Infochange Quick Reads

Hotting Up!

The causes and consequences of climate change

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Contents

Cover: Ice sculptures, handcrafted by Brazilian artist Nele Azevedo, melt on the steps of Berlin's Concert Hall. The event was sponsored by WWF to attract attention to the earth's melting ice caps

The science and politics of climate change

by Aditi Sen

It rained all day. It rained like it had never rained before. Trains stopped, cars were submerged, several died, and hundreds and thousands of people waded through the streets of Mumbai. The city that never stands still came to a grinding halt. It almost sounds like a scene from a sci-fi film, but in fact it is scarily real. Mumbai witnessed the heaviest rains ever recorded in India, in July 2005.

In 2008, heavy rains caused the river Kosi in the state of Bihar to break its embankments destroying millions of homes and acres of crops. In 2009, flooding, induced by heavy rains, left approximately 2.5 million people homeless and more than 250 dead in the states of Andhra Pradesh and Karnataka. This deluge occurred just two months after the Indian government announced that it would begin importing food to make up for shortages caused by a drought that affected 700 million people throughout the country.

Around the world, extreme weather conditions have wrought havoc. In 2008, tropical cyclone Nargis left 138,366 people dead or missing in Myanmar. Three typhoons that struck the Philippines in September and October killed 963 people and affected 10 million people across the country.

Though floods, drought, storms and other extreme weather conditions have always been a reality, they have been rare

occurrences in nature's largely gentle rhythm. Now, because of human-induced climate change, that gentle rhythm is breaking up. Overwhelming scientific evidence indicates that climate change is real — the world is warming up and climate systems are changing.

The science of climate change

In February 2006, scientists found that the vast ice sheets over Greenland are melting far faster than previously believed, with twice as much ice going into the sea as five years ago. What happens in the remote Arctic may seem far removed from what happens in the tropics of India, but the implications for climate change could be dramatic.

If the Greenland ice sheet melted completely, it would raise global sea levels by about 7 m. The oceans play a pivotal role in the climate system. Changes in ocean circulation or water properties can disrupt this hydrological cycle on a global scale, causing flooding and long-term drought in various regions. The El Nino phenomenon is but a hint of how oceanic changes can dramatically affect where and how much precipitation falls throughout the planet.

Findings from the Intergovernmental Panel on Climate Change (IPCC), which was established by the World Meteorological Organisation (WMO) and the United Nations Environment Programme (UNEP), show that the global average surface temperature increased by 0.6 degrees Celsius over the course of the 20th century. Scientists have recorded the 1990s as the hottest decade in the world since the Industrial Revolution began. As a result of global warming, the extent of snow has decreased by about 10% since the 1960s, while mountain glaciers have retreated rapidly. Global average sea levels rose by 10 to 20 cm during the 20th century, and the amount of heat stored in the oceans has measurably increased since observations began in the 1950s.


Raaj Dayal

Rainfall patterns have also changed in the northern hemisphere, with generally more rain at high latitudes and near the equator, and less in the sub-tropics. Warm El Nino (which causes drought and flooding) episodes have been more frequent, persistent and intense since the mid-1970s than in the previous 100 years.

One of the most important features of the IPCC Third and Fourth Assessment Reports is that they strengthen the conclusion that human activity is driving the observed climate change. The atmospheric concentration of CO2 is now 31% higher than it was in 1750, the highest it has been for the past 20 million years. And it's accelerating. About three-quarters of the increase is from burning fossil fuels, while the rest is mostly due to deforestation. Atmospheric methane has increased even more dramatically, by 151% since 1750. Nitrous oxide and synthetic greenhouse gases (halocarbons) also continue to rise.

Much of this discussion sounds like technical babble to a lot of people. But while it may seem like something esoteric that only scientists in white coats need to contend with, its impact on ecosystems, economies and local weather patterns is real. Throughout the 10,000-year history of human civilisation, weather patterns have remained relatively constant, but the frequency of extreme weather events has increased steadily over the 20th century. The number of weather-related disasters during the 1990s was four times that of the 1950s, and cost 14 times as much in economic losses. These trends confirm the predictions of computer models: As the atmosphere warms, the climate will not only become hotter but much more unstable. Extreme events are likely to increase, and drought and floods will become more common in a number of regions. Many alpine glaciers will disappear, snow cover and the extent of sea ice will decrease, and sea levels are projected to rise.

Climate change also raises other important concerns: How will our health be affected by

global warming; how will agricultural practices change; how will wildlife cope?

The impact of climate change

Climate change is an issue that threatens the entire globe. However, it disproportionately affects developing countries and it will be most disruptive to the poorest of the poor — those who have the least resources and the least capacity to cope. Already there are signs that Africa's favourite crop, maize, is struggling to survive the vagaries of a changing climate. It might even have to be dropped in favour of more traditional crops like sorghum and cassava. So says the first continent-wide study of how crop yields change with major oscillations in global climate such as El Nino and the North Atlantic Oscillation. The study concludes that 20 million Africans will go hungry in the years ahead when the climate is not in their favour (proceedings of the National Academy of Sciences, Vol 103, p 3,049).

With its huge and growing population, a long, densely populated and low-lying coastline, and an economy that is closely tied to its natural resource base, climate change could have potentially devastating impacts on India. The average temperature is predicted to rise by 2-4 degrees Celsius with a doubling in CO2 concentrations. With climate change, rainfall patterns are also set to change. Western and central areas could have up to 15 more dry days each year, while in contrast the north and northeast are predicted to have 5-10 more days of rain annually. In other words, dry areas will get drier and wet areas wetter. In an almost sadistic twist of events, climate change will make India more susceptible to both drought and flooding. IPCC findings indicate that there will be an increase in the frequency of heavy rainfall events in South and South East Asia. Studies have also shown that the impact of snow melting in the high Himalayas will lead to flood disasters in Himalayan catchments.

The most dramatic effects of climate change will manifest in agriculture and forestry.

These changes could, in turn, have profound implications for livelihoods and food security. Agriculture and allied activities continue to be fundamentally dependent on the weather in India. IPCC and other studies suggest that there will be a decrease in yields, though the percentage of decrease varies across different scenarios. Higher temperatures reduce the total duration of a crop cycle by inducing early flowering; the shorter the crop cycle, the lower the yield per unit area.

Climate change is also likely to have a substantial impact on forestry. Climate is an important determinant of the geographical distribution, composition and productivity of forests. Therefore, changes in climate could alter the configuration and productivity of forest ecosystems. In a case study of Kerala (Achanta A and Kanetkar R, 1996), results indicate that because of climate change soil moisture is likely to decline, in turn reducing teak productivity from 5.40 m3/ha to 5.07 m3/ha. The study also shows that the productivity of moist deciduous forests could decline from 1.8 m3/ha to 1.5 m3/ha. Changes in forestry could potentially result in the extinction of some species and loss of biodiversity.

The impact on water resources is also expected to be severe. India is considered rich in terms of annual rainfall, but these resources are unevenly distributed, causing spatial and temporal shortages across regions. Climate change and variability are likely to worsen the problem of water scarcity faced by people in many parts of India. Under a changed climatic regime, the combined effects of lower rainfall and more evaporation will have dire consequences. Both these will lead to less runoff, substantially changing the availability of freshwater in the watersheds. Also, potential changes in temperature and precipitation could have a dramatic impact on soil moisture and aridity levels of hydrological zones. With changes in flows, annual runoff and groundwater recharge, water available for use will further decrease.

Most major river basins across the country are likely to become considerably drier. One assessment (Hadley Centre Model Simulations) indicates that by the year 2050, the average annual runoff in the river Brahmaputra will decline by 14%.

Sea level rise associated with climate change threatens India's low-lying and densely populated coastline that extends about 7,500 km. The UNEP identifies India as among the 27 countries most vulnerable to sea level rise. Most of the coastal regions are agriculturally fertile, with paddy fields that are extremely vulnerable to inundation and salinity. Coastal infrastructure, tourist activities, and onshore oil exploration are also at risk. The impact of any increase in the frequency and intensity of extreme events, such as storm surges, could be disproportionately large, not just in developed coastal areas but also in low-income rural areas. A case study of Orissa and West Bengal (IPCC, 1992) estimates that in the absence of protection, a one-metre rise in sea level would inundate 1,700 km of predominantly prime agricultural land. The economic implications of such a rise could be huge — ranging from Rs 2,287 billion in the case of Mumbai, to Rs 3.6 billion in the case of Balasore (TERI, 1996).

Climate change has other impacts that may seem less obvious at first, but have serious socio-economic consequences. For instance, some reports predict that India will be more prone to malaria, as changing weather patterns result in potential breeding grounds for malarial mosquitoes at higher altitudes. Adverse weather patterns will also affect large-scale infrastructure projects that are designed to have a long lifespan. The recently constructed Konkan railway, a major infrastructure project laid through the high rainfall mountain region in mid-western India, is one example of a high-value long-life asset vulnerable to the impact of climatic extremes.

The politics of climate change

The science of climate change is not 100%

accurate, and different models and simulations suggest different scenarios. But there are certain facts that all scientists are unanimous about — that the earth is getting warmer, that climate systems are changing, and that we are already contending with the impacts of climate change. What is also clear is that human activity is responsible for this. But, despite such unanimous and compelling evidence on global warming the response to this threat has been sluggish and mired in controversy.

