excessive amounts. *Greenhouse gases are emissions that rise into the atmosphere and trap the sun's energy, keeping heat from escaping.* As the atmosphere becomes richer in these gases, it becomes a better insulator, retaining more of the heat provided to the planet by the sun. Most of the world's emissions are attributed to the United States' large-scale use of fuels in vehicles and factories. The United States was responsible for 35 percent of the global greenhouse gases emitted in 2007.

India and China with their population and exploiting industry and technology, are contesting with each other to exceed U.S emissions. As a result, during the past 100 years global sea levels have risen 4 to 8 inches. Some predictions for local changes include increasingly hot summers, frequent violent storms and intense thunderstorms. Damaging storms, drought and related weather phenomena cause an increase in economic and health problems. Warmer weather provides breeding grounds for

insects such as malaria-carrying mosquitoes, deadly virus and bacteria. *We are already witnessing changes to global weather patterns including unpredictable changes to the seasons, more frequent and severe storms, floods and droughts. In the future we can expect a greater number of increasingly severe natural disasters to sweep across the planet.* While the issue of global warming and its effects influences all our lives, it is the poor, those who have done least to cause the problem, who are already suffering its consequences and will be hit the hardest. Existing levels of poverty, poor infrastructure, the high dependence on rain-fed agriculture and the limited ability of people already living in poverty to protect themselves from extreme weather events, mean that they are so much more vulnerable than those of us in developed nations.

The current global warming is an effect of all greenhouse gases put in the atmosphere during the last 100 years, global warming is not just caused by the greenhouse gases emitted this year or last year! This is also one of the reasons why immediate action is required to reduce the emission of greenhouse gases like carbon dioxide, because the effects of the greenhouse gases will last for about 100 years. A better way to understand the issue is to concentrate on the top 10 producers of all time: US 41.17%, Russia 11.72%, China 10.98%, Germany 9.75%, UK 7.36, Japan 5.93%, India 5%, France 3.76%, Canada 3.13%, Australia 3.2%. *In another 5 years, India and China will be polluting 33%, moving up to third slot. The future is an opaque mirror, anyone who tries to look into it sees nothing, but the dim outlines of an old and worried face.* We know not what future holds, but we know who holds the future! The climate crisis is, indeed, extremely dangerous.

In fact it is true planetary emergency. The voluminous evidence now strongly suggests that unless we act boldly and quickly to deal with the underlying causes of global warming, our world will undergo a string of terrible catastrophes. *This is not ultimately about any scientific discussion or political dialogue. It is about who we are as human beings. It is about our capacity to transcend our own limitations, to rise to this new occasion.* To see with our hearts, as well as our heads, the response that is now called for. This is a moral, ethical and spiritual challenge. The climate crisis also offers us the chance to experience what very few generations in history have had the privilege of *knowing a generational mission;* the exhilaration of a compelling moral purpose; a shared and unifying cause; the thrill of being forced by circumstances to put aside the pettiness and conflict that so often stifle the restless human need for transcendence; the opportunity to rise above all divisions of caste, religion, race, country, color and language. When we do rise, it will fill our spirits and bind us together.

Wealthy industrialized nations in the developed world have caused the problem of climate change through their large-scale use of natural resources for economic gain and they have a moral obligation to address the problems their actions have created. *Sadly, the best interests of the poor are often ignored in the political wrangling of countries looking after their own national short-term interests. This has to stop.* Industrialized nations must commit themselves to substantial reductions in their greenhouse gas emissions to help address the cause of the problem. Developed nations must also contribute to the costs that developing nations incur in mitigating, and adapting to the effects of climate change and in developing their own low-carbon economics.

To achieve this, it is estimated that a further $ 150 billion per annum will be needed in addition to existing international aid commitments. This is a large sum. However, it is not acceptable to deny poor countries the right to a more prosperous future when the wealthy themselves live in relative luxury. *Indeed, when compared to the $ 680 billion spent on the war in Iraq and $ 18 trillion spent globally during the recent economic crisis, it is a small price to pay to ensure millions of people have the hope of a sustainable and prosperous future.* God created the earth and entrusted its care to us. We have seriously neglected this important responsibility. It is now time to restore a more sustainable relationship with our environment, so that all human beings have the opportunity to live in dignity.

Aerosols

Aerosols are tiny particles suspended in the air. Some occur naturally, originating from volcanoes dust storms, forest and grassland fires, and sea spray. Human activities, such as the burning of fossil fuels and the alteration



of natural surface cover, also generate aerosols. *Averaged over the globe, aerosols made by human activities currently account for about 10 percent of the total amount of aerosols in our atmosphere*. Most of that 10 percent is concentrated in the Northern Hemisphere, especially downwind of industrial sites, slash and burn agricultural regions and overgrazed grasslands. Scientists have much to learn about the way aerosols affect regional and global climate. We have yet to accurately quantify the relative impacts on climate of natural aerosols and those of human origin. Moreover, we do not know in what regions of the planet the amount of atmospheric aerosol is increasing, is diminishing, and is remaining roughly constant. *We do not even know whether aerosols are warming or cooling our planet*. Why do we care about aerosols? Aerosols tend to cause cooling of the Earth's surface immediately below them. Because most aerosols reflect sunlight back into space, they have a "direct" cooling effect by reducing the amount of solar radiation that reaches the surface. The magnitude of this cooling effect depends on the size and composition of the aerosol particles, as well as the reflective properties of the underlying surface. It is thought that aerosol cooling may partially offset expected global warming that is attributed to increases in the amount of carbon dioxide from human activity.

Aerosols are also believed to have an "indirect" effect on climate by changing the properties of clouds. Indeed, if there were no aerosols in the atmosphere, there would be no clouds. It is very difficult to form cloud droplets without small aerosol particles acting as "seeds" to start the formation of cloud droplets. As aerosol concentration increases within a cloud, the water in the cloud gets spread over many more particles, each of which is correspondingly smaller. Smaller particles fall more slowly in the atmosphere and decrease the amount of rainfall. *In this way, changing aerosols in the atmosphere can change the frequency of cloud occurrence, cloud thickness, and rainfall amounts.* If there are more aerosols, scientists expect more cloud drops to form. Since the total amount of condensed water in the cloud is not expected to change much, the average drop must become smaller. This has two consequences; clouds with smaller drops reflect more sunlight, and such clouds last longer, because it takes more time for small drops to coalesce into drops that are large enough to fall to the ground. Both effects increase the amount of sunlight that is reflected to space without reaching the surface.

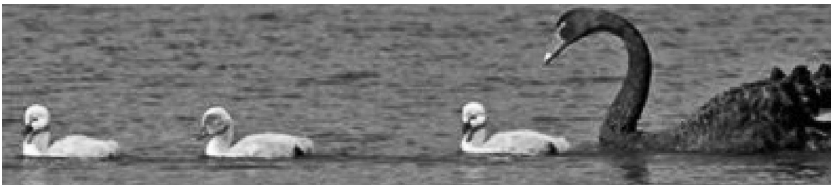
What is the deal nowadays with aerosol spray cans? The aerosol spray can have a storied history. It was invented in the 1920s by the Department of Agriculture scientists to pressurize insect spray. American soldiers eventually used the technology to help ward off malaria in the South Pacific

during World War II. Use of aerosol spray cans for consumer aerosol products made in the U.S. have not contained ozone-depleting chemicals; also known as chlorofluorocarbons (CFCs), since the late 1970s, first because companies voluntary eliminated them, and later because of federal regulations. All consumer and most other aerosol products made or sold in the world now use propellants, such as hydrocarbons and compressed gases like nitrous oxide, that do not deplete the ozone layer. *Aerosol spray cans produced in some countries might still utilize CFCs.* Now all countries should switch out ozone-depleting propellants with non-depleting forms because they signed 1987's Montreal Protocol, a landmark international agreement signed by 191 countries with the goal of phasing out the production and use of CFCs and other ozone-depleting chemicals.

