

Down To Earth

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DECEMBER 15, 1997

Child of chaos

The strongest El Niño of the century has led to fires in Indonesian and Amazonian forests and storms and drought worldwide



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DownToEarth

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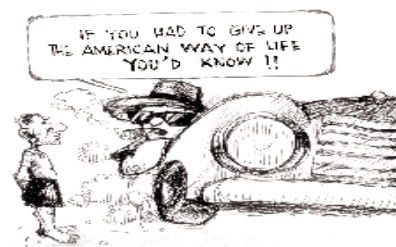
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COVER PHOTO: GREENPEACE / PERRINE

A house damaged by an El Niño-induced storm in Miami, Florida, USA

Good work

The report 'Vanishing breeds' (*Down To Earth*, Vol 6, No 8; September 15, 1997) correctly identified the problems facing livestock breeding. Having taken training at the National Dairy Research Institute (NDRI) at Karnal, Haryana, I gave up a comfortable life in a metropolitan city and set up a farm in a remote place in Tamil Nadu. The area has received scant attention from experts in forestry and animal husbandry. Scarcity of vegetation and artificial cross-breeding have made a mess of things. The *Sahiwal* breed seems to have disappeared from the region. I can attest to the fact that technical training is near useless in such conditions, whereas traditional breeding techniques are successful.

S R DANIEL

Sathyamangalam, Tamil Nadu

Fifty years of injustice

The article titled 'Out of mind and sight' (*Down To Earth*, Vol 6, No 11; October 31, 1997) is just a glance at the problems faced by those displaced by large dams. The issue is not restricted to a Hirakud or a Koel-Karo project. There are hundreds of examples of oustees scattered all over India. The initiative taken by *Down To Earth* (DTE) is commendable and you should continue to highlight the plight of people ousted from their own lands by large developmental projects.

AKSHAYA PANIGRAHI

Sambalpur, Orissa

Our ecological wealth

The editorial 'Perils of incompetence' (*Down To Earth*, Vol 6, No 9; September 30, 1997) was absolutely correct and to the point. Our country is seriously suffering from political incompetence and the generations to come will have to pay the price.

I think you are doing a good job by spreading awareness on environmental preservation. But your magazine appeals only to a particular class due to the language barrier. The percentage of Indians who know English is quite low. I feel that if you publish your magazine in Hindi, your appeal would be much wider. Also, issues of environmental



preservation should be connected with business concerns, both large and small-scale industries. Informative posters will also go a long way in realising this goal.

RAVINDRA PENDHARKAR

Ujjain

Vandalwood

In publishing a detailed analysis on the sandalwood smuggler Veerappan 'Catch me a colossus' (*Down To Earth*, Vol 6, No 10; October 15, 1997), you have done a good job. We ought to be cursing ourselves for electing governments and politicians who cannot catch a smuggler running a one-man show.

Going through the article, it hurts to

Advertisement

Wanted for a Delhi-based NGO a development professional for a challenging hill area environmental project. Candidate must have proven creative audio-visual communication skills, expertise in participatory workshop strategies, grassroots level organising abilities and experience in process documentation. Fluency in written and spoken Hindi is essential. Academic background in law and work experience in hill areas will be given merit. Women are encouraged to apply. Remuneration will be commensurate with experience.

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know that even the Special Task Force has failed to nab a culprit who can be nailed by the police if the governments set their minds to it. The nexus between politicians and smugglers has something to do with the incompetence on the part of the administration.

I also liked the article titled 'Vanishing breeds' (*DTE*, Vol 6, No 8; September 15, 1997). We should be proud of our wealth in terms of biological diversity and take good care of it. On the contrary, most of our species of domestic animals are on the verge of extinction. The lack of foresight among officials is appalling.

Whereas the first article reveals the devastation of our trees, the other points to destruction of our livestock. You are doing an excellent job in bringing this to light. Keep up the good work.

SHASHANK H

Ponda, Goa

Forest mismanagement

On reading *Down To Earth*, one gets the impression that only one dimension of forest management is emphasised. Sustainability in forest management, as in the case of any other natural resources, is multi-dimensional. Besides the "political" dimension, which though powerful is indeterminate and uncertain, there are other aspects to forest management, such as the ecological, technical, socio-economic and institutional. Similarly, there are several goals of the same.

The problem with forest management is that at any given point of time, only one aspect and one goal is emphasised. The issue needs to be discussed in totality. We should integrate technology with ecology, economics and ethnology.

J B LAL

Former director, Indian Institute of Forest Management, Bhopal

Down To Earth welcomes contributions from readers. You can send your contributions to Ajit Chak, Copy Coordinator, *Down To Earth*, 41 Tughlakabad Institutional Area, New Delhi - 110 062. For any other queries, you can write to Anil Agarwal, Editor, *Down To Earth*.

LEADER

Beware of the Ganga



A dip in the Ganga was meant to purify both body and soul. But devotees in Bihar have had a bad experience

It was not the spending of hundreds of crores of rupees in cleaning the Ganga that made the average Indian who takes a dip in the river, sit up and acknowledge something that the world had known for long. The Ganga was polluted. And highly polluted at that.

At Patna, a few days after celebrating the venerated *Chhath* festival on the banks of the Ganga, several devotees had eruptions, red spots and other skin irritations all over their bodies. Apparently, it was the 'holy dip' which had led to this impious problem. Something in the water, undoubtedly a result of indiscriminate waste disposal into the river, had triggered off this reaction.

With another religious festival, *Kartik Purnima*, just around the corner, the lakhs of devotees who take a dip in the river at Patna, would probably think twice before they do so. And more importantly it may lead to a situation where the average person on the street demands from his local or state government that something more is needed to be done for tackling pollution in the river.

Cynical though it may sound, it must be mentioned that such an incident was just waiting to happen. For far too long have rivers in India been treated as glorified sewers. On the one hand they are considered sacred, and on the other, they are abused day in and day out by the very populace that reveres them. Religious ceremonies and practices, that have been followed in the land for centuries are also in dire need of an updation of sorts. This task had been attempted once at Benares, where the cooperation of priests and other holy men had been sought. Sadly though, nothing could come from the attempt, as the Hindu clergy stood to lose more, if any alteration was attempted in these age-old practices, which have been acknowledged to be harmful for the health of the river.

Along its 2,525 km long course, the Ganga receives mostly untreated sewage from 27 major towns. The Ganga Action Plan (GAP) Phase one, still paraded as the show-piece of river cleaning in India, has taken in more than 450 crore rupees with hardly any results to show anyone at the end of the day. At the first meeting of the National River Conservation Authority, held in New Delhi in July, the Prime Minister's only worthwhile comments regarding the GAP were that the delays in implementation needed to be done away with. At the same meeting, the minister of environment and forests chose to pile all failures of the plan to less than minimum flows: lack of fresh water in the river.

The ground reality is that in all the main towns situated on the banks, untreated and partially treated sewage still flows into the river. The sewage treatment plants lie idle for most of

the day for want of power to run them. Many pumps remain clogged with plastic bags while the unconcerned public throws them all over the towns. Public toilets have been converted into offices at Patna, and sewage ponds serve as cricket grounds in that same town.

The waters of Ganga always had the quality of longevity, where its waters did not putrefy even after long periods of storage. Scientific studies carried out by Roorkee University in the early 1980s, confirmed an age-old belief that its waters were special. The Ganga had a unique quality in that it had a remarkable self cleansing ability, certainly better than any river in the world. It had a very high oxygen-retaining capacity, which explains why its waters remained fresh over long periods of storage.

Conducted between 1982-84, the studies indicated that more than two thirds of the initial biological oxygen demand (BOD) loads present in the form of a suspension, settled down in the river bed within 30 to 60 minutes at the rate of three metres per hour. This was, their studies indicated, 15 to 25 times faster than values reported in other rivers. Further, Roorkee University scientists realised that concentrations of disease causing bacteria, which shot up at waste dumping points along the river, reduced by almost 90 per cent 7-10 km downstream.

As far back as 1896, E. Hanbury Hankin, a British physician had reported in the *Annales de l'Institut Pasteur* that cholera microbes died within three hours in Ganga waters while they continued to thrive in distilled water even 48 hours later.

Thus, when such a unique and remarkable river becomes the source of skin problems, it is reflective of the river's degradation. It is also reflective of the failure of the GAP to improve water quality. Essentially a 'pipes and pumps' scheme, the plan is being replicated in 14 polluted rivers in the country with not a thought spared on the failures of the GAP. While sewer drains and sewage treatment most certainly are a necessity in any town or city, mindlessly replicating an expensive plan is certainly not the best way to tackle the situation.

And, perhaps most important, the public are as unconcerned and disinterested as ever. It cannot be the task, nor the duty of any government, state or central, to instil civic sense into the country's populace. While plans such as the GAP give to a town a facility, the average man on the streets isn't at all concerned, primarily as he hasn't paid for the facility. And none of the municipalities have had the courage to get the user public to pay for the facilities thus set up. Ironically, it would be instances such as these that would virtually pry open the public's eyes to the reality that rivers, however holy, are bound to hit back. ■

Global cops



In just less than a decade, a big shift has taken place in the substance of the dialogue between environmental NGOs in the North and the South. Whereas in the mid-

1980s the focus was on national issues, for example, on how Indian and British NGOs could work together to oppose a British aid project in India, the focus now is increasingly on the global rules and regulations that are being set up to manage the world's environment.

Few people realise that two processes of globalisation are taking place simultaneously: Economic globalisation pushed by industrial corporations and ecological globalisation pushed by environmentalists. The former is driven by the fact that the Northern markets are now saturated and thus there is a desperate search for new markets and, secondly, by the need to search for competitive advantage on a global scale, made increasingly feasible by the extraordinary changes taking place in communications technologies.

Meanwhile, ecological globalisation is being driven by the fact that levels of world production and consumption have reached a stage that what one does in one's own country can have major impacts on neighbouring countries or even on the rest of the world.

Even simple things like using a refrigerator or an air conditioner can today destroy the ozone layer; running an automobile or cutting a tree without planting another one can destabilise the climate; and, using a persistent compound like DDT in India can mean life-threatening pollution for human beings and other life forms in the remote polar regions, these compounds being slowly but steadily carried to these regions by oceanic currents and air streams.

As a result, nations are increasingly getting together to create systems of global economic and environmental governance — the former being best represented by the creation of the World Trade Organisation and the latter by the numerous environmental

treaties that have come into existence since the mid-1980s. The management of the current process of globalisation leaves a lot to be desired.

Firstly, the two processes of globalisation outlined above are not accompanied by any form of political globalisation. As a result, no political leader has any interest to ensure that the emerging global market or the emerging global ecological policy is managed in the best interest of the maximum number of people and on the basis of the principles of 'good governance', that is, equality, justice and democracy.

Secondly, there is no clear and transparent mechanism to integrate the two processes of globalisation. But nations are doing so individually, often in a covert manner, through the positions they take to set the rules for the two processes.

When leaders of nation-states meet to develop rules and regulations for economic globalisation they take positions which help them to derive the maximum economic benefits for their national economies whereas when they meet to develop rules and regulations for ecological globalisation, they take positions which ensure that there would be either no costs or, at worst, least possible costs to their individual national economies. And companies simultaneously insist that global ecological rules be set in a way that it does not reduce the competitiveness of some while increasing the competitiveness of others, which is called the 'level playing field' principle. Though the polluter pays principle is the key principle used within nations to manage the environment it is strongly opposed at the global level because it would mean high costs to industrialised economies. As a result of these two shortcomings, the rules and regulations that are emerging

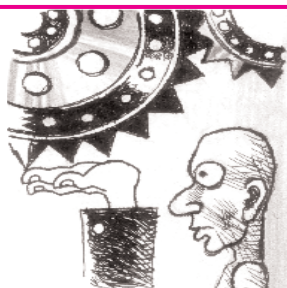
generally tend to be based on the principles of 'business transactions' rather than on the principles of 'good governance'.

In the absence of a global government or a global political order which is going to ensure the greatest good of the greatest number of people, the obvious question is: How do we ensure that the ongoing processes of globalisation helps to develop fair and just social and ecological policies?

The answer may well lie in the global spread of democracy. Social and ecological policies are of great concern to the civil societies of different nations. Is it, therefore, possible for the thousands of members of different civil societies to work together to develop a global civil society to fight for fair and just global social and ecological policies? Without this, there will be no pressure on governments to stop taking positions that are built largely on vested interests.

Therefore, the need to develop a global civil society is becoming imperative for us all. While the civil societies of most nations have reacted negatively to the process of globalisation for a variety of important reasons and fears, it is equally important for them to realise that if they cannot stop the process of globalisation then they must organise themselves to manage the process of globalisation. While, admittedly, the costs of such an exercise will be high, ironically the very communications technologies that are giving industries a chance to promote global economic integration also provide an opportunity for NGOs and other members of the civil society to reduce the costs for global dialogue, debate and advocacy. In other words, the world today has an opportunity for the first time to create a truly 'global consciousness'. The politics of Kyoto shows that the global civil society as yet has little influence. ■

Anil Agarwal



Is it possible for civil societies of different nations to work together to develop a global civil society to fight for just global social and ecological policies?

The magnificent 500

DNA studies suggest that a mere 500 people moving out of Africa could have populated the rest of the world

GENETICISTS who gathered at a conference on human evolution in October at the Cold Spring Harbor Laboratory, New York, have come out with some estimates that could change our understanding of the evolution of our species. They say that as few as 500 individuals, who moved out of Africa some 1,40,000 years ago, may have populated the rest of the world. The estimates have been derived from a new kind of archaeology which depends on the human genome.

error. This created a lot of confusion for those participants at the conference who came from other disciplines — especially archaeologists. However, the fact that DNA from a few drops of blood can unravel the mysteries of human evolution is hard to ignore despite the flaws in the current level of understanding.

The genetic variation found among humans is very small compared with that of most other species. Humans evolved too recently to have accumulat-

populations around the world reveal that sub-Saharan African populations possess greater genetic diversity than non-Africans. When a smaller group breaks away from a founding population, it takes only a sample of the full range of genetic variation. This can explain why non-Africans retain only a subset of the diversity that the sub-Saharan Africans retain.

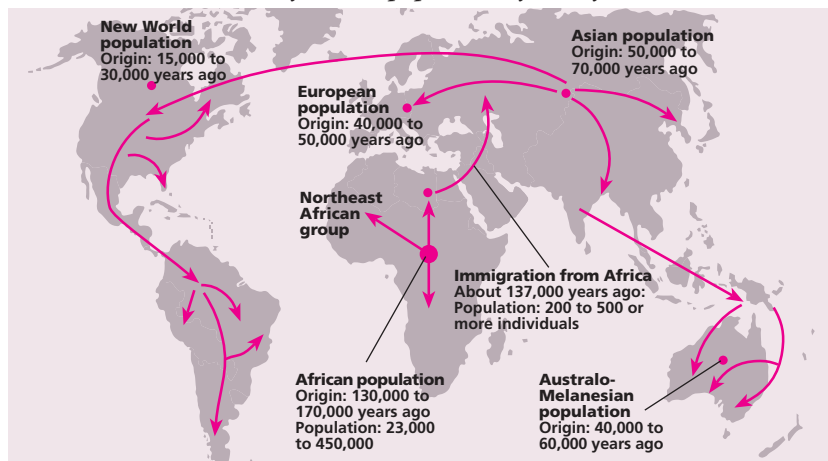
Non-Africans got separated from the main human population in Africa some 1,37,000 years ago, according to the estimates of Mark Stoneking, population geneticist at Pennsylvania State University. He studied genetic elements known as Alu insertions (small and apparently useless pieces of DNA that have gradually spread throughout the human genome) from 34 different populations. The diversity of Alu insertions among African populations suggests that Africans maintained a larger population size through the prehistoric period than those who emigrated, says Stoneking. Small populations tend to lose their genetic diversity over time.

The original human population is estimated to have numbered a few thousand people. Studies of mitochondrial DNA (a unique category of genetic material derived only through the mother's line) indicate that the founding human population stood at a mere 10,000 individuals. But results of the research conducted by Sarah Tishkoff, evolutionary biologist at Pennsylvania State University, dispute this. Her estimates of the size of the long-term early human population varies between 23,000 and 4,47,000 people.

However, it is not clear as to exactly where in Africa was the cradle of ancestral human populations. But estimates say it was in East Africa. Elizabeth Watson of Massey University, New Zealand, says the Turkana people of Kenya reveal the greatest genetic diversity of any known group in their mitochondrial DNA. This kind of genetic material is free from the shuffling of genes that creates new individuals and changes over time only through mutations. Watson says that the region with the highest genetic diversity of a species is generally its place of origin. Moreover, fossil remains of early humans found at Lake Turkana in Kenya support her claims. ■

The seeds of time

The estimated movement of human populations from Africa



Sources: "The History and Geography of Human Genes", Cold Spring Harbor Laboratory

The estimates will only be accepted when historians and archaeologists can find dates and numbers to match. But the estimates establish DNA as a vast resource for information on human evolution. Due to the fast methods of DNA sequencing and reading of chemical letters, geneticists are gathering an immense amount of data regarding human populations. But work on developing methods to interpret this data is still in the initial stage. Estimates of the size and location of human populations and the timing of their migration from Africa were also discussed.

But the calculations of the geneticists are based on a number of assumptions, and their dates have large margins of

ed any significant amount of genetic changes or mutations. However, there is still a considerable amount of genetic variation in people for geneticists to study — much of which was present at the emergence of the species. From studies in the past, geneticists compared proteins that are structured and coded in DNA. This does not yield much for scientists as the coding region of DNA does not change much. But most of the genome is composed of non-coding DNA. This is ideal for geneticists as it accumulates at a regular rate, providing the most useful data regarding diversity and age of different populations.

The estimates have yielded some important results. Genetic samples of

JAPAN / HUMAN RIGHTS

Foreigners' nightmare

AMNESTY International, the London-based human rights organisation released a report in Tokyo on November 10 that says that foreigners in Japan are subject to violence, racism and even sexual assault by immigration officials, police and prison guards. The report says that Japanese officials have tried to ignore or cover up cases of ill treatment of detained foreigners. The 46-page report mentioned 18 cases of foreigners who were allegedly mistreated while in detention recently.

The human rights watchdog group

urged the government to start an independent review of the situation. "It shows patterns," said Pierre Robert of the organisation who had helped to compile the report. "It shows that human rights violations are not simply accidents," he said. The report mentioned the case of an Iranian citizen who died after what his wife claims was a beating by immigration and police officials. The organisation also brought notice to the case of a Chinese woman who had to undergo an abortion due to the lack of proper medical care after she was held for overstaying her visa. The government, however, denied the allegations in the above-mentioned cases in a written response. ■

UK / CONTROVERSY

Labour's love lost

BRITAIN'S governing Labour party's abrupt volte-face on November 5 on the plan to ban Formula One racing sponsorship by tobacco companies has become as a major embarrassment. This was one of the electoral promises of the party before the general elections in May, which it won by a landslide. Recently, the finance minister was asked during an interview on BBC radio about the party receiving donations from Bernie Ecclestone, president of the

Formula One Constructors' Association. He had no answer. The party later admitted that it had received a donation of more than £5,000 (US \$8,150) and claimed that it returned the amount.

This has given a new twist to the controversy surrounding sports sponsorship by tobacco companies. Junior health minister Tessa Jowell said the pledge to ban Formula One tobacco sponsorship had been dropped as a matter of "practical politics" because of the risk that the sport might move out of Europe. Formula One racing is heavily dependent upon money from tobacco companies. ■

INDONESIA / SMOG

The smog spreads

SMOG from the forest fires that have been raging in the Indonesian provinces of Sumatra, Kalimantan, Sulawesi, Irian Jaya and Java for the last three-four months has spread to five more Indonesian cities. At the beginning of November, 25 cities in the country were covered by the smog. By the second week of the month, the figure stood at 30. "More cities are covered with smog. Zero visibility was reported in Jambi, Sumatra. In general, the smog still persists," said an official at Jakarta's smog control bureau.

The latest data received from the US National Oceanic and Atmospheric Administration (NOAA) revealed that the number of "hot spots" in areas affected by the forest fires was 40. "Identifying the hot spots has been difficult due to the smog. The provinces of Jambi, South Sumatra and Lampung are almost completely covered by the smog," the official said. The official Antara news agency reported on November 6 that at least 12 people, most of them elderly, had died of respiratory problems in Jambi, which has been covered by the smog for the last three months. ■

US / DISEASE

Trans-Atlantic BSE

IN A new book titled *Mad Cow USA: Could The Nightmare Happen Here?* co-authors John Stauber and Sheldon Rampton say that thousands of cattle in the US are carrying a deadly strain of bovine spongiform encephalopathy (BSE), commonly known as "mad cow disease". But the administration has played down the dangers in order to protect the meat industry, they allege.

They say that although the strain of BSE that is linked to the fatal Creutzfeldt-Jacob disease (CJD, which affects the brain) in humans is endemic to Europe, other fatal strains are present in North America. Richard Marsh, a virologist at the University of Wisconsin, Madison, had detected strains of transmissible spongiform encephalopathy (TSE) in the 1980s in minks fed on meat from cows at his father's mink farm in Oregon. ■

KENYA / AIDS

Natural resistance

TWO prostitutes in Kenya have a surprising resistance to AIDS. Researchers at a clinic in the Majengo slum on the outskirts of Nairobi say that Hawa Chelangat, 34, and Hadija Chemutai, 31, are immune to HIV. They are cousins, divorced, desperately poor and have been working as prostitutes in the Majengo slum for the last 14 years. More than half of the world's 23 million HIV-infected people live in Africa and the virus has infected 95 per cent of prostitutes in the Majengo slum. But the cousins, who have visited the clinic since 1985, have remained HIV-negative for the last three-four years despite being in the high-risk group.

"We are calling it resistant. We are not calling it immune, but we have a lot of evidence that their immune systems are able to recognise and kill the HIV

virus," said Frank Plummer, a physician from the University of Manitoba who is also the principal researcher at the clinic. That the prostitutes are cousins is very important as the researchers have strong evidence that HIV-resistance clusters in families. If the source of the prostitutes' protection can be identified, it could result in the creation of a vaccine against AIDS. ■



SANJAY GHOSH

HONG KONG / ANIMAL RIGHTS

In which the shark won

IT WAS a case of a shark escaping from the jaws of human "cruelty". A restaurant owner in Hong Kong is facing charges of animal cruelty after a 2.6-metre female shark was rescued from a fish tank a day before it was to be served to customers. The Lie Garden Restaurant in Mangkok had paid between US \$1,950 and 2,600 for the eight-year-old nurse shark and had launched a massive publicity campaign including invitations to the media. Some reporters sought the comments of the agriculture and fisheries department.

Consequently, four inspectors of the department arrived at the restaurant with a mobile fish tank and took the fish away. Inspector Howard Wong Kai-hay said the fish was in a "pretty unhealthy" state. "The shark only had eight cms in which to move," he said, describing the tank as a coffin. However, a restaurant spokesperson claimed they had sought the officials for guidelines for keeping sharks but did not receive any. "There are no written laws for this type of thing. But the law provides for cruelty proceedings if the animal goes through unnecessary suffering," said Wong. ■

BRAZIL / SPACE TECHNOLOGY

Pop goes the launch

BRAZIL'S floundering space programme suffered another blow when the ground control was forced to destroy the first space rocket launched in Brazil after one of its four engines failed to start. Colonel Thiago da Silva Ribiero, spokesperson of the Brazilian space agency, said controllers destroyed the 20-metre rocket by remote control 65 seconds after lift-off at 10.25 am local time from the Alcantara base in the northeastern state of Maranhao on November 2. The rocket had reached an altitude of 3,320 metres when it had to be destroyed.

The rocket had been built at a cost of about US \$6.5 million. It was scheduled to carry a satellite into the Earth's orbit to gather environmental and agricultural data. But officials of the space agency said the agency will go ahead with scheduled launches in each of the coming three years. ■

MONEY MAKERS

RESEARCH CENTRE: Ethical Pharmaceuticals of Sweden plans to set up a research and development facility in India, said Perake Oldentoft, the company's director, Asia/Pacific, on November 7. The company develops pharmaceutical products including controlled release tablets and transdermal patches. The Swedish company currently has three development facilities at Sweden, the UK and Argentina. The company has already entered into an agreement with the Indian pharmaceutical company Kemwell to produce diltiazem tablets that are used to deal with hypertension and angina. The commercial production is expected to commence in December this year.

SOFTWARE CENTRE: Microsoft Corp, the world's biggest software company, plans to set up a software development centre in India, according to Orlando Ayala, Microsoft's vice-president for intercontinental operations. This would be the company's first major centre outside the US. "We should come out with an announcement by the end of the year," Ayala said. "India is definitely being picked as a centre. It is not a question of if, it is a question of when," he said. He added that the Indian centre could be used to develop an entirely new kind of software.

IN THE PIPELINE: Enron, the US energy giant, is in the process of completing an agreement with Qatar to set up a US \$5-billion liquefied natural gas (LNG) venture as soon as it finalises its gas arrangements with India. On November 8, Qatar General Petroleum Corporation held negotiations in Abu Dhabi with Enron regarding firm agreements for the joint venture in Qatar. In a press statement issued in Doha, Enron said that it expected the agreements to be completed as soon as its gas arrangements in India were finalised.



DRIVING THE BUZZ: Citrus Clean is the name of an ecologically sound insect repellent launched by Ecosense Labs (India) Pvt Ltd. It is

a special combination of natural herb extracts such as citronella oil, lemon grass oil and pine oil. The product can also be used as a disinfectant to mop floors. It is non-toxic and can also be used to clean kitchen and dining tabletops and is available at a price of Rs 89.75 for a 250 ml pack. The company also produces a range of biological pesticides and fertilisers.

FAT BILLS: Americans spent US \$57.3 billion on illegal drugs in the year 1995. This is slightly lower than that of 1994 and two-thirds of what was spent nine years ago. This was revealed by president Bill Clinton's top advisor on drug control on November 9. Of the money spent in 1995, \$38 billion was on cocaine, \$9.6 billion on heroin and \$7 billion on marijuana, according to a study released by Barry McCaffrey, director of the White House office of national drug control policy.

OIL TO PAKISTAN: Hindustan Petroleum Corporation Ltd (HPCL) has said that it can export oil to Pakistan from its proposed refinery in Bhatinda, Punjab. The oil can be transported by road as the border is quite close to the refinery. HPCL is all set to submit its detailed feasibility report for the proposed refinery



which is also being promoted by the Saudi Arabian company Aramco. As proposed, HPCL and Aramco will hold 26 per cent stake in the joint venture and the balance will be offered to the public. The total project cost including a 1,000-km long pipeline to the Gujarat coast and a 1,100 MW power plant is estimated at Rs 11,000.

