

Down To Earth

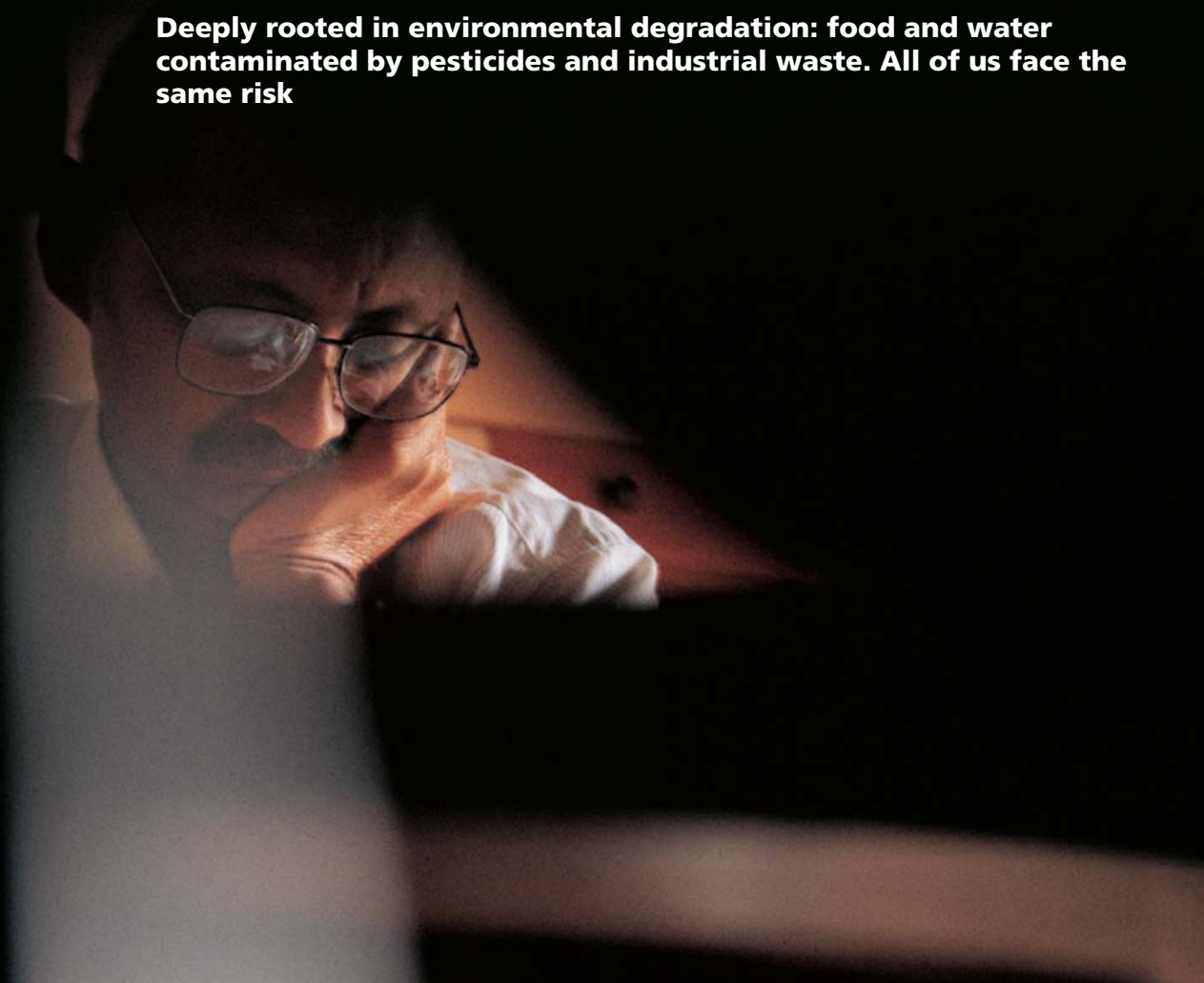
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NOVEMBER 30, 1996