Scientists report that the phase out of the chemicals is now about 90% complete. Of course, just because those deodorant and perfume sprays and shaving cream cans aren't depleting the ozone layer doesn't mean they are actually good for the environment. *They still contain hydrocarbons and compressed gases notorious for their contribution to global warming. Every time you hit the button, then, you are raising your carbon footprint, albeit ever so slightly.* Modern day, CFC free aerosol sprays also emit volatile organic compounds (VOCs) that contribute to ground level ozone levels, a key component of asthma inducing smog. Apart from aerosol sprays, there are fingernail polish, mouthwashes, pump hair sprays, and roll on and stick deodorants, paints, solvents, plastics and many other goods. The principal sources of aerosols are fossil-fuel combustion, biomass burning, desert dust, volcanoes, and sea spray. The most straightforward climate effect of aerosols is their ability to alter the amount of incoming solar radiation that reaches the Earth's surface. Much like clouds, light-colored aerosols reflect incoming solar radiation, thereby decreasing the amount of energy that reaches the Earth's surface.

Overall Global Effects of Climate Change

The scientific consensus on current climate changes is that average global surface temperatures have risen 0.74 degree Celsius (1.33 degrees F) in the past century, with "most of the warming observed over the last fifty years"



very likely due to the observed increase in anthropogenic greenhouse gas concentrations. According to the World Meteorological Organization, the Earth's ten warmest years on record occurred after 1990, and the warmest years in the observational record are 1998, and 2005. The National Academy of Science's 2001 report to the White House said that the global mean surface air temperature warmed in the twentieth century 0.4 degree to 0.8 degree Celsius (0.7 to 1.5 degrees F); that the oceans have warmed by about 0.05 degree Celsius (0.09 degree F) over the water layer extending down 10,000 feet since the 1950s; and that this warming occurred mainly in noncontiguous ways throughout the century. But the report also said that the atmosphere at altitudes of about 13 miles has cooled in the last thirty-five years.

In addition, the oceans are warming. Observations show that the uppermost 300 meters (1,000 feet) of the ocean have warmed 0.31 degree Celsius (0.67 degree F) since the 1950s. *With carbon dioxide levels already at 385 parts per million (over 100 ppm higher today than they were before the industrial revolution), experts agree that levels will continue to rise to between 600 ppm and 1,000 ppm by 2100*. In its Fourth Assessment in 2007, the Intergovernmental Panel on Climate Change (IPCC) predicted an increase in the global average surface temperature of 1.8 degrees to 5.0 degrees Celsius. Other recent studies predict much higher global temperatures. Even the low end of the estimated increases should rule out the "negligible warming" of natural climate variability that is proposed by some global warming contrarians.

Significant increases in global mean temperature are projected to result in heightened health risks for much of the world's population. Heat-related mortality increases significantly on days when the air temperature tops. By raising the baseline average temperature, heat waves will become more intense, and the number of days that exceed a given temperature will also grow. These changes will increase the number of heat-related deaths, especially among the elderly and the urban poor. The likelihood of heat waves, such as those that ravaged much of Europe in the summer of 2003 and resulted in over thirty thousand cases of heat prostration, is expected to increase a hundredfold over the next forty years as a result of anthropogenic climate change. *Scientists agree that the summer of 2003 was likely the warmest summer recorded in Europe over the past five hundred years and noted that increases in global temperature drastically increased the probability of the heat wave*. Ironically, what today is classified as an extremely warm season, like the summer of 2003 across much of Europe, is expected to be classified as an extremely cool season by the end of the twenty-first century.

Each year, extreme weather events such as floods and heat waves are responsible for the loss of thousands of human lives, billions of dollars in damages, and irreversible environmental harms. Extreme events are the main channel where climate and social and economic systems interact, and they attract the most climate-related media reports. Ecosystems are able to cope with so-called normal climate conditions, but both ecosystems and human beings are vulnerable to extreme events such as droughts, heat waves, and floods. Thus, the harshest effects of climate change in the twenty-first century will be experienced through changes in extreme events. Extreme weather events contributed to over $200 billion of damages worldwide in 2005.

Changes in extreme weather events are already apparent. The Intergovernmental Panel on Climate Change reported an increase in heat-wave frequency, intensity, and duration and a 2 to 4 percent increase in the number of heavy-precipitation events across the Northern Hemisphere during the twentieth century. However, present changes are benign compared to the anticipated changes in extreme events during the twenty-first century. Modeling studies have suggested that there will be a significant increase in the frequency of extreme precipitation events and heat waves in an enhanced greenhouse climate. Extreme weather events, including tropical storms, have been at the forefront of media attention after the summer of 2005. Tropical storm records for the Atlantic basin dropped like dominoes during 2005. There were twenty seven named storms. Fifteen of these storms became hurricanes, a tropical storm with winds exceeding 74mph, and four attained the most powerful category 5 status, winds exceeding 155mph, including Hurricane Wilma, the most powerful hurricane ever recorded in the Atlantic, with winds exceeding 175 mph. several of these powerful hurricanes, most notably Hurricane Katrina, made landfall across the U.S, Caribbean, and Central America, resulting in over 2,500 fatalities and over $100 billion in damage.

Warm surface ocean temperatures in the tropics provide the energy that fuels tropical storms, so a warming of the tropical ocean would be expected to lead to more powerful tropical storms. Theoretical results confirm these expectations by suggesting that tropical storm wind speeds increase 5 percent for every 1 degree Celsius (1.8 degrees F) increase in surface ocean temperatures. Winds from tropical storms are devastating in their own regard and serve as a catalyst in producing storm surges. *Although there appears to be no global trend in tropical storm frequency, the number of major hurricanes (categories 4 and 5 which are the most dangerous) has nearly doubled in the last thirty-five years*. This observation is consistent with the 0.8

degree to 2.4 Celsius (1.4 degree to 4.3 F) increase in tropical surface ocean temperatures over the last fifty years. Additional evidence shows that maximum wind speeds in tropical storms have increased 15 percent over the last thirty years. These results suggest that tropical storms are getting stronger. Tropical surface ocean temperatures are expected to increase 1 degree to 2.5 Celsius (1.8 degree to 4.5 F) over the next one hundred years, and state-of-the art numerical models suggest that warmer waters will beget stronger and more devastating tropical storms in the coming century.