THE SOUTH

ASIA & THE PACIFIC

THAILAND: Gemologists in Bangkok say that hundreds of dangerously radioactive gemstones are circulating in Asian markets and some of them have found their way into finished jewellery. Tests conducted by radiologists in the city revealed that some stones had radiation levels 50 times higher than that permissible under US standards. These can lead to health problems including cancer.

The main reason for concern is batches of a precious stone called "cat's eye" that are believed to have been irradiated to change their

of a Geiger counter (which is used to measure radioactivity), we literally leapt back," said Jon McDonald, editor at a local jewellery media firm, who witnessed the testing of the ring. "The machine was just screeching every time the ring went near it," he pointed out.

Tests conducted recently on a 3.5-carat stone showed radioactivity levels higher than 52 nanocuries per gram. Gemologists point out that the acceptable level according to US standards in one nanocurie per gram while that in Asia is two nanocuries per gram. "This is dangerous. It could make

coming through." But an Indonesian jewellery industry official doubted his country was the source of the radioactive stones. "Indonesia buys a lot of gemstones from Burma, Thailand and India. But to my knowledge, there are no laboratories here to treat these stones," he said.

Thai gemstones dealers have been buying radiation detectors as pointed out by distributors. "Most of the people doing business in

Thailand have very little knowledge of radiation in gemstones. I hope we can help educate them" said Monta Chaiyabal, managing director of Duwell Intertrade Co, which sells Geiger counters.

BANGLADESH: The country is to go ahead with a much-delayed plan for a nuclear power plant, said officials of the Bangladesh Atomic Energy Commission (BAEC) in Dhaka. The plan has been



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colour from yellow to an unusual chocolate hue. Yellow-coloured stones cost a few hundred US dollars per carat, whereas the chocolate-coloured ones are priced at thousands of dollars per carat. "It is most likely that the stone has been bombarded with neutrons in a nuclear reactor," warned the Center for Gemstone Testing, Bangkok.

Recently, a 30-carat radioactive cat's eye set embedded with diamonds in a finished ring was found at a jewellery fair in Hong Kong. "When it was placed in front

your skin cancerous and destroy white blood cells," said Bandhong Wangcharoenroong, director of radiation measurement division at Thailand's Office of Atomic Energy for Peace.

Hundreds of carats of the stones are thought to be circulating in Bangkok. But the problem is region-wide, said Ken Scarratt, director of the Center for Gemstone Testing. "The biggest problem is in places like Indonesia and Japan," said Scarratt. "In Indonesia, a gem laboratory has seen hundreds of these stones

SOUTH ASIA

RIVER OF SORROW: Several families have been affected by the release of water from the Indian side into the Jogbuda river in Nepal. In this regard, local residents of Dodhara submitted a memorandum to the prime minister of Nepal and called for immediate relief measures. According to estimates, nearly 50 ha of land with standing crops, homes and cattle sheds are damaged each year after the excess water is released from the Sharada Sagar reservoir and the Lohiya head power house. India is said to have failed to initiate any process to solve the problem despite repeated pleas from Nepal.



FLOOD ASSISTANCE: The Asian Development Bank (ADB) has approved a US \$100 million loan to Pakistan for a flood protection project. The loan will be used for building embankments, spurs and flood retention and dispersion structures and also to plant trees, shrubs and reeds along river banks to save them from erosion. The total cost of the project has been estimated at US \$200 million. The Overseas Economic Cooperation Fund of Japan would provide US \$50 million for the project.



IN SHALLOW WATERS: Spraying of pesticides and insecticides in paddy fields has posed serious threats to several varieties of rare and attractive fresh water fish in Sabaragamuwa province of Sri Lanka. As paddy fields are close to the waterways, the chemicals reach these streams and rivers. The most beautiful variety of fresh water fish in the province, called *Bulath Hapaya*, has already disappeared from the streams, whereas other varieties such as *Mal-Handaya*, *Thal-Koraliya*, *Weli-Gowwa* and *Lela* may soon face extinction.

in the pipeline for more than 35 years. Sheikh Hasina Wajed, the Bangladeshi prime minister, gave her approval for the project to meet the country's growing demand for electricity. "The political commitment was very much required, which we got. Now we will locate sources of funds," said an official of the BAEC. "Suppliers are known and there are many, but funding will be crucial."

However, officials at the ministry of energy doubted the availability of foreign funding for nuclear power projects in the country. They point out that the West lacks confidence in Bangladesh's ability to run such a project safely. The World Bank (WB) does not favour the project, they point out. The WB is an important donor to Bangladesh's energy sector. In a recent review of the government's expenditure, it had suggested that the project should be dropped.

The WB president James Wolfensohn told the press during a recent visit to the country that the bank was unlikely to provide finance for the project. "They have great influence over other donors," said an official.

IRAN: Tehran has ratified the Chemical Weapons Convention, a new treaty banning the production and possession of nerve gas weapons. The treaty subjects all signatories to mandatory international inspections. Countries that do not join the treaty will be gradually excluded from selling conventional chemicals such as pesticides. So far, 104 countries have agreed to participate in the international control and inspection system established by the treaty.

UNITED NATIONS



The United Nations Development Program (UNDP) offices in South Korea have extended their helping hands in transfer of agricultural equipment from to North Korea.

Severe drought and tidal waves have destroyed a major part of the country's crops this year, including 70 per cent of the maize crop. The equipment would include earth-moving machinery and transport and support vehicles. According to Christian Lemaire, resident representative of the UNDP in Pyongyang, this is the first real cooperation between the two countries on

sustainable activities in the agricultural sector. The shipment is expected to bolster the UNDP's Agricultural Rehabilitation Programme in South Korea.

The United Nations Population Fund (UNPF) has planned to provide US \$15 million for its fourth programme of cooperation with Angola till the year 2000. The decision was announced by UN officials in Luanda recently. Idalina Bamba, a UNPF official, said that the grant is aimed at reviving the development process in the country and that it would enhance the quality and life standard of the people in Angola. Bamba said that UNPF has also planned to improve the quality of medical services rendered to pregnant women and reduce mortality.

AFRICA

EGYPT: The Egyptian government scrapped controls on rents for farmland in October after a gap of five years. Egypt's 9,04,000 tenant farmers have become subject to a 1992 law allowing landowners to charge market-level rents and denying tenants the right to pass rented land on to their children. Effects of the move can be noticed easily. State-imposed production quotas have been abandoned and import levels left to the market. The law is intended to improve agricultural output, diversify production, encourage investment and promote exports.

Supporters of the reforms say they will allow more flexible land use. "When the rent is low, the tenant does not have any interest in increasing output," said Saad Nasser, economic advisor to the agriculture minister. Critics argue that they will undermine the country's food security and create an underclass of labourers. Tenant farmers, on the other hand, view the law as an intrusion in their business. They say it would interfere with age-old practices.

LATIN AMERICA & THE CARIBBEAN

MEXICO: Close at the heels of hurricane Pauline that destroyed parts of Mexico in October killing at least 230 people and rendering 3,00,000 homeless, another hurricane — Rick — struck the fishing villages and tourist resorts over the country's southern coast on November 10. High seas, heavy rains and winds up to 120 km per hour destroyed roads, damaged bridges, severed communication links and drove hundreds of people from homes in holiday resorts such as Huatulco, Puerto Escondido and Puerto Angel. All airports

and seaports in the area were closed and power supply in the region was disrupted. But there were no reports of injuries or deaths.

The limited extent of the damage due to hurricane Rick has been attributed to two factors. Firstly, the hurricane was nowhere as strong as Pauline. Secondly, after suffering the havoc in the previous hurricane, people responded to the warning well in time to significantly curtail the damage to life and property. Also helping preparedness this time were hundreds of rescue workers from across Mexico still deployed in the affected parts to handle the aftermath of the hurricane Pauline.

Jose Flores sifts through the wreckage of his home after the hurricane Rick struck the coast of Mexico on November 10



AP/PTI

SOUTH KOREA / AGRICULTURE

Ban on US fruit

THE South Korean government temporarily banned the import of fruits from two areas of California on November 7 following the US administration's declaration that harmful insects were found in the fruit grown in the region. The ban covers nine fruits including oranges, lemons, melons, kiwi and limes grown in Walnut Park, Los Angeles county, and Mitipas, Santa Clara county. The US administration is exterminating the medfly in these regions.

"It is a follow-up measure after the US kept fruit produced in the areas from trading to prevent the transfer of harmful insects to other areas," said Chang Young Kook of the South Korean ministry of agriculture and fishery. Earlier in the week, South Korea suspended beef imports from Nebraska following reports that it was contaminated by *E coli* bacteria. This has caused a sudden drop in consumer confidence in US meat and fruit, according to reports. ■

RUSSIA / SPACE TECHNOLOGY

Solar panel for Mir

THE beleaguered Russian space station Mir received a shot in the arm when two cosmonauts made a space walk of six hours and 17 minutes to install a new solar panel outside the station's scientific module Kvant on November 6. The new panel would double the power supply on the station. Solar panels soak up light from the Sun to provide power. Anatoli Solovyov, the flight commander, and Pavel Vinogradov, an engineer, also worked on an air purification system and tried to mend a leaking hatch.

David Wolf of the US National Aeronautics and Space Administration (NASA) was backing up his colleagues inside Mir

during their space walk. The solar panel had been delivered two years ago by the US space shuttle Atlantis but had been hanging packed outside Mir after it failed to unfold at first. The cosmonauts had to open them manually. Mir has been plagued by a series of problems after it collided with a cargo vessel on June 25. The next space walk will be on December 5, when Solovyov and Wolf will replace several US scientific devices placed outside Mir. ■

Back to full power: the Russian space station Mir



AP/PTI

Appointment

SPWD

Society for Promotion of Wastelands Development (SPWD), a national NGO, invites applications for the posts of **Programme Director** from highly qualified and experienced persons with a green vision for and commitment to sustainable rural development.

QUALIFICATION: Master's Degree in Science/ Agriculture/Forestry/Rural Management/National Resource Management with an excellent academic record.

EXPERIENCE: At least 10 years' experience in rural development programme with focus on wastelands development/natural resource management/conservation and sustainable development, out of which 5 years should be in a managerial capacity. Skills in project management/developmental communication/policy advocacy/field research and networking would be an added advantage.

LOCATION: The position is at present for Delhi but transferable to any part of the country.

COMPENSATION: At the minimum basic the gross salary is Rupees one lakh twenty thousand per annum plus benefits like EPF, LTA and medical cover. A higher start can be considered for exceptionally good candidates.

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Society for Promotion of Wastelands Development
Shriram Bhartiya Kala Kendra Building
4th Floor, 1, Copernicus Marg
New Delhi - 110 001

INDIA / AIDS

The epidemic grows

AS MUCH as 0.4 per cent of India's population has AIDS. The country has the sixth highest incidence of AIDS in Southeast Asia, says a World Bank (WB) report titled *Confronting AIDS: Public Priorities in a Global Epidemic*. The report adds that the problem is growing rapidly in India and Pakistan.

The situation is at its worst in Thailand, where 2.1 per cent of the adult population is reported to be infected with HIV, the virus that causes AIDS. In Cambodia, the figure stands at 1.9 per cent. In Myanmar and Maldives, the figure is 1.5 and 0.6 respectively. "In many developing countries, the AIDS epidemic is spreading rapidly," the WB officials warned at a meeting held to mark the release of the report on November 3 in Washington DC. They said "a multi-pronged strategy" needs to be urgently drawn up to prevent the disease from becoming a "full blown" epidemic.

The incidence of AIDS is high among users of injectable drugs in the Northeastern states and prostitutes in South India. In other parts of the country, the epidemic is in the nascent stage, the report says. ■

INDIA / HEALTH

Threat from pesticides

INDIANS have the highest levels of pesticide residues in their bodies, says a study conducted at the King George Medical College, Lucknow. Devika Nag, head of the department of neurology who led the study, warned that there was an urgent need for public awareness campaigns to promote the use of safer pesticides. She added that unacceptable levels of human-made chemicals, especially pesticides, in the environment are enhancing and seriously affecting the central nervous system which controls the functioning of the brain.

Pesticides such as DDT and fenthion have been used indiscriminately in homes and farms. Extremely high levels of pesticide residues, mainly DDT, were found in drinking water and dairy products such as milk, butter, cheese and even baby foods, Nag indicated while delivering an oration at the All India Institute of Medical Sciences.

The residues are stored in tiny fat globules in the bodies of humans and animals. The study found that Indians have the highest concentrations of these, while the Japanese recorded the lowest levels. ■

IN COURT

MAKING SOME NOISE: A division bench of the Calcutta High Court has ruled that artists who use loudspeakers in their performances between 9 pm and 6 am and disturb the peace will be punished. Earlier, the same bench of justice B P Banerjee and justice S Barman Roy said that nobody would be allowed to use loudspeakers during the same period for any given purpose. The decision has come in the wake of a complaint made by the special officer of the court, Gitanath Ganguly, who was asked to monitor the decibel level during functions held in the city. Ganguly told the court that after Durga and Kali pujas during the festive season, some singers held open air concerts through the night. The court has directed the West Bengal Pollution Control Board (WBPCB) to inquire in the case and submit a report. A WBPCB spokesperson admitted that numerous complaints are received during the festive season of musical soirees continuing till the wee hours of the morning. The court has also directed Doordarshan, All India Radio (AIR) and the media to inform all singers in this regard. However, the decision has come as a scathing blow to artists. Several artists have expressed their disappointment at the ruling.

POWER GAMES: The Kerala High court has admitted a writ petition challenging the proposed 500-MW naphtha power project in the private sector. The project is to be set up at district Kannur with an estimated cost of Rs 1,750 crore. C Rajan filed the petition on behalf of the Association for Protection of Environment, Kannur. They say that the power station would pose threats to the ecology of the region. Rajan said that the project has been initiated without taking local people into confidence. He pointed out that the location of the project was harmful to the estuarine circulation of unpolluted waters of Valapatanam lake.

INDIA / BIRD TRAFFICKING

Catching them poisoned

BIRD-TRAPPERS have evolved new methods to hunt migratory birds that have started arriving at the Chilika lagoon in the state of Orissa, the largest salt water lagoon in Asia. The latest tactic is the use of oral tranquilisers mixed in foodstuff to eliminate or capture the birds in an unconscious state. It is estimated that at least 15 per cent of the migratory birds

are usually killed by trappers despite the efforts of the forest guards and the police. No less than 156 different species of migratory birds visit come to Chilika during winters. The revelations were made by U N Dev, eminent ornithologist at Bhubaneswar. He said the novel methods have been adapted by trappers after security around the lagoon was tightened by forest guards. Certain villages near the lagoon such as Khalikote, Balugaon, Kuhudi and Mukteswar have become the centre of the poaching activities.

Following the tight vigil by forest guards on the activities of the villagers, the trappers have stopped using guns to avoid the noise and developed new methods. The dead birds are smuggled out by private taxis and trains. Truck drivers are also suspected to be involved in the illegal traffic. ■

Migratory birds at the Chilika lake are being poisoned



IN FOCUS

November marks the beginning of the breeding season of the endangered Olive Ridley turtle on the Gahirmatha coast in the eastern state of Orissa. The first school of the protected turtles is expected on the beach by the third week of the month, according to the estimates of the Coast Guard.

Commodore K V Subramaniam, the Coast Guard (east) commander, said that a Coast Guard patrol ship spotted a school of the turtles off the coast off Chennai on October 10. "Taking into account the ocean current and the speed with which they are moving, we estimate that the turtles will reach the Orissa coast by November 15," he said. The Coast Guard has been involved in the conservation of the endangered turtles since 1978-79 when a sharp rise was noticed in high-sea poaching of the reptiles off the coast of Gahirmatha. Late Indira Gandhi, the then Prime Minister, had intervened to move the Navy and the Coast Guard to the area following concern expressed by ecologists and conservationists.

"The number of turtles killed has come down quite dramatically from the 1980s," said commandant S Murali, chief staff officer (operations), Coast Guard (east). Along with education and awareness programmes for the fisherfolk of the area, the Coast Guard has also provided them with turtle excluder devices for their fishing nets. "We are also assisting the state forest department to sanitise the area," said Murali.

However, it is not the turtles but their nesting area that is under threat now. Ekakulanasi, the largest known rookery of the turtles off the Gahirmatha coast is facing extinction. This has resulted in a reduction of the breeding area of the reptiles. And things seem to be turning for the worse. The problem was discussed at a workshop on conservation of the turtles and the beach organised by the Defence Research and Development Organisation at Bhubaneswar.

INDIA / BIODIVERSITY

Yarns of problems

THE findings of the Central Institute of Research for Cotton (CIRCOT), New Delhi, published in the *Indian Textiles Journal*, say that it is favourable for the Indian industry that fewer varieties of cotton are grown in the country. The institute has recommended the immediate withdrawal of some cotton varieties. "An almost unanimous opinion has been expressed against an excessive number of varieties under cultivation in the country," the findings say. At pre-

sent, more than 60 varieties of cotton are grown in the country.

Findings have revealed that the prevalence of too many varieties results in the mixing of cotton — inadvertently as well as due to fraudulent practices. Also, mixing of seeds leads to the erosion of "varietal purity" and makes it difficult for cotton mills to choose the preferable varieties for spinning different counts of yarns. "Though it would be difficult at present to prescribe any number of varieties, a think-tank must be constituted to come out with clear proposals on varietal denotification," said K R Krishna Iyer, director, CIRCOT. ■

INDIA / INDUSTRY

Deeper than hide

AT A recently held workshop at the Central Leather Research Institute, Chennai, a consensus was reached to adopt an eco-label scheme for Indian leather in accordance with international standards. The workshop was sponsored by the United Nations Industrial

Development Organization's (UNIDO's) regional programme for pollution control in the tanning industry in Southeast Asia (REPO). "To exploit the growing trading opportunities available, the developing countries of the world have to be alive to the concerns of the modern society in the areas of green consumerism and the environment," said N Ravi, joint secretary with the Union ministry of commerce. ■

COMMENT

'Holy dip' leads to boils and sores for devotees in Bihar



RUSTAM VANIA

Future tense

Asian countries voice concern over the irresponsible attitude of the North in reduction of greenhouse gases

NIKHAT JAMAL QAIYUM DHAKA

EVEN as Japan expressed doubts whether the industrialised countries would agree to cut down greenhouse gas (GHG) emissions at the third Conference of Parties (COP-3) in Kyoto, developed countries came in for criticism for not honouring their commitments to the UN Frame-

to account for pollution in previous years. Lack of consensus between the European Union (EU), which is willing to make concessions, and the US, has led to a deadlock at the preparatory meetings at Bonn in October and at Tokyo in November. The Dhaka meet was the third of the regional workshops focusing on the common experiences of

initiatives have been taken in developing countries, many of which will also reduce net GHG emissions. But the developed countries have been extremely slow on their part.

A review of current strategies, and improved access to information on low emission technologies, better networking capabilities, and incentives to promote new partnerships will be critically important to reducing growth rate in GHG emissions. Mintzer urged that the new partnerships identify "North-South, South-South, and South/South-North opportunities for cooperation". Efforts in education and dissemination of information would go a long way in strengthening national and regional institutions, he said.

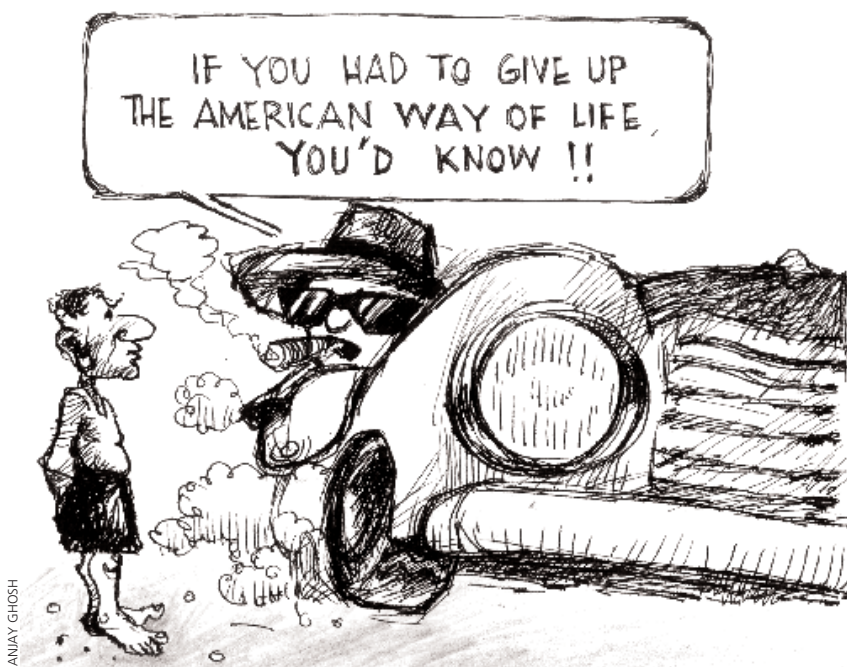
Participants emphasised that technical and financial support was essential for developing countries to be able handle the transition.

Mintzer and others, including Bangladeshi negotiator at the FCCC, Towfiq Ali, said that understanding of global warming has increased over the years. Experts today are calling for deeper worldwide cuts in GHG emissions. However, they said, some parties have launched a misinformation campaign, blaming the developing countries for inaction.

Ali said that at the climate negotiators' meeting at Bonn in October, news of good practices adopted by the South was not circulated widely. Most actions in GHG reduction and sink enhancement are being undertaken by ordinary people and communities. These are hardly being reported.

Reiterating the view that developing countries "see the issue of climate change in the context of sustainable development", president of the Bangalore-based International Energy Initiative, Amulya K N Reddy, said that it is only natural that the concern of the South proceed from the local to regional and national level, before moving on to the global level.

Participants agreed that the South should ask the North to bring down CO₂ emissions and compensate the South for the cost of keeping emissions low. Brazil would propose the setting up of an international fund to finance emission abatement in developing countries at



SANJAY GHOSH

work Convention on Climate Change (FCCC) at a two-day regional workshop in Dhaka on November 8-10.

Industrialised countries are responsible for about 80 per cent of the global carbon dioxide (CO₂) emissions, though they account for only 20 per cent of the world's population. The US, which tops the list of polluters, has been hedging on the issue of reduction of GHGs. Though US undersecretary of state Timothy Worth recently said that the US will "adopt an intricate approach" using many variables to calculate each nation's rate for cutting discharge of GHG, it has not spelt out how it is going

countries of the South in technology cooperation programmes.

About 50 global experts, policy planners and activists participated in the deliberations at Dhaka. The inaugural session was addressed, among others, by Bangladeshi environment and forests minister Syeda Sajeda Chowdhury, Irving Mintzer of the US-based Pacific Institute, and well-known scientist Ogunlade Davidson from Senegal.

Setting the "doing well by doing good" tone for the discussions, Mintzer said that the task before developing countries was to illustrate good practice through country case studies. Several

Kyoto. The fund would run on 'a quota' system. Developed countries with emissions higher than their ceiling would be required to contribute accordingly.

It was also agreed that the common perception of industrialised countries that the South is trying to 'ride the environment bogey as a ploy for begging must be dispelled.' The first step should be to develop comprehensive statistics of the contribution of the South. Negotiators from developing countries would be responsible for conveying this information.

The world is looking to Japan for an initiative, which has announced official targets for emission cuts of 5 per cent of the 1990 level by 2010. The proposal, however, includes exceptions which could mean that the actual cuts amount to only 2.5 per cent.

The Japanese press has been highly critical of the government, stressing that more is needed from Japan which is the host for COP-3. Japan's CO₂ emissions hit a record 332 million tonnes in fiscal 1995. This was 8.3 per cent higher than the 1990 figure. ■

Shell condemned

Ken Saro-Wiwa's second death anniversary marked by protests

PROTESTS and demonstrations were held across the world in support of the struggle for the rights of Ogoni tribals, whose land has been exploited by oil and natural gas transnational Shell in Nigeria. Human rights activists and environmentalists picketed petrol stations selling Shell products on November 10 in New Delhi, Mumbai, Washington, DC, Vancouver (Canada), the Netherlands and Germany at the second death anniversary of Nigerian human rights activist Ken Saro-Wiwa.

In London, environmentalists protested against the Queen's planned visit to Shell on its hundred-year celebrations just one day after Saro-Wiwa's death anniversary.

Shell has a bad environmental and

human rights record. It is heavily implicated in potentially catastrophic climate change and is a member of the Global Climate Coalition in the US, a group actively lobbying against attempts to reverse climate change.

Buckingham Palace had stated that the Queen was acting on the advice of her government in persisting with the visit.

Mark Brown, spokesperson for 100 Days, a network of groups and individuals who have come together in an initiative to challenge the oil industry in the countdown to the Kyoto climate conference commented: "This advice makes a mockery of New Labour's supposed commitment to the environment and an ethical foreign policy. Human rights

transgressions and systematic environmental destruction are the bedrock of Shell's vast wealth and longevity. There is nothing to celebrate."

Although guilty of environmental damage throughout the world, Shell Oil is infamous for its exploitation of Nigerian oil reserves. It has laid pipelines through villages, creating frequent oil spills, destroying once fertile land, polluting rivers, and increasing respiratory diseases. The Ogoni people of the oil-rich Niger delta organised themselves in peaceful protest and successfully forced Shell to virtually abandon Ogoniland in 1993.

However, Shell continued operations. When the Ogonis organised peaceful protests, demanding that Shell clean up the spilled oil and share the profits with the Ogoni, the Nigerian dictatorship — with financial and logistical support and guns from Shell money — conducted a campaign of terror on the Ogoni. Over 1,800 people were murdered. Eight Ogoni activists along with their leader, Ken Saro-Wiwa — winner of the 1995 Environmental Prize for Africa — were executed after being falsely charged with political incitement. Before his death, Saro-Wiwa had addressed a letter to the people of the world through the Press, asking them to boycott Shell products and demand justice for the Ogoni.

Shell makes over US \$300 million a year from Nigeria and is about to begin work on a US \$4-billion natural gas joint venture with the military regime. About 90 per cent of Nigeria's foreign income and 80 per cent of its military revenue is derived from oil. Half of this comes from Shell.

Since the 1950s, Shell has extracted over US \$30 billion worth of oil from Ogoniland. While these huge oil deals have benefited the corrupt dictators, the Ogoni remain among the poorest in Africa, lacking running water, electricity, adequate schools and health care.