My story today Your story tomorrow

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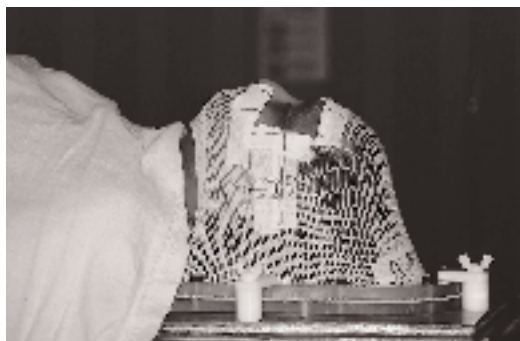
Down To Earth

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Initials. _____

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COVER: PRADIP SAHA

The flip side

We were happy to see Himanshu Thakkar's article on the World Bank (WB)-funded Uttar Pradesh Rural Water Supply and Environmental Sanitation Project (UPRWESP) (*Down To Earth*, Vol 5, No 6). But his article seemed a little rushed. There are more interesting and dynamic angles to the programme, apart from its plans to provide drinking water to 700 villages of Uttarakhand and other parts of UP.



The Project marks the first partnership between the WB and NGOs, which is delicately balanced by the state government's participation. The project offers enormous potential to break new ground in a collective effort involving the local community, NGOs, the government and the funding agencies to address the needs of the UP hills.

Thakkar's assertion that the Project's need for service organisations (read NGOs) prevents any community from taking up the scheme itself, is not far from the ground reality. However, a more important implication of his statement is that it underscores the distant relationships that the government shares with the village folk. NGOs can play a special role in bridging these gaps.

Other concerns voiced by the article — like the equitable distribution of water and the high costs — are very much on our minds. As a participating NGO, one can say that for the first time we are involved in a project that is

sensitive to NGO realities. The project's director, Parameshwar Iyer, as well as the secretary of the rural development ministry, Indrani Sen, are both interested in ensuring that this collective effort heralds a new approach to the development process.

CYRIL R RAPHAEL

*Shri Bhuvneshwari Mahila Ashram
P O Anjanisain, Tehri-Garhwal
Uttar Pradesh*

Simply the best

I have been subscribing to *Down To Earth* — the best environmental magazine I have ever read — right from the start and have been learning about the environmental and social problems of India. I am greatly interested in getting in touch with people in India involved with landscaping and environment problems. I shall be visiting India/Nepal from December 1996 to March 1997. Could you please send me the addresses of some environmental and landscaping engineers and institutes whom I could get in touch with.

LUDWIG R GOTHE

*Landscaping architect
35083 Mellnau
Germany*

Their addresses are:

B V DOSHI
*M/s Stein, Doshi and Bhalla
Architects, engineers, planners
and consultants
'Sangat'
Thaltej Road
Ahmedabad - 380 054*

S S MATHUR
*Secretary general
Institute of Town Planners
4-A, Ring Road
I P Estate
New Delhi - 110 002*

DINESH MEHTA
*Director
National Institute of Urban Affairs
4, Nyaya Marg, Chanakypuri
New Delhi - 110 021*

Fresh pastures

On behalf of a friend, who is the chief agricultural adviser in Timbuktu, Mali,

I would like to enquire if there is an institute in India concerned with camels and their use in agriculture. In particular, my friend seeks hints on how to train camels to be draught animals for agricultural activities like plowing.

GUNNAR JACKS

*Land and Water Resources Royal
Institute of Technology
Stockholm
Sweden*

The address is:

N D KHANNA
*National Research Centre on Camels
P O Box - 701
Bikaner - 334 001
Rajasthan, India*

Acting locally

This is with reference to the debate 'Stressed woods' (*Down To Earth*, Vol 4, No 15). The majority of government servants and politicians in India today are corrupt and are together destroying the forests. The conservators of forests are the culprits and a lot of public money is being spent on their salaries and other perks. Middlemen who are in collusion with forest officials are also beneficiaries.

Forests measuring hundreds of thousands of square kilometres go up in smoke as fires rage every summer, all over the country. The forest dwellers of the nation — the adivasis, are hard working and if encouraged — could save and guard the forests better. It is the duty of the government to provide the deprived people of the forest with safe drinking water, food and shelter. The government should decimate the forest departments and provide them with the minimum basic needs. If even a minute fraction of the forest department's budget were to be given to the adivasis, the savings in the form of forest wealth would be much higher. I appreciate and thank you for the noble work you are doing.