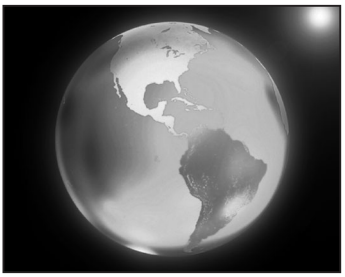
The effects of Global warming extend across all sectors of health, the economy, politics, and international relations. Increased humidity worsens urban air pollution; malaria and dengue are spread by vector-borne infections (and mosquito population increases with moisture); storms damage agricultural sectors and threaten food supplies; and potentially higher sea levels would displace millions of *"climate refugees."* Natural ecosystems in the industrialized world also face the effects of climate change. Climate change may result in the loss of biodiversity, may increase extinction rates for vulnerable species, and may cause a decline in the viability of important ecosystems. *Sea-level rise and the warming of the ocean will further harm coral reefs, which provide the greatest biodiversity of any marine ecosystem.* The growing seasons in temperate regions will lengthen, and plant and animal ranges will shift pole-ward and move to higher elevations. Signs of spring will shift as well: trees will flower, insects will emerge, and birds will lay eggs earlier in the year. This is already happening: the spring bloom in the northeastern U.S is arriving four to eight days earlier today than it did during the 1960s. Plant and animal species currently labeled as critically endangered will become extinct, and the majority of those labeled as *"endangered or vulnerable"* will come closer to extinction. Given a slow enough change in climate, many species will be able to adapt to the changes, but rapid changes in climate severely limit adaptation strategies.

The bulk of the increase in sea-level rise today is a result of warming temperatures. Computer models predict that the thickness of Arctic sea ice will decline, the Greenland ice sheet will melt, and the area of ice-free seas will increase. The melting of large continental glaciers, such as those in Greenland and Antarctica, would add a huge amount of mass to the oceans. In addition, a majority of the world's high altitude glaciers are currently eroding. For example, the glaciers in Himalayas and Alps are expected to melt completely within the next thirty years. Because the ocean has a large heat capacity, it takes a long time to translate changes in atmospheric temperature to changes in oceanic temperature. Researchers conclude that even if the atmosphere stopped warming today, the global sea level would continue to rise for centuries before reaching a new equilibrium.

The IPCC models suggest a total rise in sea level up to 7 meters (23 feet) by the end of the 2100, if the Greenland ice sheet is eliminated. Sea-level rise is expected to cause increased levels of flooding, accelerated erosion into freshwater sources. Many of the people who live near present-day sea level will likely be displaced as waters inundate the land. Climate scientists also expected that the hydrologic cycle, the cycling of water among the atmosphere, land, and ocean through precipitation and evaporation, will intensify because of global warming. A warmer climate will lead to enhanced rates of evaporation and increased precipitation for the globe as a whole. Regional precipitation distributions may be drastically altered, leading to an increase in the intensity and frequency of rainfall in some regions and of drought-like conditions in other regions. With depleting snow peaks, rising sea levels, and increasingly severe deluges, floods will likely increase in number and severity. It is also generally believed that in a warmer world the atmospheric concentration of water vapor will increase and that increased water vapor, which is an important greenhouse gas, may further enhance the predicted warming.

An Ozone Hole over Antarctica

In the late 1980s, there was a sense of the new about the greenhouse effect, even though scientists had been positing since the 1890s that heat-trapping gases, particularly carbon dioxide released by burning coal and other focal fuels could raise global temperatures. A combination of observations and computer stimulations seemed finally to be giving a face to theory, which made it easy to sell as a cover story in Time magazine or to Science Digest, Discover, the Washington Post, or the New York Times. At that time, there was also a newly perceived global atmospheric threat, the damage to the ozone layer from chlorofluorocarbons (CFCs) and other synthetic compounds and an international solution in a treaty that banned the chemicals. But eliminating a handful of chemicals produced by a handful of companies is a very different challenge than eliminating emissions from almost every activity of modern life, from turning on a lamp to driving a car.



Another difference between global warming and ozone damage was the iconic nature of the ozone problem. It was an issue with an emblem, the stark, seasonal "hole" that was discovered in the protective atmospheric veil over Antarctica. *If a picture is worth a thousand words, a satellite image of*

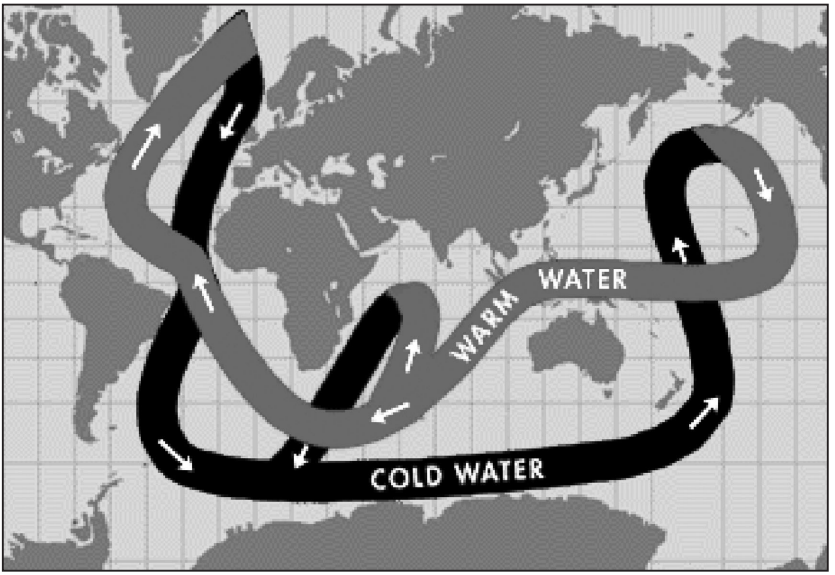
a giant purple bruise-like gap in the planet's radiation shield must be worth 10,000. Indeed, according to many surveys, the ozone hole still resonates in the popular imagination, incorrectly, as a cause of global warming simply because it is so memorable and has something to do with the changing atmosphere. The ozone hole also resonated with the public because it was directly linked with an issue that concerns everyone, their health, through the possible risk of increased rates of skin cancer.

The Ozone layer is a deep layer in the stratosphere, encircling the Earth that has large amounts of ozone in it. The layer shields the entire Earth from much of the harmful ultraviolet radiation that comes from the sun. Interestingly, it is also this ultraviolet radiation that forms the ozone in the first place. *Ozone is a special form of oxygen, made up of three oxygen atoms rather than the usual two oxygen atoms. It is usually forms when some type of radiation or electrical discharge separates the two atoms in an oxygen molecule (O2), which can then individually recombine with other oxygen molecules to form ozone (O3)*. The ozone layer becomes more widely appreciated when it was realized that certain chemicals mankind manufactures, called chlorofluorocarbons, find their way up into the stratosphere where, through a complex series of chemical reactions, they destroy some of the ozone.

As a result of this discovery, an international treaty was signed and the manufacture of these chemicals was stopped. The ozone layer has since begun to recover as a result of these efforts. *The stratospheric ozone, which protects us from the sun, is good. There is also ozone produced near the ground, from sunlight interacting with atmospheric pollution in cities that is bad.* It causes breathing problems for some people, and usually occurs in the summertime when the pollution over a city builds up during stagnant air conditions associated with high pressure areas. Still, human contributions to the greenhouse effect have remained a perennial issue. Specialized reporters have tracked the developments in climate science and the policy debated over the implications of that science.