Climate change negotiations started over two decades ago. In 1992, a global Framework Convention on Climate Change was signed under the auspices of the United Nations (UNFCCC). The framework recognised that industrialised nations needed to take the first step in reducing emissions because not only were they more responsible for the problem, they also had greater capacity and resources to take corrective action as they had already reached a high level of economic development. The Kyoto Protocol was drawn up in 1997 to implement the UNFCCC. According to the protocol, industrialised nations that sign the treaty are legally bound to reduce worldwide emissions of six greenhouse gases (collectively) by an average of 5.2% below their 1990 levels, by 2008-2012.

However it took seven years for the protocol to finally become international law. For it to come fully into force, the pact had to be ratified by countries accounting for at least 55% of 1990 carbon dioxide emissions. With countries like the US and Australia unwilling to come on board, the key to ratification came when Russia, which accounted for 17% of 1990 emissions, signed the agreement on November 5, 2004. Under its new president Barack Obama, the US is showing signs of being more amenable to accepting emissions caps.

Some countries claim to have met their 1997 Kyoto targets. The EU-15 promised as

a whole to reduce emissions of six greenhouse gases by 8%, by a 2008-2012 timeframe, compared to 1990 levels, and overall has achieved a total reduction of more than 13% below the base year, according to the Copenhagen-based European Environmental Agency. However, individual members such as Italy, Spain, Austria and Denmark are off target. Canada, one of the first countries to sign up, has increased emissions by 20% since 1990 and has no clear plan to reach its target. Japan is also uncertain about how it will reach its 6% target by 2012.

One of the things that people were excited about as a possible solution and a potential win-win situation for both developed and developing countries was the Clean Development Mechanism (CDM). The Kyoto Protocol included provisions for two so-called "flexible mechanisms": Joint Implementation (JI) and the Clean Development Mechanism. The CDM is supposed to be a market-based way to combat climate change. Through it, developed countries may invest in bankable projects in developing countries by paying the extra cost of upgrading to cleaner technology. In turn, they get credits for the amount of emissions reduced.

The CDM clearly has some immediate and apparent benefits — it brings in cleaner technologies and provides financing to projects in developing countries. But on closer inspection, the deal is not as attractive as it seems. The system, as currently proposed, risks being no more than a way for wealthy countries to buy their way out of their obligations, without significantly reducing domestic emissions. These markets do not create the right conditions for the structural change needed to tackle global warming. On the contrary, they shore up the fossil fuel status quo while blocking constructive alternatives.

Some developing nations, most notably India, argue that North-South trading mechanisms are inherently unfair. The way it is currently designed, the emissions trading

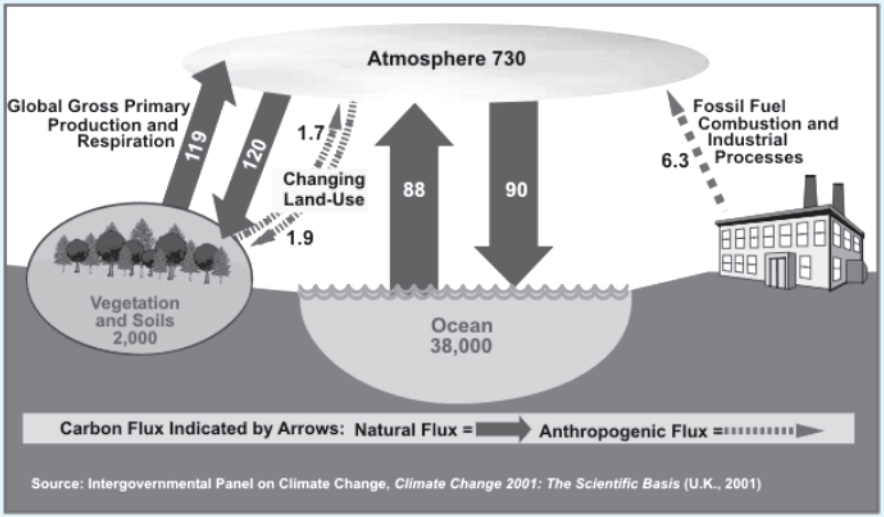
Carbon rush

In just the last 150 years, human-induced activity has pushed the level of carbon dioxide in the atmosphere from a comfortable 280 ppm to 381 ppm

Ninety-nine per cent of the earth's atmosphere consists of two gases, nitrogen (78%) and oxygen (21%). Both these are responsible for complex biogeochemical cycles that support life on the planet. But they play little direct roles in regulating climate. The remaining 1% is made up of small amounts of 'trace' gases like argon, water vapour, carbon dioxide, nitrous oxide, methane, chlorofluorocarbons (CFCs) and ozone — all of which are important in the regulation of climate. These trace gases are known as greenhouse or radiatively active gases (those that absorb or reflect infrared radiation).

Carbon dioxide represents just a few hundred parts per million (ppm) of the overall atmosphere. But this tiny component (0.037% of the atmosphere) helps warm the earth to a comfortable level. Too much of this gas in the atmosphere can do a lot of damage, however, because it is CO2 that allows sunlight to stream in but prevents much of the heat from radiating back out. During the last Ice Age, the atmospheric concentration of CO2 was just 180 ppm, freezing the earth. After the glaciers retreated, the total had risen to a comfortable 280 ppm. In just the last 150 years, we have pushed that level to 381 ppm. As a result, the earth is heating up. Of the 20 hottest years on record, 19 have occurred in or after the 1980s.

Are increases in trace gases, particularly CO2, the result of people's activities? The vast majority of scientists believe so. First, the increase is much larger than the natural variability of CO2 concentrations over thousands of years. Second, they know how much coal and oil Industrial Age societies have burned and how much forest they have cut down, and these factors are enough to account for the increase. The combustion of fossil fuels like coal, oil and gas, takes carbon that has been locked beneath the earth's surface for millions of years and releases it into the atmosphere. Third, isotope analysis of the carbon in atmospheric CO2 suggests that much of the increase did come from the burning of fossil fuels.



Fourth, complex models of the carbon cycle that represents important processes and feedback between the atmosphere, biosphere and oceans cannot explain the observed changes in CO2 without the human component.

Anthropogenic emissions of carbon dioxide from fossil fuel combustion and cement production reached a peak of about 6.6 GtC/year in 1997 (0.2 GtC/year of that was from cement production) and continues an upward trend, averaging around 6.3 GtC/year over the 1990s, an increase from an average of 5.4 GtC/year during the 1980s

regime is based on an inequitable distribution of atmospheric property rights — in other words, the right to emit carbon dioxide is not the same for all individuals on this planet. The industrial nations, for instance, decided on 1990 emissions as a baseline for allocating emissions rights to ensure continuity of their economies.

Despite the criticisms against CDM in terms of its operational inefficiencies and the ideological battle surrounding it, the 2006 Montreal climate conference which was touted as the "son of Kyoto" enshrines market mechanisms and emissions trading as the key policy response to climate change.

While neither the Montreal conference of 2006 nor the G8 summit of 2005 provided any breakthroughs, they represent a small step forward in building a consensus around the issue. They set the stage for a dialogue on long-term climate change management beyond 2012, which is the last year of the Kyoto Protocol. On the last day of the Montreal conference, Kyoto Protocol signatories agreed to extend the treaty on emissions reductions beyond its 2012 deadline.

The 15th Conference of the Parties to the UN Framework Convention on Climate Change (COP15), in Copenhagen, Denmark, held from December 7-18, 2009, is meant to take Kyoto forward. In the run-up to the summit, the two biggest polluters, the US and China, announced voluntary caps on emissions. The indications are, though, that while a comprehensive political agreement on cutting greenhouse gas emissions may be signed, all the difficult details will be left for later next year.

(Aditi Sen works in the Environment and Socially Sustainable Development [ESSD] Network of the World Bank in Washington DC. She has written this article in a personal capacity)

Infochange News & Features, June 2006, with updates

Satabhaya village in Orissa goes under

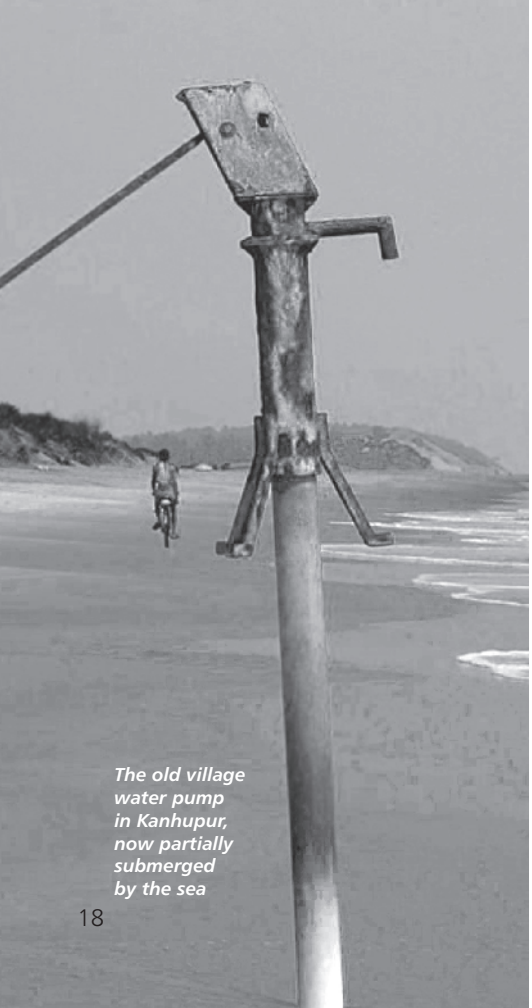
by Richard Mahapatra

The swift incursion of the sea has gobbled up the village of Satabhaya in Orissa's coastal Kendrapara district. The village is at present surrounded by seawater, and only eight families are left here. "They too are negotiating a safer place to migrate to," says Sashmita Das, sarpanch of the village panchayat.