J P MAHTO
*Ferro Alloys Corporation
Keonjhar
Orissa - 758 078*

LEADER

The global green garb

THE discussions on the ecodevelopment project — which ostensibly proposes to protect core areas of resource-rich forests from human intrusion in a bid to preserve them — at the recently concluded Global Environmental Facility (GEF) Council meeting in Washington, clearly brought out the dangers of discriminating between global environmental benefits and local issues. To save globally significant biodiversity in protected areas in India, the GEF and its implementing agency, the World Bank (WB), will be supporting the eviction of thousands of poor forest dwellers from these protected areas, trampling upon their human rights. It will be also be strengthening the country's forest bureaucracy through money and infrastructure to continue in its dictatorial ways of managing the forests by alienating and harassing the local communities. Projects like these are indications of a gloomy fact — that in the present international political scenario, local issues are going to get sacrificed for global benefits!

The fact that the three implementing agencies of the GEF are the WB, the United Nations Development Programme, and the United Nations Environment Programme does not leave much room for relief. It was clear from the strong reaction against the WB president James Wolfensohn from the non-governmental organisations and local communities during his recent visit to India, that the popular image of these agencies is one of ravaging the environment through funding of mindless development projects. As these multilateral funding agencies are accountable to the GEF, one of GEF's objectives was to act as a "Trojan horse" to initiate change and sensitise all three agencies to environmental impacts of their projects. Unfortunately, there is little evidence of this happening.

Perhaps the key issue is that it is nearly five years since the inception of the GEF, and already about 200 projects have been funded. Yet there has not been a comprehensive evaluation of the GEF activities — how much of global environmental benefits has it actually manage to achieve? And at what cost? Till now, it did not even have a semblance of a monitoring and evaluation (M&E) system. It is only now, with an eye on the upcoming replenishment of funds, that hectic activity has erupted and at the council meeting a draft of the proposed M&E system was discussed. This is a welcome step, albeit late.

But several important issues are yet to be addressed. There seems to be an over-reliance on the implementing agencies to do the monitoring and evaluation, making the whole exercise suspect. Evaluation of any process has to be done by an inde-

pendent, transparent and multi-representative body, where effected communities play a vital role in bringing actual feedback from the field. These communities are ultimately the beneficiaries of projects in the field, and their effective participation will also bring in that valuable insight into innovative and experimental approaches that GEF seeks to promote. Without such an independent evaluation, a true assessment of the impact of GEF will be impossible.

The activities as well as the structure of the GEF is extremely complex, and so are the issues it has the mandate to deal with — biodiversity loss, climate change, ozone layer depletion and cleaning and prevention of depletion of international waters. Perhaps the most sensitive of all the issues is biodiversity, in which the GEF is pouring in most of its funds. Then again, developing countries are in the process of fighting for intellectual property rights on biodiversity and recognition of traditional knowledge, and are suspicious of activities of funding agencies in this field

So, can the GEF and the implementation agencies be expected to really understand the strong local dynamics of each country? In the case of the ecodevelopment project in India, the Bank has plunged into a field it has little experience or sensitivity to deal with. The project hopes to smoothen the relation between people living around protected areas and the forest department — a relation that has been extremely conflict ridden through the years.. Unfortunately, without actually attacking the power dynamics between an all powerful bureaucracy and the poor, marginalised forest dependent communities, the project will perhaps only succeed in aggravating the scenario.

The GEF was to provide a new global governance to the world. The key objective was also to bring about greater participation of people and NGOs into projects at all levels. However, there are serious indications that with increasing influence of the implementation agencies on the activities of the GEF and a domination of donor countries in the decision-making processes of the GEF council, it could have lost its way into becoming yet another mechanism for the developed countries to dictate terms to the recipient countries under a green garb. It is imperative that at the time of funds replenishment by the council, some serious evaluation and reflection be done if GEF has to achieve its long-term goals. It is also perhaps time that the developing countries took up the lead in demanding that a mechanism like the GEF comes back to the right track. ■



While reviewing the final manuscript of *Slow Murder: The Deadly Story of Vehicular Pollution in India* prepared by my colleagues Anju Sharma and Anumita Roychowdhury, a thought about the toxicity of the Western economic dream came to my mind. Western societies have been able to survive and acquire some breathing space only because of high discipline and the massive investments they have made in pollution prevention and control.