Ken Saro-Wiwa's brother, Owens Wiwa, who fled Nigeria after the execution, is continuing the fight for Ogoni rights. He had urged Indian NGOs to support the fight. One of Shell's next targets is India. Europe's Shell International Gas has signed an agreement with India's Essar Group. It will invest US \$2 billion in Indian projects, including one each in Gujarat and Tripura. ■

Shouting loud: picketing and protests against Shell on November 10 in New Delhi



Yangtze dammed

China continues with the world's most environmentally unsound dam project

EVEN as Chinese dissident journalist Dai Qing blasted the Three Gorges project and environmentalists urged investors to stop financing the world's 'most environmentally and socially destructive project', China went ahead and cut off the Yangtze river at Yichang. A final 40-

metre section of a coffer dam was filled in on November 8. The project has been criticised. In September 1997, the Berne Declaration and Swiss non-governmental organisations (NGOs) had strongly opposed the government's decision to cover the Swedish-Swiss company, Asea Brown Boveri, which had landed a contract for setting up eight turbines for the project. At least 25,000 persons joined a postcard-writing campaign to persuade the Swiss government that the project was a bad risk.

From the environmental viewpoint, the Three Gorges — the world's largest hydroelectric project — has been widely opposed. Critics say that a series of smaller dams would be more efficient than the current. Many industries have

Project flayed

Tehri project criticised for lapses in rehabilitation and flouting of environmental norms

EVEN as Sunderlal Bahuguna continued his hunger fast in protest against construction of the Tehri dam, the expert committee on rehabilitation and environmental aspects of the hydroelectric project submitted its report to the government on November 13, 1997. The panel noted major flaws in the project's 20-year old rehabilitation and resettlement (R&R) programme and lapses in following environmental norms.

The 12-member panel, headed by former Planning Commission member C H Hanumantha Rao, has recommended that cost assessment of environmental safeguards be made mandatory for economic clearance. The panel has also given recommendations for eligibility for compensation of majors in families affected by the project. "Dissent" notes by four members suggest that the report omitted many other recommendations.

Three days before the report came out, Union energy minister Y K Alagh met Sunderlal Bahuguna, who has been on total fast since October 2. "If an accredited authority says the dam should be stopped, it should be stopped," Alagh said. Meanwhile, in a letter to Bahuguna, the Prime Minister has urged him to give up the fast and cooperate with the project. A prolonged fast by Bahuguna some years ago had resulted in the setting up of the environment, R&R and the dam safety panels. The latter has yet to submit its report. The government now plans to appeal to the Supreme Court, asking for clubbing of all pending cases.

The Tehri Bandh Virodhi Sangharsh Samiti, meanwhile, has welcomed only the environmental recommendations of the report. "Without the safety report of this risky dam, which is being built in a seismic zone, there is no point talking about R&R," said a samiti spokesperson.

The earth-and-rock-fill dam, along with its subsidiary, the Koteshwar dam, would affect 125 villages, 37 of which



AP / PTI

Look hard: this magnificent site in central China will disappear by the year 2009

metre section of a coffer dam was filled in on November 8.

The Three Gorges project, to be completed by the year 2009, will dislocate over 1.2 million people, disrupt aquatic life, submerge archaeological treasures — including, ironically, a natural stone beam which recorded 72 years of low-water data starting AD 764, and coffins left in the cliffs of Qutang Gorge by an ancient tribe — and reduce the stunning magnificence of the Three Gorges, which soar to a height of 1,000 metres at places.

According to one estimate, the dam will cost US \$28.9 billion (240 billion yuan). Another estimate places the project cost at over US \$73 billion. The project is financed mainly by bonds sold by the US-based Lehman Brothers and other financial institutions. But even from the business perspective the pro-

ject has been criticised. In September 1997, the Berne Declaration and Swiss non-governmental organisations (NGOs) had strongly opposed the government's decision to cover the Swedish-Swiss company, Asea Brown Boveri, which had landed a contract for setting up eight turbines for the project. At least 25,000 persons joined a postcard-writing campaign to persuade the Swiss government that the project was a bad risk.

From the environmental viewpoint, the Three Gorges — the world's largest hydroelectric project — has been widely opposed. Critics say that a series of smaller dams would be more efficient than the current. Many industries have

been located along the Yangtze which have polluted the river and the land. The proposed dam will trap a vast pool of industrial and human waste, creating an environmental nightmare. The dam will flood 632-sq km of fertile land in central China. While rehabilitation of the dam oustees was begun in 1992, few have got new concrete homes and access to land fertile enough to raise cash crops. Many have been resettled in mountainous areas where the soil is thin. These people will find it difficult to break out of the trap of poverty. According to the investigations of environmental consultants Sklar-Luers and Associates, the project is unsafe. In a letter to the International Rivers Network, they said that coffer dam failures may lead to major delays. More importantly, there is "a real risk" that the dam may flood millions. ■

would be fully and 88 partially inundated. It will displace 10,303 families and partially affect 4,278 families.

The project's land acquisition process, which began in 1979, caused considerable confusion, the panel report noted. There were inconsistencies in evaluation, low valuation for trees, non-valuation of common resources, and corruption. The compensation worked out was two acres of land to each fully-affected family and cash compensation for the land submerged for the partially affected. The panel has redefined the word "family"



PRADIP SAHA

Tehri: only rubble and poverty remain

in the R&R policy to include sons and daughters who are 18-plus as of January 1990 as a new family unit. Married sons would receive Rs 150,000 and unmarried sons and daughters would receive Rs 75,000. Those who could not be rehabilitated so far would receive cash instead of land. "It's just a handout, not proper rehabilitation," said S Parasuraman, committee member and professor at the Tata Institute of Social Sciences, Mumbai. He said that the government members in the committee insisted that there was no land available for rehabilitation.

On the environmental aspects, the panel questioned the practice of giving environmental clearance before studies are completed. It noted that the plans for protection of flora and fauna, water quality management, disaster management, catchment area treatment and command area development had not been submitted on time or had not been

submitted at all. Moreover, the ministry of environment and forests has not approved any of the plans submitted. ■

NGOs at risk

Naxalites have moved into tribal areas, forcing social workers to pull out in Andhra Pradesh

THE People's War Group (PWG) has threatened NGOs working in the tribal hill tracts of Andhra Pradesh, blaming them for 'creating an illusion among the masses that their problem could be solved within the existing system'. At least one NGO, Samata, has pulled out of the area.

Accusing NGOs of 'suppressing rebellion, which is part of the revolution', the PWG had apparently taken objection to their tackling 'non-serious issues' such as literacy, hygiene, savings and environmental protection. The naxalite group distributed leaflets in villages in the districts of East Godavari, Vizianagaram, Srikakulam and — straying from its beaten track — Visakhapatnam.

In Orissa, the PWG has moved into the Koraput and Ganjam districts as well. Some of these districts are mineral rich, and large investments have been made to take up mining projects.

"We thought it better to move out once we felt that we were under threat," said Ravi Pragada of Samata, speaking to *Down To Earth* from Visakhapatnam. Samata had been working in the tribal area of Arakku Valley for close to a decade. "Even the tribals we had worked with advised us to leave, as they did not want us to get hurt on their account," adds Pragada.

Pragada had supported the cause of the tribals and helped them file a case against private companies who had obtained mining leases in scheduled areas. The Supreme Court, in a ruling in July 1997, revoked all the leases — including that of Birla Periclase, which had obtained a calcite mining lease in Arakku valley. The PWG has made its presence felt in the valley only in the past few months.

Other NGOs like Laya have also been affected. Most of these NGOs have asked their workers to pull out of the hills. "This is certainly a setback for the tribals in the Orissa-Andhra hills," says Walter Fernandes of the Indian Social Institute, New Delhi. "Some of these organisations have been assisting tribals displaced from other mining and hydro projects in the area and in their rehabilitation. This may change now." ■

Positive move

Kerala to set up biodiversity board

P R J PRADEEP THIRUVANANTHAPURAM

THE chairman of the Kerala science, technology and environment department (STED), A D Damodaran, has ordered the setting up of the Kerala Biodiversity Board (KBB). The board will advise the government on all decisions relating to implementation of provisions of the Convention on Biological Diversity (CBD) '...with a view to converting such genetic wealth into economic wealth in an environmentally sustainable manner.'

To begin with, a biodiversity committee has been constituted for three years. Headed by the chairperson of the STED, the committee will consist of secretaries of the departments of forest and wildlife, agriculture, and fisheries and ports, and the principal chief conservator of forests, apart from panchayat representatives and five experts. However, it remains to be seen whether this will be effective in implementation of conservation measures. Damodaran has a strong political backing, and had supported the setting up of the Pooyamkutty hydel project, which saw a pitched battle between environmentalists and the government. The project was eventually shelved.

Meanwhile, in another move to protect wildlife, the Kerala High Court has banned the use of plastic bags at and en route to Sabarimalai, a popular shrine located in the middle of Periyar Wildlife Sanctuary. ■

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Fisherfolk unite

People from fishing communities across the world are getting organised to fight for their rights



FAO

Poised for the big wave: fisherfolk group up to fight industrial exploitation

IT'S a battle between small fry and the big fish. Fisherfolk from 32 countries have launched a global forum to fight the fishing industry, aquaculture and marine pollution, which have affected their livelihood. Launched at the end of a five-day meet at New Delhi on November 21, the World Forum of Fish Harvesters and Fish Workers (WFF) aims to "protect, defend and strengthen" fishing communities all over the world.

About 100 million people across the world depend on fishing for their livelihood. "Issues before developing and developed nations are not similar, but resources are under threat worldwide," said noted Canadian trade unionist Earle McCurdy, who is one of the coordinators of the WFF. "The North is privatising fish resources. Fisherfolk are struggling to save their livelihood as resources decline." In developing nations, the poor are marginalised when big business interests step in. WFF coordinator from South Africa Andrew Wilfred Johnson noted with emotion that many of his colleagues have died as a result of industrial "gangsterism".

The idea of WFF was mooted at Quebec at the golden jubilee celebrations of the Food and Agriculture

Organisation (FAO) in 1995. Fisherfolk are the only occupational group who did not have a world forum. As a result, fish resources have been over-exploited. In Canada, the cod has been annihilated, and salmon stocks are declining. The FAO's 1995 and 1996 reports have noted

that fisheries are undergoing the most serious crisis ever recorded. Seventy-five per cent of the resources are under threat. The Law of the Seas (1984) and Code of Conduct for Responsible Fisheries (1995) mandate urgent action.

However, the remedies prescribed often work against fisherfolk. Arthur Bogason, chairperson of the National Union of Small Boat Owners, Iceland, said that big industries buy up shares meant for small-time fisherfolk and monopolise the trade. Anti-trawling activist Angela Sanfilippo from Massachusetts, USA, said that as many as 360 trawlers are allowed to harvest fish in an area which is closed to fisherfolk.

At the inauguration of the meet, Union home minister Inderjit Gupta said that concerted action at the global level was required to check over-exploitation of resources. The Indian government set up some controls on the fishing industry after a strike by the National Fishworkers' Federation in 1996. A bill seeking to free industrial aquaculture from the checks imposed by coastal regulation and lifting of the court ban is pending before Parliament.

In a move reflecting dedication to the fishworkers' movement, WFF convenor Thomas Kocherry refused the prestigious Pew fellowship, worth US \$150,000 (Rs 55 lakh). The award is given by the Pew Foundation, set up by the owners of the Sun Oil Company, one of the largest polluters in the US. ■

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Dr Jaya S Verma

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New Delhi - 110 048

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Lurking threat

Nascent, nasty and lethal, ozone has risen to dangerous levels in Delhi, and is increasing in various cities — damaging human health and affecting agriculture

ANUMITA ROYCHOWDHURY

GOING by the limited data that the Central Pollution Control Board (CPCB) is willing to part with — based on monitoring of ozone at a single site in Delhi — there is no cause for alarm. But according to a report published in September this year by another governmental agency, the Central Road Research Institute (CRRI), ozone had already crossed the danger mark in 1993. CPCB's claim flies in the face of logic and contradicts its own findings on the magnitude of air pollution in the Capital.

CPCB has been monitoring ozone at the ITO crossing for the past eight months. But CPCB officials remain tightlipped about their findings. All that they are willing to say is that ozone levels in the city have been "hovering around 40-45 parts per billion by volume (ppbv), much lower than the World Health Organisation limit of 50-60 ppbv". The CPCB attitude is a slight improvement over its previous stand. In an interview with a researcher from the Centre for Science and Environment in November 1996, CPCB chairperson D K Biswas had altogether dismissed the issue, saying that ozone is "not a problem". While it now recognises the need to monitor ozone levels in the city, it has yet to set up a comprehensive system.

Moreover, CPCB's claim is in sharp contrast to the evidence presented by the CRRI. The CRRI study is based on tests conducted at seven locations in Delhi in the winter of 1993 — Parliament Street, Daryaganj, Paharganj, Ashram chowk, Karol Bagh, Maharani Bagh and Vasantkunj. Average levels of ozone at five

sites over eight daytime hours exceeded the WHO mean standard of 50-60 ppbv by 10 to 40 per cent (see graph: *Ozone rising*).

Even more alarming, the peak levels observed in areas with heavy traffic and congestion like Karol Bagh, Daryaganj, and Parliament Street were as high as 119.0 ppbv, 125.8 ppbv, 123.9 ppbv, respectively. In most cases, the maximum concentration of ozone exceeded the upper WHO limit by two times.

Scientists point out that even short-term exposure to high levels of ozone can be deadly — talking about mean or average levels does not help understand the true impact of ozone on health. Studies in other countries have shown that exposure to high ambient ozone

over a short period can adversely affect the lungs. It causes inflammation of the airways (bronchus and bronchioles) and leads to typical respiratory problems — shortness of breath, wheezing and chest pain (see box: *Erroneous ozone*). Keeping this in mind, the WHO has set two standards for ozone concentration. The first, an average measured over eight hours, is 50-60 ppbv. The second, for peak concentrations over one hour, is 76-100 ppbv.

The scope of the CRRI study was restricted to monitoring ozone for a few months in Delhi and, therefore, did not indicate the seasonal trend in ozone formation. Since the objective of the study was to see the effect of atmospheric inversion on the concentration of pollutants during winter, ozone was monitored along with other pollutants. But Anil Singh of CRRI emphasises that the trend in ozone formation during summer should be investigated separately: bright sunlight catalyses photochemical reactions in the atmosphere, aiding the formation of ozone.

Scientists had, in fact, sounded the alarm some six to seven years ago. Studies conducted by the School of Environmental Studies, Jawaharlal Nehru University (JNU) and the Tata Energy Research Institute (TERI) in Delhi had shown that peak levels of ozone in the city had touched the 128 ppbv mark in 1989-90 and 114 ppbv in 1990-91, crossing the WHO safety standard (based on an hourly average) of 76-100 ppbv.

Urban genesis and impact...

Ozone is not emitted directly into the atmosphere. High atmospheric concentrations of ozone are a result of a complex set of reactions in the atmos-

Vehicular and industrial pollution have led to an alarming increase in ozone levels in metros



SOUVENDU CHATTERJEE

Vehicular and industrial emissions release pollutants like nitrogen oxides into the atmosphere. These react to form ozone, which affects the lungs and can even prove fatal

phere which involves emissions of nitrogen oxides and certain reactive hydrocarbons. Most of the primary pollutants are generated by motor vehicles and industries in cities and towns. Scientists point at the dramatic rise in motor vehicles in Indian cities as primarily responsible for emission of ozone-forming gases like NO_x and reactive hydrocarbons.

CRRRI scientists had observed a close correlation between peak traffic flow and peak ozone levels in their study. Interestingly, the study indicated that ozone concentrations in winter peaked before noon and in the evening — closely following the peak traffic trend. Though ozone levels peak at noon in a normal diurnal pattern, the actual pattern showed discrepancies in winter. According to the scientists, this could be due to slow dispersion and trapping of ozone owing to inversion of temperature in the lower atmosphere during evenings and at night. Higher wind speeds at noon could also help in dispersion of ozone.

According to C K Varshney, professor at the School of Environmental Sciences, JNU, ozone formation accelerates during summer due to higher solar radiation. The same factor is responsible for higher ozone levels at noon time, when the sun is brightest. Seasonal variations were noted between 1989 and 1991 in Delhi by Varshney and his team. The maximum concentration was in June 1990, with the monthly mean between March and July ranging from 76 to 81 microgramme per cubic metre (one microgramme is one millionth of a gramme). The mean decreased between September and January to 55-59 microgramme/cu m, but increased between March and July 1991 to 83.45-88.94 microgramme/cu m. Between September 1991 and January 1992 it ranged from 61.85 to 64.11 microgramme/cu m.

Sonia Thimmiah of TERI, who has put together these findings in a study, says that ozone at the ground level in Delhi has often far exceeded the WHO limit (see

table: *All across the country*). Both CRRRI and JNU scientists feel that ozone is bound to rise in Delhi with increase in emissions of NO_x , carbon monoxide,

methane and other hydrocarbons. This will be facilitated by climatic and weather conditions such as high temperature, intense sunshine, and stable wind.

Erroneous ozone

The adverse effects of ozone on human health

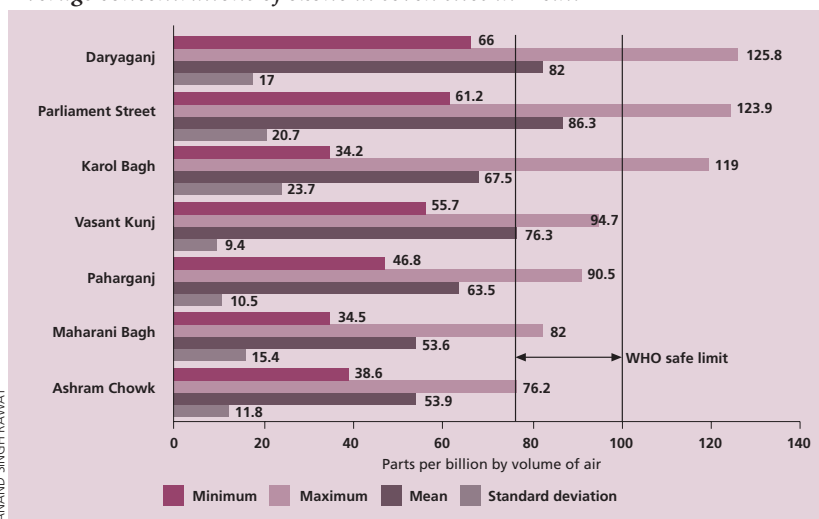
Ozone can affect both healthy people and those suffering from respiratory illnesses such as asthma. Epidemiological studies done in the US and Europe have shown worsening of asthma symptoms, a spurt in use of medicine for treatment of respiratory problems and increase in hospital admissions due to asthma attacks during or immediately after "asthma episodes" in laboratories. Studies have also established rise in incidence of asthma in areas with high levels of ozone. Even in healthy people, short exposure to high levels of ozone affects lung function. The symptoms — shortness of breath, wheezing and chest pain — subside after 24 hours. Ozone releases free radicals which damage cells and affect the immune system.

Following the rise in ozone levels in London between 1984 and 1992, a close relationship was observed between ozone and incidence of asthma. According to a report published in the *Journal of Environmental Health Perspectives* in December 1996, the frequency of emergency hospital visits for treatment of asthma during this period was higher by almost 33 per cent. Maximum one-hour concentration of ozone exceeded 75 parts per billion by volume in these years.

Comprehensive epidemiological studies in India on the effects of ozone have yet to be conducted. But some indicative studies are available. One such study — on the association of air pollution with asthma — by S K Chabra of the Patel Chest Institute, Delhi, has shown that about 12 per cent of school children in the age group of 5-16 years suffer from asthma.

Ozone rising

Average concentrations of ozone at seven sites in Delhi



Source: CRRRI, 1997

The Central Pollution Control Board is willing to concede that air pollution has increased over the years, but does not admit that ozone has risen to alarming levels in Delhi

Recent data published by the Central Road Research Institute, a governmental agency, and other studies clearly show that ozone levels had crossed the danger mark over six years ago

All across the country

Ozone levels in select cities in India

City	Year of monitoring	Ozone levels	Status with respect to standards
Delhi	1989-90	9-128 parts per billion by volume (ppbv) (hourly concentration)	Upper level exceeds World Health Organisation (WHO) standard as well as the one used by the US National Crop Loss Assessment Network (NCLAN)
Delhi	1990-91	15-114 ppbv	Exceeds NCLAN standard
Ahmedabad	1991	9-55 ppbv (15 minute average)	Exceeds NCLAN standard
Chandigarh	1984	29-57 ppbv (monthly average based daily mean)	Exceeds NCLAN standard
Varanasi	1990-92	10-76 ppbv (two-hour average)	Close to WHO standard
Pune	1989	1-34 ppbv (hourly mean)	Does not exceed any standard

Source: Sonia Thimmiah, 1996, 'Air pollution in India with respect to deleterious impact on agriculture,' Tata Energy Research Institute, New Delhi

...And the rural aftermath

Though emissions from motor vehicles and industries in urban areas are responsible for formation of ozone, the hinterlands are equally vulnerable. Alarming levels of ozone have been noted in rural areas within an 80-km radius of cities by scientists from the Imperial College of Science, Technology and Medicine (ICSTM), London, who, along with scientists from JNU and the Banaras Hindu University have recently investigated the damaging effect of ozone on crops.

Interestingly, some of the ozone generated in cities is mopped up when it combines with nitric acid and other gases in the atmosphere. But the ozone that drifts to rural areas does not get scavenged and remains in the atmosphere for a longer period. As a result, these rural hinterlands are turning noxious. The level of ozone recorded by Varshney and team in Delhi in 1992, for instance, was higher at sites away from the heart of the city. Ozone levels at these sites exceeded the WHO standard by 20 per cent, while sites in the city violated the standard by 4-9 per cent.

A significant reduction in crop yield has been reported from areas close to cities with high ozone concentrations in the atmosphere. Data supporting this was presented by scientists at a national

workshop on the impact of air pollution on agriculture in India held in the second week of June 1997. The workshop, organised by the World Wide Fund for Nature (WWF) in association with Imperial College Centre for Environmental Technology, UK, and the ICSTM, presented the preliminary findings of a project on the impact and cost of air pollution on agriculture in developing countries.

Damage due to ozone in rural areas is estimated to be as high as 40 per cent in case of sensitive crops in Punjab, Haryana, Uttar Pradesh, Gujarat and Maharashtra. A team of scientists led by Nigel Bell, professor at ICSTM, conducted field experiments on four crops (wheat, rice, cotton and groundnut) at sites close to Mumbai, Ahmedabad, Pune and Lucknow. Their preliminary findings show large local impacts of ozone. The yield loss reported by them is as high as 40 per cent at sites close to Mumbai, Ahmedabad, Pune and Lucknow (see table: *Cereal killer*).

"There has been no monitoring of ozone in rural India. The predictions made in our risk assessment were based on data from Pakistan which were extrapolated to India. Using city population size as a surrogate for NO_x emissions, we calculated the levels of ozone." The scientists said that the threshold for

significant yield reduction (at seven-hour mean seasonal concentrations) is lower for sensitive cereals like wheat than for less sensitive crops like rice. The threshold for wheat is 50 parts per billion (ppb), while that for rice is 70 ppb.

"Though mean average concentration of ozone for a season is a workable

The Lahore experiment

Conclusive evidence of crop damage by ozone in Pakistan

A group of scientists from the University of Panjab, Pakistan, led by S R A Shamsi, studied the impact of ambient ozone on soybean crop at three sites near Lahore — the Botanical Gardens in the suburbs, Rakh Dera Chahl, a rural site 35 km east of the city, and Kala Shah Kaku, an industrial zone.

The scientists treated some plants at the experimental sites with ethylene-diurea (EDU), a compound known to protect plants from ozone, but allowed the rest to grow untreated. The result showed significant reduction in seed weight in the untreated plants, ageing of leaves and substantial visible injury. Seed weight declined by 32 per cent in the Botanical Gardens, 49 per cent in Rakh Dera Chahl and 62 per cent at Kala Shah Kaku.

The difference in the impact of ozone between urban and rural sites was due to reduction of some of the ozone in cities to oxygen through subsequent reaction with NO_x in the atmosphere. Monitoring at the chosen sites confirmed this. Ozone level at the Botanical Gardens was 40 parts per billion by volume (ppbv), 49 ppbv at the Rakh Dera Chahl and 48 ppbv at Kala Shah Kaku.

The World Health Organisation has set a safe limit for ground-level ozone at an average 50 to 60 parts per billion by volume (ppbv). Ozone in Delhi has often exceeded 120 ppbv

Some of the ozone in urban areas is reduced to oxygen by reacting with nitric acid in the atmosphere, but rural areas nearby get a larger dose of the gas, affecting crops and trees

indicator, it is the peak concentration which is dangerous and we need to keep track of that," says Bell. The scientists have now worked out a new standard for the critical peak level of ozone for plants to estimate damages. The new standard has been developed under the auspices of the UN Economic Commission for Europe. The standard says that the level of ozone absorbed by a plant over a growing season of three months should not exceed 3,000 ppb in a daylight hour (over the baseline limit of 40 ppb). Agricultural scientists in Europe feel that this standard is more reliable compared to the one calculated on the dose-response relationship, since it takes into account damaging peak concentrations of ozone.

Vulnerable varieties...

The impact of ozone on agriculture in India was considered by scientists after conclusive evidence was presented by a study in Lahore, Pakistan. The study showed a significant effect on crop yield when the six-hour mean concentration of ozone varied between 40 ppb and 60-70 ppb. Concentration of ozone was generally higher during the rice season than the wheat season (see box: *The Lahore experiment*).

Ozone can injure cells and tissues or the whole plant. It penetrates through the stomata (minute apertures in leaves that help in respiration and transpiration), reacts with organic molecules and forms secondary oxidants that damage cell membranes. According to M R Ashmore of ICSTM, high concentrations of ozone can cause cell collapse, leading to visible injury to the plant and reduction of photosynthetic processes. Plants use carbon dioxide (CO₂) for photosynthesis. Exposed to ozone for a long period, plants cannot fix and assimilate CO₂ adequately, leading to increased loss of respiratory CO₂. This accelerates ageing and reduces yield in crops. Ozone-

Cereal killer

Estimated crop losses due to ozone in India

Cities	Loss in yield (per cent)	Loss in yield (thousand tonnes)			
Mumbai	40	4.3	20.4	—	3.2
Ahmedabad	29	96.0	91.0	28.5	28.5
Pune	19	39.0	55.9	—	9.9
Lucknow	12	300.1	165.2	—	3.7

Source: M R Ashmore, Nigel Bell and others, 'Estimating crop losses in the field,' Imperial College, Centre for Environmental Technology, London



Spillover: ozone produced in cities can damage crops

induced changes in plants can also alter their sensitivity and ability to react to stress.