Infochangeindia.org was the first to highlight the plight of villages in this area that are being submerged by the sea. The report was part of a detailed study on the impact of climate change on Orissa. The article on Satabhaya linked global warming and the resultant rise in sea levels with the sea's ingress into the land.

In the first four months of 2008, more than 100 families were rendered homeless as the sea marched on, relentlessly submerging homes and agricultural lands. Families from Satabhaya and Kanhupur villages migrated to Okilpara village, 8 km from the coast. "Since January 2008 the sea has been unusually furious. The incursion has been faster than in 2007," said Das.

The village panchayat estimated that since January 2008, 93 families had left Kanhupur village. In Satabhaya, around 25 families moved out when the sea reached their doorstep. Left with no option, not even a government rehabilitation package, people have been settling in nearby villages like



The old village water pump in Kanhupur, now partially submerged by the sea

Okilpara. And this has triggered conflicts.

According to local estimates, the sea advanced at least 30 feet into Kanhupur village in 2008 alone. Two borewells that were used by local residents to gauge sea levels are already submerged. The panchayat office in Satabhaya (where I stayed in 2006 whilst researching climate change) is just a few metres from the sea now. In 2006, the sea was around 200 metres from the office.

During high tide in Satabhaya, seawater enters the 800-year-old Panchubarahi temple that was located 2 km from the sea 10 years ago. In 2006, the sea was around 200 metres away; in January and April 2008 tidal waves entered the temple.

"The sea advanced at least 10 feet into Kanhupur village on September 21, 2007. It wiped out the government-run primary school. One of the borewells catering to the drinking water needs of both villages was consumed by the sea," said Asish Senapati,

a local reporter working with an English daily.

Kendrapara collector Kashinath Sahu conceded that rehabilitation has not been possible despite government assurances. "The resettlement colony for displaced people is yet to come up. Major areas in and around Satabhaya come under classified forestland, and this has led to delays in resettlement," he said.

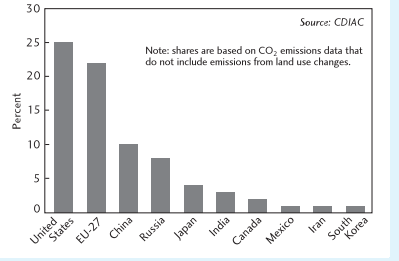
Orissa is slowly waking up to the real threat of sea erosion. And the link between it and climate change. In the last one year there has been massive sea erosion in Puri, Gopalpur and other areas of Kendrapara district.

An Orissa assembly committee on natural calamities has sent a draft memorandum to the Union government asking for Rs 7,000 crore to help save the coastal villages from sea erosion. The committee has also asked the department of oceanography to study the causes of rising sea levels and suggest ways to tackle the problem.

(Richard Mahapatra is based in New Delhi and writes on environment and development. In 2006 he was awarded an Infochangeindia Research Fellowship for reportage on the impact of climate change in Orissa)

Infochange News & Features, April 2008

Top 10 CO_2-Emitting Nations' Share of Global CO_2 Emissions, 1950–2007



Climate change impact

As the Intergovernmental Panel on Climate Change (2001) states: "Climate change represents opportunities and risks for human development." The areas where climate change could produce opportunities include:

• Expansion of agriculture into areas previously limited by temperature, but only if adequate soils are present.

• As the Arctic ice thins, areas will be accessible for surface navigation that were previously inaccessible.

• Heating demand and mortality from the cold in winter could decrease due to milder weather.

The following areas are those where climate change will cause adverse effects, and which can be predicted with more than 90% certainty:

• There will be an increase in precipitation events, leading to increased flooding and landslide occurrences.

• Run-off will increase leading to higher levels of soil erosion, along with an increase in maximum temperatures producing heatwaves that could cause heat-related stress in crops and livestock.

• Mid-latitudinal drought risk through summer heat, higher intensity of tropical cyclones, and a more variable Asian summer monsoon. This last prediction is thought to have an especially great impact as it will affect half of the world's population that lives in China, India and surrounding countries.

Death of the seasons

by Richard Mahapatra

Every time I jog my memory I come up with a distorted picture of my home state Orissa. When I try to compare my childhood memories with the present climate patterns in Orissa, I realise that things have changed completely. And most Oriyas will agree with me.

Till about 15 years ago, the winters here would make a precise entry on Dussehra day, which usually falls in the second week of October. Around a week before Dussehra, my mother would take the warm clothes out of an old trunk. "Now it is late-November that we get a bit of the cold. Only a few days in December are cold enough to wear warm clothes," says my mother.

My mother is 78 years old. Her memories of Orissa's climate are alien to the generation I belong to. For her, that Orissa has already died; for me, my childhood Orissa is dying. The state now has a new and strange climate that nobody can understand or predict.

People like my mother remember six distinct seasons — grishma (summer), barsa (rains), sarata (autumn), hemanta (dew), sisira (winter) and basanta (spring). She has precise dates for the arrival of the six seasons in our hometown Sonepur. And she taught me how to look for signs of each of the six seasons. If our peepal tree started flowering, summer had already set in; when the bats began coming to the peepal tree at night, winter was at its peak; when damselflies flew around our house it was time for the monsoon. As for me, I recall only four seasons: summer, autumn,

winter and spring.

Nowhere today will you find mention of six seasons in Orissa, except maybe in school textbooks. "While teaching children about the seasons, the textbook description of six seasons reads like something from the long-forgotten past," says Ramesh Mishra, a secondary school teacher in Dhama, a small town in Sambalpur district.

When I return home now, my mother mourns the death of the seasons. She explains that growing up without any source of entertainment, like television or cinema, festivals related to the specific seasons were times to rejoice. And so she began noticing small things in the world around her that indicated the arrival of each season.

Today, there are no such signs. Orissa has only two seasons: the rains and summer, with winter being a mild transition between the two.

Orissa's climate has changed so dramatically and quickly over the years that many people believe the state is under a supernatural curse.

In February, the state government goes into 'emergency mode' to fight the heat conditions. All schools and colleges switch to early morning shifts. Food-for-work programmes run during the early mornings and late evenings. Hospitals across the state stock huge sheets of ice. Public transport operates during the early mornings and late nights. People avoid the auspicious March-May period for getting married — it's simply too hot.

During the hot summer months, people's desperation for the monsoon begins to build. But the monsoon plays hide-and-seek with the state. It doesn't rain much when required. It rains during September and October, causing crop losses and floods. In the last decade, most of the big floods occurred during September and October. "The total rainfall may be around the average figure, but the monsoon has become erratic," says Biswamber Naik, an

agriculture extension officer in Bolangir district.

Scanty rainfall during the crucial months of June and July has triggered massive conflicts: for the past five years various police stations across the state have recorded close to 34,000 cases pertaining to conflicts over water. Of these, 50% occur between June and August.

A public perception study done by the Sambalpur-based Manav Adhikar Sewa Sanstha (MASS), an NGO working with local communities in the field of drought-mitigation, shows clearly how much Orissa's climate has changed.

The study found that three seasons out of the traditional six have already vanished. While the monsoon and summer are still distinct seasons, the average number of hot days is unprecedented. People say summer-like conditions now prevail for close to eight months in a year.

Dark clouds hover over Orissa but vanish almost immediately. For farmers who use traditional weather forecasting *(Panjika)* methods, the change in climate is perceptible.

Tikeswar Tripathy of Satibhata village in Sambalpur district is worried. According to him, the *Oriya Panjika* (a traditional weather book) used to be more accurate than the government's weather predictions. "The *Panjika* never failed us. But God knows what has happened — for more than a decade the *Panjika* has been unable to predict the weather perfectly."

The people of Orissa have always relied on ancient knowledge systems to predict the weather and plan their agriculture and other activities.

Traditional weather forecasting methods have been preserved in strong oral proverbs, which, for generations, farmers considered essential knowledge for their farming. The following is an example of a proverb from western Orissa:

Shrabana masara adya chouthi.
Chari digu jebe megha na uthi.
Dakhina digaru bahile baa.
Chasi bhai hala nangala dhari bidesh ja.

(At the dawn of the rainy season, if clouds do not form from each of the four directions, and if the wind is from the south then the farmers must pack up and migrate in search of bread and butter.)

Likewise, there are several indicators to predict the rains:

Dahuk gagale barsa hesi.
Dhamna gachke chadhle barsa hesi.
Chanti anda buhile barsa hesi.

(When the bronze-winged jacana bird calls [a short harsh grunt], when the hybrid cobra or local snake climbs a tree, and when red ants start transporting eggs, rain comes.)

Haldar Nag, a nature poet who has written extensively on the various seasons, says: "The peacock dances in anticipation of rain, but soon, to its surprise, the clouds fade away. And the beautiful creature feels ashamed." For ages, farmers have monitored the peacock's rain dance to begin ploughing. "I think nature is finally paying us for our sins," says Nag.

People used the behaviour of animals and birds to get a sense of what the weather would be like for three to five months. "But most of these birds have changed character. This has made weather forecasting difficult," says Nag.

In the villages of western Orissa, birds like the cattle egret, little egret, open-billed stork and others are referred to as "wisdom birds" or "knowledge birds". These birds helped people forecast the weather.