Yet every Indian wants to live like an American. It is high time we Indians realised that our efforts towards emulating the Western economic dream will only end up killing us in the process. Vehicular air pollution is a perfect example of what will happen if Indians were to blindly follow Americans. Industries can be relocated; vehicles cannot. They stay with the settlement. Therefore, urban Indians have only two choices. Either they control vehicular air pollution if they want to propel themselves using internal combustion engines, or they die in the resulting pollution.

The question is: does anybody want to die? Presumably not. Yet public anger on this issue is muted. Why is this so? A World Bank study reported recently in *Down To Earth* (Vol 5, No 10) presents the staggering figure of 7,500 deaths a year from existing air pollution levels in Delhi — about 21 deaths a day. And in all probability, this is an underestimate. When compared to the fuss created in the media about the recent dengue epidemic which has claimed slightly over 300 lives, the lack of concern over air pollution is indeed surprising.

Part of the problem is the scientific mystery that surrounds health effects of persistent toxins in environment. No doctor, for instance, can tell a patient that the cancer, heart problem, respiratory disorder or ear, nose and throat irritation that he or she is suffering from is the result of air pollution. These linkages between the problem and its effects can be identified only through epidemiological studies. And there is thunder-

ing silence on this count from both the ministries — of health and of environment and forests. One survey of 10,000 schoolchildren in Delhi does show that about one-sixth of their total number suffers from asthma. The public would only begin to listen if the government and the medical community were to provide it with regular updates on the threats to their health. And only then would there be greater pressure on the government to deliver. But that is precisely why nobody does anything about it!

Equally, there could be greater pressure on a recalcitrant industry. Well-known and highly respected industrialist Rahul Bajaj, who manages Bajaj Auto Ltd, one of the companies producing two- and three-wheelers based on highly polluting two-stroke engines, admits that he produces polluting vehicles, but also argues that he is doing India a service by providing mobility. It is extremely difficult to agree with Bajaj. No producer or consumer has any right to manufacture or use a product that is a threat to public health. At such high levels of pollution as those existing today, the Right to Clean Air must take precedence over the Right to Mobility. While Bajaj smothers us to death, he is making profits running into crores of rupees at the same time. The argument that he and his community of auto manufacturers love to put forth — that they are all following the standards set by the government — is a load of irresponsible nonsense.

Indian industrialists, from Bajaj to the Tatas and Birlas, have walked away with an environmental rape of unbelievable proportions through underhand techniques without ever thinking that this is one day going to rebound back on them. That incompetent and

dishonest bureaucrats and politicians have aided and abetted this process is definitely one factor. But another significant factor is the absence of conscience that marks Indian industrialists. Just imagine Bajaj playing holy despite his family's Gandhian background and reputation on an issue which is so morally indefensible. Why did the 1996 standards steadily go down? Can Bajaj truly argue that the automobile industry did not put any pressure on the MEF to dilute the standards which were going to be notified? Surely Mr Bajaj, you do not want to make money in a way that occasions mass murder? Even if the government was prepared to dilute the standards, you could have said that this does not make sense. The reason is simple: industrialists get away with this nonsense only because our bureaucrats are dishonest and there is no transparency in the system. It was during the time of the previous environment secretary, B J Krishnan, that the standards for vehicle emissions received the final kick downwards. What is the point, Mr Bajaj, of honouring Gandhian social activists with Jamnalal Bajaj awards while you yourself cannot follow the principle of trusteeship so ardently advocated by the Mahatma?

The government is yet to present a study to the public which would show that the new standards, despite the growing numbers of vehicles including those based on two-stroke engines, will make any difference to the air quality of a city like Delhi. And if there is going to be no difference, then why even make the effort of announcing these standards? What are we trying to do? Give everybody the false impression that we are doing something or just make the road to hell a few furlongs longer? ■



Indian industrialists, from Bajaj to the Tatas and Birlas, have walked away with environmental rape, partly because they lack conscience

Mite but mighty!

The key to unravelling the mysteries of the earth could actually lie in the functioning of organisms so small that a million of them could be found in a single drop of water



VISHVALYOTI

IT IS a whole new twist to the very concept of geochemistry. And what are propelling the changes in outlook are millions of tiny microbes working quietly behind the scenes, literally, to effect mighty changes in the earth's interior. These microbes, hitherto neglected as subjects for study, have shot into prominence after scientists credited them to be the moving spirits behind the '80s Sierra Pelada gold-rush in Brazil.