Global Conveyer Belt

Invisible to us creatures, an underwater current, circles the globe with a force 16 times as strong as all the rivers combined. This deep water current is known as the Global Conveyor Belt and is driven by density are also known as thermohaline circulation because water density depends on its temperature (thermo) and salinity (haline). Density refers to an object's mass per unit volume, or how compact it is. A heavy, compact bowling ball is obviously going to be denser than an air-filled beach ball. With water,



colder and saltier equals denser. At the Earth's poles, when water freezes, the salt doesn't necessarily freeze with it, so a large volume of dense cold, salt water is left behind. *When this dense water sinks to the ocean floor, more water moves in to replace it, creating a current.* The new water also gets cold and sinks, continuing the cycle. Incredibly this process drives a current of water around the globe. *The Global Conveyer Belt begins with the cold water near the North Pole and heads south between South America and Africa toward Antarctica, partly directed by the landmasses it encounters.* In Antarctica it gets recharged with more cold water and then splits in two directions: one section heads to the Indian Ocean and the other to the Pacific Ocean. As the two sections near the equator, they warm up and rise to the surface in what you may remember as *"upwelling."** When they can't go any further, the two sections loop back to the South Atlantic Ocean and finally to the North Atlantic Ocean, where the cycle starts again.

The Global Conveyer Belt moves much more slowly than surface currents: a few centimeters per second, compared to tens or hundreds of centimeters per second. Scientists estimate that it takes one section of the belt 1,000

**Upwelling is the distribution of food in the oceans. Life in the oceans is not uniformly abundant. Because of the low ratio of surface water to deep water and the lack of seasonal nutrient enrichment, much of the open ocean is a watery desert, especially the tropical seas. The most productive areas are the coastal regions, areas of upwelling, and the Arctic and Antarctic oceans.*

years to complete one full circuit of the globe. However slow it is, though, it moves a vast amount of water, more than 100 times the flow of the Amazon River. The Global Conveyer Belt is crucial to the base of the world's food chain. As it transports water around the globe, it enriches carbon dioxide-poor, nutrient-depleted surface waters be carrying them through the ocean's deeper layers where those elements are abundant. The nutrients and carbon dioxide from the bottom layers that are distributed through the upper layers enable the growth of algae and seaweed that ultimately support all forms of life.

The belt also helps to regulate temperatures. It brings warmth to Europe otherwise they would be locked in a permanent Ice Age. A well-known density-driven current occurs where the saltier Mediterranean Sea empties into the Atlantic Ocean. During World War II, submarines used this current to enter and leave the Mediterranean without even turning on their engines. *Many scientists fear that global warming could affect the Global Conveyer Belt. If Global Warming leads to increased rain, as some believe it might, the added fresh water could decrease the salinity levels at the poles.* Melting ice, another possibility of global warming would also decrease salinity levels. Regardless of the means, the end scenario is the same. Warmer, less dense water won't be dense enough to sink, and the Global Conveyor Belt could stop and trigger Ice Age, having far-reaching and devastating consequences.

Pressure on Our Children

In public health Sector: Air pollution has reached an alarming proportion in all the major cities of the world, to the extent that very soon we all may have to resort to some kind of artificial respiration. All over the world millions of vehicles consume billions of gallons of fuel everyday releasing CO2 and other harmful chemicals into air besides fumes released by thousands of aircraft and millions of industries and power plants. Unclean water, along with poor sanitation, will kill 15 million people every year, most in developing countries like India, Brazil and China. Air pollution will kill another 5 million people. Global warming brought in waves of new diseases and air is almost not breathable in many places. Heavy metals, electronic waste and other contaminants will also cause widespread health problems and deaths.

In Food supply Sector: Manmade technologies that have endured for thousands of years are now getting rapidly corroded due to atmospheric pollution and resulting in acid rain. Ozone contained in automobile emissions, annually reduces crop yields significantly, sometimes as much as 20 to 30 percent of the rice and wheat production, as the harvest is affected as ozone is harmful at ground level. Many fruit bearing trees are affected,

yielding in less quantity and quality. Will there be enough food to go around? In 64 of 105 developing countries studied by the UN, Food and Agriculture Organization, the population has been growing faster than food supplies. Global warming has considerably cut down the food productivity. Population pressures have degraded some 2 billion hectares of arable land, an area the size of Canada and the US. If India protects its food security from Climate Change impacts, it could negotiate with greater confidence climate talks. China strengthened its food security … and now they negotiated at Copenhagen, from a positive strength. *Food security and agriculture were primary casualties of Climate Change. Already agriculture yields are down, due to the decline in bee population.* India produces less than half of China's 500 million tones of food-grains per year, leaving New Delhi more vulnerable than Beijing in the global negotiations in Copenhagen. *Just one degree rise in global temperatures would mean an annual loss of six million to seven million tones, or 10 per cent, of India's wheat production.* Indian Government has to put its energies into adapting to the impacts of Climate Change on agriculture, droughts and floods, sea-level rise and soil salinity. We must prepare to strengthen the climate resilience of our agriculture. All knowledge and technology is already available in India. Steps that need to be taken, including setting up virtual centers for climate research and risk management for each of the 127 distinct agro-climatic zones, which could cost about Rs. 100 crore. Seed banks should be set up to encourage diversification to climate-resilient bajra, jowar and tuber crops. Training needed to be given in starting farming below sea level.

In Freshwater Sector: Most of the fresh water lakes and rivers all over the world are highly polluted. The supply of freshwater is finite, but demand is soaring as population grows, and use per capita rises. By 2025, when world population is projected to be 8 billion, 48 countries containing 3 billion people will face shortages. Global warming is causing glaciers melt away faster. Once glaciers have melted away, more spark, is added to the problem. China and India are the most vulnerable targets of this problem. The water table in India has declined by an alarming 12 meters between the year 1995-2005 and shallow water is available now only at a depth of 58 meters. Scientists blamed it on the indiscriminate sinking of borewells and exploitation of river sand for constructions. Another problem is connecting all the rivers in India! It could be an ecological disaster for India as this could cause dangerous repercussions. Aral Sea in Russia is a good example of this impending disaster. Besides the Himalayan Glaciers are receding fast and by 2020 there may not be glaciers at all. The rivers will have no more water and all those known perennial rivers like Ganges, Yamuna, and Brahamaputra would become just seasonal rivers.

In Coastlines and Oceans Sector: Half of all coastal ecosystems are pressured by high population densities and urban development. Majority of human population lives along seashores. A tide of pollution is rising in the world's seas. Corals are dying along with plankton, due to the Global Warming. Shrimp production along the sub-continent's coasts left the land poisonous and doomed. Ocean fisheries are being exploited, and fish catches are down. Thousands of fish die due to the shortage of food supply in the oceans.

In Forests Sectors: Forests are very much essential to humans as they prevent soil erosion, absorb CO2 and release oxygen and keep the environment cool so that rains fall in season. Thus without forests, no life can survive on this planet. Man, by destroying forests at an alarming rate, is bringing his own doom. Nearly half of the world's original forest cover has been lost, and each year another 16 million hectares are cut, bulldozed, or burned. Global Warming left rainforests unproductive, its wildlife at the brink of extinction. Forests provide over US $400 billion to the world economy annually and are vital to maintaining healthy ecosystems. Yet, current demand for forest products may exceed the limit of sustainable consumption by 25 percent.