Tropical cultivars and plant varieties are more vulnerable to ozone compared to crops grown in the US and Europe. While indicative figures from India show that the loss can be as high as 40 per cent, the concurrent loss in average yield in the US is only 10 per cent of total agricultural production. The loss is higher only in case of some highly sensitive crops like dry beans and onions in states with a warmer climate like California. In the Netherlands, where the climate is cool, yield loss due to ozone is only 3-4 per cent. While Bell

says that further investigation is required to explain the difference, *prima facie* it appears that plant varieties in the Indian sub-continent and tropical countries are more vulnerable to ozone.

...And the resistant

Interestingly, ozone does not affect some plants and cultivars. Scientific evidence from field studies in Egypt show that stomata in a turnip variety almost 'waive off' ozone penetration, and in a variety of radish stomata open readily to allow ozone to pass through. Moreover, a combination of plant enzymes determines the level of resistance of a variety to ozone. Scientists feel that this knowledge could be useful in planning cultivation of crops in areas with high levels of ozone.

Overall, however, the bulk of evidence suggests that the problem of ozone impact on agriculture is no longer restricted to North America and Western Europe. It cannot, therefore, be dismissed as a problem of the North. Ozone has had a severe impact on regions and localities in countries of the South. The evidence is further reinforced by the steady increase in global and regional NO_x emissions, primarily from vehicles in urban areas.

Agricultural scientists are worried about the limited or

poorly coordinated monitoring of air pollution in rural areas in Asia, Africa and South America. As of now, it is only possible to draw on isolated studies in a few countries that indicate the gravity of the problem. Urges Bell: "It is important to combine data on pollutants and agricultural yield in a compatible form in developing risk assessment models." He suggests appropriate use of geographical information systems in landuse planning and pollution control to minimise the adverse impact of ozone on crops. ■

With inputs from Priti Kumar and Shafali Verma

Lost in the Thar

The Indira Gandhi canal project is a costly failure that has led to destruction of habitat and loss of arable land



PHOTOGRAPHS: AMIT SHANKER / CSE

Sun, sand and salt: rising water tables spell doom for agriculture in Rajasthan

INDIRA KHURANA JODHPUR

THE Indira Gandhi canal project is an example of what short-sighted planning can do to the environment. More than solving water problems in Rajasthan, it has converted the area it irrigates into a marshy and saline desert. Arable land and habitations have become waterlogged. Villages lie deserted and native flora and fauna are dying out, while non-native species thrive in the saline, waterlogged areas.

The water table in areas along the canal and in its command area has risen. Satellite imagery indicates that there was no waterlogging in the area in 1975. In 1995, 6885 hectares (ha) of the command area was waterlogged. The Thar conjures up images of conditions hostile to life — dry, barren sand dunes stretching for miles on end, interspersed with scrawny bushes and babool trees battered by the sun and wind. Yet, biodiversity in the desert is a source of wonder to even the most know-

ledgeable botanists and zoologists. As the locals put it: '*Marwar mein barah kos mein boli, jeev aur vanaspati thodi badle*' (The dialect, the fauna and the flora change every 38 km in Marwar). Some 600 species of plants, six per cent of them endemic, and over 470 animal species have been recorded so far. These species compete in a delicately balanced ecosystem.

The Indira Gandhi canal has wreaked havoc on this fragile system. Says M M Bhandari, emeritus scientist at Jodhpur University: "Exotic species are spreading. Species which could be found just 30-40 years ago cannot be found any more."

Excess of water and clearing for agriculture has also affected sewan grasslands. Sewan grass grows in areas characterised by low rainfall, and is an important part of the Thar ecosystem. "One does not see rolling sewan grasslands anymore," says Ishwar Prakash, emeritus scientist at the Desert Regional Station, Jodhpur. Satellite images show

Unhealthy trend

Rise in infectious diseases in the canal's command area

Desert rodents like the Indian gerbil (*Tatera indica*) and *Meriones* are carriers of plague, but are resistant to the disease. Another group of rodents, which includes the house rat (*Rattus rattus*) and the bandicoot (*Bandicota bengalensis*), is highly susceptible to plague, which is transferred by fleas (*Xenopsylla cheopsis* and *X. astia*). Decimation of plants and insects species that the rodents fed on has increased competition for food between the two groups — the wild reservoir (*Tatera* and *Meriones*) and the highly susceptible *Rattus* and *Bandicota*. Both now occupy the same habitat. This has increased the risk of transfer of the plague bacillus from one species to the other. The house rat sometimes goes into fields in search of food and can get infected, transferring the disease to humans. Sporadic cases of plague are now more likely in vulnerable pockets.

Waterlogging has also created conditions suitable for breeding of mosquitoes and the sand fly. Cases of malaria are now on the rise. Leishmaniasis, caused by a parasite borne by the sand fly, has also become a serious health hazard. Several cases have been reported in Suratgarh and Sriganganagar. Some fear epidemics of the disease in the canal's command area.

that perennial grasslands, dominated by sewan (*Lasiurus indicus*), cover nearly six million ha in the region. These are being degraded either due to

Problem of pests

Ecological imbalance and pestilence in western Rajasthan

The availability of water for irrigation has changed agricultural practices. With new crops, new pests have emerged. Hardly any records are available prior to 1975. Studies carried out between 1975 and 1991 indicate several changes — four insects have changed their hosts, 13 classified as minor pests have now acquired major pest status and 15 new pests have been recorded.

Locusts are unable to lay eggs in the dry, compact soil of the desert. After the first showers during the monsoon, the soil becomes penetrable. This is the time locusts lay eggs and multiply. With the irrigated soft soil now spread over a vast area, locusts can now find a perpetual breeding ground. The locust threat was formerly only in the months of May and June. In 1997, locusts have

been spotted in Barmer district as late as September. The migratory locust could turn into a resident pest of crops and vegetation — it has a tendency to inflict damage throughout the year.

Desert rodent species like the *Meriones* and the Indian gerbil (*Tatera indica*) are being replaced by rodents like bandicoots (*Bandicota bengalensis*). The bandicoot is a big threat. Not only does it consume twice as much as desert species, it also inflicts more damage to the standing crop due to its propensity to hoard. Bandicoots quickly adapt to inhabit godowns and warehouses and urban settlements. *Millardia meltada*, another rodent, is notorious for its depredation of standing crops and natural vegetation.

Invasion of crops by insects not native to the desert have also been recorded in recent years. These include the stem borer (affecting cotton), the leaf defoliator (on groundnut), army worms, root aphids and paddy hoppers which have attacked wheat, paddy and gram.

land. The Indira Gandhi Nahar Pariyojana (IGNP) command area covers the districts of Sriganganagar, Bikaner, Jodhpur and Jaisalmer — the driest part of western Rajasthan. The main and feeder canal will command over two million ha, of which 1.3 million ha is cultivable.

The IGNP is in two stages. Stage I includes the total length of the Rajasthan feeder (204 km) and the Rajasthan main canal (189 km), with a total service area of 0.95 million ha, more than half of which (0.54 million ha) is cultivable. Stage II includes the Rajasthan main canal from its 189th km to the tail (445 km). The gross service area is nearly 1.10 million ha, while the cultivable command area is 0.76 million ha. The command area of stage II annually receives less than 150 mm of rainfall. The terrain is dune covered.

Critical areas are those where waterlogging has already occurred or has risen to within six metres of the land surface. It has been estimated that by the year 2000, about 3,960 km or 50 per cent of the canal command

impoverishment of useful species or indiscriminate grazing (see box: *The wonder grass*). Nearly 24 per cent of the pastureland has been lost to the desert and 44 per cent is in a highly degraded state.

Destabilising dunes

As more and more land is coming under agriculture, the balance of nature has been affected. Stable sand dunes are being eroded by the wind and have become unstable. These unstable 'moving' sand dunes — barchans — cause soil erosion.

"This is a particularly serious problem in western Rajasthan, specially southwest of Bikaner, where the wind velocity is high. The whole area has become unstable," says Amal Kar, senior scientist at Central Arid Zone Research Institute (CAZRI), Jodhpur. Cultivation has become more difficult, while the cycle of erosion continues.

Traditional crops are being replaced by rice, wheat and cash crops. This has encouraged growth of weeds and insect species not native to the area, which have invaded marshy land (see box: *Problem of pests*). The threat of locusts

attacks looms larger than ever before. "Moist soil conditions are conducive for locust breeding," warns Prakash. Earlier, locusts were a threat in the months of May and June. Now locust swarms have been reported in September.

The changed environment has also caused health problems — malaria and leishmaniasis. The threat of plague looms large (see box: *Unhealthy trend*). The concept of 'greening the desert by means of canals' has created an early grave for western Rajasthan's biological diversity.

Stepwise destruction

Originating from the Harike barrage on the Sutlej river in Punjab, the canal, designed to transport 9,856 million cubic metres of the Ravi-Beas waters, was supposed to transform 11 per cent of the barren area of western Rajasthan into green, arable

Reduced grass cover has increased wind erosion





Cultivable land has turned into a marshy desert

area will become critical.

In stage I, the main problems are due to waterlogging caused by seepage from the canal and bad irrigation practices. The subsoil consists of a layer of gypsum, which is impermeable. Soil and groundwater contain some dissolved compounds of sodium, calcium, magnesium. Trace amounts of these salts are beneficial, but an excess has an adverse effect on plant growth and crop yield. "Salt-affected soils are naturally found in deserts," explains D C Joshi, soil scientist at CAZRI. "But faulty irrigation practices need to be controlled."

In places like Dabli Kalan and Dabli Khurd, at the head of the canal, and at Sansardesar, seepage of water has led to waterlogging, flooding of agricultural fields, abandonment of settlements and salt infestation. The rate of rise in the water table in stage I of the IGNP varies from 0.7 to 1.1 metres per year.

"Water is available, and farmers use the amount that has been allotted to them, rather than the minimum that they should. Since there is an impermeable layer below the soil, the water has no place to go. This excess water dissolves the salts in the soil and gradually comes up," says K D Sharma, senior

hydrologist at CAZRI. This salt deposits on the soil and makes the land unfit for cultivation. "Prime agricultural land is being lost," says Kar. "Farmers find that they have to abandon their fields almost overnight."

In Suratgarh, Baropal, Manaktheri, Jakharanwali and Kanau, stagnation of water has created vast lakes invaded by weeds and supporting insects and pests. Fields and settlements have been flooded. Even the village temple has been submerged.

In stage II, the problems started with the digging of the canal. Dune vegetation consists largely of *Calligonum polygonoides*, 'khimp' (*Leptadenia pyrotechnia*), 'bui' (*Aerva pseudomentosa*), 'phar' (*Dipterygium glaucum*), 'lana' (*Haloxylon salicornicum*), and 'aak' (*Calotropis procera*). These have been disturbed or removed during construction, leading to formation of mobile barchans, many of them in the cultivated fields, which are now infertile. Inundation of low-lying areas has also wiped out *Prosopis*, *Acacia* and other species. Canal seepage has waterlogged areas near Amarpura, Bajju and Madasar. In Awai village, movement of machinery is impossible — waterlogging has created 'quicksand' and many heads of cattle have been lost.

The tail end of the canal with low water level has a lot of silt at the bottom, facilitating fast growth of green algae. Low levels of water support the growth of submerged species like *Polygonum hydropiper*. Water hyacinth (*Eichhornia crassipes*) is a major problem in areas like Birdwali, severely impeding water flow.

Looking for solutions

The fragility of the ecosystem makes it is necessary to understand the environment impact of developmental inputs before any plan is executed, says Kar. "The damage caused by some earlier irrigation schemes should be warning enough," says Kar. Since the project has

proceeded without the necessary geological information and knowledge of the ecology, it has caused more harm than good.

Kar, however, is still hopeful. It is possible to reclaim land if the flooding is stopped, he says. The rising water table can be checked by digging shallow tube wells and pumping water back into the canal. This has to be calculated and precise, since about 75 per cent of the command area is characterised by saline groundwater — mixing this with fresh canal water would defeat the purpose.

But little can be achieved without political will. "I get a standard reply from villagers when I visit the area," says Kar. "We get a lot of visitors — politicians and bureaucrats — who look around and mouth platitudes. That is the last we hear from them." That just about sums up the political will. ■

The wonder grass

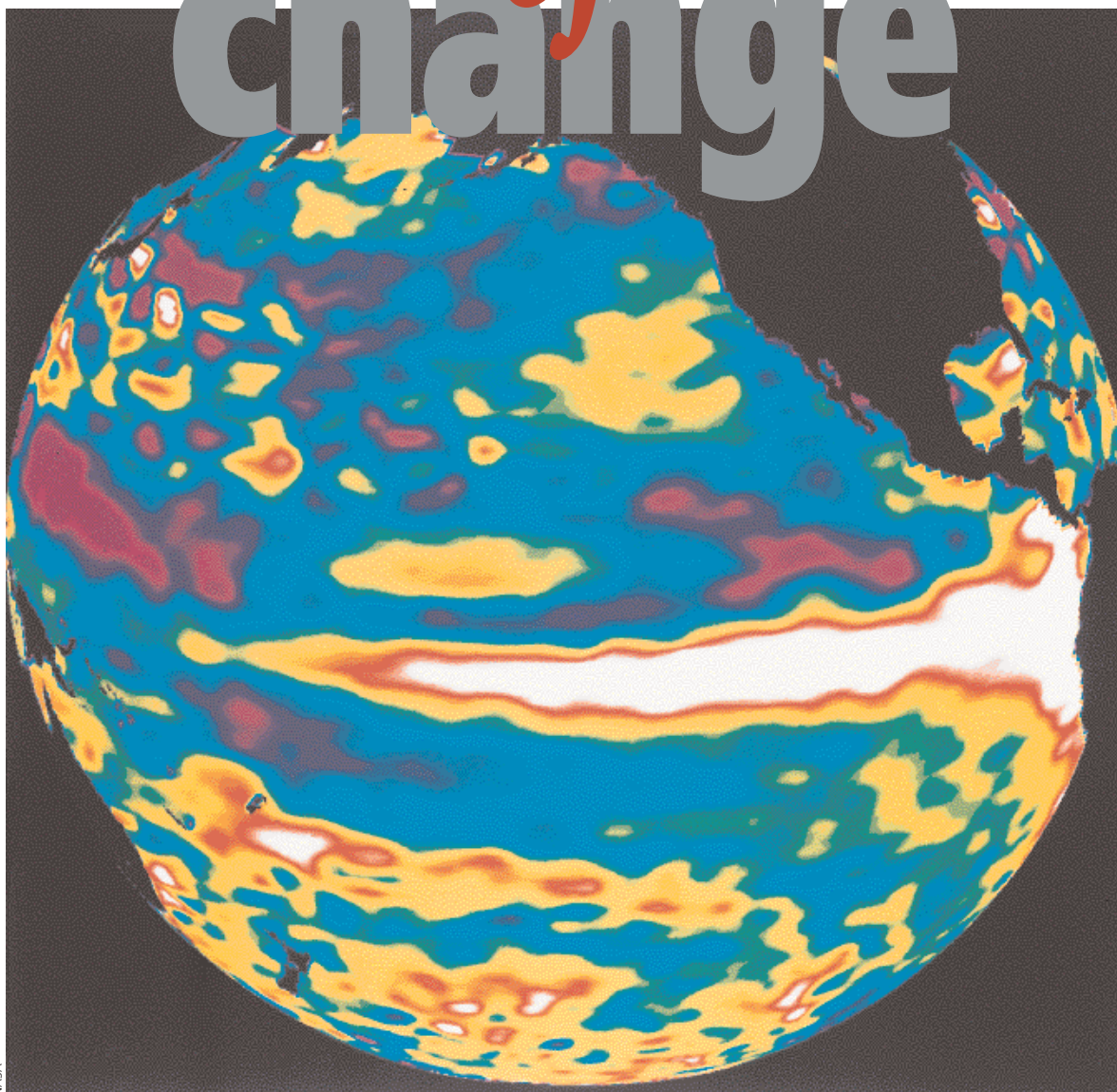
Adaptation in the desert

Sewan grasslands occupy areas with low rainfall. They were spread across Bikaner, Jaisalmer and Barmer districts, but can no longer be seen now. Irrigation became possible with water from the Indira Gandhi Canal, and the grasslands were transformed into agricultural fields. But flood irrigation has also increased soil moisture, threatening the survival of species.

Sewan is very well-adapted to the desert. Highly energy-efficient, it produces substantial biomass with little water. Sewan is one of the most nutritious grasses known (protein content 7-11 per cent). Locals say that butter milk of cattle fed on this grass is highly rich in protein.

Sewan's roots lie dormant for years at a stretch, despite recurring droughts. Growing to a height of 75 to 100 cm, it is a tough grass. Vegetative growth begins in July and the seed is ready by August or September. It is cut and stored by the villagers for use in times of drought and scarcity, and can last up to 10 years. But excess water is harmful for the grass, which can only thrive in a harsh and dry environment.

Winds *of* change



NASA

A satellite image of the Pacific Ocean taken on June 25 1997 shows that the weather disrupting phenomenon known as El Niño is getting stronger. The white and red areas (where El Niño emerges) indicate the abnormal warming up of the ocean. This area is about one and a half times the size of the US. The green areas indicate normal conditions

El Niño, a weather phenomenon caused by a complex interaction between atmospheric and oceanic conditions has ushered in drought, forest fires and devastation this year

Genesis of a crisis

In 1982-83, El Niño caused worldwide destruction. But the present one, scientists say, is the worst this century. Interestingly, commodity brokers and construction material firms stand to gain from this weather phenomenon

IT HAS caused a severe drought in Australia and Papua New Guinea. It has led to a famine in South Africa. Hurricanes in Mexico are said to have been caused by this phenomenon. Floods in Peru are due to its movements. It has fuelled the forest fires in Indonesia and the Amazon. It has affected marine and wildlife. It has killed thousands and has rendered millions homeless.

Ironically, it is the "Christ child" which is causing all this devastation.

El Niño, which means "the little one" in Spanish was first recognised by fisherfolk off the coast of South America as early as the 19th Century. A warm current in the eastern Pacific brought in its wake the inexplicable death of thousands of fish. Since it normally became optimal around Christmas they called it the Christ child. The tiny micro-organisms which fish depend upon for food, were the first to die. The fish followed suit. Sharks retreated to the bottom of the ocean where the temperature was cooler. But worse was to follow.

Devastating rainstorms and floods would become the order of the day. In some areas the rains would cease and wind patterns could turn green pastures into deserts. Scientists today believe that the Atacama desert in Peru is the result of

atmospheric activity associated with El Niño. In some regions there would be more than abundant rainfall. The rainforests of Borneo and Indonesia are supposed to owe their existence to this phenomenon. Social behaviour and eating habits of animals are also affected: from mating patterns between sea lions to eating patterns for marine iguanas, to the death of penguins and other flightless birds by starvation.

Cropping patterns also do not escape the wrath of El Niño, whether it is the corn harvest in Zimbabwe or the rice bowl of Asia. The weather patterns created by El Niño threaten food supplies in many Asian and Pacific rim countries.

NO CHILD'S PLAY

This summer's El Niño is said to be the strongest of the century.

The world will soon be divided into two groups, those who will benefit from El Niño and those who won't.

In 1982-83, El Niño caused severe flooding in Latin America and drought in Asia. Total damages were estimated at around US \$8-13 billion and 2,000 lives were lost.

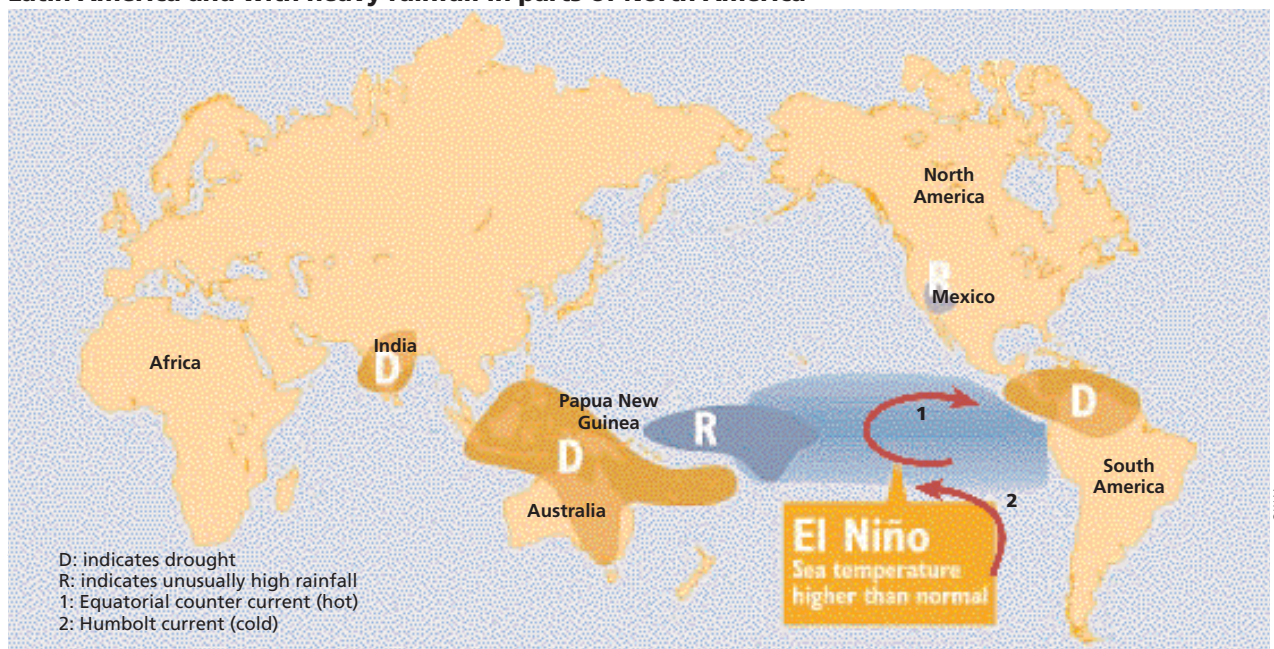
The FAO has observed deviation in weather patterns in Asia which is worrying.

Weather experts from the West say that El Niño will strike India next year. Indian scientists, however, feel otherwise.

The drought in India in 1987 was supposed to have been due to El Niño, but till today the Indian government has no contingency plan.

Which way the wind blows

El Niño has been associated with drought in Indonesia, northern Australia, India and northeastern Latin America and with heavy rainfall in parts of North America



Already a drought grips most areas of Southeast Asia and threatens to bring down the production of commercially important crops like coffee and palm oil. Mining activity dependent upon hydroelectric power has been suspended and weather patterns linked to El Niño could lead to a decline in the wheat yield in Australia which is at present leading to bushfires there.

Misinformation about the phenomenon could also end up costing businesses and consumers a lot of money in terms of cancelled vacations, a drop in tourism and even speculation on energy pricing in the hope of a mild winter. El Niño winters on the contrary can be brutal.

Satellite imaging and data gathering computers have shown that the tentacles of El Niño spread from the Pacific to vast areas in Australia, Africa and Asia which become susceptible to drought. In the North American continent specially from California to Florida heavy torrential winter rains can be expected. Memories of the arid tornadoes and torrential winter rains caused by the 1982-83 El Niño are still fresh in the minds of residents of southern California.

The planet is warming

Warm conditions have persisted in the tropical Pacific since July 1997. According to the World Meteorological Organisation (WMO), sea surface temperatures throughout the equatorial east-central Pacific increased during April and May, when temperatures normally decrease in this region. During August and September ocean surface temperatures reached near-record levels in many sections of the equatorial Pacific. Temperatures increased by four degrees along the Equator east of 120°W and increased by five degrees near the Galapagos Islands along the coast of northern Peru. Exotic warm water species of marine life such as the swordfish have been found as far north as in the state of Washington. Much to the delight of anglers a 130 kilogram goldfish was caught in Seattle and giant rainbow-striped anchovies and crabs are adding to the quality of the fishing there.

This delight is not mirrored in California where mass hysteria with regard to El Niño has gripped the populace at large which is readily lapping up quick-fix remedies promoted by unscrupulous marketing agents. As Californians prepare for an unusually brutal winter the demand for roofing material like gutters has gone up by more than 20 per cent. Manufacturers are doing roaring business in the selling of roof repair products.

According to Michael R Smith, the president of Weather Data Inc. a weather forecasting company located in Winchita in Kansas in the US, the situation has gone out of hand. "This is the best publicised potential disaster in history," he says. "People are drawing a very close parallel to 1982-83," he adds. "Some of the precautions like cleaning out flood control channels will pay off handsomely if there are problems," he nevertheless concludes.



Unholy blaze: extreme dry conditions made it impossible to put out the forest fires in Indonesia

The Antichrist

El Niño takes birth in the Pacific periodically to upset weather patterns globally

The weather is a complex system and a number of factors influence it. Chief among them are the rotation of the planet which helps give direction to the winds. This disturbance in the atmosphere takes the form of a giant heat exchange system with hot air moving from the tropics to the poles and cold air moving from the polar regions towards the Equator. These movements help to balance the overall temperature of the Earth. Otherwise the tropics would become unbearably hot and the middle latitudes increasingly cold.

The sea gains and gives up heat more slowly than the land. The ocean currents are dependent on the winds themselves and influence the winds helping to carry heat to the colder parts of the Earth. The winds also carry the life-giving rain on which human activities like agriculture depend. The El Niño effect leads to the strengthening of a warm ocean current called the Equatorial Counter Current in the mid-Pacific.

The Humbolt or Peru Current, (See map: *Which way the wind blows*) which is a cold current in the south Pacific Ocean and responsible for bringing nutrients and micro-organisms to the sea surface is disrupted by this. The nutrients which are food for fish do not reach the surface. The fish migrate or die by thousands, affecting other parts of marine life. The entire weather mechanism is disrupted. This happens approximately every ten years. Rainfall is delayed, crops are adversely affected and storms occur where they should not. The change in temperature leads to an aberration in the growth of vegetation which normally does not grow as well in the particular region, and plant life, which fared better in the cooler climate, dies out. The world puts on a new garb to welcome the Christ child. As of now a full blown El Niño is underway.

Meanwhile, the weather is still dry. This presents dry condition means more wine. Wine lovers are definitely not whining over El Niño, nor is anyone in Bordeaux in France, where the empty bottles are now in short supply.

The flip side

As things stand the world is soon going to be divided into two groups, those who benefit from El Niño and those who don't stand to benefit from it.

The President of Peru, Alberto Fujimori, has cast off his bullet-proof vest after having disposed off the terrorists at the Japanese embassy. He has now decided to take on "the little one" to boost his sagging image. Construction work is in full swing reinforcing the nation's dams and bridges as Peru prepares for a showdown with nature.

There is also a growing realisation that El Niño's adverse effects on the sugar crop will be limited in the current crop cycle. According to the International Sugar Organisation in the UK, the unseasonal rains have only marginally affected Australia's sugar crop. On the other hand,



WORLD WIDE FUND FOR NATURE

Soft target: marine iguanas may starve to death by hundreds due to El Niño

the phenomenon is expected to boost the yield in Brazil's north and northeast region bringing prosperity to Brazilian farmers. It is also hoped that the weather conditions will benefit farmers in the Philippines.