William A Fyfe, an environmental geochemist based at the University of Western Ontario in London, Ontario, who along with his colleagues undertook a detailed study into the rich lode at Sierra Pelada said, "There is lot of evidence that microbes played a critical role." Earlier, it was thought that the presence of gold was a result of natural ore formation. Evidence, however, points out to fossil bacteria and organic compounds in the area which was followed by careful demonstrations in the laboratory of how microbes can concentrate gold.

Precious metal aside, microbes are being held responsible for creating and arranging the rocks, seas, oils, soils, gases, metals and minerals that make up the earth's surface. Perhaps, the formation of earth's surface itself was a result of microbes at work. Said Henry L Ehrlich, a biologist at the Rensselaer Polytechnic Institute in Troy, New York, "We are still at the very beginning stages of understanding how microbes shaped the planet."

The implications of the new findings are immense. While the

research has spawned off new fields of interest with fascinating names like geomicrobiology, microbial geobiology and environmental geochemistry, it could also lead to an upheaval in the various functional processes. For instance, scientists have discovered that microbes are adept at forming "an enormous variety of minerals — carbonates, phosphates, oxides, sulfides and silicates as well as silver and gold", according to Grant F Feris, a microbiologist at the University of Toronto, Canada. In lab experiments, microbes were found to crystallise a variety of metals on their cellular surfaces in pure form, including iron, magnesium, copper, sodium, potassium, manganese, zinc, calcium and gold. Mining corporations want to turn microbes into effective miners by getting them to eat the sulphur and iron out of gold ore and thus making it easier to retrieve gold in its purest form.

Scientists are now toying with the idea of pumping carbon dioxide — a result of the burning of fossil fuels —

underground where microbes could turn them into carbonates, occurring primarily as limestone. The problem of carbon dioxide emissions is acute in China and these emissions may possibly be targeted into the country's depleted gas fields to form mineral precipitates by microbial action.

Yet another field open to microbe processing involves the formation of gases. Scientists from the University of Michigan and the Chevron Petroleum Technology Company in California, studying a natural gas field in Michigan realised that the gas was actually produced by billions of microbes. This discovery overturned a previously held theory that the gas could have been made when the earth's heat cooked rich organic remains in a bed of shale (fine-grained rock made of ancient silt and clay) some 370 million years old. This finding could lead to the discovery of new sources of natural gas globally. Geologists have opined that microbes could also be responsible for the preservation of ancient soft tissues by mineralising them into rock.

Understanding the exact means of microbial behaviour could also help in deciphering the realms of other planets, for example, Mars. In fact, the red planet was in the news recently after it was reported that it harboured primitive lifeforms. "To read the fossil record more intelligently on Mars, you have to understand it here," Fyfe observed. The National Aeronautics and Space Administration (NASA) in the US is deeply into microbial research to act as possible role models for Martian relatives. Lake Mono in California, a highly alkaline body of water full of hot volcanic vents and microbial communities, is the site of the NASA study.

Microbes have thus turned traditional beliefs and theories on their heads and started a whole new way of thinking. As a scientist working with NASA remarked, there has been a belated realisation of the cause-and-effect relationship of the microbes. "These processes have gone on for billions of years and we just did not know about them. And there are probably other processes that we have not discovered yet. It is pretty amazing and humbling." ■

UN / HIGH SEAS

Water rows



A NEW United Nations (UN) agency, set up primarily to resolve conflicts of the sea, has taken shape. Inaugurated mid-October in Hamburg by the UN secretary general, Boutros Boutros Ghali, the tribunal will administer the UN Convention on the Law of the Sea (UNCLOS) to solve water disputes. UNCLOS, which has already been approved by more than 100 countries, regulates aspects of ocean management including fisheries, pollution con-

trol, seabed mining and pathways to ship travel. It also allows coastal states to proclaim a 322 km economic zone or a continental shelf based on geological formations. The tribunal's success will depend on whether nations are prepared to abide by its decisions.

The international maritime court has already several disputes to deal with. A chain of islands in the Pacific Ocean has been claimed by Japan, which calls it Senkaku on one hand, and China, Taiwan and Hong Kong, who identify it as Diaoyu. China has summoned the Law of the Sea to support its possession to the Paracel islands in the South China Sea which also has Vietnam and Taiwan laying claim to it. ■

UK / DISEASE

Steer clear!

