factsheet
GLOBAL ENVIRONMENTAL NEGOTIATIONS

IMPACTS OF CLIMATE CHANGE

WESTERN AND CENTRAL INDIA

Climate-related disasters have brought widespread misery and huge economic losses to India, adversely affecting public health, food security, agriculture, water resources and biodiversity. The situation is likely to worsen if human beings continue to pump 'greenhouse gases' (GHGs) like carbon dioxide into the atmosphere.

These gases trap heat from the sun and thus lead to 'global warming'. As the Earth's temperature rises, a series of reactions take place – for instance, sea levels rise and inundate land, weather patterns change and have an impact on agricultural productivity, precious fresh water evaporates faster, disease carrying vectors increase, thus leading to epidemics.

The United Nations Framework Convention on Climate Change (UNFCCC) agreed to in 1992 and the 1997 Kyoto Protocol, the two international agreements to deal with global warming, have not yet succeeded in reducing GHG emissions. Rich countries, where per capita emissions of carbon dioxide are much higher due to higher usage of fossil fuel, are unwilling to compromise their lifestyles by reducing fossil fuel consumption. The US, in particular, is responsible for a quarter of the world's total emissions of carbon dioxide, but has refused to cooperate in a global agreement to reduce these emissions. Meanwhile, subsidies on fossil fuel around the world prevent sustainable energy technologies such as solar power from becoming competitive.

The world today faces two challenges if we are to deal effectively with the biggest challenge faced by humankind. The first is to reduce carbon dioxide emissions drastically by moving to renewable technologies as soon as possible. The second is to prepare to deal with the impacts of climate change that are already inevitable due to existing levels of greenhouse gases in the atmosphere, and cannot be avoided even if the world stops emitting carbon dioxide immediately.

Although limited scientific research has been carried out on the impacts of climate change on India, this factsheet documents existing studies on the impacts on western and central India.

Agriculture

The arrival and performance of the monsoon is no insignificant matter in India every year, and is avidly tracked by the national media. This is because most of the states in the country are largely dependant on rainfall for irrigation. Any change in rainfall patterns poses a serious threat to agriculture, and therefore to the country's economy and food security.

Scientists predict that because of global warming, this already fickle weather system could become even more undependable**.** Semi-arid regions of western India are expected to receive higher than normal rainfall as temperatures soar, while central India will experience a decrease of between 10 and 20 per cent in winter rainfall by the 2050s.[1]

Agriculture will be adversely affected not only by an increase or decrease in the overall amounts of rainfall, but also by shifts in the timing of the rainfall. For instance, over the last few years, the Chattisgarh region has received less than its share of pre-monsoon showers in May and June. These showers are important to ensure adequate moisture in fields being prepared for rice crops.[2]

Agriculture will be worst affected in the coastal regions of Gujarat and Maharashtra, where agriculturally fertile areas are vulnerable to inundation and salinisation.[3] Standing crop in these regions is also more likely to be damaged

If maximum and minimum temperatures rise by 3°C and 3.5°C respectively, then soybean yields in Madhya Pradesh will decrease by five per cent compared to 1998

due to cyclonic activity. In Rajasthan, a 2°C rise in temperature was estimated to reduce production of pearl millet by 10-15 per cent.[4]

The state of Madhya Pradesh, where soybean is grown on 77 per cent of all agricultural land, could dubiously benefit from an increase in carbon dioxide in the atmosphere. According to some studies, soybean yields could go up by as much as 50 per cent if the concentration of carbon dioxide in the atmosphere doubles. However, if this increase in carbon dioxide is accompanied by an increase in temperature, as expected, then soybean yields could actually decrease. If the maximum and minimum temperatures go up by 1°C and 1.5°C respectively, the gain in yield comes down to 35 per cent. If maximum and minimum temperatures rise by 3°C and 3.5°C respectively, then soybean yields will decrease by five per cent compared to 1998.[5]

Changes in the soil, pests and weeds brought by climate change will also affect agriculture in India.[6] For instance, the amount of moisture in the soil will be affected by changes in factors such as precipitation, runoff, and evaporation.[7]

Health

In the summer of 1994, western India experienced temperatures as high as 50°C, providing favourable conditions for disease-carrying vectors to breed.[8] Not surprisingly, 1994 was also the year that the town of Surat in Gujarat was hit by an epidemic of pneumonic plague, resulting in 59 deaths. In the same year, as summer gave way to the monsoon and western India was flooded with rains for three months, Surat was hit by a malaria epidemic.[9]

Weather conditions determine malaria transmission to a considerable extent. Heavy rainfall results in puddles, which provide good breeding conditions for mosquitoes. In arid areas of western Rajasthan and Gujarat, malaria epidemics have often followed excessive rainfall. In very humid climates, drought may also turn rivers into puddles.[10]