While there is bad news for cocoa farmers in Malaysia and Indonesia, the output of these countries is meagre compared to the Ivory Coast. Merrill Lynch in its commodity market trends report has stated that rain after a long dry spell in the Ivory Coast could lead to a bumper cocoa crop more than offsetting the losses sustained in these two countries.

While the Christ child has brought luck to Australian fisherfolk resulting in a bumper tuna catch, it has meant bad luck to Papua New Guinea where the catch has been much lower. Sea water temperatures that normally range between 23°C to 29°C have climbed to 37°C forcing many fish to migrate north in search of cooler water. The western Atlantic and Caribbean have also been uncharacteristically quiet in view of the fact that it has been dubbed the "hurricane alley". The eastern Pacific, however, has seen heightened storm activity.

The full picture is yet to emerge. According to Glenn McGregor, climate expert at the University of Birmingham's school of geography in UK: "The current El Niño is still in its early stages. It's certainly some months off its peak."

That El Niño definitely means good fortune for some is evident from the satisfied smiles of futures brokers who operate in the commodity market. Coffee futures soared and dropped creating ripples of hysteria in the market. A few days ago coffee beans were worth their weight in gold in the international market. Now that it is raining in Sumatra they are worth just beans.

Disturbing aftermath

Life is thrown out of gear for wildlife as they face the wrath of El Niño

To say that El Niño has had a devastating effect on wildlife, will only be an understatement. Sharks in the famed islands of Galapagos are reported to have migrated to a depth of 130 metres to stay in cooler waters. These warm, tropical waters — in contrast to the normally cold, nutrient-rich waters of the Humbolt (or Peruvian) Current, which flow from the southern Pacific — are transparent and barren. Already, starved sea lions have been reported on the west coast of Ecuador, presumably attempting to escape the sterile waters.

The less mobile animals of the Galapagos, such as marine iguanas, will also suffer the consequences of a strong El Niño event. In 1982-83, for example, the *alga Giffordia* replaced sea lettuce *Ulva* on the rocky shoreline. The marine iguanas fed on the tropical invader that proved indigestible to them. As a result, thousands of reptiles died of starvation. Meanwhile, penguins, flightless cormorants and other flightless birds are also starving as their prey species have migrated.

In 1982-83, dominant bull sea lions were also affected. This was because their favourite areas at the top of beaches, where they breed, became overgrown with vegetation. The females were therefore forced to congregate in the normally less favourable territories held by sub-dominant bulls, where they bred.

Hurricane Paul



PHOTOGRAPHS: AP / PTI

Global havoc

Changes in the weather patterns due to El Niño have resulted in a flood of natural disasters across the globe. Agriculture is the worst hit

SCIENTISTS have been struggling to come up with conclusive answers on the extent of damage El Niño would cause on the entire world. Since March 1997, they have been observing significant warming of sea-surface temperatures in the Pacific Ocean, off the coast of South America. The phenomenon usually peaks around late December and is often associated with important changes in temperatures and precipitation, which may positively or negatively affect agriculture and water resources. The change in sea surface temperatures also affect marine ecosystems.

El Niño has occurred twice in the last fifteen years. In 1982-83, El Niño caused severe flooding and extensive damage in Latin America and drought in parts of Asia. In 1991-92, the effects of El Niño led to a severe drought in Southern Africa. Scientists believe that this year's El Niño will be the most severe this century. Meteorological organisations around the world also indicate that this phenomenon will continue

throughout 1997 and possibly extend into 1998. The worst effects of El Niño are expected to be felt over the next few months.

In recent months the FAO's Global Information and Early Warning System has been closely monitoring weather anomalies and assessing the possible damage these may cause on crop production and the food supply. Researchers working at the FAO have observed significant deviations in weather patterns in Asia which they say is a cause for concern.

Raising a storm

Cambodia is witnessing serious weather anomalies affecting agriculture. Heavy rainfall and floods have affected the early rice crop in several parts, specifically in Kratie province in the east. The 1997-98 target for paddy production has been set at 3.6 million tonnes, slightly higher than estimated output of 3.39 million tonnes in 1996-97, from an area of 2.17 million hectares.

China experienced its worst drought in 20 years in July and August. This is seriously affecting crops, particularly in the provinces of Henan, Hebei, Shanxi, Hubei, Liaoning and Jilin in central and north eastern parts of the country. Officially, it is estimated that up to two-thirds of the country has been affected by prolonged dry spells. In the central and southwestern regions drought conditions continue to affect some 3.1 million hectares of crops along the

havoc in Palma Del Sol neighbourhood of Acapulco, Mexico. Such phenomena are linked with El Niño



upper and middle reaches of the Yangtze river. This may affect the autumn harvest. But unseasonal rains have improved conditions for planting winter wheat, normally sown from the second half of September, in central parts of the country.

The current drought in Indonesia is reported to be the worst in half a century. For the remainder of 1997 and into 1998, dry conditions are predicted to continue over southern Sumatra and Kalimantan, on the Island of Borneo, Java and eastern parts of the country. In these areas, although monsoon rainfall normally begins in September the first rains only came in November. The impact of this will be most noticeable in the second season of rice and maize in Java, the country's largest producing area. It will also affect soil moisture conditions for maize planting in November and December in eastern parts of Java and southern Sumatra. Insufficient rainfall and dry conditions may also affect the output of coffee in key growing areas of Lampung and Bengkulu in south Sumatra, cocoa and rubber. Overall, official estimates indicate that the drought would affect some 300,000 hectares of rice.

Prevailing dry conditions have also exacerbated the forest fires which have affected agriculture and forest plantations and reduced water supplies. In August and September, there have been various reports of falling water reserves in wells and rivers in parts of Sumatra and Java.

In North Korea the prolonged drought has worsened. This is expected to have serious and far reaching repercussions on

the country's already grave food supply situation in the year ahead, especially as its population has already been severely affected by a shortage of food over the last two years.

Although the 1997 season began favourably with rainfall appreciably above normal in May, subsequently precipitation fell sharply. Consequently, rainfall in the critical months of June, July and August fell to between 20 and 30 per cent of the long term average. Crops were also adversely affected by significantly above normal temperatures at

Heat on the Amazon

The fires in the Amazon rain forests are greater than the ones in Indonesia

El Niño has a lot to do with the ongoing forest fires in both the Amazon rain forests and Indonesia. The dry conditions created by El Niño have resulted in the fires spreading out of control in Indonesia. The rains which came finally in November have failed to stamp them out. Worse conditions prevail in the Amazon. While the forest fires in Indonesia attracted a lot of media attention because of the haze that enveloped Malaysia, the burning going on in Brazil is far greater even though it has failed to draw the attention of the media.

According to the World Wide Fund For Nature, large scale logging and felling of trees over the years and the forest fires have combined to wipe out almost 12 to 15 per cent of the Amazon rain forest. According to Eduardo Martins, the president of the Brazilian federal environment agency, permits for burning only 10,000 hectares had been issued in 1997. But Brazil's President Fernando Henrique Cardoso has acknowledged that the agency needs more muscle as it is usually ignored. The burning that takes place is far in excess of the permits. Moreover, with the weather conditions created by El Niño, the Amazon rain forest has reached a critical level of dryness in which standing forests can catch fire and burn out of control. The noxious clouds which cover western Brazil are proof that a disaster is in the offing in the region.

A man wades through knee-deep water to save his rooster, following a flood which left 230 people dead in Mexico in October





Villagers in Papua New Guinea carry rice provided to them by the Australian army. Over 50,000 people have been affected by a drought estimated to be the most serious in 50 years

critical stages of growth.

The food outlook for North Korea in 1998 is worse. Domestic production of cereals, even under the most optimistic scenario, will meet less than half the country's minimum food needs, whilst imports are likely to become increasingly strained due to growing economic difficulties. Further, as imports last year were highly dependent on barter trade with neighbouring provinces of Jilin and Liaoning in China, the fact that the drought this year has seriously affected crop production in these provinces too, may reduce surpluses and the volume of trade next year. This, therefore, may exacerbate food problems.

Malaysia, which suffered the haze from forest fires in Indonesia due to El Niño's induced wind patterns, has had below normal rainfall. But, coffee, cocoa and sugarcane crops are reported to be in a satisfactory condition so far. However, in areas affected by severe dry conditions, production is predicted to decline. The government had to declare a state of emergency in eastern Sarawak due to the haze emanating from forest fires in Indonesia.

In the Philippines, various parts of the country have been devastated by the worst drought in years. In northern parts of the country, rainfall has been below normal since May affecting major rice and maize growing areas. Elsewhere, large portions of the country, including eastern Luzon, Visayas and Mindanao, experienced little rainfall throughout August and the number of tropical storms across the country, which bring significant amounts of rainfall, has been fewer than normal.

Disasters galore

In October this year, hurricane Pauline in Mexico tore apart houses, washed out roads and killed around 230 people. Again in November, another hurricane, Rick struck the southern coast of the country. Hurricane Rick did little damage, compared with the destruction caused by hurricane Pauline and no deaths were reported. In the Chiapas region, flooding of the coast in upland river valleys, has been saturated by three previous storms. The hurricane season in Mexico has been particularly intense, which some blame on El Niño.

In Papua New Guinea the government declared a state of emergency in response to a devastating drought, the most serious in over fifty years, allocating US \$14 million in aid to 19 of the country's 20 provinces as concern over food shortages increases. In the coming months, there is going to be a shortage of water, both for agriculture and for human consumption. Large numbers of people living in the mountains, who rely on home gardens, are reported to be deserting villages in search for food as drought has resulted in widespread bushfires destroying homes, crops, grasslands and forests. Rivers and dams have also been severely depleted in highland areas, which have been the worst affected by a combination of four months of drought and serious frosts.

The areas most affected include Enga and southern and western highland provinces, where extensive damage to the sweet potato crop has left the communities with severely reduced food supplies and planting material. These regions are also the most vulnerable to food shortages as there are limited alternative foods available and no cash crops to generate income. In addition to these areas, communities in the upper



A bulldozer creates a mass grave for sheep killed in a blizzard in Lincoln County in the US, where 24,000 cattle died

Multinational games

MNCs are looking for profits even in a disaster situation

Under the garb of providing food in famine-affected areas, multinational companies (MNC) are disposing off genetically-engineered soyabean. The fallout of El Niño may profit certain MNCs that produce genetically-engineered food crops.

The shortage of food has provided an entry point for transgenic food crops. Christine von Weizsacker, a noted German scientist who is working on biodiversity issues told *Down To Earth*: "MNCs might market genetically-engineered food crops even in a famine situation". Thus El Niño might indirectly promote dubious export of transgenic crops. Worse, these genetically-engineered crops might prove to be an ecological disaster, according to von Weizsacker.

Western consumers are suspicious of genetically-engineered food. MNCs are therefore finding it difficult to do business. In Europe, resistance to transgenic food is high. Many European countries have refused to accept transgenic food unless it is labeled.

"Now they are targeting countries where there is no legislation to prevent the sale of genetically-engineered food," says von Weizsacker. The label system, she says, can warn people about possible allergic reactions caused by transgenic food products such as rashes, respiratory problems and palpitation.

Fly River, especially those around Kjunga, are experiencing difficulties in meeting food needs as the main river supply line is no longer functioning due to the drought and seriously reduced water levels.

Although there is a possibility of some rainfall later in the year, overall serious drought conditions are likely to continue till December or January 1998 and possibly March. The food supply and water situation, therefore, is likely to deteriorate significantly. So far official reports indicate that between 700,000 to one million people have been affected by extreme weather conditions and face food shortages. Unconfirmed reports indicate that the country's 1997 coffee crop, a key export item, will be reduced by up to 50 per cent by the drought, while damage to cocoa and palm oil is also expected.

In Australia, a severe drought threatens the livelihood of thousands of farmers. According to the WMO, the region has been very dry since June, with large-scale wildfires and drought. Many areas have already experienced rainfall deficits of 400-500 mm (16-20 inches) in the last several months.

Due to the shortage in rainfall, thousands of cattle have starved to death. In many areas farmers are abandoning their farms and are coming to the cities in search of employment.

Africa is also facing the wrath of El Niño. The southern part of west Africa received abnormally low rainfall since July. WMO says that the region also received an extended period of suppressed rainfall during the 1982-83 El Niño. The onset of the rainy season has not begun for most of southern Africa.

As of the first part of November, eastern Africa experienced abnormally intense rainfall along the coast, and generally higher than normal precipitation.

Target India

There is no preparedness in India against El Niño, the Indian government does not even have an action plan

THERE IS still confusion among Indian scientists on whether El Niño will strike India. However, weather experts from the West have predicted severe drought conditions and a shortage of foodgrains in 1998. Despite these warnings, Indian scientists are either ignorant or playing down this effect. Some fear that publicising its effects on India could lead to panic in the market and speculation and hoarding of foodgrains.

As yet, western forecasts have not proved true. A forecast issued on June 26 by the US National Oceanic and Atmospheric Administration (NOAA) had said that India would be drier than normal. Also, Ants Leetmaa, director of the Climate Prediction Center of the US National Oceanic and Atmospheric Administration had said that El Niño would bring drought to India. The Food and Agriculture Organization (FAO) says that although the overall rainfall situation in 1997 has been normal, poor temporal and spatial distribution of rains adversely affected crops in southern states where reductions in the output of winter foodgrains and oilseeds are expected. As a result, the output of winter grains is expected to be some two million tonnes below target and to fall from 105.1 million tonnes in 1996-97 to around 103.5 million tonnes in the current marketing year. Overall output of rice is projected to increase, by some 1.6 million tonnes, compared to 1996-97, though production of coarse grains and pulses are both expected to fall. The 1997-98 target for rice production, from the kharif and rabi crop, has been set at 83 million tonnes.

Government apathy

So far, no alarm bells have been sounded to face an impending crisis. No contingency plan has been worked out to face the calamity. "The last time India had drought was in 1987, which is said to have been caused by El Niño," says Devinder Sharma, who is with the Delhi-based Biotechnology and Food Security, a research institute. The Indian Meteorological Department (IMD), New Delhi, had not predicted that drought. In fact, the government was caught unawares. Nevertheless, it acted quickly.

Following the failure of the south west monsoon, the government of India set up a cabinet committee on drought (CCD) which was headed by the then prime minister, Rajiv Gandhi. Among the steps the CCD undertook were:

- Appropriate contingency measures and supply of adequate power in the agricultural sector to minimise crop losses
- Preparation of water budgets to optimise the use of water available in the reservoir and utilisation of ground water.
- Effective steps to provide drinking water to the drought affected population.
- Strengthening of the public distribution system
- Public health measures and providing supplementary nutrition for the young and the needy children in the drought affected areas.

While other countries are taking measures to meet the shortage in food supply, India in the second week of November exported wheat and rice. The government in Ecuador has stopped the export of foodgrains without debating over the authenticity of the prediction.

"The government does not even think it fit to appoint a committee of scientists or agriculturists to study the impact of El Niño on India. The government, whenever questioned, takes recourse in the fact the monsoons have been normal and



there is no cause for alarm,” adds Sharma.

Well-known scientist M S Swaminathan while speaking to *Down To Earth* said that it is difficult to predict whether El Niño will affect India as the Indian monsoon is a very complex phenomenon. However, he says, “Keeping in mind the predictions of the FAO and the WMO, the Indian government should be prepared with a contingency plan”.

View from India

Indian weather experts believe that El Niño will have no impact on India. “Despite what the prophets of gloom in the West are predicting, our observations from meteorological centres across the country indicate a normal monsoon,” says N Sen Roy, director general, IMD.

The Indian monsoon has a direct impact on the Indian economy. A normal monsoon has great importance for India, where the agriculture sector accounts for more than 34 per cent of the country’s net domestic product. It provides employment to about 64.8 per cent of the country’s total work force.

IMD officials insist quantity and distribution of rainfall in the current monsoons has been normal so far. According to Roy, 29 of the country’s 35 meteorological sub divisions have received normal or excess rainfall. Most of the other regions have suffered only a marginal deficiency, which could be made up as the season progresses. He explained that the weather pattern is too complex, with far too many variables involved for a simplistic reading of weather to come by. “There is no correlation between El Niño and the state of the monsoons,” experts say.

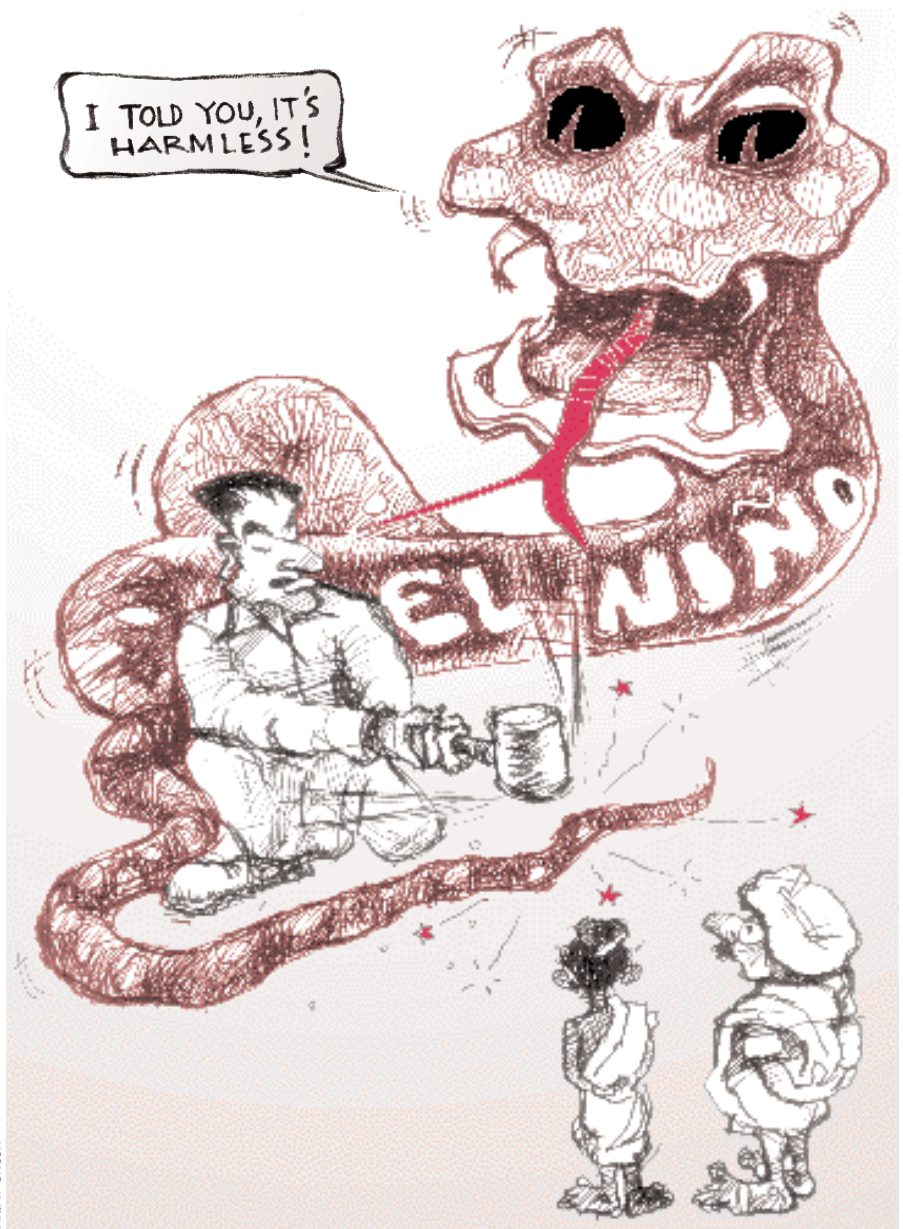
Sources at the IMD said that the department had taken the El Niño into account while making the monsoon forecast. “There is no direct evidence to link the Indian monsoon with El Niño and how it affects the crops,” says P S Datta, a scientist working with the Indian Agricultural Research Institute, New Delhi. “It is too early to predict whether El Niño will strike India,” says S K Dubey, Centre for Atmospheric Studies, Indian Institute of Technology, New Delhi.

In his book, “The history and economics of Indian famines (1914)”, A Laveday, a British drought and famine expert, wrote that it is towards the middle and the end of each century that most of the calamities have struck

India. However, it is to be noted that it is only recently that scientists have linked disasters in various parts of the world with El Niño. Therefore, whether disasters in the past were related to El Niño, remains a debatable question. Richard Grove, professor of environmental history at the Australian National University, who has been doing major research on El Niño, feels that El Niño will have a direct effect on the monsoons in India. He told *Down To Earth* in a recent interview: “When you get a strong El Niño, the Indian monsoon fails. You can demonstrate that historically. The biggest famines in Indian history were directly linked with the El Niño effect.”

Indirect impact

At the same time there are a few scientists who see some connection between El Niño and the monsoons in India. D R Sikka, former director of the Indian Institute of



Tropical Meteorology in an interview with a fortnightly magazine said that the El Niño effect occurred when the pressures over the Pacific Ocean and the Indian Ocean were out of phase. According to him, whenever the El Niño phenomenon has occurred, 60 per cent of the time India has had a bad monsoon. He says that it, however, has been different this year, and added that “regional or other factors” may have offset the El Niño effect.

J Srinivasan, chairperson, Centre for Atmospheric Studies, Indian Institute of Science, Bangalore, says that whenever there was unusual warming or cooling of the east Pacific, global circulation patterns changed and hence rainfall in India was affected. “However”, he says, “we are not ready for a conclusive prediction.” While it cannot be said that sea warming will produce a serious drought, all the four serious droughts that have occurred in India over the last 120 years have been El Niño years.

Unending confusion

Though US weather experts have warned that a severe El Niño factor could badly affect the monsoons, Vasant Gowariker, who is working with the IMD and is the creator of the 16-parameter monsoon prediction model in India, rejects this opinion. According to him, El Niño is just one of the parameters taken into account while preparing a long range forecast by the Indian Monsoon Prediction Model. He adds that US scientists consider only three to four factors. Gowariker believes US scientists have been consistently wrong for several years while predicting the Indian monsoons.

According to K S Sivasami, a professor at the Centre for the Study of Regional Development, Jawaharlal Nehru University (JNU), “Indian monsoon prediction is currently based on an empirical 16-parameter model which the IMD has been successfully using since 1988 to predict monsoons. If we analyse monsoon rainfall data since 1951 onwards, it is clearly seen that there is no direct relation between El Niño and the Indian monsoon. There are many years in the past when El Niño has occurred, but India has witnessed good monsoons.

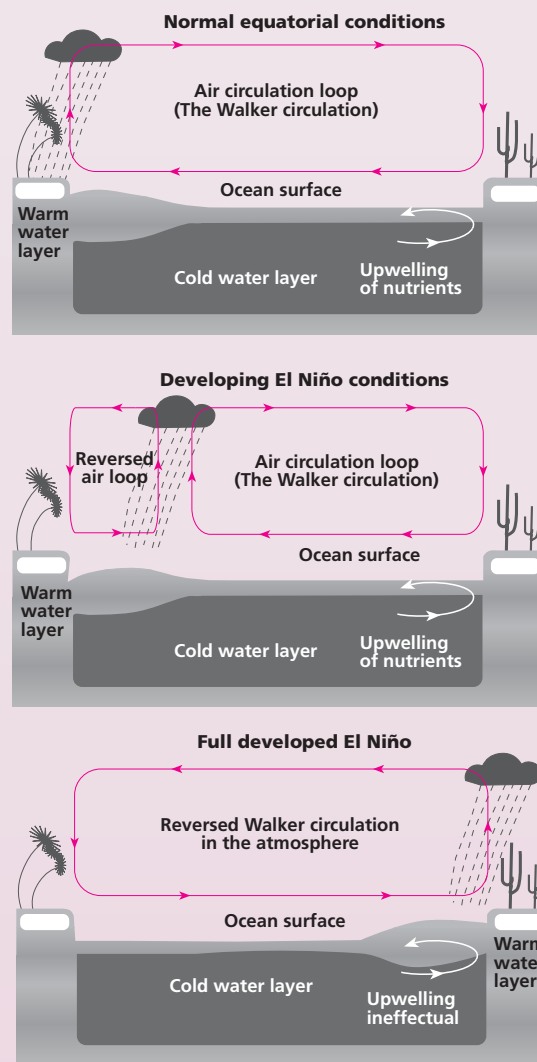
The Walker circulation

In the 1920s, Sir Gilbert Walker made the seminal connection between barometer readings of air pressure at sea level at stations on the eastern and western sides of the Pacific Ocean (Tahiti and Darwin, Australia). He observed that when pressure rises in the east, it usually falls in the west, and vice versa. Walker and his team sorted through data on weather records till they found some patterns of rainfall in Latin America which could be associated with changes in the temperatures of ocean waters (See diagram: The Walker effect).

What robbed Walker of the credit for establishing the vital link between patterns of rainfall in South America and the ocean temperatures was his theory of a connection between monsoons (or the want of it) in India and unusually mild winters in Canada. Walker was criticised for his thesis: How could climatic conditions over such widely separated region be linked?

The Walker effect

Change in the temperature of the sea affects wind patterns which affect weather globally



Source: Institute of Ocean Sciences, Canada

Weak forecasting

Some scientists acknowledge that there is something wanting with monsoon prediction in India. “Monsoon prediction in India is still at an empirical stage. Widespread droughts occur due to fluctuations in the monsoon. If the good monsoon period is longer, the subsequent decade may face drought,” says Sivasami. This means the drought may occur over large areas. It is mainly due to the fluctuation of monsoon and El Niño may be one of the factors. But in what way it is linked is still unknown. Moreover, it is still difficult to predict what will happen in the entire monsoon season and definitely not day-to-day or region-to-region variations.

Till then India has to wait. If El Niño strikes, the government machinery will be caught napping and the worst hit will be the people. ■

Written by S S Jeevan with inputs from Jitendra Verma and Richard Mahapatra

Snatching someone's baby

Villagers in Rajasthan have revived a dried up river in the region with help of a NGO. Now, their fight is with the state government, which has denied them rights over it



JASHBHAI PATEL

IT WAS a change from despair to hope. Concerted efforts of the villagers of Alwar district in Rajasthan converted a dried up rivulet into a river, flowing throughout the year and benefiting as many as 70 villages.

The first step to revive the rivulet — Arvari — was taken in 1987. The villagers constructed a small reservoir, called *johad* (in Rajasthan), in a village Bhavta. Impressed by the benefits of the *johad* many people from other villages came forward and built such structures in their areas. By 1988 many such *johads* had come up in villages like Bhuriavas, Dumli, Khadata, Khatala, Samatsar, Chosla, and Lalpura. This trend continued till 1991. More *johads* were constructed in places such as Palasana, Joge-ki-dhani, Hamipur, Samra, Natata, Kaled, Jagnathpura and many others. Today, there are 200 *johads* in the catchment area of the river Arvari.