BEEF is bad, really. All speculations can now be put to rest with the confirmation through a study that eating a 'mad cow' beef dish could land you with a new strain of the Creutzfeldt Jakob Disease (CJD). The study was headed by John Collinge of the Imperial College of Science and Medicine, London, and the team included researchers from the National CJD Surveillance unit

The scientists discovered a 'molecu-

lar marker' which they concluded to be a new form of the disease. The marker, which was similar to bovine spongiform encephalopathy (BSE), could also lead to tests which could reveal the presence of the disease. Said Collinge, "This provides supportive evidence for BSE being the cause of the new variant CJD."

Collinge's team worked with the prion proteins associated with both CJD and BSE. Prions from the new variant of CJD resembled those which were affected by BSE, rather than the prevailing versions of CJD. ■

US / RESEARCH

Smoking gun!

NEW forays into the much-heard-of link between smoking and cancer has established beyond doubt that there is a definite and clear relationship between the two. Researchers from the University of Texas and Beckman Research Institute, California, working on the p53 gene, which is known to prevent proliferation of cells leading to cancer, found that a chemical, BPDE, in cigarette smoke suppresses the gene's function.

The findings were published in a recent issue of *Science* and are the first conclusive evidence to establish the link between lung cancer and tobacco. While the tobacco industry in the US remained silent over the new discovery, scientists were enthused. Declared Bert Vogelstein from the Johns Hopkins Oncology Centre in Baltimore, "It puts a very firm nail in this coffin." John Banzhaf, professor of law at Georgetown University, Washington DC, believed that the research could have profound consequences both in the courtroom and in everyday life. Tobacco manufacturers have until now got away from lawsuits which blamed them for illness, for want of hard evidence. ■

UK / COSMOS

Red hot evidence!

THE red planet — Mars — continues to interest. British geologists have found another meteorite, designated 79001, which crystallised some 175 million years ago and was ejected from Mars due to a possible asteroid impact. The meteorite, also found in Antarctica, has revealed organic compounds that also hint at the possibility of Mars harbouring lifeforms. British scientists Ian Wright and Colin Pillinger of the Open University, Milton Keynes, and Monica Grady of the Natural History Museum, London, were involved in the research.

Exulted Michael Meyer, a biologist who specialises in extraterrestrial studies at the National Aeronautics and Space Administration, US, "It means we have more than one sample with hints of life. And it means Mars could have been inhabited for quite a long period and could even have some life today." ■

ANTARCTICA / AVIFAUNA

Venture into danger

YOUNG emperor penguin chicks have been observed moving further away from their home in Antarctica to warmer waters of north. And therein lies the danger, for these waters are not bound by international treaties. The Antarctic Treaty primarily covers the Ross Sea, a frigid body of water where the penguins reside. Human interference

is minimal in this region.

Gerald Kooyman, a biologist with the Scripps Institution of Oceanography, California, US, wondering where young chicks went in their early years (penguin chicks about six months old usually leave their parents for up to five years) discovered that they actually swam into balmy waters. In fact, one penguin, tracked with a transmitter attached to it, had travelled 2,800 km away from the Ross Sea.

Observed Polly Penhale, a marine biologist with the National Science Foundation's programme on polar biology, "You can write many regulations, but animals are not reading them and changing their migration patterns accordingly." Kooyman now wants to track more penguins with better transmitters but fears that as global fishing expeditions expand, the emperor penguins' existence could be threatened. ■

Emperor penguins: swimming to unsafe shores



UK / BIODIVERSITY

Funding slash

CONSERVATION scientists are dismayed at the proposed cuts to UK's biodiversity programme. An as yet unpublished internal review by the department of environment (DOE) recommends the scaling down of the programme and also reduce its bird conservation activities. Critics argue that DOE has worked rather slowly on this programme. For instance, it took 17 years to designate 136 sites as special protection areas for bird conservation under European laws. The status of another 130 sites are still awaiting confirmation.