In Biodiversity Sector: The Earth's biological diversity is crucial to the continued vitality of agriculture and medicine, and perhaps even to life on Earth itself. Yet Global Warming and human activities are pushing many thousands of plant and animal species into extinction. Unfortunately, bees are dying at an unprecedented level: we depend on bees in the production of food through their pollination. Other sad news is, that frogs are dying out at a faster rate, leaving new diseases on the rise. Two of every three species is estimated to be in decline.

In Global Climate Change Sector: The Earth's surface is warming due to greenhouse gas emissions, largely from burning fossil fuels. If the global temperature rises as projected, sea levels would rise by several meters, causing widespread flooding. People living on the coastline, face with destruction and replacement. Global warming also could cause droughts and disrupt agriculture. Recorded climate variations have caused or contributed to ecological adaptations, migrations, catastrophes, and successes.

Global Population Sector: The first billion was reached a long time ago in the early years of the 19th century. The two billion mark was reached only in 1930. the three billion mark was reached in 1964 and four billion in 1974, while the six billion mark was reached in 2000. We have added three billion

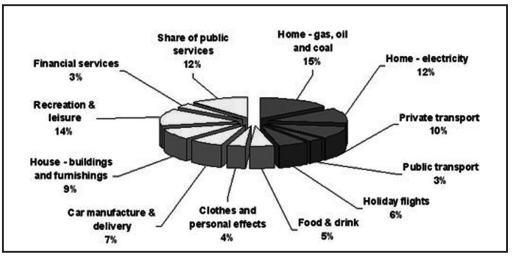
people in a matter of just 50 years. In India and China, for every 1 second, a baby is born with an estimated birth of 70,000 babies a day. Since Independence (1947) "another India" has been added in numbers! Now, one out of six people in the world is an Indian. The population growth rate in India is 2.50 percent annually. *The nation now adds 16 million people every year. An "entire population of Australian Continent" is added every year. By the year 2050, India will have two billion mouths to feed on this fragile planet.* At this rate of increase of population the planet Earth will not have enough food and other basic amenities for the teeming millions. No government can do anything about it. However, much they try to provide jobs, education, housing, clothing, food…, it looks like a futile task.

Carbon Footprint

Have you ever stopped to think about how your actions add up your life time? Just think of all the things we produce and consume! Imagine the food we eat, all the soda we drink, all the water we flush down the drain, all the clothing we buy, the amount of fuel we use, and all the things we do depend upon. Think about every day goods, we consume in our lives to show the impact each one of them makes on our world. It's the journey of a life time and as we take each step, we see how we leave our step or stamp upon the world. *This is our human footprint. With six billions of us on this planet, our presence is simply Earth-shaking.* As individuals we may think we have a little impact on the world around us. We may feel that our contribution to the world goes unnoticed. We'll be wrong. Each of us makes a contribution. *Each makes an impact and we each leaves a footprint.* And by examining everything we consume across the country, we've been able to calculate the effect, we each make on the world around us, from the miles we drive, the waste we throw away, the gasoline we use, the quantity, the numbers that reveal the impact that each of us makes per person, her life time. As individually we are different but as statistically we are remarkably the same. Imagine what we eat and what we drink and how we travel, and what we buy and consume during each phase our lives? Because at no time in our history, have we consumed as much as we are now.

Recently, the Wildlife Conservation Society has mapped our impact on the planet. They call this as *"the human footprint",* and found that just 17% of the world's land surface is unaffected by us. These untouched areas they call it *"the last of the wild."* This means we directly influence 83% of the world's land. Remember it takes 500 kg of coal to produce one unit of electricity and we consume billions of units of electricity. Each person can measure his consumption of energy in electrical units and figure out how

much coal we use daily. One refrigerator consumes two units of electricity. A carbon footprint is a measure of the impact our activities have on the environment, and in particular climate change. It relates to the amount of greenhouse gases produced in our day-to-day lives burning fossil fuels for electricity, heating and transportation etc. *The carbon footprint is a measurement of all greenhouse gases we individually produce and has units of tones (or kg) of carbon dioxide equivalent.*



The pie chart here shows the main elements which make up the total of a typical person's Carbon Footprint in the developed world. *A carbon footprint is made up of the sum of two parts, the primary footprint (shown at the right side of the slices of the pie chart) and the secondary footprint (shown at the left slices).*

1. *The primary footprint* is a measure of our direct emissions of CO2 from the burning of fossil fuels including domestic energy consumption and transportation (e.g. car and plane). We have direct control of these. Things to consider: Minimize motor cycle, car and plane travel. How long is your shower or bath; How warm or cool do you keep your home? How long you stay inside the house? How many lights and fans you use? How long you watch television? How much energy you use for cooking?

2. *The secondary footprint* is a measure of the indirect CO2 emissions from the whole lifecycle of products we use: those associated with their manufacture and eventual breakdown. To put it very simply: the more we buy the more emissions will be caused on our behalf. Things to consider: Do you buy more stuff than you really need? Do you reuse, recycle and compost? Do you purchase items with a lot of packaging or bulk when possible?

Calculate how much gallons of gasoline you pumped last year into your motorbikes, cars and any other internal combustion engines in your life. Count the number of "disposable" plastic bottles, or plastic bags or grocery bags you and your family discarded. Figure out how many cubic feet of natural gas, gallons of heating oil, or kilowatts of electricity your house consumes in a year in heating, cooling, and lighting. Now multiply this for six billions of people across the globe. The amount of resources being

consumed will expand as the human population continues to grow. Neither gasoline nor plastics nor even much electricity would exist had hydrocarbons not been extracted from Earth as crude oil or coal. After being deposited in the days of the dinosaurs, that oil and coal resided underground for millions of years. Now, in scarcely a century, vast amounts of it have been removed from the ground and used to power our growing industrial society. The waste products are being released into the atmosphere, in part greenhouse gases such as carbon dioxide and methane. Today the concentration of atmospheric carbon dioxide is higher than it has been in at least 400,000 years, perhaps even for the entire Holocene era.

Although some individuals were concerned about this trend as far back as the 1960s, scientific knowledge was still uncertain enough over succeeding decades that there was room for disagreement about the significance of the data. But since the 1990s, many signs worldwide have been unmistakable: the rate shrinkage of both the Greenland icecap and Antarctic ice: the melting of glaciers in Alaska, the Tyrol, the Himalayas, and Kilimanjaro and better understanding of the connection between temperature and atmospheric carbon dioxide. With the publication of scientific papers and reports by the Intergovernmental Panel on Climate Change (IPCC), the consensus is clear: *temperatures are rising, and human activities are having an impact on the process.* Every individual is responsible for this critical situation hence it is necessary that every individual checks his own carbon footprint.

Apocalypse – Earth is Ill

1. *Future Scenario:* It's 2097, Mumbai, once a bustling island metropolis is largely underwater. Huge seismic blasts have long split Gujarat in half: Orissa, Andhra Pradesh and Tamil Nadu are reeling under the battering deluge of Indian Ocean Typhoons: defenseless people flee to the nearest dry patch of land. But with the Antarctic and Arctic icebergs all melted by Greenhouse Gases, there is nowhere to go. From Singapore to Sumatra, Southeast Asia has sunk into the sea. Impossible? Definitely not! Well I have a very bad news for you. Many experts around the world tell us how humanity's end might come about.