Water in the *johads*, raised water-table in the entire catchment area of the river. This, in turn, enriched the surrounding forests. The revival of vegetation helped to restrict the run-offs of monsoon waters. This way, in a decade the river Arvari came to life from a dried up dead water-course.

Today, the river flow continues year-round. At places the river is full of fishes two-feet-long and weighing up to seven kg. Lush green fields of wheat, gram, and mustard can be seen on its banks during winters.

The river Arvari originates in the Thanagazi block of Alwar. The northern catchment area of the river is near Kankad-ki-dhani. Of the two sources of the river, one source stream originates near the village Bhavta and the other source stream near the village Agar. Also, at village Amka, there is a third stream, quite close to the second one, that gets lost in the ground. Thus, the two remaining source streams meet

near the Ajabgarh-Pratapgad road at a place called Palasana-ka-Pahad. From this point, the river is known as Arvari.

This rivulet runs down to the village Hamirpur and meets Nahar-Nala, a stream from the west. At this place, the Tarun Bharat Sangh (TBS) has built a small dam whose length is 500 feet and height is 11 feet. The small lake formed by the dam is named Jabbar Sagar, whose submergence extends up to three km upstream. The water now makes its way down stream and meets Samrawala-Nala, a stream coming from the east, just north of the village Samra. Another stream, called Gujro-ki-dhani, which too comes from the East, meets Arvari south of Samra. A western stream, named Nijrawali-dhani, also joins Arvari north of the village Kaled. Here, the TBS has constructed another small dam, whose length is 250 feet and height is eight feet. This small lake is named Kunj Sagar, whose submergence too extends up to three km upstream. The water flowing over the dam continues its course downstream, leaves the Thanagazi block of Alwar, and enters into the Jamva-Ramgarh block of Jaipur near the village Basi. From the south of

Basi, comes another stream from the village Dageta, which is located in the Jamva-Ramgarh wildlife sanctuary of Jaipur district. This stream joins and augments the river Arvari. The augmented river further joins an equally big tributary near a place called Romewala. This tributary has its origin around the village Lothabas in the west and then passes through the Jaitpur, Gujrun, Rasayawala, and Rayanwala regions.

The question of ownership of the river arose in 1994, when Arvari river came into existence. The people of the region, who gave life to the river, objected to the claims over it by the Rajasthan government.

Though the people acknowledge that the river belongs to India and falls under the jurisdiction of the government of Rajasthan, they insist that the river water should be used for the people residing on its banks. The people protested any misuse of the water in an attempt to fetch revenue for the government.

Arvari began to flow for the full year in 1994. Since then, the aquatic life began to establish itself in the river. Towards the end of 1996, big fishes were

Deprived: villagers now have no rights over the river they revived

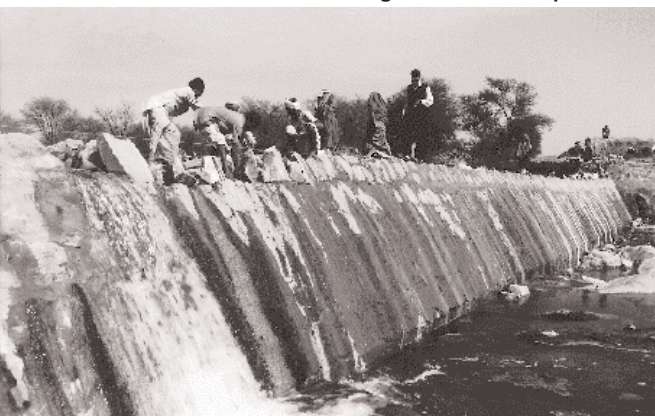


PHOTOGRAPH BY JASHBHAI PATEL

noticed in the river. When the people approached the Rajasthan government's fisheries department for the fishing rights, the contract for fishing was given to a fisherman named Latif on November 21, 1996. Latif, after obtaining the contract, went for fishing to Hamirpur where the residents objected to his fishing saying that they made the river and would not allow him to fish.

Latif left Hamirpur and went downstream to Samra the same day. However, there too people seized his boats. Since then the people maintain thorough vigilance and to this date they have not allowed Latif to fish in the river. An agitated Latif went to Alwar and lodged a complaint before the officials of the fisheries department. On November 30, 1996, Latif took officials and police to Hamirpur. The party went down the river and made a survey. Later, they gathered the people of Hamirpur and threatened them with dire consequences if they did not allow Latif to fish. During the conversation,

The dam and the Jabbar Sagar lake at Hamirpur



the police party came to know about the TBS support to them.

On December 2, 1996, the fisheries department served a notice to the TBS and asked it to reply within a week. The government made a few observations;

- The river belongs to the government of Rajasthan
- TBS is a party to the present agitation
- The fisheries department was giving fishing rights to the fishermen for the past several years (this claim is disputed) and,
- If the TBS continues to support the river Arvari's present agitation then it would face dire consequences.

The TBS in its reply mentioned that

- The people's movement is justified

The young and committed

The Tarun Bharat Sangh was formed in Jaipur in 1975. The members came to Bheekampura in 1985 and surveyed the region for two years. It was then that they decided to undertake watershed development in the nearby villages. The organisation has since come a long way, involving itself in many developmental activities.

but the TBS is not a party to it.

- The fisheries department should supply earlier contracts (of fishing rights) to the TBS, so that it could see the terms.

The fisheries department could not furnish the earlier contracts because it had none. Also Arvari was then a dry river course.

A week later, when the officials of the fisheries department came to the TBS for talks, it reiterated its stand and gave the officials a copy of its rejoinder and the people's memorandum. Finally, during the talks it was decided that the TBS should arrange a meeting between the people from the area and the officers.

Accordingly, on December 25, 1996, a meeting between the people and the officials took place at Hamirpur. The people told the officials that the river was theirs and that they will

not allow any fisherman to fish. The people expected that their view would be put before the government. However, to their surprise the tehsildar came with the officers, the fishing contractor, and policemen to inform the people that legal steps would be taken against any person trying to obstruct the fishermen.

People who had, by then, organised themselves quite well were prepared to fight for their rights. In a mammoth meeting that was organised on January 28, 1997 in Hamirpur, the people once again resolved to fight for their rights on the river. They also launched a *satyagraha* against the Rajasthan government. The agitation continues. ■

C A M P A I G N

Die hard

Noted environmentalist Sunderlal Bahuguna's fast, undertaken to highlight the dangers of the Tehri dam project, has lasted for more than 40 days.

This is the fourth fast by the 72-year-old Chipko movement leader. The last time when the environmentalist embarked upon a 72-day fast, the then prime minister H D Deve Gowda had assured that an independent review of the problems associated with the project would take place.

Bahuguna and his supporters have expressed fears that the design of the dam is faulty and that in the event of an earthquake the reservoir could burst leading to a disaster. Those residing in the downstream areas namely, Rishikesh, Haridwar, Bijnor, Meerut, Hapur, and Bulandshahar would be worst affected if the dam breaks down. Also threatened by the waterlogging and salinisation are the 20,000 ha of fertile land in western Uttar Pradesh.

Moreover, it has been pointed out that the dam lies within the missile range of Pakistan.

The Save Himalaya Movement leader is peeved about the false promises made by the government from time to time.

Bahuguna is joined by eminent economist H M Desarda, who has concluded that the project was ill-suited to the region and that it would lead to further exploitation of the Himalaya. Desarda recently completed a tour of Garhwal and Kumaon region and has alleged gross irregularities in the utilisation of funds.

Desarda has demanded an inquiry by the Central Bureau of Investigation, saying that two-thirds of the expenditure incurred on the project was being siphoned off. "For every three rupees of expenditure shown, corrupt officials and contractors are pocketing two rupees," he said. He said there was no justification in saying that since Rs 2,000 crore have been spent in the project, it should be completed.

Hope for iguanas

Misguided introduction of the Indian mongoose by farmers in Jamaica over 50 years ago had resulted in decimation of the reptile population in the island. The mongoose had been introduced in an attempt to control the rat population. But they failed to take into account the animals' habits. The mongoose hunts at dawn and dusk, whereas rats are nocturnal. So the mongooses started preying on reptiles, including iguanas, which were believed to have become extinct in Jamaica. But, in 1990, a small population was discovered in the Hellshire Hills near Kingston. A joint project between Fort Worth Zoo, Texas, and Hope Zoo, Kingston, was launched to strengthen the population. The first batch of four six-month-olds raised in the zoos was released in July, 1997. The project is likely to be successful since iguanas — unlike other species which have to be coached to avoid predators — do not need any training (*Environment*, Vol 39, No 9).

Treating toxins

A cheap, effective technique to remove toxic polychlorinated biphenyls (PCBs) from contaminated soil has been developed in the US by scientists at Oak Ridge National Laboratory, Tennessee. The technique is considered an important advance since, unlike the biological remediation (disintegration) process developed by research workers in the early 1990s, it does not require mixing PCB-contaminated soil with river sediment. Sediment is the only element in the environment in which anaerobic bacteria thrive. These bacteria can degrade the persistent chlorine compounds, PCBs. The new technique uses two types of bacteria — anaerobic, which do not require oxygen, and aerobic, which do. The two-stage treatment degrades 70 per cent of the PCBs in soil samples to harmless substances. Preliminary studies show that chemical reactions between the remaining PCBs and a solution of special suspended solids to which the toxic compounds are attached eliminate the rest of the PCBs (*Oak Ridge National Laboratory Review*, Vol 29, No 3&4).

ENVIRONMENTAL SCIENCES

Silent invasion

Non-native plant species are growing at the expense of the native in Askot sanctuary in Uttar Pradesh



The last of the natives: Himalayan species are threatened in Askot sanctuary

ASKOT sanctuary in Kumaon, Uttar Pradesh, has been invaded by non-native plant species. According to scientists of the G B Pant Institute of Himalayan Environment and Development (GBPIHED), Almora, if conservation is not taken up immediately, the sensitive balance of nature in the sanctuary may be irreversibly damaged.

A team lead by scientist U Dhar surveyed part of Askot, a less well-known but important Himalayan wildlife sanctuary. "A number of non-native plants have taken root," says Dhar. "If their population increases, they could pose a serious threat to native plant diversity."

Environmentally sensitive areas that are rich in biodiversity are declared protected areas (PAS). Repositories of living resources in a defined geographical area, PAS shelter native plants, animals, insects and microbes. There are some 105 PAS, covering six per cent of the geographical area occupied by the Indian Himalaya. There is little to no information on the existing biodiversity in these areas, making conservation attempts difficult.

With elevation ranging from 600 feet to 6,700 feet, Askot sanctuary is home to the endangered Himalayan musk deer, barking deer, goral, Himalayan black bear and the snow leopard.

Focusing on the native flora and for-

est composition, Dhar and his team found that significant changes had come about. Increase in population of non-native plants and trees that have invaded the sanctuary poses a serious problem to the native species. Among the native species, oak (*Quercus leucotrichophora* and *Q. lanuginosa*) is the most threatened since it is also being lopped to meet local fuelwood requirements. Though a native, the population of chir pine (*Pinus roxburghii*) is increasing, threatening other native trees.

It is clear that mere notification of an area as protected is not enough. Changes in species diversity due to loss of forest cover is alarming. The scientists fear that it will lead to a new biodiversity regime. "It's a case of survival of the fittest," explains Dhar. "Cut a tree and the associated elements of the ecosystem — microbes, lichens, grasses, shrubs and trees that thrive in its shade — are destroyed." Gradually foreign or exotic species find their way in and expand. So do the associated elements of the ecosystem. These gradually spread and take over the native species. The infiltration is insidious and persistent. The disturbance spreads over a period and the whole ecosystem changes.

Dhar laments that efforts stop at identifying and understanding what is

happening. "In each forest type, the mechanism by which unwanted trees invade forests is understood. But mere notification is not enough. What is required is a thorough assessment of the forest area and conservation measures." ■

Fire, brimstone and cooling

Large volcanic eruptions contribute significantly to global cooling

VOLCANOES eject large amounts of sulphur into the atmosphere when they erupt, and actually contribute significantly to global cooling. The eruption of Mount Pinatubo, Philippines, on June 15, 1991, discharged huge amounts of ash and other debris into the atmosphere, creating the largest stratospheric cloud of sulphur dioxide (SO_2) ever measured — at least 17 megatonnes of the gas was released. According to a study, this had a significant effect on the global climate and ozone layer (*Nature*, Vol 389, No 6651).

The potential influence of volcanic eruptions on the Earth's climate has long been recognised, but quantifying the effects has not been easy. Compared to factors such as dust, which permits cooling by blocking solar radiation, sulphur emissions produce sulphuric acid 'aerosols'. These stay longer in the atmosphere than dust. Studies of polar ice cores show that these aerosols are dispersed globally. The implication is that the effects of volcanic activity on climate are mainly controlled by the amount of sulphur emitted, and not simply related to the size of the eruption or the amount of volcanic dust produced.

Though global estimates suggest that they are much smaller than human-induced emissions, large explosive volcanic eruptions can inject sulphur directly into the atmosphere, whereas anthropogenic sulphur is mainly limited to low altitudes and is rapidly removed by precipitation.

Estimation of the amount of sulphur injected into the atmosphere during eruptions relies on studies of debris or, in case of recent events, on remote-sensing measurements. These measurements make use of satellite-based spec-

troscopy designed to map atmospheric ozone, and can provide reasonable estimates. Studies of erupted materials involve analysis of melt inclusions — elements trapped within crystals of the erupted material. This provides a measure of the sulphur content of the magma before eruption — the crystals act like sealed containers for samples of high-pressure melts. Comparison of the sulphur content of the inclusions with that of the surrounding degassed matrix glass provides a measure of how much sulphur was lost during an eruption. The difference for the total volume of material erupted gives an estimate of the sulphur injected into the atmosphere. ■

Troubled waters

Oil exploration may lead to extinction of deep-water coral in the Atlantic

WARM, shallow waters in the tropics are known to support a great diversity of life, including coral — colonies of polyps cemented together by calcium carbonate or the 'skeletons' of the organisms. But cold, deep waters are also one of the most complex ecosystems and support life forms as diverse as the tropical. The *Lophelia* coral family is one such exception. Unlike most corals, it inhabits deep waters. This habitat, which has remained undisturbed for centuries, has been threatened in the past decade by deep-water trawling. Now even *Lophelia pertusa* is threatened by drilling for oil on the Atlantic frontier off the Scottish coast (*New Scientist*, Vol 156, No 2100).

The British government's decision in early 1997 to allow oil companies to

explore the seas near Scotland has been sharply criticised by environmentalists.

But it is uncertain how exactly oil exploration would damage coral. A group of scientists at the Scottish Association of Marine Science (SAMS) has taken up a three-year study of the deep-water coral to understand, inter alia, the implications of drilling.

It is reasonable to suppose that if the oil companies proceed with their activity without proper assessment of the impact, *Lophelia* could face extinction. One of the impacts is muddying of the waters. *Lophelia* grows at a slow rate of 0.5 cm per year, as against the 2 cm-per-year growth of tropical coral. Deposits of sediments on the coral could inhibit its growth or kill it. Additionally, heavy metals in grease, used as a lubricant in drilling, could also prove fatally toxic.

According to Murray Roberts of SAMS, the threat to *Lophelia* assumes greater importance since, like other corals, it supports a variety of life forms, which will also die if it is affected. As yet, little is known about the coral.

A photographic survey carried out in 1996 by the Southampton Oceanography Centre, UK, revealed that there were few large coral colonies off the Scottish coast. Only one colony, 20 cm in diameter, could be located in a 60,000 square metre (sq m) stretch of the seabed. However, the survey was limited. While there may be no 'Scottish Great Barrier Reef', the coral can be found scattered along the edge of the continental shelf in isolated patches up to 10 m in diameter. Off the Norwegian coast, there are banks up to 30 m high, 100 m wide and hundreds of metre long. The SAMS study will add to scientists' knowledge of the coral and help in conservation of marine life. ■

Down in the sea: corals support complex ecosystems harbouring various life forms



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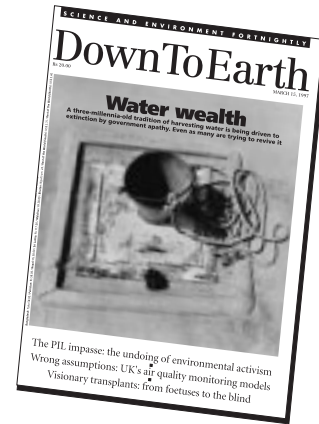
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Cancer prone

Women who gain weight between the age of 18 years and post-menopausal years may be twice as likely to develop breast cancer as those who do not. Zhiping Huang and his colleagues at the Harvard School of Public Health, Boston, USA, say that staying within 2-4 kg of one's weight at age 18 may reduce such risks. When the ovaries shut down after menopause, body fat is the main source of natural oestrogen. In such cases, weight gains severely affect women who are not supplemented with oestrogen pills. Non-hormone users who put on nearly 20 kg after age 18 double the risk of developing breast cancer. About 16 per cent of post-menopausal breast cancers are linked to weight gain.

Troubled future

Babies infected at birth with a common sexually transmitted bacterium *Ureaplasma urealyticum*, are more likely to develop asthma in later life. More than 50 per cent women in western countries are found to be asthmatic. Rita DeLollis at the Winchester and Lawrence Hospital, Massachusetts, USA, screened throats of 132 wheezing children up to age 3. Nearly one third of the children were found to carry the bacterium. She suggests that proper treatment of the infection during first 12 months of life could help kids ward-off asthma at later stage. Parents could also be treated before childbirth to eliminate the bacterium from their body (*New Scientist*, Vol 156, No 2103).

The good news is ...

Treatment with an anti-depressant drug can help smokers give up the habit. People who smoke are more likely to have depression than non-smokers. Richard Hurt and his colleagues of Mayo Clinic in Rochester, Minnesota, USA, conducted a study on 615 people. They found that an anti-depressant bupropion helped many of the volunteers stop smoking. Nearly 19 per cent smokers who were undergoing medication kicked the habit. The quit rate was 44 per cent for those who took 300 mg of bupropion per day.

HEALTH & MEDICINE

Dying out

Sperm count and quality of human semen are declining in India

HUMAN sperm count and quality of semen have shown a decline in India in the past decade, report scientists at the Institute of Research in Reproduction (IRR), Mumbai. They reached the conclusion after studying semen samples of more than 1,500 humans from various parts of the country between 1986 and 1995 (*ICMR Bulletin*, Vol 27, No 8).

A team of researchers led by E Carlsen at the University Department of Growth and Reproduction, Copenhagen, Denmark, had reported in 1992 that the sperm content and quality in

ber of sperms declined by about 30 per cent during this period in India. The reduction in the number of sperms clearly indicates that there is a definitive trend in the deteriorating semen quality in humans in India.

A study published recently by Rajvi Mehta and T C Anand Kumar at the Reproductive Health Clinic and Research Centre, Bangalore, suggests that the semen quality in humans in Bangalore is declining. The researchers have tried to correlate the declining trend in sperm count and quality with



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Dangerous curve: decline in sperm count and quality of semen in India is worrying

humans are decreasing in the developed countries (*British Medical Journal*, Vol 305, No 6854).

Data collected by Carlsen's group between 1938 and 1990 had suggested that the mean sperm concentration has decreased by over 40 per cent from $113 \times 10^6/\text{ml}$ to $66 \times 10^6/\text{ml}$ during the period. Most of the data included in the analysis of Carlsen paper came from the European countries such as England, France, Denmark, Scotland and Finland.

Scientists at IRR say that while the volume of semen remained unchanged between 1986 and 1995, the number of motile sperms was found to have decreased by over 10 per cent. The num-

ber of sperms declined by about 30 per cent during this period in India. The reduction in the number of sperms clearly indicates that there is a definitive trend in the deteriorating semen quality in humans in India.

Apart from these findings, there are various other theories that have been put forward to explain the decline in the quality and quantity of sperm in humans. One important reason for this decline in western population appears to be an appreciable (three to four times) rise in testicular cancer between 1960 and 1980 in countries such as Denmark, Finland, the UK, Germany, the USA, Japan and Puerto Rico. The increase in testicular cancer has been attributed to the influence of oestrogen

on the developing foetus. Researchers have postulated that in the last 50 years, both endogenous and exogenous oestrogen has been on the rise.

The increase in changing diets has led to elevated level of oestrogen inside the body. In fact, some of the livestock such as chicken that were fed anabolic steroids could also have contributed to this increased availability of such chemicals in the body. In addition, increasing amounts of organochlorine compounds that react with other chemicals present within the body also result in oestrogen-like compounds.

Experts say, we now live in an environment that is virtual sea of oestrogens. They feel that it is necessary to systematically collect semen samples from various populations from different parts of the country under uniform conditions, employing internationally acceptable methodology. It is equally important to study the semen quality, especially in urban and rural populations that are continuously exposed to pesticides, for dietary and environmental influences. Such initiative would track down the agents actually responsible for decline in sperm quantity and quality. ■

Fruit for thought

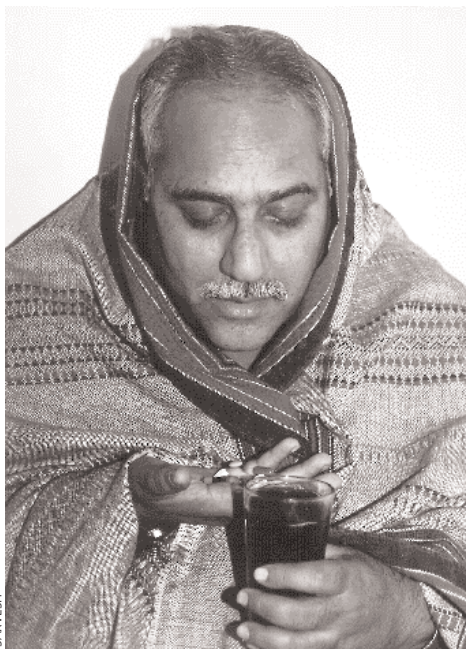
Grapefruit juice induces a long-term drug effect in the body by removing an enzyme

STUDIES have shown that when some common blood pressure-reducing drugs are taken with the juice of the grapefruit, the impact of these drugs significantly increases as compared to the conventional way of taking them with water. There are other drugs besides the blood pressure (BP) regulators that are affected by the grapefruit juice. They include some common and potent ones such as Plendil (felodipine) and nifedipine for high blood pressure and heart disease, Deldane (terfenadine) for allergies, Sandimmune (cyclosporine A) to prevent rejection of transplanted organs and Inivase (saquinavir) for treating AIDS.

Unlike many drugs that are directly absorbed by the intestine into the blood stream, these drugs are first broken down by an enzyme called CYP3A in the walls of the small intestine. Now, Paul Watkins

and his colleagues at the Department of Internal Medicine, University of Michigan, Ann Arbor, USA, report that grapefruit juice removes large amounts of this enzyme from the intestinal wall.

When a certain amount of the enzyme is inhibited, the drug is not broken down instantly. And most part of



Blood pressure can be effectively regulated by taking drugs with grapefruit juice

the drug remains present on the wall of the intestine, which is absorbed into the blood stream over a longer period. In this case, the patient requires lesser dose for enhanced and long-term effect.

The researchers postulate a new mechanism by which all such drug substrates are spared for their intended actions by the inhibition of CYP3A in small intestine. People between age group of 18-65 years were supplemented with 240 ml of double strength grapefruit juice along with the drug. The specific chemicals in the juice called furanocoumarins or psoralens functioned like 'little suicide bombers' by attaching to the enzyme and damaging it badly. In this process, the entire complex disappeared from the cell (*Journal of Clinical Investigation*, Vol 99, No 10).

The amount of enzyme present in the liver and small intestine varies greatly among people. This is the reason that the same amount of grapefruit juice does not induce an equivalent effect in all individuals. The finding could be

important for some and of no consequence for others. But it is important to identify these groups, since a glass of grapefruit juice in some sensitive people could make drug levels soar as high as nine times the normal blood levels. This may considerably enhance the action of the drug that may be dangerous for the patient.

In fact, in one case reported in 1993 a patient took anti-allergic terfenadine, which proved fatal for him. He did not know that he had rich quantities of CYP3A, and took the drug with two glasses of grapefruit juice.

Such instances have prompted manufacturers of drugs like Seldane (terfenadine) to add a warning that grapefruit juice should not be taken with this drug. But physicians argue that the information is often printed in very small type, which is usually ignored by doctors and pharmacists. They also feel that there could be other drugs, whose effects have never been tested under the influence of grapefruit juice. In circumstances where the amount of enzyme secreted in the body is not known, it is advisable to avoid taking drugs with grapefruit juice.

The study is considered a significant breakthrough in the emerging area of food-drug, nutrient-drug and environmental exposure-drug interactions. The researchers concluded that the addition of such natural and presumably safe substances to oral formulations of CYP3A substrate may reduce costs and improve the reliability of current and future medications. ■

It's all in the tomato

Eating tomatoes may keep heart problems away

TOMATO consumption may reduce the risk of developing heart disease. A recent study reveals that people who consume lycopene — a substance that makes tomato red — are half as likely to have heart attacks as those who consume the least. Lenore Kohlmeier, a

professor of epidemiology and nutrition at the University of North Carolina, Chapel Hill, USA, and her colleagues from several European medical centres have reached the conclusion after studying 1,379 people in the Europe.

The study has its own significance because the researchers assessed lycopene consumption and absorption by measuring its presence in body fat rather than using a less reliable method of asking men how much lycopene-rich food they regularly consumed. As lycopene is fat soluble, dietary fat is required for it to be absorbed through the intestine. The substance prevents free radicals from damaging cells, molecules and genes as they circulate in the blood. Free radicals are highly reactive molecules that combine with other substances and change them in harmful way.

Such damages help circulate cholesterol into a form that sticks to arteries and clogs them, leading to heart attack. Free radical damage is sometimes also involved in lung disease caused by inhal-

Tomato is good for the heart



SARAFI

ing pollutants such as ozone and cataracts caused by exposure to sunlight.

Tomatoes have rich quantity of lycopene that can only be absorbed well in the body when tomatoes are cooked. So the substance can be found prominently in tomato paste, ketchup and tomato sauce. According to Kohlmeier, one gets five times more lycopene from tomato sauce as against the equivalent amount of fresh tomatoes. ■

Drug overkill

Irrational drug prescriptions are giving rise to drug-resistant bacteria

PRESCRIBING drugs according to the will of patients is proving hazardous throughout the world. Private hospitals and clinics on the street are often suspected of adopting such practices. As a result, more and more bacteria are responding to people's overuse of antibiotics by evolving new ways to combat drug effects. If the trend continues, experts fear, some of the most powerful weapons against infections would become useless.