Coastal areas

The coastal states of Maharashtra, Goa and Gujarat face a grave risk from sea level rise, which could flood land (including agricultural land), and cause damage to coastal infrastructure and other property. Goa will be the worst hit, losing a large percentage of its total land area, including many of its famous beaches and tourist infrastructure.[11] A one metre rise in sea level will adversely affect 7 per cent of the population in Goa, and cause damages to the tune of Rs 8,100 crore.[12]

In the state of Maharashtra, over 13 lakh people are at risk.[13] The cost of damages for Mumbai, the business capital of India, is estimated to be Rs 2,28,700 crore.[14] Mumbai's northern suburbs like Versova Beach and other populated areas along tidal mud flats and creeks are vulnerable to land loss and increased flooding due to sea level rise.[15]

Beyond actual inundation, rising sea levels will also put millions of people at greater risk of flooding. This will displace a large number of people and result in rapid urbanisation (as already seen in some parts of Gujarat and Maharashtra), straining resources and putting more pressure on civic amenities. Increased seawater percolation may further reduce freshwater supplies.

Biodiversity

One of the largest breeding colonies of the Greater Flamingo lies in the salt-water marshes and mudflats of the Rann of Kutch in Gujarat. As global warming

The habitat of the Greater Flamingo, the endangered Lesser Florican and Indian Wild Ass could be lost

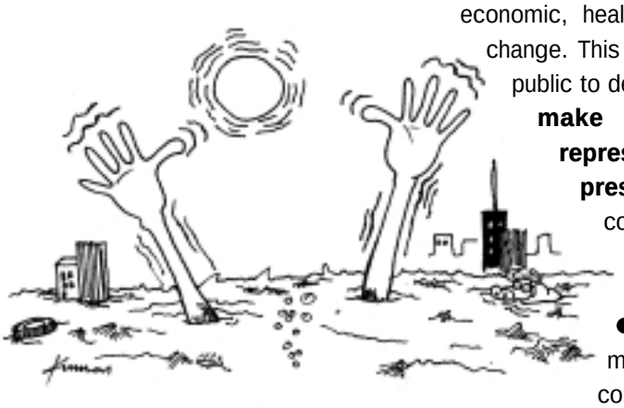
causes a rise in sea level, these marshes and mudflats are likely to be submerged. The habitat of the endangered Lesser Florican and Indian Wild Ass, both found in the Rann of Kutch, could also be lost.[16]

All along the western Indian coastline, tropical ecosystems and species such as mangroves and coral reefs are threatened by changes in temperature, rising sea levels and increased concentrations of carbon dioxide in the atmosphere. Already, nearly 30 per cent of the coral reefs in the Gulf of Kutch are 'bleached' as they loose the colourful algae that live on them — an occurrence associated with seawater warming.[17] In future, the entire belt of coral reefs along the south Gujarat coast is in danger of getting bleached.[18]

The state of Gujarat has the largest area of mangrove forests after West Bengal. While the mangroves of the Gulf of Kutch could possibly adapt to low or moderate sea level rise, a rise of more than one metre in the next century could cause serious losses.[19] The mangroves are also threatened by the rise in temperature, which causes decreased tree height and leaf size. Besides sea level rise and temperature stress, the mangroves in the Gulf towards Jamnagar and the Kutch coasts are also threatened by drought.

Gujarat — particularly the district of Kutch — has large areas of marine wetlands, which play an important role in maintaining the coastal environment, and in providing sustenance to coastal communities. These could be adversely impacted due to sea level rise, and changes in water temperature, availability and quality.

What can you do?



Policy makers in India either do not know about, or do not take seriously, the economic, health-related and environmental impacts of climate change. This is largely because they feel no pressure from the public to deal with the problem. **It is therefore important to make sure that your local government representatives understand this threat and feel pressure from you to take action**. Urban and rural communities should pressurise their representatives to take up the issue with the state and central government, and develop strategies at three levels:

- At the local level, steps should be taken to minimise the impacts of global warming on communities, and to build adaptive capacities where possible. For instance, constructing sea walls can reduce the threat of coastal flooding. Crop varieties tolerant to saline water should be developed for regions likely to suffer salt-water intrusion in their aquifers.
- At the national level, a wide section of the Indian civil society, including economists, scientists and legal experts, should be involved in understanding the threats from global warming to the country, and in developing strategies to deal with them. In particular, scientists should be encouraged to further study the impacts of climate change, to better understand the nature of the impacts and take preventive action where possible.
- At the global level, India should demand that industrialised countries, largely responsible for causing global warming, should reduce their emissions of harmful gases and pay for the damage they have already caused.

The positions taken by the Indian government on climate change at global meetings should be made public, and Indian civil society should be allowed to participate in their formulation.