2. *Climate Change:* What's the situation? Climate Change takes effect by 2020, with the sea level rising to swamp coastal areas. By 2040, the Arctic ice-cap has fully melted and rotting vegetation releases huge quantities of Methane gas. By 2107, Earth has a climate like Venus. A few thousands survive. What else? We have got just seven years before Climate Change

becomes Irreversible. That means, whatever we do, we can't fix the problem. Planet Earth is doomed. It'll happen, as fossil fuels are so lucrative, the amount of oil left is worth trillions; any legislation that outlaws its consumption will be met with serious opposition. Disaster is waiting just 100 years from now.

3. *Viral Pandemic:* New diseases on the rise, like AIDS, Bird Flu, Swine Fever, Ebola etc. What is the situation? Dr. Alan Hay of the World Influenza Center, says "Bird Flu's calmed down, but we don't know what's smoldering in some part of the world we can't keep our eye on." In three pandemics between 1918 and 1916, the Flu killed 59 million. What else? If a Flu pandemic hits, there'll be vaccines for just nine percent of the world's population and it could strike any day. More were killed in the 1918, outbreak of Spanish Flu than in the World War I and World War II combined.

4. *Ice Age:* What is the present situation? In 2004, the Gulf Stream, the warm water also known as Atlantic Current that keeps our climate temperate, stopped for 10 days. If it stops for good, temperatures could fall by 10 degrees Celsius, prompting famine in South Asia and plunging Europe into a mini Ice Age. What else? Dr. Lloyd Kegwin, a US scientist at the Woods Hole Oceanographer Institution, calls the 2004 shutdown "the most abrupt change in the whole climate record" adding "suppose it hadn't started again for 30 or 60 days, at which stage do you call the Prime Minister and say, "Let's start stockpiling food and fuel." Homo sapiens will adapt and survive, but millions of species of animals and plants would perish.

5. *Nuclear War:* What is the situation? A 20 megaton explosion from a single warhead will kill millions and there are over 12,000 warheads on the planet. Nuclear weapons states are US, UK, Russia, France, China, India, Pakistan, North Korea, Iran and Israel. Dr. Paul Rogers from Bradford University has formulated a worst-case scenario involving one nuclear programme failing, the other country then shows off its hidden underground facilities, a superpower intervenes with the massive air assault of its own. Major cities would be flattened in response. In future, war will be waged for the natural resources still left in some countries. The Cold War was incredibly dangerous and while we've backed away now, we could easily go there again.

6. *Asteroid Strike:* In July 2006, a mountain-sized asteroid sailed past the Earth at a distance of 4, 32, 709 km. Right now there are 127 asteroids

half a mile or bigger in diameter thought to be on a 1, 00, 000 mph collision course with our planet. Such an impact would cause instant carnage over a massive area, but its aftermath would be more terrifying. Scientists at Arizona University gauge a "deep impact" to have a explosive equivalent of one million megatons of TNT. The dust ejected would darken the skies in a matter of days. Crops would fail and over one billion lives would be lost due to global starvation. Worryingly, there is nothing we can do about it. Most scientists feel that a possible impact might happen on February 1st, 2060.

7. *Rise of the Machines:* In 1979, Robert Williams in Michigan became the first human to be killed by a robot. Many scientists fear the potential dangers of robots that increasingly "think" for themselves. The robotic guards patrolling the border of South and North Korea are a big worry. The killing machines are armed with machine guns and scanning video cameras, which can differentiate between people and trees. In many countries, armed robots are coming definitely. Good news is, if robots ever began fighting back, we'd crush them pretty quickly. Rise of modern machines like, airplanes, rockets, and modern technology and development lead humanity on a disaster course.

8. *Super Volcano:* Just a handful of these huge underground volcanic cauldrons exist in Yellowstone National Park. When one blows, clouds of ash plunge on the planet into a long, dark winter. An eruption at Lake Toba, Indonesia, 71,500 years ago, wiped out around 60% of the life forms. Yellowstone last erupted 64,000 years ago. And now, with a highly pressurized magma bubble forming under the park. Scientists are certain that it'll blow at some point. It's coming very soon. Comforting new is that we'd survive this. We'd build shelters and hoard food before the winter struck.

9. *Biological Warfare:* sending anthrax in the past seems to be the extent of today's threat. Jessica Stern, from the US Council on Foreign Relations explains; "Large-scale biological terrorism is likely to be found among terrorist group." Russia has worked on bio-weapons for decades; if the research fell into the hands of terrorists, the results could be horrifying. A British study found that a decline in public vaccinations means diseases such as smallpox will spread exponentially if unleashed. We need to monitor the situation very closely.

10. *Earth is Ill:* Man has declared war on creation. Earth is in advanced stage of exhaustion, causing environmental imbalance. Devastation of Earth

and plundering its wealth man has left Earth in chaos and disequilibrium. There is absolutely no respect for present and future life. State of the mind is connected with sate of mind. *Earth and its life forms are sick, leading to stress, depression and other psychological problems. Land and worker both are perilously wounded and bleeding*. Our attitude is, subjugate nature, press it into delivering secrets like atomic energy, nanotechnology and cloning, tie it to our need and service, making a monopoly of it and make it a slave. Humans are result of a long biological process. We are shattering the great wisdom of building by nature for 15 billion years. We never forget that! Humans commit not only homicide, ethnocide but biocide and genocide as well. Global Warming has caused damage to Lithosphere, Atmosphere, Hydrosphere and Biosphere. One species, every hour is disappearing from the planet. We build a kind of civilization of energy devouring and systematically destroy all ecosystems along with its biodiversity.

One Brave Woman's Crusade from India in Copenhagen

Sunderbans is one of the most ecologically vulnerable zones in India. Global warming is wrecking the delicate ecology of this estuarine region which stretches from West Bengal to neighboring Bengladesh. The Intergovernmental Panel on climate change (IPCC) has predicted that by the end of this century the sea level could rise by 0.8 meters due to Global Warming. Studies indicate that even an increase of 0.6 meters could totally submerge the Sunderbans. The area is an alluvial archipelago, with creeks, streams and rivers meandering around the largest mangrove forest in the world. *It's also home to the endangered Royal Bengal Tiger.* The villagers living in the islands here are already facing the brunt of rising sea levels. Rivers breach embankments regularly, while cyclones and floods have become a way of life. Incoming saline water has ruined agriculture, mainly paddy cultivation, and is threatening the conservation of the mangrove forest.

Some islands are already submerged, leaving about 10,000 villages as climate refugees. They are not perpetrators of carbon emission or global warming, but they are primary victims by virtue of our geographical location. Conservation and protection of this area should be an international responsibility. Sunderbans, with its mangrove forests* is a carbon sink for Indian subcontinent, absorbing carbon emission. *Studies*

**Mangrove, common name applied to several kinds of tropical flowering plants that are members of three different families. Mangroves are trees or shrubs that have the common trait of growing in shallow and muddy salt water or brackish waters, especially along quiet shorelines and in estuaries.*

indicate that sea surface temperature is rising in the Bay of Bengal and the north Indian Ocean Basin. Over 120 years, the region has been hit by severe cyclones more frequently. The cyclones have made survival extremely difficult for the villages in Sunderbans. Homes, cattle and standing crops get washed away, income generation comes to a standstill, there is nothing to eat, and there is no drinking water as well.