Now, says Nag, these 'symbols of knowledge' are themselves confused. Many popular and common birds and animals, like the parrot (rose-ringed parakeet), black drongo, Indian mynah, Indian house crow, red-wattled lapwing, ring dove, and bats have changed their mating and seasonal behaviour.

People believe these changes are due to changes in the seasons; the birds have begun to adapt to the new climate conditions.

Damselflies used to be the most dependable indicators of the monsoon. Just before the rains lashed the countryside, the sky would be covered with damselflies. When the farmers saw them arrive, they would get their agricultural implements ready for ploughing.

Now there are no such swarms to indicate rain. Instead, sometimes, you see swarms of damselflies in the sky during late-October, early-November.

"Bio-indicators are the first symptoms of climate change. There are scientific reasons for these changes. Increases in temperature will definitely change a creature's behaviour," says G K Pujari, a scientist with Orissa's environment department.

"Everything was fine until 1985-86," says Krushna Chandra Pati of Ghanapali, a village on the outskirts of Sambalpur. "What has happened since then I cannot say exactly, but the temperature is increasing year after year."

An Oriya farmer believes there should be at least 120 rainy days in a year. A popular proverb says:

Aatha dumukani sohala asara.
Batisa jhipi jhipi chousathi kundajhara.
Tebe jaai chasi bhai peta hue pura.

(Eight heavy falls and 16 continuous downpours, 32 visible drizzles and 64 light drizzles help the farmer feed with satisfaction.)

It's obvious this number has dropped drastically.

"Traditional knowledge about the weather is an indication of past weather patterns. If you compare the current situation with this knowledge, you can surely point to a deviation in the weather pattern," says A B Mishra, a former life sciences professor with Sambalpur University who has studied traditional weather forecasting.

Going by people's perceptions, it rains for close on 50 days, in varying degrees, during the monsoon season.

In many places in western Orissa, sugarcane used to be cultivated as it was a lucrative crop and a major source of income for farmers. Now, due to inadequate rainfall, sugarcane farming has not been taken up for at least 12 years.

Although there's still an ongoing debate as to whether Orissa's climate has really changed all that much, the people's perception that their climate is indeed changing should not be ignored. "I give high credibility to people's perceptions, because these are the first signs of the impact of climate change," says Kalipada Chatterjee, adviser on climate change at Winrock International, Delhi.

Infochange News & Features, April 2006

India's GHG emissions

India's initial national communication to the United Nations Framework Convention on Climate Change (UNFCCC) in June 2004:

- Total amount of GHGs (greenhouse gases) emitted in India — 1,228 million tonnes in 1994, which accounted for 3% of total global emissions.
- 63% was emitted as CO2, 33% as CH4, and the remaining 4% as N2O.
- GHG emissions increased from 988 million tonnes in 1990 to 1,228 million tonnes in 1994 and 1,484 million tonnes in 2000.
- Emissions from the industrial sector registered the highest rate of growth per annum within this period.
- India's GHG emissions are projected to increase almost three times with respect to 1990 emissions, in 2020.

Source: 'India's greenhouse gas emissions', Current Science, *Vol 90, No 3, February 2006 (http://www.ias.ac.in/currsci/feb102006/326.pdf)*

Glaciers in retreat

by Freny Manecksha

The release of a paper in November 2009 by V K Raina, former deputy general of the Geological Survey of India, stating there is no conclusive evidence to show that melting Himalayan glaciers pose a serious threat, may have been to "stimulate discussion", in the words of Union Environment Minister Jairam Ramesh.

But, for the people of Ladakh, such facile talk cuts no ice. They have been directly impacted by the faster rate of melting glaciers and have seen their livelihood threatened by climate change.

Says 73-year-old Chewang Norphel, a retired engineer who works on creating artificial glaciers as a water harvesting method: "We have been witness to glaciers disappearing and to the volume of water in the Indus river reducing by as much as two-thirds. This affects us since 80% of Ladakhi farmers depend on glaciers for irrigation."

Tundup Angmo works with GERES India, a not-for-profit organisation working on issues of environmental conservation and climate change mitigation.

She says that analysis of meteorological data, baseline surveys and interviews with villagers have shown that, increasingly, minimum winter temperatures are up by 1 degree Celsius. "There is a clear declining trend in precipitation from November to March (that is, a reduction in snowfall) and villagers have spoken about the impact of this on glaciers in the Khardungla and Stok Kangri region."


1780
1935
1956
1964
1971
2001
Gangotri Glacier
Scale (km)
0
0.5
Land Processes Distributed Active Archive Center

Ladakhis also say that the duration of the 'Chaddar trek' in Zanskar is getting shorter. The trek over a frozen sheet of ice that forms over the rivers and streams was once the only way for the villagers of Zanskar to cross from one valley to another in winter when all other routes are closed due to the heavy snowfall.

Climate change is still a very nascent science and though there is enough anecdotal and documentary evidence to show that Himalayan glaciers have been impacted by global warming, there are very few benchmark studies on small glaciers.

One glaciologist who is spearheading a study on how glaciers are reacting to climate variations and how black carbon aerosols are affecting water resources is Professor Syed Iqbal Hasnain of The Energy and Resources Institute (TERI). Hasnain is studying four glaciers — Durung in the Zanskar basin, Kolahoi in Kashmir, Chhota Shigri in the Chandra valley of Himachal Pradesh, and East Rathong in Sikkim.

Since the terrain is rough and inaccessible, as the glaciers lie between 4,000 and 6,000 metres above sea level, Hasnain and his team are using the expertise and assistance of mountaineers to place and fix equipment.

Another study, 'Witnessing Change: Glaciers in the Indian Himalayas', by Dr Rajesh Kumar of the Birla Institute of Technology, Divya Mohan and Shirish Sinha of the World Wide Fund for Nature (WWF) is carrying out research on the retreat patterns of the 30-km-long Gangotri glacier and the smaller 4.2 km Kafani glacier in Uttarakhand.

What is the kind of data that glacier studies can yield? Why are such studies crucial in monitoring climate change?

Glaciologists explain that glaciers (dynamic rivers of ice), which are a result of accumulation and transformation of snowfall over a number of years, are very vulnerable and fragile and react in a complex way to climate variations.

A glacier stores information of past climates

in the ice in the form of enclosed air bubbles, layers of dust, and ice chemistry.

Studies on the length, breadth, mass balance and growth/shrinkage of glaciers are visible indicators of how healthy the glaciers are. There is a line of snow accumulation that demarcates the zone above which no melting takes place.

When the accumulation area ratio (AAR) begins to shrink, one knows that the glacier is in recession (it is decreasing in length).

Hasnain, in his interaction with environmental journalists in Leh recently, showed a photograph of Kolahoi in 1942 that he had been able to procure from the long-established Mahatta Studios in Srinagar. Comparison with a current photograph of Kolahoi shows that the glacier's accumulation area has indeed shrunk.

Hasnain believes that a glacier is like a thermometer. It is sensitive to the climatic environment and through calibrations and adjustments glaciologists can define the local relation between mass balance and the climate. Glacial networks, if monitored properly, can thus become important tools for mapping spatial and temporal climate and climate change.

Glaciers are also widely recognised as sensitive climatic indicators. Measuring glacier evolution gives insights into regional climate changes in high and remote regions. This is of particular interest in the western Himalayas that receive snow and rainfall from both the monsoons and the westerlies.

A weather station that has been set up by Hasnain's team on the Kolahoi glacier will measure input to see how the westerlies affect precipitation.

Historically, glaciers have undergone changes over long periods of time, but it is the rapid rate of glacial retreat in the 21st century that is alarming scientists. It is now widely accepted that anthropogenic causes have most likely committed the earth to a

warming of 2.4 degrees Celsius above pre-industrial surface temperatures. This is impacting the glaciers.

The WWF study lists the findings of studies on some important glaciers by glaciologists and scientists.

According to a study by D P Dhobal, glaciologist with the Wadia Institute of Himalayan Geology, Dehra Dun, the 5.5 km Dokriani glacier in Uttarakhand has been continuously retreating, with slight increases in the retreat rate, by 1m/year in the 1990s as compared to the average rate in the previous years. This has led to a reduction in thickness, from 55 m in 1962 to 50 m in 1995.

The Milam glacier, also in Uttarakhand, is one of the largest valley-type glaciers in the Kumaon Himalayas and it has been monitored since 1906. Recent studies suggest it is in a continuous state of recession. Since 1906, it has retreated by about 1,740 m with the average rate being 19.1 m per year.

The increased rate of recession in the second half of the 20th century is being attributed to global warming (these findings were presented by S P Shukla and M A Siddiqui in 1999 at a symposium on 'Snow, Ice and Glaciers, A Himalayan Perspective', in Lucknow, in 1999).

The WWF study says that the Gangotri glacier is not only receding in length but also in terms of glaciated areas from all sides. The length of the glacier has decreased by almost 1.5 km in 66 years, with an average retreat rate of 22.1 m per year. However, because of its size it is less likely to show signs of change than smaller glaciers, the study says.

It adds: "The smaller Kafani glacier is more affected by climate change than the Gangotri because of its smaller accumulation area. Its tributary glacier is now hanging, that is, it is not directly connected any more through an ice mass to

the main trunk of the glacier. This indicates loss of huge ice volumes in the glaciated catchment of Kafani."

Professor Hasnain's study, besides studying the health of the glaciers, also entails taking samples to assess concentrations of black carbon and setting up aethalometers to measure these major short-lived warming pollutants.