A study shows that such irrational prescription of antibiotics is even widespread in the US. Ralph Gonzales and his colleagues at the Colorado Health Sciences Center, Denver, USA, report that nearly 12 million prescriptions were issued in 1992 for colds, non-specific upper respiratory tract infections and bronchitis. Of these, about 60 per cent patients were given antibiotics despite the fact that those medicines have little or no beneficial effect in such complications. According to the researchers, about 90 per cent of them could be caused by viruses impervious to antibiotics (*Journal of American Medical Association*, Vol 128, No 11).

Last year, the Mumbai-based Foundation for Research in Community Health reported a similar study on irrational use of drugs as reflected in physicians' prescriptions. The irrational prescription of drugs was found to be 19 per cent, unnecessary in 43 per cent and hazardous in 12 per cent. The study, however, did not specifically focus on irrational use of antibiotics.

Antibiotics kill bacteria in the body including useful ones that aid in digestion and keep other body systems humming along. Such killings of useful bacteria result in diarrhoea or vaginal yeast infection in some people. Whenever a patient takes medicines, all the bacteria do not get knocked out no matter how strong the dose is. In this process, some of the harmful bacteria manage to fight the drug and develop drug resistance.

There is another common and more dangerous habit of patients that compounds the problem of drug resistance. It happens when a patient takes antibi-

otics, as prescribed by the doctor, and discontinues drug intake before the specified time. Once the patient starts feeling better, he avoids medicines further. In such cases, when the disease causing bacteria have just shown temporary tactical retreat, they may strike back with more vigour, once the patient becomes vulnerable.

Why do physicians over-prescribe such antimicrobials? According to data collected by the Centers for Disease Prevention and Control (CDCP), Atlanta, USA, one of the major reasons is unrealistic expectations of patients that they can get well quickly if they seek doctor's advice. Further, doctors do not have sufficient time to discuss with patients why an antibiotic is not required and some simple symptom-relieving measures would do.

A team of researchers led by Benjamin Schwartz at the CDCP does not rule out the possibility of ignorance on the part of physicians about the spectrum of symptoms and signs. The natural history of such illnesses may not necessarily warrant antimicrobial use. Physicians in their defence argue that when they try to explain the concept of rational therapy and refuse to prescribe antibiotics unless absolutely essential, patients get angry. At times, they go to another doctor who is willing to prescribe medicines according to their wish. Patients take such decision in an eager to recover fast.

As a large number of doctors depend upon repeated visits by patients, they prescribe medicines to keep patients happy. However, doctors say that often it becomes necessary to prescribe antibiotics in a viral infection to prevent an occasional secondary infection. A virus can weaken upper respiratory tract and make it susceptible to be attacked by bacteria. They say even if you send a patient home to treat the symptoms with rest, fluids and medicines, he might come back a week later with an infection for which antibiotics are required.

Health policy experts argue that educating physicians and patients of proper use of medicines are necessary. Patients should not be merely influenced by advertisements of pharmaceutical companies that every ailment has a fast cure with drugs. Physicians, on the other hand, should not cave into the patients' pressure and try to convince them that whatever is being done is in their interest. ■

Gene trap

A gene related to deafness has been discovered in a Costa Rican family that may help understand why people become hard of hearing. E Lynch and his colleagues of the Department of Medicine and Genetics, University of Washington, Seattle, USA, say that low-frequency deafness in the family starts at nearly age 10 and becomes intense by age 30. Children of deaf parents have 50 per cent chance of becoming deaf themselves. The researchers detected an unidentified gene called HDIA1 that produces a deformed protein associated with the family's deafness syndrome. The protein is linked to actin — a major component of the cytoskeleton of hair cells of the inner ear.

Radio in the brain

A team of researchers led by Ehud Ahissar of the Weizmann Institute of Science in Rehovot, Israel, says that the brain always keeps track of changing frequencies of neurones like a Frequency Modulator (FM) radio. Information is passed in form of electrical pulses to the processing centre in the cortex. The researchers monitored neurones in the cortex of rats. Even when the rats did not move their whiskers or touch anything, a tenth of the neurones had an intrinsic frequency of about 10 Hz. When the whiskers touched an object, the frequency of the neurone oscillation altered. It showed that the brain interprets signals like an FM radio (*New Scientist*, Vol 156, No 2105).

Touching tale

The absence of a mother's touch can severely affect the development of an infant's brain. Mary Carlson, psychologist and neuroscientist at the Harvard Medical School, USA, says that the lack of physical touch increases levels of a critical stress hormone in a child's brain, making a baby ill-natured. This may lead to life long behavioural and physical problems. Children who do not receive regular reassuring physical contact experience levels of stress hormones far higher than normal. These can lead to impaired growth and development of both the brain and the body.

LIFE SCIENCES

Cause for alarm

Studies show that a crop pest may evolve resistance to a biological pesticide Bt toxin more rapidly than believed



SANJAY GHOSH

BIOLOGICAL pesticides offer a more sound means of controlling insect pests than synthetic chemicals. A bacterium called *Bacillus thuringiensis* (Bt) produces a crystalline protein that is highly toxic to moth larvae. At a time, when nearly 500 species of arthropods have evolved insecticide resistance to other pesticides, there is only one crop pest — the diamond back moth called *Plutella xylostella* — that has shown resistance to Bt toxin. Now, B E Tabashnik and his colleagues at the University of Hawaii, USA, warn that resistance to Bt toxin in *P xylostella* may evolve at faster pace than anyone had foreseen (*Proceedings of the US National Academy of Sciences*, Vol 94, No 5).

Whenever a larva eats leaves containing the protein, it binds and creates pores in the membrane of the larval gut, leading to rapid death of the larva. The bacterium is distinct from a majority of insecticides because it is not harmful to people and other organisms. A long-term advantage of Bt toxin is that insects are unlikely to evolve resistance to it easily.

Nevertheless, the recent findings are alarming. By carrying out single-pair genetic crosses, Tabashnik's group has discovered that a gene in *P xylostella* can encode a factor or factors to make the larva highly resistant to as many as four

Bt toxins. Though a single gene appears to confer resistance to four Bt toxins, genes that confer resistance to a subset of these four are also known to occur in natural populations.

Earlier, it had been assumed that different genetic factors must mediate resistance to different toxins and a single larva cannot exhibit resistance to many toxins. But the researchers say that *P xylostella* shows four independent mutational events, each one rare by itself, in a single organism.

During the study, they also found that in a susceptible strain, at least one in five individuals carried the gene that encoded multiple-toxin resistance, albeit in a single copy (so that the toxin still managed to kill). This frequency should be compared to the expected frequency of one in thousand. The implication is that under natural conditions (in absence of exposure to Bt toxin), the moth hardly had to work for harbouring one copy of the resistant gene.

On the contrary, if initial frequencies of genes conferring resistance are high, resistance can spread much more rapidly than anticipated after a new insecticide is introduced. The evolution of resistance to insecticides in mosquitoes may also be a rapid process because starting frequencies of resistance genes are already high. ■

Blind vision

How do you locate an object even with eyes closed?

NERVE CELLS help detect an object even if it has been seen just once. They are stimulated by vision, but continue to respond in the dark as if the stimulus is present and visible. M S A Graziano and his colleagues of the Department of Psychology, Princeton University, USA, have found the neurones in the region of a monkey's brain known as ventral premotor cortex (PMV). It is an area of the cerebral cortex that guides the movement of a body (*Science*, Vol 227, No 5323).

Nearly half of the neurones in the PMV respond to both touch and sight. In other words, the neurones have receptive fields (RFs) for touch and vision. The receptive field for touch is an area of a body that excites a given neurone after being touched. The RF for vision is an area from which a visual stimulus

and noting the region that caused maximal electrical response corresponding to one position of the electrodes. Visual RFs were similarly determined by presenting objects on a wand. Out of 153 single neurones in the PMV that were located, about 60 per cent responded to touch or sight. Of these, six responded only to visual stimuli, 34 only to touch, 55 to both and 11 to sound (in addition to vision and touch).

Graziano and his team outlined the visual RF of a neurone. When an object was moved into the visual RF but in dark the entire procedure being invisible (and inaudible), the neurone did not respond. When lights were switched on with a small time-lag, the neurone started showing signs of activity. And when the lights were switched off once again, the activity decreased but remained significantly higher than it was in the beginning.

This decreased level of activity persisted even when the object was removed. The monkeys could not have

Ruling over worms

The length of worms is determined by the hosts

WHEN a population is exposed to the same infectious agent, not all individuals show susceptibility to the infection. To find out the reason, M J Stear and colleagues of the Glasgow University Veterinary School, UK, investigated the basis of resistance to nematode infection in sheep. Nematode worms are major parasites of plants and animals that cause lethal infections (*Nature*, Vol 389, No 6646).

The researchers monitored sheep from the same flock of a commercial farm. They studied them for the load of nematode worms, which the sheep carried during their life span and also at the time of death. Most of the parasites belonged to a single specie called *Ostertagia circumcincta*. At least 25 *O circumcincta* were measured from each sheep and data were analysed to find whether sheep that were genetically related to each other at a level higher than the average degree of relatedness in the flock, also resembled each other in respect to some property of the parasites that they carried.

The researchers also estimated heritability — the extent to which genetic factors in a host might be used as predictors of the severity of parasite infection. It was found that heritability of parasites was close to zero. There was no evidence that the parasite load in an individual was influenced by genetic variability from one lamb to another. But heritability of worm length was found extremely high — when sheep carried worms that were unusually long or short, their relatives too tended to carry worms that were unusually long or short.

It shows that worm length in female worms is strongly correlated with the number of eggs in that female's uterus, and therefore, with the number of young that she gives birth to. If a worm is long, the fecundity would be high. So genetic factors in a host that regulate the length to which a worm can grow, indirectly serve to control the increase in the worm population.

Though the researchers have not



excites the same neurone.

The visual RF is anchored to a body part and not to the eyes. It means that the visual RF does not move when eyes are rotated. If a visual RF is to remain active even after a stimulus is withdrawn, it can do so with the help of tactile RF.

The researchers conducted electrical recordings of the PMV of macaque monkeys. The monkeys were seated in chairs with their heads fixed and electrodes were positioned in their PMV. Then tactile RFs were plotted by stroking the skin

any idea that the object had disappeared. On the other hand, when the disappearance was confirmed by switching the lights on, all activity ceased abruptly.

It shows there is a significant time period when nothing is visible. But a neurone responds as if something is there. In contrast, to this behaviour, neurones in the primary visual cortex — the chief cerebral centres for visual inputs — respond only when an object is within their RF. ■

been able to know about the factors, they speculate that the quantity and specificity of a type of immunoglobulin known as IgA may be one factor. If true, this would be useful means of distinguishing between resistant and susceptible lambs. ■

Talking about sex

Male development is crucially dependent on the expression of a gene present on the Y chromosome

THERE is a genetic basis for sex determination in mammals — females have two x chromosomes, whereas males have one x and one y chromosome. A gene known as Sry that is located on the y chromosome, is crucial for male sexual development. Mice with two x chromosomes can be developed as males if they are engineered to express the Sry gene. The gene is not the only factor to influence such changes. The x chromosome plays a more crucial role. Male development depends on a balance between Sry that promotes maleness and factors on

the x chromosome that promote femaleness.

The duplication of a certain region of the x chromosome causes chromosomally male (xy) individuals to develop female sexual characteristics. Researchers say that the role of such duplications is mediated by a genetic locus known as DSS (for dosage-sensitive sex reversal) that must be kept under check if Sry is to play its full role in male development.

A team of researchers led by R V Jamieson of the Children's Medical Research Institute, Wentworthville, Australia, has shown that at the earliest stages of male development in an xy individual, if Sry is to exert its full activity, DSS has to be transiently suppressed. For suppressing DSS activity, the developing male embryo inactivates the entire x chromosome — a feat that is performed routinely by females.

In normal females, one of the two x chromosomes in each cell is permanently inactivated because of the expression of a special gene known as Xist. It suggests that when Xist is active, rest of the x chromosomes containing it remains inactive.

The researchers judged the state of

activation of the x chromosome by monitoring the functioning of a foreign gene engineered in way so that it could be under control of a x chromosomal regulatory sequence. The foreign gene encoded a protein that gave rise to a blue colour after appropriate staining. If a cell was not coloured blue, the implication was that the regulatory sequence and by inference the chromosome as a whole, was inactive.

The activities of the Sry and Xist genes were assessed independently using genetic probes. Jamieson and his team found that even in male, the Xist gene remains active during the development of urogenital ridge — a structure that mediates the formation of male germ cells.

The observations are based on experiments conducted on mice, but it is attractive to think of a similar activation of Xist (and therefore inactivation of the x chromosome, specifically of the DSS locus) during male development in humans. It shows that the inactivation of x chromosome in males during a brief period, and in a relatively small population of cells, may be crucial for subsequent sexual development. ■

Wear your verdict!

November 1, 1996

The Centre for Science and Environment publishes *Slow Murder*. The deadly story of vehicular pollution.

November 8, 1996

Justice Kuldip Singh takes action.

He issues *suo moto* proceedings against the Delhi Transport Department. Plug pollution, he says.

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"The South should work with NGOs"

WALDEN BELLO, co-director, Focus on the Global South, a research institute in Thailand, has done extensive work on the East Asia Miracle Paradigm. Author of several books, Bello is associated with Greenpeace International and Oxfam America. On a recent visit to India, he spoke with S S JEEVAN on the various issues that confront Southeast Asian countries

On whether the World Bank (WB) has a hidden agenda while helping developing countries:

I think its agenda has always been the belief that development can best take place in a free market system and that the role of the state in the economy should be reduced. Deregulation for the WB is the most efficient way of organising the economy. It is not a hidden agenda but it is a mistaken agenda because the WB and the International Monetary Fund (IMF) do not know or acknowledge its implications. No formal adjustment is possible in this system because the economies of the South are increasingly being subordinated to the interests of the US.

India has still the time and the strength to avoid the crisis of globalisation. The full integration of the local capital market with that of the international financial market is a bad fundamental. It should be cautious about the whole process and should realise that the requirements of the domestic market are important. It should raise the capital for its development internally, by means of effective taxation and through certain reforms, including land reforms, and by adopting a better distribution system.

On the strategy for an alternative development in the countries of the Asia-Pacific region:

At present it seems that the strategy of foreign capital dependency or high speed or fast-track capitalism will not work. People need to think of new strategies. One is the short-term controls on capital flow. Another is taxing capital flow through the so-called Tobin tax (named after the Nobel Prize laureate, James Tobin). The whole idea is to tax capital flow and thus slow it down. A third strategy is to have development through domestic resources. The fourth, of course, is to make people rely less and less on export and begin to think about the domestic market more.

The logic of economic rationality



will coincide with the logic of social justice. A part of this process is the principle of ecological sustainability. High economic growth rates resulted in the degradation of the environment in all sectors. Ecological sustainability also means stronger control of population so that there is a more balanced relationship between humans and the environment.

On the Southeast Asian countries' lip service to environmental issues:

The Southeast Asian countries have often paid lip service to environmental issues. Many of them may have good laws for environmental regulation and sustainable development, but the laws are not enforced. They are afraid that capital inflow will skip the country if there is tight enforcement of environmental laws. So there is a lot of doublespeak there.

On ways to counter imposition of the views of the North on the South through organisations such as the World Trade Organization (WTO):

Governments of the South should work closely with non-governmental organisations (NGOs) to counter the pressures of international agencies. Some governments in the North are sensitive to the needs of the South. It is important to create a coalition that can ward off efforts to deepen the process of

globalisation, such as the multilateral agreement on investment. Countries in the South should work with NGOs within the little space available in the WTO in which we call for accountability, treaties and review of the cultural accord. There are a number of points within the WTO system which are legitimate. They are used to slow down or aggregate the WTO process. Countries which are with the WTO are supposed to be equal. But there is a difference between reality and the law. We can make use of the differences to mobilise alliances between NGOs and governments of the South, and some governments in the North, to drive wedges in the 'coalition' of the countries of the North. I think we should not underestimate the differences, say, between European countries, the US and Japan.

For instance, the US is basically taking a retrograde line by opposing cuts on emission of greenhouse gases. For this, it has drawn criticism from the European Union. So it would be imperative to unite with these forces of the North to isolate the most powerful, (and at times the most retrograde) nation. Beyond this defensive mechanism, I think it would be very important to articulate different visions of development.

On the need for Southeast Asian countries to work closely as a pressure group to have a say in the formulation of global policies:

I would like to stress the importance of working together as sub-groups. I think Southeast Asian countries need to work together to be able to have a common front against the IMF, which is trying to restructure and readjust their economies so that 'free market' forces are released. However, these governments are weak. They tend to yield to IMF pressures. In such a position, I do not think inter-governmental cooperation alone is going to succeed. What is required is the coordination of the civil societies and the mobilisation of populations in Asia to resist the IMF model. We have a crisis, but we also have a situation of opportunity. The opportunity will come from the delegitimisation of the globalisation model by the Southeast Asian experiences and faster growth in all sectors in these countries, moving towards alternative development. This is an opportunity that we must not miss. ■

X-ray vision

Scientists are developing radar flashlights that would see through doors and walls. The device developed at Atlanta's Georgia Tech Research Institute, USA, can detect a stationary human's presence through solid wood or a 20 cm block wall from nearly 1.2 m away. The flashlight uses simple microwave technology. It emits an invisible beam of electromagnetic radiation one-tenth as strong as the accepted leakage level for ovens. That is roughly the same radiation exposure caused by automatic door sensors. The flashlight can sense movement including the faintest breathing. A commercial version of the device would cost nearly US \$500 (*Business Week*, October 13, 1997).

Bytes collection

Diamonds can be a computer's best friend, say researchers at the Ernest Orlando Lawrence Berkeley National Laboratory, California, USA. They claim that diamond coating could allow computer disk-drives to hold nearly 20 times more data than the existing drives. Hard drives can store merely four gigabytes of data. But the prototype diamond-drive developed by the IBM stores about 20 gigabytes. The new drive allows thousands of tiny disks to be stacked within the unit. The Berkeley team found that the diamond coating is much harder than hydrogenated carbon, meaning the new disks would last longer. The product would be available in the market within 10 months.

Flying blind

Passenger aircraft in the future may fly without wind screens for pilots to peer through. The National Aeronautics and Space Administration (NASA) has been experimenting with a wind screen-less cockpit they may find application on the second generation supersonic airliner. The NASA has developed a scale model of a fighter aircraft, the X-36, that eliminates the pilot as well as the pilot's window. The unmanned fighter jet or "Uninhabited Tactical Aircraft", would cost half the price of an aircraft with a pilot onboard (*The Futurist*, Sept/Oct 97).

INDUSTRY & TECHNOLOGY

Hanging wonder

Airships can provide transport on an eco-friendly and cost-effective basis

AIRSHIPS seem to have the potential of offering a good alternative to aeroplanes and road vehicles in some segments of the passenger transport market, say researchers in the Netherlands. Airships are dirigible-powered balloons and derive their lift from a gas (usually helium) that is lighter than air. The airship's body can be built of ribs and girders to provide it a rigid frame.

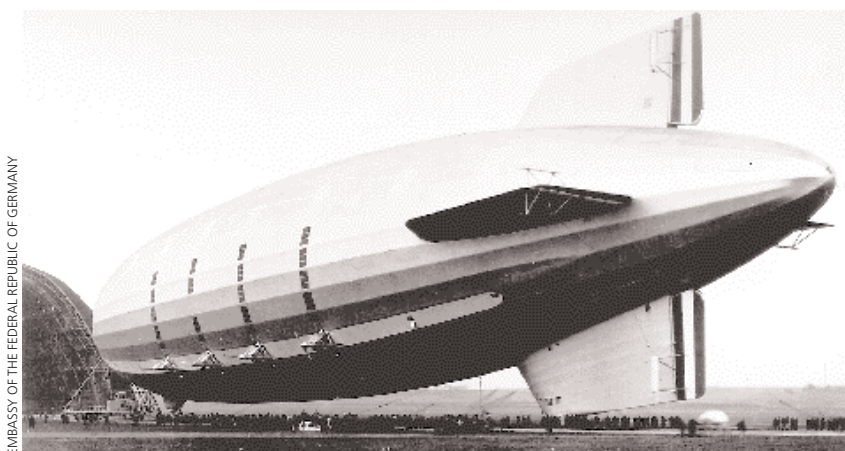
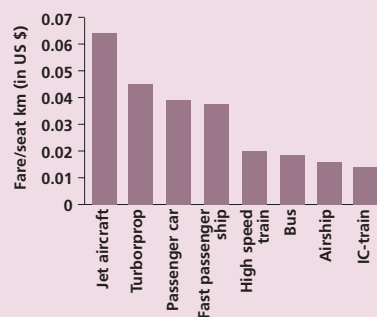
Studies show that there are no technical or economical hindrances in safe operation of an airship fleet. After analysing the environmental costs such as energy consumption, emissions of carbon dioxide, Nitrogen dioxide and hydrocarbons, space-use and material-use, the researchers concluded that the use of airships would be cost-effective as compared to several other modes of transport.

After the Second World War, the airship development continued pre-

operation of airships especially in the holiday and leisure markets. Another market for airships could be transportation of large and heavy components such as turbines and factory processors that cannot be transported in small pieces. Researchers say that it would be better to build airships specially for the

Environmental costs per seat km

Energy consumption, emissions, space-use and material-use



Airships industry: will it take-off once again?

dominantly for military operations and non-transport markets. However, a few airships later managed to provide passenger service between Paris's two major airports. The researchers have found that there is no big technical problem in building a modern large rigid airship capable of taking off and landing automatically. Airships also have the potential of meeting the current aviation safety requirements.

There are prospects for profitable

cargo industry.

The findings suggest that operating a fleet of half-and-half 100-seater and 400-seater airships may not be profitable for the domestic market. However, there is a good possibility of earning profit if airships are operated in the international market. An operator working with a mix of national and international flights of airships may have the best prospects of profitable operation. ■

A saga of lost productivity

Researchers discuss whether the use of information technology has helped enhance productivity

IT IS a common belief that computers and telecoms have been playing a major role in accelerating economic growth. The mindboggling investment by companies in the US on computers and telecommunications further proves the necessity of information technology in recent times. Yet, if official figures are to be believed, the computer revolution has not made the economy more efficient. The decline in annual average rate of productivity growth in America's business sector from 2.6 per cent in 1960-73 to nearly one per cent in recent times, has become a matter of debate for economists.

According to Paul Strassmann, the author of a recently published book, "The Squandered Computer", the investment on information technology has been a waste. He says that many companies purchase computer systems without knowing how to use them properly. The author does not find a correlation between spending on information technology and profitability in any industry.

The argument is acceptable to a certain extent. Most of the firms have been found to make unwise investments in computers. Due to irrational decisions, most of the companies have not been able to achieve desirable benefits. This productivity paradox — speedier computing and communications along with slower productivity growth — can be explained even in more easy ways.

Looking at economic history, one may find that companies have taken a long time to properly adopt a certain technology after its invention. For instance, it took nearly 40 years for companies to properly recognise and take advantage of the electric dynamo, after it was invented in 1881. Similarly, most of the firms have still not learnt how to use microprocessor even when it was invented 26 years back.

Nevertheless, the use of computers at the individual company level has certainly shown a positive trend. Many companies have improved their pro-

ductivity after taking resort to computers. According to American economists, Erik Brynjolfsson and Lorin Hitt, the annual return on investment in computers stands at nearly 50 per cent. It is much more than the average return on capital.

Now, the pertinent question is why the productivity growth has not been registered at the economy-wide level even after the use of information technology? Daniel Sichel, an economist at the Federal Reserve Board, USA, writes in his book, "The Computer revolution" that computers account for only two per cent of America's total capital stock. Even if the return on computers is higher than on other investments, their contribution to overall growth is modest.

However, Sichel's measure understates the full impact of information technology because it merely focuses on computers. If the total equipment used for gathering, processing and transmitting information is taken into account, it stands at 12 per cent of America's capital stock.

There is another most persuasive argument as to why productivity gains do not show up in the economy as a whole. Three quarters of computers are used in service sector such as finance and health, where it becomes extremely difficult to measure the output. Whereas many of the benefits are in the form of improved quality and convenience that do not reflect in cost savings or increased output. Such arguments strongly favour that information technology has boosted productivity, which for the time being is not visible. ■

Sailing with penguin power

A technology developed in the US has opened new vistas for the sea vessel industry

ENGINEERS are planning to build highly efficient ships and submarines that would be based on penguin's propulsion system. Michael Triantafyllou, a professor at the department of ocean engineering at the Massachusetts Institute of Technology, USA, and graduate student James Czarnowski have built a prototype vessel called 'proteus the

penguin boat'. After the successful trials of the ship, researchers in the US are planning to build craft driven by flapping flippers rather than propellers.

The prototype vessel is powered through the water by two foils that hang over the boat and look like rudders. The foils propel the boat forwards by mimicking the movements of the pectoral flippers of penguins and turtles. The researchers have powered each foil with its own motor.

The foils are capable of two types of motion — one is side-to-side flapping and another a twisting motion. An onboard computer has been installed to



maximise forward thrust. The system can also be used for a submarine to dive or rise. When a foil flaps, it sweeps through more water than the blades of a propeller. In this process, more water is thrown backwards giving the craft a large forward thrust. On the contrary, a propeller forces the water to rotate, wasting energy. As there is no rotation with the foils it requires less energy than the propellers.

Triantafyllou says the flipper-like foils have shown 87 per cent efficiency during trials as compared to 70 per cent of propellers. The 1992 US fuel and shipping statistics show that if the efficiency of only three per cent of vessels in the US is increased by 10 per cent, it would save 120 million litres of fuel every year.

The system could help military submarines avoid detection. Propellers generate a signature wake, which can be used to locate them, whereas the wake from the flipper set up looks more like that from a large marine animal. ■

Technology is the key

With developed countries doing little to restrict global warming, a ray of hope comes from the development of favourable technologies



PETER STONE

THE MOST disturbing spectre on the horizon of environmentalists in the West is the one that they feel most guilty about. They survey the output of greenhouse gases of their own economies and note the evident reluctance

of everybody to do anything about it even as summers grow warmer, storms more violent, and glaciers and ice caps melt from global warming.

Countries in the South have large populations and vast untapped coal reserves. Thus when these countries emulate the development process of the North, their contribution to global warming will be more. Also these countries may not heed to calls for protecting the ecology as the developed countries themselves do little in this regard.

News on the technology front is encouraging at least in Europe. This is not to report that European governments have suddenly discovered the appropriate political will. They have not. However, it does appear that market-driven changes encouraged by deregulation (the prevailing Western ideology) may, surprisingly lead in the right direction.