The case was taken to the U.N Summit on Climate Change by one brave Indian woman Tanushree from Sunderban area. While Tanushree speaks her mind in Copenhagen on her situation, along with a demand that the developed world and industrial belts reduce their carbon emissions so that places like Sunderbans can be protected, the West Bengal Government has made a case for the delta area, in support of people like Tanushree, through a charter of demands that the official Indian delegation is presenting at Copenhagen. The demands include financial assistance, advanced scientific technology transfer to mitigate the damage caused by cyclones, measures and projects to safeguard the mangrove forest and the wildlife there. If Copenhagen is to have meaning, it is vital that the world listens to the insight provided by Tanushree and others like her, and takes steps to address their concerns.

Some of the Little Things we can do!



1. *At Home:* By saving energy at home, while traveling and at work, we can reduce the impacts of energy production and use on the environment, and reduce the amounts of greenhouse gases that are released into the atmosphere. Using energy wisely at home can help to reduce the impacts of energy use on our climate through Global Warming. Choose energy efficient appliances. Switch to energy efficient light bulbs. Turn the lights off in rooms that aren't being used. Choose low energy rating appliances for cooking, washing and refrigerating. Turn of the appliances at the power point or pull away the plug from the outlet. Install photo-voltaic panels. Have a solar water heater. Have insulation. Save water and electrical energy. Do not use machines to wash and dry your clothes. Don't use serial bulbs for any decorations like birthday celebrations or any festivities. Get out of the house during the day time. Cook less and reduce heat emissions. Make a habit of enjoying

nature thereby cutting down your television time. Reduce using fire crackers during Deepavali. Switch to green power, solar panels, wind power, hydro power. Save rain water.

2. *Travel:* Get around less. Best travel is walking, bicycling. Use public transport like bus, train. Keep full air in your tires. Switch to fuel efficient cars like, hybrid and electric. Don't forget car pooling. Reduce emissions from cars, use catalytic converters. Use alternative fuel like bio-diesel and biogas. Telecommute from home. Consume less and conserve more. Single representation for cultural celebration like wedding, birthdays, anniversaries and festivals, instead of whole family attending. Flying consumes enormous amount of energy and reduce your air travel

3. *Doing Something:* Go for renewable energy like wind energy, solar energy, geothermal energy, hydro energy … etc. Pre-cycle, Recycle cans, glass. Do not burn the trash and leaves, make mulch. To reduce methane emissions, eat less meat and fish. Reduce shopping and use a cloth bag, say no to plastics. Cancel all your junk mail. Have no more than one child. Buy fresh food, not frozen. Buy vegetables and groceries from a local shop. Have a habit of going to farmer's market. Use recycled paper and save forests. Advice religious leaders and political leaders not to use extravagant decorations during the festivals or campaigning, reducing serial bulbs, illuminations and sound horns who contribute to noise pollution.

4. *Be a Catalyst:* Talk about Global Warming in your school, workplace and market. Encourage friends to spread the message of stopping Global Warming. Be strong and force yourself to do something good for environment. Select politicians who care for environment. Learn more about Global warming and Climate Change from television programmes or libraries. Persuade religious leaders to have their Sunday celebrations, outside the church and use acoustic musical instruments, saving electricity and noise pollution.

5. *Moving Toward Sustainable Development:* Sustainable Development is defined as a process of change in which, the exploitation of natural resources, the orientation of investments, and the paths of technological and institutional changes are in accordance with current and future needs. Unfortunately, no matter which terms are tagged into such development, whether self-sustaining or self-generating, it never gets away from its economic origins, namely, rising productivity, accumulation and technological innovation.

6. *New Ethics:* We need new ethics? Ethics are moral standards that guide right and wrong conduct. Ethics are framed in terms of rights and duties. Being ethical demands a sense of limitation in human desires. It demands the generational solidarity, respecting future folks not yet born. Ethics demands acknowledging other beings have relative autonomy; they also have right to exist and coexist with us and with other beings, since they have existed for millions of years before us. All life has right to present and future. Do people have a moral duty to conserve resources for future generations? Do animals have rights to be protected from extinction? What if cutting trees will later bring death to others as healthy land turns to desert. Differences over ecological ethics often can be reduced to the question of whether humans have greater rights than other living things? A thing is right when it tends to preserve the integrity, stability and beauty of the biotic and abiotic community, it is wrong when it tends to do otherwise. New spirituality is a joyous pursuit of life in a reverent and gentle relationship with all other beings.

7. *Eco Protection Force (EPF):* Every village can start Eco-Protection Group (or Force) that can persuade younger kids to take charge on the persisting eco-environmental problems in the village. The group can also cooperate with the projects supported by local governmental and NGO groups. The group should be aware of their local ecosystems like, lakes, ponds, rainforests, marsh lands, woodlands and wetlands, local biodiversity such as bees, frogs, ants, fish, snakes, monkeys, and local plants, and local environmental problems such as deforestation, erosion, water pollution and pollution of air. The group also can play a major role in preserving and conserving the local endemic species of animals, plants and their environment, providing a healthy planet for all.

8. *Last but not the least:* Keep population down. Plant trees, especially on your birthday. Grow your own vegetable garden. Talk very often about environment. Start environmental group in your village, street or area.

Renewable Energy or Green Energy

Renewable energy sources are those which can be replaced or can be replaced or can be used indefinitely, without fear of running out. They are generally more sustainable than non-renewable energy sources, such as fossil fuels, and tend to have a much lesser impact on the environment (many of renewable energy do not result in carbon dioxide production). The following are the major renewable energy sources:

1. *Solar Power:* Solar Power uses the sun's energy. Three types of technologies can currently harness sunlight energy, photo-voltaic cells, use photoreceptive cells to generate electricity from sun light energy; Solar-thermal, uses solar panels to recover the heat from the solar radiation; Solar-air heating, mainly used to heat incoming fresh air for ventilating a house.

2. *Wind Power:* Wind Power uses air movements (or wind) to turn turbines to generate electricity. Turbines can be built on a small scale (for private electricity generation) or large scale (wind farms feeding in to the national power grid). This will be feasible only in areas where there is considerable wind round the year.

3. *Geothermal Energy:* Geothermal Energy, from below the Earth's surface to generate power. Subsurface temperatures vary throughout the world, but generally as we go deeper into the Earth's crest the temperatures rises. Ground source heat pumps can access this source to provide heating. Scandinavian countries are the big fans of this source of energy.

4. *Hydro-electric Power:* Uses small or large scale hydro electric generators in rivers and streams to produce electricity. Construction of a dam is necessary for the production of power through out the year.

5. *Biomass:* Although biomass material is not strictly "infinite" as a resource, it is considered as a renewable energy source because it can be placed at the same rate at which it is used. Biomass power generation generally uses crops that grow quickly and can be easily used and replanted on a rotation system (farm wastes such as slurry can also be dried and used). Though using biomass to produce energy releases carbon dioxide into the atmosphere, the theory is that the same amount of carbon dioxide will be removed from the atmosphere by replanting the crop.

6. *Marine Power:* It uses the unlimited sea's energy (either wave action or tidal flow) to generate electricity.

7. *Hydrogen Energy:* this is a new technology that is generally not yet widely available, but for which there are high hopes in the future. Hydrogen fuel cells are used to produce water, electricity and heat by combining hydrogen with oxygen. A fuel cell is an electrochemical energy conversion device that converts hydrogen and oxygen into water, producing electricity and heat in the process. Hydrogen fuel cell cars are already available in the market.