He has been influenced by Professor V Ramanathan's paper on the 'Atmospheric Brown Cloud' which explains how greenhouse gases like CO2 swaddle the earth like a blanket, trapping heat.

Ramanathan says that in addition to greenhouse gases there are other climate warmers like methane, halocarbons, and black carbon soot which rises and envelops the atmosphere in a haze. It is eventually washed out of the sky by rainfall but not before it has travelled far enough to darken the glaciers.

"It is worrying that even at a height of 3,900 m there is a high percentage of black carbon particles," says Hasnain. He believes it is crucial to examine the contribution of black carbon deposition to ice/snow melt.

"I suspect that the transport industry in the form of trucks and convoys plying on the highways of the Himalayas, particularly the western Himalayas, may be contributing to black carbon deposits. Fortunately, the environment minister has shown willingness to commission a study on this issue," he adds.

The Himalayas, with an estimated 475 small and large glaciers, are the largest reserves of water in the form of ice and snow outside of the polar regions.

The consequences of increased glacial melt can thus have serious implications for the hydrology of associated river systems. This changing pattern of water and glaciers will, in turn, have a long-term impact on vegetation and can affect the ecosystems of deciduous and temperate forests.

Another major peril of fast-melting glaciers is the formation of lakes that can trigger floods. Such phenomena known as glacial lakes outburst floods (GLOF) have already occurred in parts of Nepal.

Glaciologists say what is crucial is a comprehensive science-based study of the Himalayas cutting across national boundaries. Such an exercise would yield a true picture of the drivers of climate change and provide answers on how to deal with the pollutants.

And, as the WWF study concludes, adaptation to climate change requires not just local action but also trans-boundary cooperative arrangements:

"Future efforts in building the resilience of the local community and the ecosystems should take into account a concerted and integrated approach.

There is an urgent need by communities, scientists and policymakers to take a closer look at the linkages between scientific research, policy interventions and the larger understanding of using resource conservation technologies and practices for promoting societal benefits."

(Freny Manecksha is a freelance journalist based in Mumbai)

Infochange News & Features, December 2009

Why India should cut emissions

by Ashish Kothari

Should India try to break the deadlock by accepting binding targets to reduce its emissions? Should it jettison the common position of the G77 countries, built up over years of negotiations: that industrialised countries must undertake mandatory cuts in their emissions and help 'developing' countries voluntarily switch to cleaner forms of development through funds and technology transfer? Or should it continue to insist that we must be given 'equal rights' to the global atmosphere, which means we will not accept any curtailment of our economic growth that may be needed to cut emissions?

Are we asking the right questions?

Most commentators have jumped on Environment Minister Jairam Ramesh for reportedly shifting our basic position, thereby weakening our bargaining strength vis-à-vis the industrial countries. He has clarified that he never said or intended this.

To me, the framing of the issue is itself problematic. Underlying it is the assumption that the current path of economic growth constitutes the only way we can 'develop', or ensure that our people's wellbeing is secured.

Much as George Bush said that the 'American way of life' was not up for negotiation when he refused to ratify the Kyoto Protocol because of its binding emissions cuts, we are saying that our right

to 'development' is non-negotiable.

The problem is, the 'development' we are trying to so zealously safeguard is itself an imposition by the West and a thoroughly inappropriate one.

Over the last half-century it has left over half our population still in the throes of poverty and hunger, even as a tiny minority has joined the world's richest elite.

It has dealt a massive blow to the environmental base we all depend on for our survival — clean air and water, productive soils, and healthy forests and oceans.

The two crucial tenets of any sane economic model are equitable benefits to all citizens and the sustainability of these benefits so that future generations can also avail of them.

Development, as currently practised in India, adheres to neither, never mind India's international commitments to 'sustainable development' or to the principles of equity.

What has this got to do with climate change? Plenty. India's contribution to climate-destroying emissions is largely a result of following an unsustainable and inequitable path to economic growth.

Taking action on this will help us reduce our climate impacts, showing the world that we are ourselves serious about the issue and are not just pointing fingers at the industrial countries.

But equally, if not more important, taking action on this will lead us to an ecologically, socially and culturally more secure future.

And so we must take on voluntary emissions cuts for our own welfare, even as we continue putting pressure on the West to cut its emissions substantially.

Voluntary emissions cuts are in our interest

What actions would these entail? Can we afford them? Do we have the technologies

needed? Let's look at some sectors:

Energy: Moving away from a carbon-intensive energy scenario — especially coal-based power generation — means much greater focus on clean, renewable sources like solar, wind, biogas, etc. A number of experts have worked out that India is in a position to lead the world in this, both because of the 'raw materials' available, as also the technologies. But we must also consider that along with technologies, governance and management of these energy sources is crucial.

It's not about investing only or primarily in huge centralised solar and wind parks, more about making smaller-scale options available to communities (rural and urban). And about investing in energy efficiency from production to consumption stage.

Transport: In the last couple of decades, especially with the onset of globalisation, a huge amount of investment has gone into encouraging the private car sector. It is a well-known fact that public transport is more efficient and less carbon-intensive or polluting per person than private vehicles. Yet, not one of our cities and towns has declared that it will make this its highest priority. Nor have any paid more than lip-service to making cycling and walking safer and more enjoyable.

Agriculture: A part of our emissions comes from chemical fertilisers used in 'modern' agriculture, introduced as part of the development package, especially since the 1960s.

Though increasingly found in policy documents, organic or sustainable farming is still a poor stepchild in government programmes while fertilisers get a whopping Rs 40,000 crore subsidy. Initiatives in several agro-ecological zones of India show that organic farming is capable of high productivity on a sustained basis, provided there are adequate inputs of high quality local seeds and organic manure, both of which can actually be

produced at the village level.

Forests: Though India is better than many 'developing' countries in maintaining its forest cover, the last couple of decades have seen a renewed assault on natural forests from mining, industry, defence installations, and encroachments. Over 600,000 hectares have been diverted since 2001, and several million hectares more degraded through over-use. This means both carbon emissions and a reduced ability to absorb carbon.

Action must be taken in all these and related sectors. Polluting energy sources, industry, and vehicles entail huge health costs and agricultural damage, together amounting to the loss of perhaps several thousand crores of rupees annually. Chemicals in agriculture pollute the water and soil and poison our food, doing incalculable damage to us all.

Privatisation of transport chokes our city streets, and no one has even thought of calculating the cost of the psychological tension and delays that commuters face every day. Loss of forests has widespread impacts on water and soil, and on the livelihoods and cultures of forest-dwellers. And all of these are responsible for the massive destruction of wildlife and biodiversity.

But can we afford to take action on these fronts? Or do we need to wait for the industrialised countries to give us money and free technology? I might be going out on a limb by saying this, but I don't think a country like India needs to wait for either. We have hundreds of thousands of crores of rupees going into all kinds of wasteful, destructive things, including the sectors mentioned above.

Making our development truly sustainable would mean putting this expenditure into alternatives, such as switching the massive fertiliser subsidy to inputs for organic farming, and coal and nuclear investments to renewable energy. It would mean heavily taxing private cars to fund public transport.

It would mean putting all the development aid we already get from abroad into alternative avenues. As for technologies, what is the point of boasting that we have the world's third largest scientific human power base (not to mention immense amounts of traditional knowledge, much of it still relevant), if we can't produce our own answers to technological challenges?

Indeed, I would wager that most of what we need already exists in the country, ready to be utilised if only we would focus more on indigenous (traditional and modern) solutions rather than run after western ones.

Reining in the rich, empowering the poor

All of this also entails putting curbs on the extreme consumerism of India's rich minority. This minority is responsible for a disproportionately high share of the country's emissions, through its use of electrical gadgets, air-conditioners, cars, etc. Indeed, the richest sections are already emitting twice the 2.5 tonnes per annum limit that each citizen on earth is supposed to be entitled to if we want to stay within the limits of climate sustainability. Their profligacy does not show up internationally simply because the very low emissions of several hundred million Indians pulls the national average down, a phenomenon that Greenpeace India, in a recent report, calls "hiding behind the poor".

Ironically, it is the poor who will be worst affected by climate change, while the rich will probably fly off to whichever safe haven still exists elsewhere on earth. And yet India's National Climate Action Plan spells out no action on curbing such destructive consumerism, or providing 'climate justice' to the poor.

Such action will not take place without fundamental changes in governance. Communities, both rural and urban, need to mobilise and empower themselves, with support from civil society and government, to take part in decision-making. We have

the beginnings of decentralisation; it needs to be taken to its logical conclusion by much greater transfers of power. Massive environmental and climate awareness programmes are necessary, linked to plans for the right to education and literacy.

Building or rebuilding local capacity to become self-reliant in meeting basic requirements, linking local institutions across larger landscapes, conceiving of long-term land use plans and other such actions have to accompany changes in developmental and technological priorities.

The moral upper hand

In taking the above steps, we would also be doing climate a favour, even if it's a small favour in global terms. And we would have a much stronger case in demanding that industrial countries take action. We already have the ecological and social arguments; we would then also have the moral upper hand.

Lest I be misunderstood, let me stress that this is not an argument to abandon our stand on 'common but differentiated responsibility', or fall for false solutions like growing biofuels for their (or our) cars, or 'carbon offsets' in which they try to buy off our share of the global atmospheric commons so that they can continue with existing levels of emissions. In none of these ways must we let them off the hook.

No, I am simply saying that we have to take action towards a low-emissions, low-carbon, and more equitable economy for our own good. And that this will only add moral strength to our case against the biggest climate-crunching countries.