Write to the Minister of Environment and Forests, and the Minister of External Affairs demanding that at CoP-8, they make a strong case for equal rights to the atmosphere

Governments from around the world will be converging in New Delhi from October 23 to November 1, 2002, for the eighth conference of parties (CoP-8) to UNFCCC. This provides an ideal opportunity for Indian civil society to demand that the Indian government prepare a strong proactive position for the meeting.

At CoP-8, the Indian government should state in unequivocal terms that any global agreement on climate change has to be based on the principles of equal rights of all human being to the atmosphere. Current inequalities, where for instance, one US citizen emited as much carbon dioxide as 19 Indians in 1996, cannot form the basis of global agreement. Rich countries should pay if they emit more than their share of GHGs.

The Indian government should also demand that industrialised countries keep up their promise, and establish a system to pay for the damages they cause in developing countries due to their GHG emissions.

Definite action

- Write letters to your local representatives providing them with information on climate change, and demanding action to minimise impacts on your community.
- Write to the Minister of Environment and Forests (T R Baalu, Minister of Environment and Forests, Paryavaran Building, CGO Complex, New Delhi) and Minister of External Affairs (Yashwant Sinha, Minister of External Affairs, South Block, New Delhi), demanding that at CoP-8, they make a strong case for equal rights to the atmosphere. *(Please mark copies to the Centre for Science and Environment, 41, Tughlakabad Institutional Area, New Delhi-110062)*

For more information on the science and politics of climate change, and on CoP-8, please contact neelam@cseindia.org.

GLOBAL ENVIRONMENTAL NEGOTIATIONS

This series provides a close analysis of important environment-related conventions and institutions from their origins, and demystifies the politics of 'saving the environment'.

A first-ever comprehensive Southern perspective of the impact of global environmental governance on the real lives of real people.

In addition to dealing with five new issues, the second volume, *Poles Apart* contains updates on the issues dealt with in the first report, *Green Politics*. The updates cover only recent developments — a complete historical background can be found in the first report.

1 M Lal *et al* 2001, Future climate change: Implications for Indian summer monsoon and its variability, in *Current Science*, Vol 81, No 9, November 10, p 1205.
2 Y S Ramakrishna *et al*, Impacts of climate change scenarios on Indian agriculture: Evidences, Central Research Institute for Dryland Agriculture, Hyderabad, p 6
3 Karen O'Brien *et al* 2001, The dynamics of vulnerability to global change, *http://www.ihdp.uni-bonn.de/IHDPUpdate0102/article4.html*, as viewed on June 28, 2002.
4 Y S Ramakrishna *et al*, Impacts of climate change scenarios on Indian agriculture: Evidences, Central Research Institute for Dryland Agriculture, Hyderabad, p 3.
5 M Lal *et al* 1999, Growth and yield responses of soybean in Madhya Pradesh, India to climate variability and change, *Agricultural and Forest Meteorology* 93, Elsevier Science, pp 65-66.
6 Tata Energy Research Institute 2002, India specific impacts of climate change, *http://www.teriin.org/climate/impacts.htm*, as viewed on July 2, 2002.
7 Anon 2000, Climate and climate change in India, *http://www.brown.edu/Research/ EnvStudies_Theses/full9900/creid/climate_and_climate_change_in_in.htm*, as viewed on July 2, 2002.
8 David Danzig 1995, Global Warming = Health hazard, *http://www.ee/lists/infoterra/1995/ 07/0019.html*, as viewed on July 2, 2002.
9 *ibid*.
10 Anon 2000, El Niño and its health impacts, Fact sheet no 192, World Health Organisation, *http://www.who.int/inf-fs/en/fact192.html*, as viewed on July 2, 2002.
11 Tata Energy Research Institute 2002, India specific impacts of climate change, *http://www.teriin.org/climate/impacts.htm*, as viewed on July 2, 2002.
12 *ibid*
13 Asian Development Bank 1994, *Climate Change in Asia: India Country Report*, Manila, p 81.
14 Tata Energy Research Institute 2002, India specific impacts of climate change, *http://www.teriin.org/climate/impacts.htm*, as viewed on July 2, 2002.
15 Asian Development Bank 1994, *Climate Change in Asia: India Country Report*, Manila, p 77.
16 Intergovernmental Panel on Climate Change 2001, *Climate Change 2001: Impacts, Adaptation and Vulnerability*, Third Assessment Report, Bonn, p 556.
17 Anon, Coral reefs - Total neglect, *http://www.sabkikhabar.com/issues.htm*, as viewed on July 2, 2002.
18 *ibid*
19 H.S.Singh 2002, Impact of climate change on mangroves, Paper presented at the South Asia Expert Workshop on Adaptation to Climate Change for Agricultural Productivity, Ministry of Agriculture, Government of India, United Nations Environment Programme and Consultative Group on International Agricultural Research, New Delhi, May 1-3.