Important International Conventions on GW

In order to deal with regional and global environmental changes, it is necessary to develop new scientific and political mechanisms that could operate at the international level. An international convention is intended to build an international consensus that a particular ecological, wildlife or pollution problem exists. The convention is worded in general terms to allow all countries to "sign on" recognizing that the problem exists and that there is some need for concern and multinational action. The conventions could include agreement to negotiate protocols on specific control or other management actions needed to resolve the problem being addressed. Some of the well known conventions are:

1. *Ramsar Convention:* It was a convention on wetlands of international importance especially, protecting waterfowl habitats. In 1971 in Ramsar, Iran, "the International Conference on Preservation of Marshes and Waterfowl" was held, the objectives of which were to recognize the importance of marshes for animals and plants and the ecological system as a whole and to promote the conservation of marshes. Most of the waterfowl that inhabit marshes or swamps are migratory birds. International cooperation to preserve the marshlands has been regarded as necessary in order to protect these migratory birds.

2. *Vienna Convention* for the Protection of the Ozone Layer: The ozone layer around the globe absorbs most of the ultra violet rays (UV-B) that harm creatures, but CFCs and some other substances destroy the ozone layer. If the ozone layer is depleted, the amount of UV rays which reaches the ground will increase and in effect human body or ecological balance will be damaged. People became keenly aware of this mechanism and Vienna Convention for the Protection of the Ozone Layer in 1985, and Montreal Protocol on Substances that Deplete the Ozone Layer in 1987 were adopted.

3. *Basel Convention* (Switzerland) on Disposal of Hazardous Wastes: In 1980s, some African States suffered from environmental pollution caused by wastes moved from developed European States. To deal with these problems, the Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal, which aims to properly administer the transboundary movements of wastes, was adopted in Basel, Switzerland in March 1989.

4. *Earth Summit*-Conventions on Climate Change and Biological Diversity: In 1992, more than 100 heads of state met in Rio de Janeiro, Brazil for the first international Earth Summit convened to address urgent problems of environmental protection and socioeconomic development. The assembled leaders signed the Convention on Climate Change and the Convention on Biological Diversity, endorsed the Rio Declaration and the Forest Principles, and adopted Agenda 21* for achieving sustainable development in the 21st century

Important International Protocols on GW

Once a convention has been established, countries can then begin to negotiate specific control actions. The protocol mechanisms allow large problems to be broken down into more achievable steps. The protocol mechanism allows for a wide range of actions to be agreed upon including the control of emissions, the control of production, trade in substances of concern, and financial aid mechanisms. It would not be possible to negotiate all of these items at one time frame but the protocol process allows for substantial progress to be made in spite of great complexities of the overall actions being taken.

1. *Montreal Protocol (Canada):* The Montreal Protocol on Substances that Deplete the Ozone Layer is a landmark international agreement designed to protect the stratospheric ozone layer. The treaty was originally signed in 1987 and substantially amended in 1990 and 1992. The Montreal Protocol stipulates that the production and consumption of compounds that deplete ozone in the stratosphere, viz CFCs, halons, carbon tetrachloride, and methyl chloroform are to be phased out by 2000. In India an Ozone Cell in Ministry of Environment and Forests came into existence with effect from 1 April, 1993. It deals with all works relating to the Vienna Convention for the Protection of Ozone Layer and the Montreal Protocol for phasing out Ozone Depleting Substances (OSD).

2. *Kyoto Protocol (Japan):* On December 11, 1997 representatives from 159 countries attended a World Climate Conference at Kyoto in Japan, and signed a historic calling for mandatory cuts in emission of Greenhouse Gases by industrialized countries in the next millennium to save the planet Earth from potentially devastating Global Warming. The accord, which emanated after ten days of deliberations, was adopted in the

**Agends 21 addresses number of ecological problems such as combating poverty, combating deforestation, protection of the atmosphere, conservation of biological diversity … etc.*

form of *"Kyoto protocol"* that requires the industrialized countries as a whole to reduce their average annual emissions of six Greenhouse Gases like CO2, methane, chloroflurocarbons etc. by 5.2 percent from the 1990 levels between the years 2008 and 2012. This accord, which strengthened the 1992 Convention on Climate Change by setting legally binding limits to industrialized countries' emissions of Greenhouse Gases, expected the governments to take steps such as converting coal-fired power plants to gas, encouraging development of more fuel-efficient automobiles. *As strong opposition was encountered from countries like India, China and other developing countries, a paragraph calling for voluntary participation of developing countries in binding targets was deleted from the final draft of the protocol.* These countries were firm in their stand that it was for the major polluters like the USA and other industrialized countries to cut down on their heat-trapping emissions and help developing countries with advanced technologies and funds to promote clean industries. Its purpose is to stabilize Greenhouse Gas concentrations in the atmosphere at a level that would prevent Global Warming, thereby, reducing dangerous human-induced interference with the climate system. Following strong opposition from countries like India and China, USA has committed itself to cut gas emissions by 7 percent, European Union by 8 percent and Japan by 6 percent by the year 2012.

3. *Copenhagen Accord, December, 2009 (Denmark)*

   (Please refer to the beginning of this book)

Finally…

Humans need animals and plants to sustain the very essence of human life, but animals and plants have no need of us. We are insatiable, our appetites cause us to consume with abandonment, driving so many species to the absolute edge of extinction. Man can do homicide, biocide, ecocide and even theocide. Sometimes, man is the most dangerous animal. This is absolutely true. These animals and plants perhaps, need man's absence to survive, not our help. How can we stop? Find the stillness, find the quiet. Discover some small miracle in nature and begin to focus all of your energy on appreciating one small process. *Do not interfere, step aside, trust in nature and life will find a way!* The last 600 years of earth's history provides a stark warning on the impact of climate change. Savage temperatures, melting ice sheets, devastating flooding, mass extinctions, escalating levels of Greenhouse Gases, once again threaten the Global Warming. Scientists believe that it is already destroying glaciers, melting Polar Ice caps thawing permafrost. If this trend continues, we could end up with the run away

Global Warming (uncontrollable). Unlike the past, today's cause for Global Warming is human. Our climate is unstable, swinging from extreme cold to extreme heat. *Left unchecked, it is a potential death sentence to humans and all life.*

If we don't slow down carbon dioxide emissions, if we don't learn from the past we'll doom subsequent generations to an uncertain future. *Our destiny lies in our own hands. Earth already had a Global Warning.* Our Earth is a special place, where millions of species coexist, each one an integral part of our planet's fabric. What we do will determine their fate and ours. We can undo the damage we have caused. The Earth we inherited can again be a garden, beautiful and bountiful. Everything we need for life is here. Shimmering blue, it is our haven, in a vast black sea of space. *This is our home; it will be home to our children and to their great grandchildren.* It'll be home to all the nations of the world. It'll be home to the people of America and Russia. It'll be home to Israelis and Arabs. It'll be home to the people of India and Pakistan. It'll be home to the Asians, Africans and Europeans. It'll be home to the species in Arctic and Antarctica. It'll be home to the aboriginal people and the farmers of the Australian outback. It'll be home to all of us. *And it is our only home!*

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