(Ashish Kothari is an environmental researcher and founder member of the environmental research and action group Kalpavriksh)

Infochange News & Features, October 2009

What should India do?

by Darryl D'Monte

Let's begin with the things that India ought *not* to do. First and foremost, it shouldn't — as Environment Minister Jairam Ramesh foolhardily wrote to the prime minister — offer to undertake cuts in greenhouse gas emissions voluntarily and offer these up for inspection by a supra-nation body like it did when it allowed the World Bank or International Monetary Fund to police the Indian economy.

The environment minister's position today is a far cry from the proactive position India took during the crucial United Nations Earth Summit in Rio de Janeiro in 1992. With Kamal Nath as environment minister, India voiced the aspirations of developing countries embodied in a lengthy document titled 'Agenda 21' (for this century), most of which has been buried today. Indeed, it is hardly a secret that India was the scourge of the US administration in particular, and the White House actually admonished India just before Prime Minister Narasimha Rao was making his speech in Rio, compelling him to tone down the rhetoric.

Secondly, much in the same vein, Ramesh should desist from stating that Himalayan glaciers aren't retreating in the face of global warming. He has only cited a paper by one scientist which hasn't been peer-reviewed. This writer can cite contrary evidence by Dr Rajesh Kumar, a glaciologist from the Birla Institute of Technology, Pilani, who has studied Gangotri and other sites, as well as an even more authoritative scientist, Professor Syed Abdul Hasnain, now in TERI.

On both counts, Ramesh's game appears to

be to send a message to our global interlocutors — read the US primarily, and EU — that India doesn't want to be a 'naysayer' in climate talks and wants to be seen as cooperating with industrial countries in coming to an agreement in Copenhagen. However, all this militates against India's long-held policy that industrial countries, which have created the problem in the first place, should pay for cleaning up the global mess, before expecting developing countries — 600 million Indians don't even use commercial energy — to come on board.

As a corollary, it shouldn't fall into the trap of signing bilateral agreements with the US and other industrial countries to accept energy-efficient technologies, even if these are offered at throwaway prices, because this would effectively scuttle the UN negotiations, as the US has made no secret of wanting to do. China seems to have gone in for such a deal, but then it isn't a democratic society and no one knows what it is up to.

There is a short but simple list of what India can do. It must, first of all, promote energy (as distinct from electricity) policies which meet the needs of the bulk of its people, rather than those of the urban elite. The overwhelming need is for cooking fuel, and here's a climate connection. Professor V Ramanathan from the University of California in San Diego is the world's foremost authority on the Asian (later sanitised to 'Atmospheric') Brown Cloud. This refers to the pall of dust that accumulates over South Asia in particular as a result of women cooking on inefficient stoves. To switch to more efficient *chulhas* would cost a fraction of what India spends on importing oil and building more power stations. It would also prolong the life of the majority of people who are exposed to these toxic fumes. The rural population must go in for biogas, for which farm waste is a ready input.

Second, also following the thread of health rather than emissions targets and deadlines, India has to crack down with a vengeance

on pollution in cities, not only to tackle warming (we are the fourth largest emitter in overall terms) but for the health of its people. Instead, we are doing precisely the opposite by encouraging the reckless growth of private cars in our cities, of which Delhi is a prime example.

Just these two measures, apart from introducing more energy-efficient appliances and buildings, will work wonders.

(Darryl D'Monte chairs the Forum of Environmental Journalists of India and is the founder president of the International Federation of Environmental Journalists)

Health alert

In May 2009, the medical journal *The Lancet* called climate change 'the biggest global health threat of the 21st century'. The epidemiological outcome of climate change on disease patterns worldwide will be profound, especially in developing countries already vulnerable to poor health and woefully inadequate healthcare systems.

Millions of additional people may be affected by malaria (and other vector-borne diseases like dengue fever and H1N1), as rising temperatures allow disease-carrying vectors to live at higher altitudes. Changing rainfall and temperature patterns will make the availability of water and sanitation more complicated, fuelling disease. Dry and hot weather conditions cause forest fires — remember South East Asia in 1997 when several major fires darkened the sky for weeks? It led to a tripling of respiratory diseases and lung infections. Something similar happened in Florida a year later with asthma and bronchitis cases increasing. Studies have also linked baking summer temperatures to increased radon concentrations (a cause of lung cancer), increased ground-level ozone (causing respiratory problems) and other forms of air pollution. Hot weather increases hay fever as the pollen count goes up. Flooding, another major fallout of climate change, spawns a whole host of diseases from muddy and contaminated water.

Jeffrey Sachs says...

by Rashme Sehgal

Jeffrey Sachs is director of the Earth Institute at Columbia University and author of CommonWealth: Economics for a Crowded Planet *and* The End of Poverty: Economic Possibilities for Our Time. *Excerpts from an exclusive interview to Infochangeindia.org*

Have we reached a point of no return as far as global warming is concerned?

We have reached a point where global climate change is occurring all the time. We are witnessing extreme weather conditions as also a change in rainfall patterns which are bound to affect food productivity.

The extent will depend on the action we take to reverse this because we are still in a position to affect how severe the change will be. But if we press on unabated, it will lead to catastrophe in many parts of the world. So the issue is really whether we can prevent this catastrophe.

We need to slow down on climate change also because it would be disastrous for food crops. We need to grow more resilient kinds

of food crops. All this comes under the heading of 'sustainable development'. How to bring this about will be the biggest challenge of this century. This is what I tell my students all the time. All these are interconnected pieces. We need more problem-solving, more technical expertise, more goodwill.

We have now reached an edge. We need to be more consequent. Going from one meeting to another is not enough. We need to create global teams which can chart a practical platform. The time for practical agreement has arrived and we need to see this through.

How vulnerable will India be to climate change?

India is extremely vulnerable because it is home to 17% of the world's population with less than 3% of the land area. It is in a very environmentally fragile position because watertables in this country are dropping sharply, and this needs to be gotten under control.

This is not to say that the problems of climate change are not being caused by the rich nations. I don't think people in many of the richer nations understand the enormity of the challenge and how we have to get on by taking significant action.

This is no longer a matter only of climate change but also because we are running out of conventional low-cost oil. I am not in the task of contributing to the blame game. All I will say in reply to your question on whether India is threatened is 'yes'. This is an issue which threatens populations across the globe. But we need to put the international politics of the situation aside and concentrate on some common truths. The poor across the globe lack the means to adjust because they live in the most fragile environmental conditions. They are therefore going to be the worst hit.

You cannot absolve the richer nations of responsibility...

Not at all. Historically, the US must bear a disproportionate share of responsibility. A population size of 5% is emitting 30% of the world's total greenhouse gas emissions. The US has not taken real action. Nor has the Obama administration put forward any programme to explain how it plans to meet its target of 16% reduction in carbon emissions on a 2005 baseline, by 2020.

China has emerged as the largest emitter in the world and faces a problem of similar magnitude. They have a much larger population though their per person emission is less. Again, India's per person emission is less but because of the size of its population, India has emerged as the fourth largest emitter in the world. The problem is that instead of pointing fingers at each other we need to say: 'Who should take the first step? Who will pay for it?' We need to sit down and develop a pragmatic, easily implementable worldview.

What kind of global strategy needs to be thrashed out to deal with this issue?

What are the sources of greenhouse gas emissions? Fossil fuel, electricity-generation, heating and cooling, transport, and industry are the key culprits. We need to address each of these specific issues; we have to look at the alternatives. We have nuclear power, wind power and carbon capture sequestration which has the potential to use coal in a clean way.

Many of these are still unproved and expensive technologies. The question is who will pay the extra cash to implement them.

Take the case of the automobile industry. India is facing a surge of vehicles. The way to handle this situation is to have rechargeable batteries which can be plugged into the power grid and be charged by nuclear or solar energy. This kind of profound transformation requires R&D and large investments. We need to come up with new design strategies that will play a major role in the way our cities function. For example, New York uses less energy per person than Los Angeles. But so far, we have

failed to come up with a new global strategy.

Isn't that overall global strategy going to emerge in Copenhagen?

I do not see nations reaching an agreement on climate change at the Copenhagen climate summit. I do not see any major convergence of sensible strategies taking place (in Copenhagen) that will set us on course for the next 10 years. I fear this is going to end up as another Kyoto with little likelihood of it producing a major outcome.

The fundamental mistake being made is that the problem of global warming is being treated as a matter of negotiation between nations rather than using global solving mechanisms to arrive at a conclusion. The more appropriate strategy is to take some modest steps; by meeting month by month rather than converging in order to bring out a grand document only to re-convene 10 years later.

The closest analogy to this style of global brainstorming is the Doha trade negotiations where nations have adopted the policy that nothing will be agreed upon till everything has been agreed upon. This process has been going on for the last seven years, and the trade talks continue to flounder.

To conduct climate talks, we need to look at four diverse areas — mitigation, financing, adaptation and technology transfer. Work is in progress in all these areas, but there is little chance of any breakthrough in any of them.

How do you see technology transfer actually taking place?

I believe most of the funding should go to the poorest countries. Middle-income nations should have access to technologies on an open IP basis, but they should not receive funding to implement this. Africa should be a significant recipient of funding, while India should be a recipient of technological demonstration for

implementing some of the higher-cost solutions. I don't see China needing our help at all.

I have been stressing that large funding debt should be around 0.5% of GNP of the donor world, which works out to $ 170 billion a year. If even half of this money were utilised every year on real projects, it would amount to a major step forward.