Europe could find up to half her electrical energy from renewable sources by 2030 and that improvements in fossil fuel generation are radically reducing carbon dioxide outputs. And if Europe can do that then the rest of the world can do the same or better. Electricity supply accounts for a third of total greenhouse gas emissions. Therefore, progress here would be a substantial encouragement. Europe's electricity supply is structured around large, central power stations which deliver electricity to distribution 'grids'. The supply system is marked by monopoly structures with regulators appointed by governments to guard the public interest.

The capital cost of power stations is susceptible to economies of scale and station capacities have risen steadily over the years. This proved to be particularly true of nuclear power stations. But over the last decade changes have appeared in this stable picture for a variety of reasons, some of which are specific to certain places but some of which are of general application. In the European Union, the drive to deregulate known as the 'Liberalisation Directive' has been going on for eight or nine years.

The first crack in the wall came from the combined cycle gas turbine (CCGT) plant which exploits ever more available supplies of natural gas with ever-increasing estimates of reserves. In the UK, there is a so-called "rush for gas" provoking further improvement of the technology, capital cost reduction and shortening construction times. Environmental pres-



ures have also had an effect on technology choices. Gas is cleaner. Old style conventional coal plants have efficiencies of around 30 to 35 per cent. But they are more expensive to build than natural gas plants and more polluting as well as contributing more carbon dioxide per kilowatt to the atmosphere.

The gas turbine has been around a long time as a power source which can be switched on in seconds to cope with sudden peaks in demand. The demands are high especially during winter mornings and evenings. In the UK, 34 per cent of the electricity generated will be from CCGT by the year 2000. Carbon dioxide output for the same electricity production is half or less for CCGT and the cost of electricity is close to half if fuel prices are low.

According to a study, by Michael Grubb and Roberto Vigotto for the Royal Institute of International Affairs, on "Renewable Energy Strategies for Europe" the costs of many



renewable resources already lie between existing conventional generating costs and existing sale prices. Over the next two decades very large amounts of capacity will be required in Europe due to retiring old plants, demand growth, restructuring and environmental requirements. A total of 300,000 to over 400,000 MW are anticipated which is nearly as much again as existing capacity.

This expansion is an opportunity for renewables but only if liberalisation proceeds. As Grubb remarks of the attitude of the management of the current huge monopolies, "it remains easier to consider one 1,000 MW investment than 1,000 investments of 1 MW each, the typical reaction being quite simply, that renewables are not big enough to bother about."

However, at the end stage of liberalisation it should in principle be possible for anyone to generate electricity for their own use or to sell it to the grid. Purchasers of electricity should

be able to buy it from anywhere in Europe. Does this help entrepreneurs interested in renewables? They already get some degree of government support and encouragement in most European countries although the payments in France are low.

Liberalisation should favour distributed as opposed to centralised electricity systems so that many more niches are created — photovoltaics in Sicily, wind power in Scotland and so on. Hydro power is the most familiar and developed of the renewable energy sources. Much of the mountain potential has been realised and contributes 13 per cent to the European Union. Another 10 per cent might be possible with development in Austria, S. Europe, Sweden and Norway (not technically part of the EU).

Liberalisation will favour trading which will involve long distance transmission. Iceland has huge potential resources but no market, satisfying 95 per cent of domestic consumption already. The key technology is that of undersea cables carrying direct current (DC) at high voltage.

In the Baltic, there are already seven undersea cables linking Norway and Sweden to Denmark, Germany and Finland. Three new ones will run from Norway through the North Sea, each 540 km long transmitting 450-550 kV DC. Iceland is proposing one to Scotland via the Faroe Islands which would carry 4,000 million kWhr per year. These transmission technologies open up more choices.

Solar electric power generation is not seen as likely, on the continent of Europe itself, to make significant contributions to reducing greenhouse gases in the next two decades unless there are some spectacular advances in technology. The present contribution is only about 0.003 per cent of annual European consumption.

In fact solar photovoltaic lags well behind wind power as a serious prospective contributor. Wind power capacity has expanded by 25-30 per cent per year in the 1990s over Europe as a whole and now contributes 4,000 MW. There is a seasonal correlation between wind energy and electricity demand. As climate change goes on, the winds blow more strongly. Denmark, the only place in Europe where the environment ministry has responsibility for energy, has a national goal (wind power generation) of 1500 MW for 2005. This will supply 10 per cent of Danish energy consumption. In the UK, the latest wind energy costs are competitive with coal or nuclear electricity generation.

Much depends on the choice of site and suitable exposed headlands, plateaus and passes are often prized for their landscape and amenity value. A "good site" has a mean wind speed of 6m/sec at the height of the rotor hub. Clearly, there is no shortage of good sites on the open sea offshore where the stronger and steadier winds offset the costs of harsher marine conditions.

Therefore the carbon dioxide reduction scenario on the supply side, at least the electricity supply side, is much more encouraging than what was supposed. There are many more complexities to reducing greenhouse gas emissions with several, which nobody much likes to think about, like methane from livestock and the thawing of permafrost. On the other hand reducing energy demand may be more painless than it was thought to be. ■

Peter Stone is a UK-based environmentalist and freelance journalist

Why the US is shy

European governments are looking forward to cut their greenhouse gas emissions. Although the US wants to follow suit, it has some apprehensions

DONELLA H MEADOWS

LISTENING to climate change talk in the US and in Europe, I wonder whether we all are living on the same planet.

Several European governments have detailed plans for cutting down their use of fossil fuels (hence emissions of the greenhouse gases, carbon dioxide) by 15 to 20 per cent by the year 2005.

The US president too has generously offered to get greenhouse gas emissions in the US down to the 1990 level — twice as high as the per capita European emission level — by the year 2008 or 2010 or maybe 2012.

European mediapersons do not ask me whether global warming is real. They take seriously the consensus of the 2,400 scientists who participate in the ongoing global forum called the Inter-governmental panel on climate change. They ask “what can be done?” and “why is the US such a laggard on this issue?”

The US reporters seem to be mesmerised by a handful of scientific doubters, most of them funded by coal or oil companies, utilities, or right-wing thinktanks. The doubters point to every uncertainty in climate science, while ignoring the certainties.

Not a scientist in the world doubts that carbon dioxide traps heat or that burning oil, coal, or gases, releases carbon dioxide. No one questions the measurements that show the increasing carbon dioxide levels in the atmosphere. The concentration of carbon dioxide was 270 parts per million (ppm) 100 years ago. It has now increased to 360 ppm.

Europeans pay four times as much for gas as the Americans do. They compete on the global market while driving high-mileage cars and riding attractive, convenient, efficient mass transit systems. Europe subsidises trains and trams; America subsidises highways and parking lots.

Last month at a business conference in Salzburg, European executives were waving around a best-selling German book called *Faktor Vier* (Factor Four) authored by Ernst Von Weizsacker of the Wuppertal Institute, Germany, and Amory and Hunter Lovins of Rocky Mountain Institute, USA. The book shows how an industrial society could get four times as much productivity out of energy and material with known technologies at costs that are not only affordable but probably lower.

That is to say the US could run its economy while reducing its assault on the atmosphere by 75 per cent or double economic output, while cutting emissions to half.

In the US, the Global Climate Information Project (a coalition of business associations) has budgeted \$13 million for a public relations blitz to convince Americans that reducing fossil fuel consumption would cause economic collapse.

Europeans, who are exposed to more education and less public relations than Americans, question that claim. It assumes, they point out, that the only way to cut energy use is through massive taxes. It does not count the savings not only from buying less energy, but from having less air pollution, fewer oil spills, better health, less dependency on foreign sup-



SOLAMEN BHOWMICK

plies — not to mention a more stable climate. It assumes that technology will freeze, rather than shift to greater efficiencies and new energy sources.

The proposed Kyoto treaty, where the emission levels will be decided, will be unfair, US industry says, because it will require the US to sacrifice — but not Mexico, China, India, or other low-income countries. The Europeans feel that those countries where fossil fuel use per person is a fraction of that in America — but rising fast — should be helped not to follow the US’s “wasteful technological path”. This, they feel, can be best achieved if the US itself demonstrates the new path.

Before he boldly promised the status quo, Bill Clinton made another speech in which he said the US could reduce greenhouse gas emissions by 20 per cent, tomorrow, with technology that is already available at no cost. He’s probably too optimistic about the “tomorrow” part — it will take a few years — but not optimistic enough about the 20 per cent. In Europe, they are talking about wasting 20 or 50 or 90 per cent less energy and helping the environment and moving away from the dirty technologies of the past century into the cleaner ones of the next century.

Why on Earth does’nt the US try to beat Europe to it?

Donella H Meadows is an adjunct professor of environmental studies at Dartmouth College, USA

Under siege

India, seen as a dumpyard by the developed countries for toxic wastes, is under pressure not to ratify the Basel Ban



NITYANAND JAYARAMAN

IN THE second week of February 1998, political representatives of more than 100 countries will meet in Kucin, Malaysia, to deliberate upon the fate of the historic decision to ban the export of hazardous wastes from the Organisation for Environmental Cooperation and Development (OECD) to the non-OECD countries. The ban, popularly referred to as the Basel Ban, is the most significant post-Rio environmental decision made by the international community.

Owing to the pressure from a section of the industry and waste exporting nations (including the USA), India has not yet supported the ban openly. That is despite India's principle of opposing toxic waste exports from OECD and non-OECD countries. Now, the government is rumoured to be exploring options to bypass the Basel Ban by negotiating bilateral agreements with the waste exporting nations.

The European Union (EU), however, has clearly conveyed its member states that negotiating bilateral agreements to facilitate hazardous waste exports from the EU to non-OECD nations violates the letter and spirit of the Basel meet. The EU has already adopted a regulation that prohibits export of hazardous wastes. India is seen as a garbage dump by the industrialised nations of the West. The wastes have added to the pollution of our waters, land, and air, and poisoned our workers, children, and communities.

Since the pollution control norms are very stringent in the West, industries there find it very expensive to dispose their hazardous wastes within their own countries. Many of these companies find it easier to pack the wastes in containers and ship them to India, where the enforcement of pollution control norms are very weak.

The wastes, such as toxic zinc, ash, lead, and battery waste, are purchased by Indian companies for recovering commercially valuable metals. But the recoverable material is only a portion of the wastes. The remainder is highly toxic trash that the West sends to India for final dumping. After recovering a small proportion of commercially important material from the imported waste, the highly toxic residue is dumped into open drains, rivers, fields, or vacant plots. The contamination seeps into the soil and ground water and poses a very serious health risk to communities living nearby.

To prevent the industrialised countries from peddling the poisonous leftovers of their affluent lifestyles to the developing world, poorer nations from Africa, Latin America, and Asia joined hands in the subsequent years to call for a total ban on the exports of hazardous wastes from developed countries to developing nations. This ban was formally adopted into the convention text in 1995 by representatives of 82 governments present at the meeting.

The Supreme Court of India has also recently banned the imports of hazardous wastes into the country. However, until



India ratifies or formally adopts the ban amendment, its people and environment will remain open to the threat of contamination by foreign waste.

By ratifying the ban, India will transfer a bulk of the onus of regulation onto exporting countries. In other words, exporters will be required to ensure that only uncontaminated, non-hazardous waste is allowed to be shipped to India.

Not only that, by ratifying the ban now, India will become the first developing nation to do so. This will send the signal that India values its environment and the lives of its citizens and is capable of making independent decisions in the interest of its people without giving in to the strong-arm tactics of wealthier nations like the US.

The Basel Ban will become a legal binding when there is a two-third majority, among of the 82 countries, agreeing to ratify it in their parliaments. The European Union has already passed legislation on the lines of the Basel Convention and has ratified the ban. However, quite predictably, major generators of hazardous wastes like the United States and Australia are keen to undermine the ban.

Efforts are on by the waste trade lobby to cut the list of hazardous wastes that are internationally banned for export. However, regardless of the definition, a hazardous waste remains a hazardous waste. And there is no safe way of recycling hazardous wastes. In India, the metals "recovery" industry gains its competitive edge by saving on pollution control. Even facilities that claim to be the best in the country are grossly polluting and present a significant threat to communities living nearby. Importers in India, however, can still import wastes that are uncontaminated or that are decontaminated by the exporter before shipping to India. ■

Nityanand Jayaraman is the Greenpeace representative in India

Select seven

Seven scientists have been awarded this year's prestigious Ranbaxy Science Foundation awards for excellence in different fields of medical research. They include a husband and wife team and an Indian working in the US. The awardees are: Minnie M Mathan and V I Mathan, professor of pathology and professor of medicine and gastroenterology, respectively at the Christian Medical College, Vellore; Asis Datta, vice-chancellor and professor of molecular biology and biochemistry at Jawaharlal Nehru University, New Delhi; M Vijayan, professor of molecular biophysics at the India Institute of Science, Bangalore; N K Ganguly, head of the department of experimental medicine and biotechnology, Post-Graduate Institute for Medicinal and Education and Research, Chandigarh; N K Mehra, professor of histocompatibility and immunogenetics, All India Institute of Medical Sciences, New Delhi; and A K Ganguly, senior vice-president, chemical research, Schering-Plough Research Institute, Kenilworth, New Jersey, USA.

The awards were distributed at a function held in New Delhi on November 13. The foundation also organised a symposium titled *Drug Resistance: Mechanisms and Management*. Eminent medical scientist V Ramalingaswami made a presentation and urged that greater attention be paid to behavioural factors than technology in dealing with the problems posed by the resurgence of tuberculosis.

REVIEWS

BOOK

Stalking plague

PUBLIC HEALTH AND URBAN DEVELOPMENT — *THE PLAGUE IN SURAT* • Ghanshyam Shah • Sage Publications, New Delhi • Rs 395

SHARMILA CHANDRA

IT IS heartening to note that in the present decade, the intellectuals and academicians of the nation are not pontificating and publishing in just the realm of abstract theory but are directly linking their expertise and studies to the very real situations

affected people, state's response to such emergencies, and social action or the lack of it.

Ghanshyam Shah has convincingly argued that "plague is not merely a biological disease. It is the symptom of

● unplanned growth that disturbs the ecology and the environment and,

● uneven distribution of resources that weakens the social fabric.

He has pointed out how a more or less complete collapse of the political system



SANJAY GHOSH

and problems faced by people.

Ghanshyam Shah is director of the Centre for Social Studies, Surat, Gujarat, and hence was the appropriate person to make a political-anthropological study of the epidemic that spread through Surat and rocked the entire world. This book examines the epidemic (widely believed to be pneumonic plague) in Surat in the context of much larger and fundamental issues like character of urban development in India, state of the public health system, the state of municipal services, socio-economic background of

and public health system led to the outbreak of the epidemic. And the vital though still unanswered question raised in the book is — despite a near consensus among all sections of society on the root causes of these problem, why is effective social consciousness and action not emerging?

The author has studied the pattern of urban growth, social setting, haphazard industrialisation, and settlement which led to social decay and made the climate conducive for communal violence of 1992-93 and the plague of 1994.

Surat is one of the fastest

growing cities of the country with a three-fold increase in population between 1971 and 1991. Industrial pollution, population congestion, inadequate supply of potable water, inefficient and inadequate public health facilities have all contributed to frequent outbreak of endemic diseases like malaria, gastroenteritis, pneumonia and diarrhoea.

In an interesting chapter on public perception and response, the book traces how various sections of society reacted differently, except of course the immediate reaction of panic. Rumours flew thick and fast, often acquiring communal overtones. Thirty per cent of the city's population fled. Not only this, 70 per cent of the doctors fled. Of those who remained, only a few attended to their duties.

The chapter which deals with crisis management describes how the government's credibility touched an all-time low and its inability to tackle the situation was brutally exposed. Early signals and various studies had warned of the possibility of epidemics but these were ignored. The plague surveillance centre had been functioning only in name.

The author has called for a holistic approach to the economy and health instead of the fragmentary approach of the present. The health system ought to be prevention-based rather than cure-oriented. Better municipal services, nutrition, slum management and scientific research are also called for.

This is a book entirely for the people. It was referred to by the Surat Municipal Corporation in drawing up its action plan for the improvement of the city. The positive fallout is that Surat today in the second cleanest city of the country. ■

Two words that have helped **build** one of
the **world's** most **efficient** cement companies.

“ I can ”

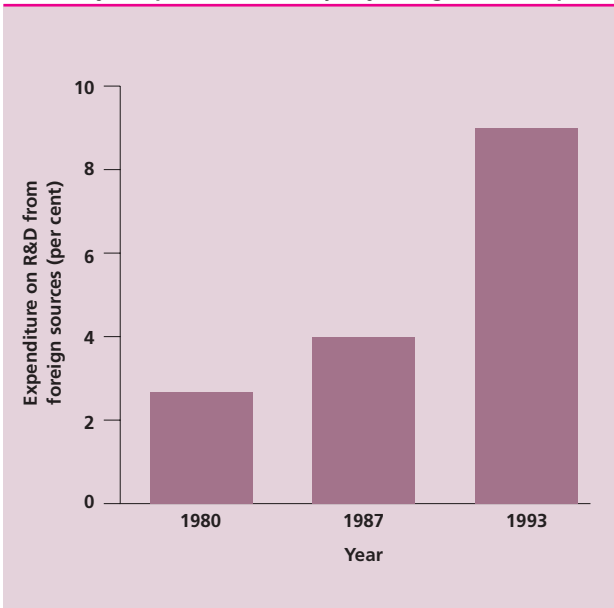
At Ambuja, we follow a unique homegrown philosophy that gives people the authority to set their own targets and the freedom to achieve them: *I can*. This simple belief is at the heart of everything our people do. And it's the reason why we're ranked as one of the world's most efficient cement companies. | **GUJARAT AMBUJA CEMENTS LTD.**

Growth of R&D

Funding and technology cooperation in the past 17 years indicate that research and development (R&D) is becoming increasingly globalised. Foreign funding of industrial R&D in the US increased almost 800 per cent between 1983 and 1990 — crossing the US \$14 billion mark — and is still growing. In contrast, US corporates invested about US \$10 billion in R&D abroad. Almost 15 per cent of industrial R&D funding in the UK, and 18 per cent in Canada, comes from foreign sources. Strategic technology alliances in the same period increased three-fold. Moreover, residents of R&D-rich nations are increasingly seeking patents in other countries. Industrial patenting rose two to three times in member nations of the Organisation for Economic Cooperation and Development.

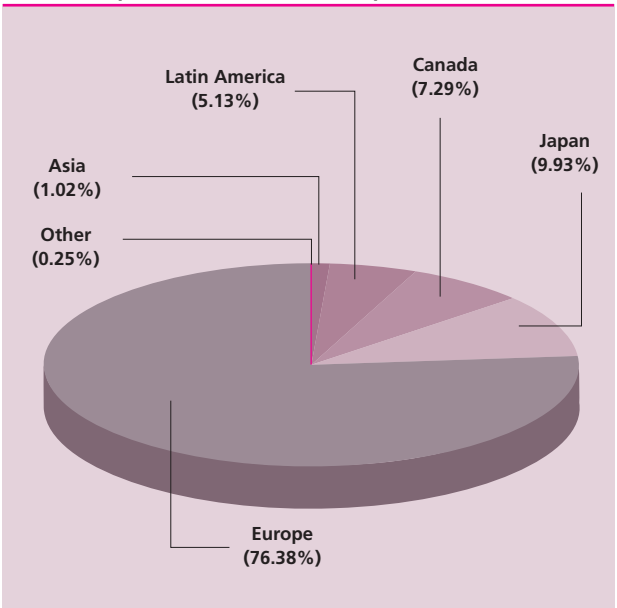
Striking increase

An increasing portion of the US industrial R&D is accounted for by companies with a majority foreign ownership



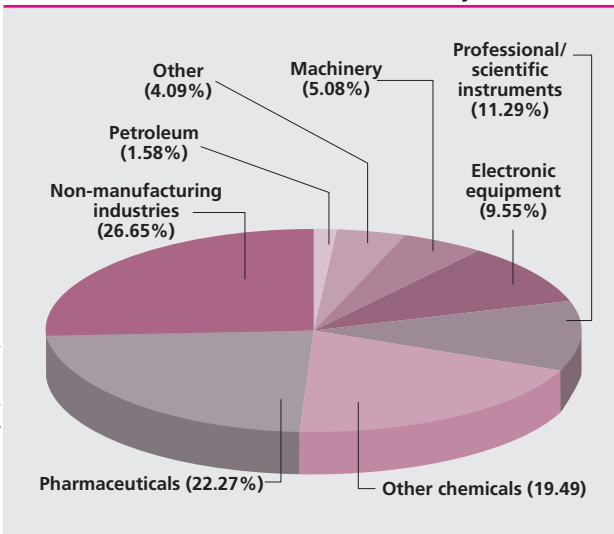
Foreign expenditures

Foreign R&D expenditure comes primarily from European, Japanese, and Canadian corporate sources



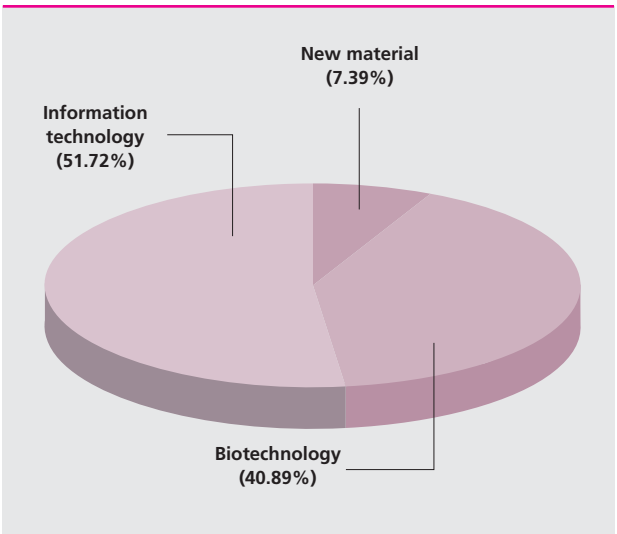
Concentration on chemicals

The focus of foreign R&D funding has been the pharmaceuticals and other chemicals industry



Technology alliances

Information technology alliances grew by about 300 per cent between 1980 and 1994



Publications of Centre for Science and Environment

■ Making Water Everybody's Business: Practice &



Policy of Water Harvesting

Edited by: Anil Agarwal, Sunita Narain & Indira Khurana
This report provides in-depth analysis of traditional practices, technologies, policy issues and the work of governments and NGOs in the field of water management. (Pages 456)
HB: Rs 890 / US \$ 30
PB: Rs 490 / US \$ 22

■ Fourth Citizens Report (SOE-4): Dying Wisdom



Edited by: Anil Agarwal, Sunita Narain
This report provides a comprehensive overview of India's millennia-old traditions of rainwater harvesting. Triggered a nationwide interest in community-based water management. (Pages 404)
HB: Rs 590 / US \$ 20
PB: Rs 390 / US \$ 14
PB: Hindi Rs 290 / US \$ 12

■ Tanks of South India

Edited by: Prof A Vaidyanathan

This book analyses the variations between and within tanks – in the distribution of water to different segments of the command and in productivity. (Pages 178)
PB: Rs 490 / US \$ 14

■ Water Harvesters' Manual for Urban Areas



This manual is built out of CSE's experience in providing technical advice to schools, residential colonies, individual households and factories to implement rainwater harvesting in the urban context. It provides basic information on the need and potential of rainwater harvesting. Available in English, Gujarati, Hindi, Marathi, Tamil and Telugu. (Pages 35) PB: Rs 100 / US \$ 8

■ Mileage – Green Rating of Indian Automobile Industry

In-depth analysis of the environmental performance of major players in the Indian automobile sector during the various stages of its life cycle. (Pages 238)
PB: Rs 490 / US \$ 18

■ Environmental Rating of Indian Caustic-Chlorine Industry

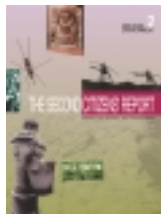
An exhaustive life cycle analysis of players in the caustic chlorine sector and its impact on environment. Deals extensively with the alarming issue of mercury pollution, its deadly effects and a comparative study with the global scenario. (Pages 334) PB: Rs 2999 / US \$ 90

STATE OF INDIA'S ENVIRONMENT – THE CITIZENS REPORTS

■ First Citizens' Report (SOE-1)

Edited by: Anil Agarwal, Ravi Chopra & Kalpana Sharma
This report analyses the little understood relationship between development and environment, the impact of environmental degradation on individual, social groups, tribals and nomads. (Pages 192)
HB: Rs 290 / US \$ 12 PB: Rs 190 / US \$ 10

■ Second Citizens' Report (SOE-2)



Edited by: Anil Agarwal, Sunita Narain
This report describes major environmental changes in India. It's a balance sheet of India's resources and focuses attention on the effect of ecological degradation on the poor. (Pages 393)
HB: Rs 490 / US \$ 18
PB: Rs 290 / US \$ 12

■ Third Citizens' Report (SOE-3): Floods, Flood Plains & Environmental Myths

Edited by: Anil Agarwal, Sunita Narain
This report remains one of the few chronicles of the ecological change taking place in the Indo-Gangetic plains — India's most densely populated area. (Pages 167)
HB: Rs 290 / US \$ 12 PB: Rs 190 / US \$ 10

■ Fifth Citizens' Report 1999 (SOE-5)

Edited by: Anil Agarwal, Sunita Narain and Srabani Sen
This report documents the extraordinary initiatives in the rural sector and the crisis the urban sector faces. As per The Economist London "A remarkable attempt to put together all the different aspects of the environment, stand back, and see how the picture looks". (Pages: Part I-440; Part II-256)
HB: Rs 1590 / US \$ 59 PB: Rs 590 / US \$ 33

■ Global Environmental Negotiations (GEN-1):



Green Politics
Edited by: Anil Agarwal, Sunita Narain, Anju Sharma
This book provides a close analysis of important environment related conventions and institutions from their origins, and demystifies the politics of 'saving the environment'. (Pages 409)
PB: Rs 590 / US \$ 31

■ Global Environmental Negotiations (GEN-2): Poles Apart

Edited by: Anil Agarwal, Sunita Narain, Anju Sharma & Achila Imchen
The second in the series this book includes updates on the issues dealt within the first report, Green Politics. This report has also new chapters on five conventions and institutions. (Pages 441)
PB: Rs 690 / US \$ 33

■ Global Warming in an Unequal World

Edited by: Anil Agarwal, Sunita Narain

A case of environmental colonialism. (Pages 34)
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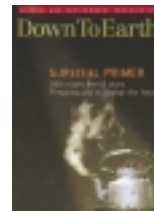
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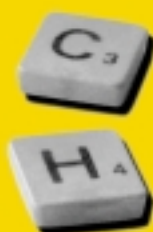
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