For example, India can start using power plants that are based on carbon sequestration which allows for coal to be used in a clean manner. Using this technology will cost half-a-billion dollars more than a conventional power plant. This is affordable. It is a small budget item for the US. This is an area where we can make progress quickly especially when we know that US banks paid $ 33 billion in bonuses to bankers last year. India needs to develop a team of geologists and engineers to use this process.

What other urgent steps do you recommend?

I would introduce new policies to get poor countries to reverse deforestation. We must pay poor communities to keep forests intact. Once we start making these payments, we can tilt the scale to conservation because forests help reduce carbon emissions. One-sixth of carbon emissions worldwide are taking place due to deforestation.

We also need to start two global trust funds — a mitigation fund by which we can transfer payments to those who adopt new emissions technologies, and a technology transfer fund. Climate resilience can be built up if we improve our water storage capacities worldwide.

How is China handling its problems?

China is doing quite well. It is working on improving its R&D especially in the field of electric vehicles and public transport. It is the largest greenhouse gas emitter and is facing a major environmental threat because a large part of north China

is drying up.

Increasing food prices are only going to heighten problems…

Four things have led to this situation. The world's population is growing while productivity of food has been on the decline. India had a green revolution in the '60s. It now needs to have a second revolution. Energy prices have shot up and this has a major impact on food as it affects the price of fertilisers.

Food insecurity is on the rise. We have to look at ways to increase food productivity by going in for more efficient seed varieties in all parts of the world. Developing nations need to reduce their fertility rate. This is especially true for India where population is a major issue.

(*Rashme Sehgal is a writer and journalist based in Delhi*)

Infochange News & Features, August 2009

Carbon karma

Every one of us on this planet leaves an eco-footprint as we go about our daily activities. This footprint consists of the CO2 and other greenhouse gases that result from our use of transportation, energy consumption, and rubbish disposal. The impact from resources consumption in our daily lives shows up in these footprints, as does a collective impact resulting from pollution and contamination caused by manufacturing, wars, and the degradation of biodiversity.

Your eco-footprint will be here well after you are gone. Like a fossil record, it remains for eons and eons. You can't eradicate your footprint, but you do have the ability to minimise it — and you can influence others to minimise theirs as well.

The world's best scientific minds believe that a combination of global warming, depletion of the planet's resources from dominant patterns of production, consumption, wars, and over-population is causing environmental devastation. We all have a responsibility to help

protect and restore the earth's ecological systems.

The most significant changes each of us can make in our impact on the earth's ecology are related to lifestyle, transportation, shelter, and family. We can't all do everything possible to reduce human-induced environmental degradation, but we can each do something. Here are a few things you can do *now* to have a measurable effect on the footprint — and planet — you leave behind.

Lifestyle

• RECYCLE paper, plastic, metal, batteries; reuse old things or donate them to a good cause; sell them or give them away.

• COLLECT kitchen water (from washing rice/dal/vegetables) and water plants with it.

• TURN OFF THE LIGHTS when you leave a room.

• DON'T USE tissue paper/cling wrap/ aluminium foil.

• CLEAN YOUR HOME, CAR and BODY with green, non-toxic products.

• COMPOST your yard and garden waste to keep it out of landfills and sanitation sewers.

• EAT SUSTAINABLY by choosing organic, fair trade, and locally produced foods when they are available — find out where your food comes from. Apples from Kashmir or oranges from Nagpur (or even closer home) rather than apples from Washington and oranges from Israel. Produce that travels long distances requires refrigeration plants that consume huge amounts of electricity, storage space, and that big pollutant — transport fuel. In fact, if you can buy locally produced food from the local unsophisticated market, or the roadside *bhajiwalli*, you save the huge costs of electricity and air-conditioning that big retail chains require to light and cool their retail premises and warehouses.

• TURN OFF THE TAP while brushing your teeth or washing dishes.

• SHORTEN YOUR SHOWER and remember that tub baths use tens of gallons of water — save them for treats. The good old BUCKET BATH is extremely eco-friendly!

• START A RECYCLING PROGRAMME at your company, neighbourhood or school for paper and bottles.

• TURN OFF APPLIANCES especially TV sets, chargers, stereos and computers that draw phantom energy with their instant-on features. Laser printers emit half-a-tonne of greenhouse gases a year in the US; inkjet printers just 20 kg. Standby power — not switching off appliances at the socket — eats up 10% of electricity in homes with set-top boxes, TVs, stereos, computers, etc. It is responsible for emitting 5 million tonnes of greenhouse gases a year in Australia, and 30 million tonnes in the US.

• TURN OFF that geyser, AC or fan — you'll survive!

• BUY what YOU NEED, not everything your friends buy. THINK about what 'need' really means.

• BORROW, EXCHANGE, LEND, TRADE are all good alternatives to BUY.

• AVOID BUYING DISPOSABLES when there is an option.

• AVOID PLASTIC BAGS altogether. Carry a cloth carry bag in your backpack.

• ENCOURAGE YOUR COLLEGE to turn off lights and computer monitors.

• ENCOURAGE YOUR ORGANISATION, CLUB, CHURCH, SYNAGOGUE, MOSQUE or TEMPLE to develop an environmental sustainability plan.

• GIVE GIFTS that improve the environment.

• PLANT A TREE or start an organic garden.

Transportation

• CAR POOL if you must use a car.

• RIDE A BIKE to school, work, the store or the gym.

• WALKING reduces pollution, avoids parking delays, and tones your legs.

• PUBLIC TRANSPORTATION reduces the use of land for roads and reduces the pollution from personal vehicles.

• NEW VEHICLES AND FUELS like hybrid, electric and biofuel produce fewer emissions and make a public statement that you're going greener.

• SMALLER VEHICLES use fewer resources to produce, and give better mileage.

• TURN OFF your car AC; open the windows instead.

• BUY ONLINE, save trips to the mall. Besides less personal vehicle fuel and emissions, many

online companies use better logistical and delivery services to save more fuel.

• REDUCE AIR TRAVEL. Take holidays closer to home that don't require air travel. India's greenhouse gas emissions from aviation are slated to grow by 4% per year.

• TUNE UP YOUR CAR and keep your tyres properly inflated for better mileage and less pollution.

Shelter

• We don't have much choice in how our HOMES ARE BUILT until the government brings in legislation to force compliance from builders. But if you are lucky enough to be able to build your own home, ensure that it is designed to remain cool, like the *havelis* and bungalows of old, to cut down on the use of fans and air-conditioners.

• REPLACE LIGHTBULBS with fluorescent and LED bulbs for energy and money savings.

• REDUCE WATER USE by installing low-flow toilets and showerheads. Or, reduce the capacity of the flush tank by putting a brick or a 1-litre bottle inside.

• FIX leaky taps.

• Convince people to BUY ENERGY STAR-rated appliances.

• COLLECT RAINWATER from gutters to water plants.

• BUILD RAIN GARDENS and plant native drought-resistant plants.

• GO CHEMICAL-FREE in the garden.

• HAND WASH YOUR CLOTHES in cold water with bio-degradable laundry products.

• CEILING FANS are better than ACs; open windows are better than fans!

• CHANGE YOUR PAVING — replace some outdoor hard surfaces like driveways and patios with permeable surfaces to allow water to percolate.

Politics and family

• VOTE for individuals and policies that protect the environment. Question what kind of development path we are on that requires us to foul our own nest. India's stand at the climate change negotiations is that we are still a developing country and if we have to cut emissions (when we don't emit as much now, nor have in the past, as developed countries)

we will only stunt our growth. But should we be aping a western growth model that has landed us all in this mess, or can we do some out-of-the-box thinking?

• RUN for public office, and green-up local, state, and federal laws.

• START A GREEN organisation, study group, book club or kitchen garden/farm.

• DISPOSE of diaper and medical waste safely — whatever choice you make.

• READ poetry and fiction and view art and theatre that consider the earth.

• PLAY in ways that respect the environment.

• LEARN about how plants and animals and people are inter-related.

• TEACH others what you have learned about preserving the planet.

• JOIN an online green community for resources and networking.

• DONATE time and money to environmental action.

Useful websites

1 Climate Change Education (http://climatechangeeducation.org/tv.html) has a number of resources on climate change — videos, documentaries and art

2 Climate change and the visual arts (http://climatechangeeducation.org/art/visual_arts/) includes 'Warming Winds, Rising Tides', Gary Braasch's photographic documentation of climate change in several countries, from Bangladesh to Florida (http://www.worldviewofglobalwarming.org/pages/rising-seas.html)

3 The website of The Energy and Resources Institute (TERI), which deals with sustainable development (http://www.teriin.org/). Also, TERI's newsletter *TERI 4U* (http://www.teriin.org/newsletter/august/news.htm)

4 http://www.kyotoprotocol.com

Documentaries and videos

1 *Melt: A Teenager's View of Global Warming* (http://video.google.com/videoplay?docid=5617318652349295608)

2 *A Sea Change — Imagine a World Without Fish* (http://www.aseachange.net/)

3 *Earth 2100. Is this the Final Century for Our Civilisation?* (http://abcnews.go.com/Technology/Earth2100/)

4 *Mean Sea Level,* a documentary by the Centre for Science and Environment, India, looks at the human tragedy behind the statistics of internal displacement due to rising sea levels and erosion in the Sunderbans

5 *The 11th Hour.* The film explores how we've arrived at this moment — how we live, how we impact the earth's ecosystems, and what we can do to change our course. Written, directed, narrated by Leonardo DiCaprio (http://wip.warnerbros.com/11thhour/)

6 *The Great Warming.* Filmed in eight countries on four continents, endorsed by dozens of the world's leading scientists, this is a factually accurate, visually stunning and wide-ranging production (http://www.the great warming .com/ index .html)

7 *An Inconvenient Truth.* Backed by former US Vice-President Al Gore, the film has had a huge influence in making audiences think about climate change

Hollywood jumps on the climate change bandwagon

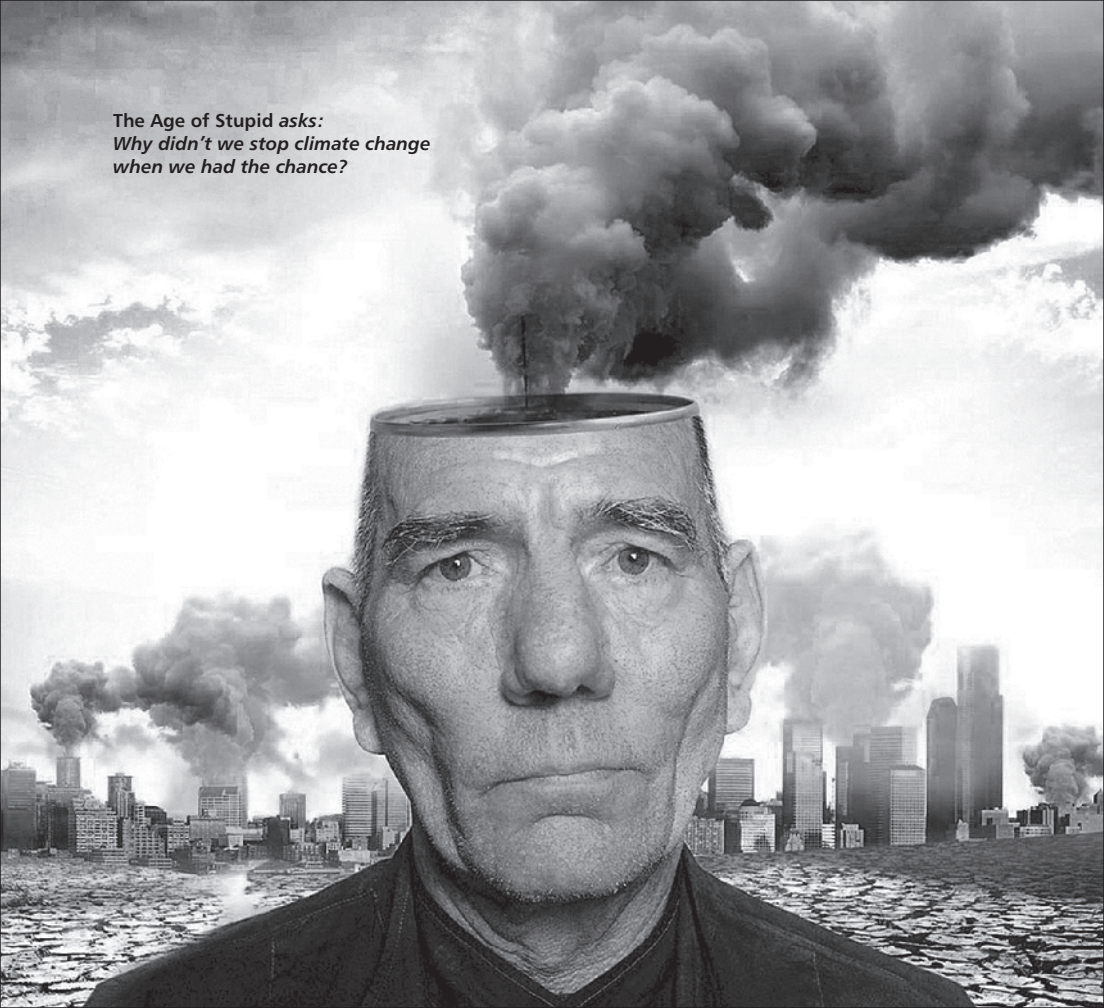
1 *The Day After Tomorrow*, 2004. A climatologist tries to figure out a way to save the world from abrupt global warming. He must get to his young son in New York, which is being taken over by a new Ice Age.

2 *Waterworld,* 1995. In a future where the polar ice caps have melted and most of earth is under water, a mutated mariner fights starvation and outlaw "smokers" and reluctantly helps a woman and a young girl find dry land.

3 *The Age of Stupid,* 2009. A man living alone in the devastated world of 2055 looks at old footage from 2008 and asks: Why didn't we stop climate change when we had the chance?

4 *2012.* Directed by Roland Emmerich, the 2009 film is about an old Mayan prophesy about the end of the world and how a group of people must deal with natural disasters such as volcanic eruptions, typhoons and glaciers.

2012


The Age of Stupid *asks:*
Why didn't we stop climate change
when we had the chance?

Did you know?

• In socially responsible Sweden, food labels tell you how much carbon dioxide has been emitted in the production/preparation of the food. A menu board in a restaurant informs diners that a hamburger contains 1.7 kg of carbon dioxide emissions while a chicken sandwich is just 0.4 kg. New dietary guidelines have also been released which, for instance, recommend that Swedes favour carrots over cucumbers and tomatoes because, unlike carrots, the latter two must be grown in heated greenhouses there, consuming energy.

• On a per capita basis, every Canadian releases 23 tonnes of CO2-equivalent GHG each year. This compares with 10 tonnes of CO2-equivalent GHG released by one person in Japan, five in China, and less than two in India.

• 'Green burials' is the latest eco-conscious act. Conventional burials in the USA produce 1.5 million tonnes of greenhouse gases every year. Each burial emits over 1 tonne of greenhouse gases. Cremation emits half-a-tonne of greenhouse gas, consumes large amounts of electricity, and causes air pollution. In 'green burials', instead of solid bronze caskets, biodegradable body bags are used, or coffins made of bamboo or cardboard.

• It takes 400-500 kg of wood to burn a body completely. That means about 50-60 million trees, covering 1,500-2,000 sq km of forest land, are cut every year to burn the dead in India, producing half-a-million tonnes of ash and releasing 8 million tonnes (mt) of greenhouse gases or carbon dioxide.

• Philippines architect Nestor Archival's eco-friendly two-storey home has holes in all the walls and doors including the bathroom; the ceiling is made up of wine bottles and the windows of plastic construction pipes. All energy is supplied by solar panels. The eccentric design means the house remains cool and is bathed in light, thus cutting down on energy needs, besides, of course, using recycled material.

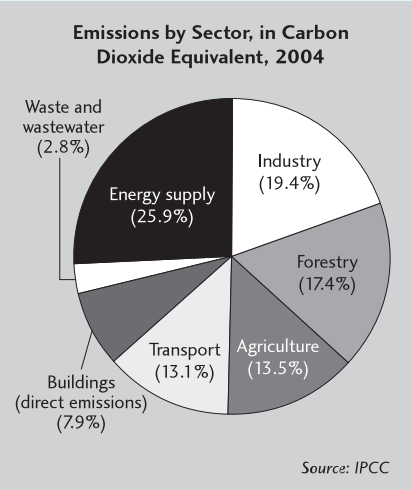
• Deforestation of tropical forests accounts for 17% of global emissions — more than all the world's cars, trucks, planes, trains and ships combined. If left unaddressed, deforestation could undermine efforts to solve the climate crisis. Brazil and Indonesia together account for 50% of global deforestation.

Vital statistics

Greenhouse Gas Sources, by Sector

Greenhouse gases come from a broad range of human activities, including energy use, changes in land use (such as deforestation), and agriculture.

Source	Sample Emission-generating Activities
Energy Supply	Electricity and centralized heat generation, resource extraction, and grid base transmission/ distribution
Industry	Production of metals, pulp and paper, cement, and chemicals; petroleum refining
Forestry	Deforestation, decomposition of biomass that remains after logging
Agriculture	Crop and livestock production
Transport	Travel by car, freight truck, plane, train, or ship
Residential and Commercial Buildings	Heating, cooling, and electricity
Waste	Landfills, incineration, wastewater



Climate Tipping Elements

Scientists believe that several "climate tipping elements" could destabilize the planet's climate by setting off chain reactions—"positive feedbacks"—that accelerate other climate changes. Once a tipping element is triggered by crossing a threshold or tipping point, there is no turning back even if all greenhouse gas emissions were to end. Some tipping elements, such as the loss of Arctic summer sea ice, may be triggered within the next decade if climate change continues at the same rate. Others—the collapse of the Atlantic ocean current, for instance—are thought to be many decades away.

Tipping Element	Expected Consequences
Loss of Arctic summer sea ice	Higher average global temperatures and changes to ecosystems
Melting of Greenland ice sheet	Global sea level rise up to 7 meters
Collapse of West Antarctic ice sheet	Global sea level rise up to 5 meters
Collapse of the Atlantic ocean current	Disruptions to Gulf Stream and changes to weather patterns
Increase in El Niño events	Changes to weather patterns, including increased droughts, especially in Southeast Asia
Dieback of boreal forest	Severe changes to boreal forest ecosystems
Dieback of Amazon forest	Massive extinctions and decreased rainfall
Changes to the Indian summer monsoon	Widespread drought and changes to weather patterns
Changes to the Sahara/Sahel and the West African monsoon	Changes to weather patterns, including potential greening of the Sahara/Sahel—one of the few positive tipping elements

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