The attempt to effect cuts comes at an inopportune time, considering that the UN Convention on Biological Diversity is being held from November 4-15 this year in Argentina, where UK will be formally represented by John Gummer, the environment secretary. UK's response to the UN Biodiversity Convention has been to complete 116 'action plans' detailing its efforts to conserve declining species. However, 278 more have yet to be undertaken. ■

CANADA / FORESTS

Logging a protest

NATIVE Indians in Canada are up in arms against a continued assault on the mineral-rich Temagami region. The Indians are pressing for land rights in this more than 6,000 sq km area which is 500 km north of Toronto. The region is considered by geologists to be one of the world's most mineral-rich areas.

Logging operations started in September this year. Lumber operators have plans to swipe through nearly 300 sq km of pine trees nearly 200 years old. Conservationists have joined the battle and are seeking a court injunction to halt the logging. Earthroots, a Toronto-based green group has had its members handcuffed to bridges and machinery as a last resort to halt the logging operations. The loggers, meanwhile, sing a different tune. "I cannot see why we should preserve something that is going to die any way," said Lionel Robitaille, an employee of Goulard Lumber which has timber rights in the Temagami region. ■

MONEY MAKERS



GREEN COPIES: RPG Ricoh Ltd, an Indo-Japanese joint venture company recently launched the FT 4027, a user-friendly and eco-conscious copier.

In order to promote optimum use of available resources, the company has built in an auto response in the copier, which turns on the machine when the user approaches and switches it off once the person walks away. All major parts of the photocopier are marked recyclable to promote recycling. The new recycling system minimises waste, thereby decreasing the quantity of toner required. The copier is priced at Rs 1,86,000.

CLEAN REMEDY: Hitachi Ltd and 27 of the group's companies are setting their sights on environmental engineering. The conglomerate is a well-known designer of products for sewage disposal, smoke scrubbing and soil cleansing. The group has sketched a plan called Eco 2000, to provide integrated solutions to environmental problems. The company is targeting annual sales of US \$2.7 billion by the year 2000. The group will develop techniques for resource-recycling and sewage-treatment and systems to turn waste into heat and electricity. The company has also developed a machine to break down ozone-depleting gases.



SMOKELESS VEHICLES: Yet another electric car, developed by Toyota Motor Corp of Japan, will join the ranks of eco-friendly vehicles. The car runs on electricity generated by a reaction between hydrogen and oxygen in the fuel cell and its emission will consist of water vapour only. Germany's Daimler-Benz had unveiled the world's first fuel cell-powered car in May. The Toyota fuel cell system has an efficiency rate of more than 60 per cent.

ANTIDOTE AT HAND: Hepatitis-B patients in India will benefit from a collaboration between the Pune-based Serum Institute of India (SII) and Smithkline Beecham of Belgium to manufacture Dtpw Hep B for the treatment of diphtheria, tetanus, pertussis and whole cell-Hepatitis B. The companies would develop new vaccines and launch them in India and abroad in the next two years. SII supplies vaccines to 110 countries for immunisation programmes. Smithkline Beecham is considered a pioneer in the development of Hepatitis-B vaccine based on the recombinant-DNA (genetically engineered) technology.

KITCHEN TO ROADS: Vehicles in India would soon be running on liquid petroleum gas (LPG), courtesy Shri Shakti LPG Ltd of Hyderabad. The company plans to launch LPG as automobile fuel in a year's time. It has already acquired the technology for the use of LPG as auto fuel in four wheelers and two wheelers. Owners will have to pay Rs 10,000 in case of four wheelers and Rs 1,000 for two wheelers to purchase the conversion equipment for running automobiles on LPG. The company plans to supply LPG to customers by charging a deposit of Rs 5,150 each.



TOUGH THINGS: Matsushita Electric Industrial Co of Japan has introduced a new line of notebook personal computers which can withstand vibration, moisture and damage from falls. Compared to Matsushita's conventional notebook computers, the ProNote FG series, is three times more resistant to vibrations and can endure the impact of a 70-cm fall, the company claimed. The new models will cost between US \$3,580 and US \$4,479. The computers' hard-disk drives, which are particularly prone to damage, are cushioned by a gel-like substance.

THE SOUTH

ASIA & THE PACIFIC



UAE: The Gulf waters are turning murkier day by day with illegal waste being dumped by ships in sea, making it unfit for marine life. Wastes from large vessels, which sail through the Gulf or anchor there, find their way into the sea in violation of local rules. The sea is being continuously polluted by oil-contaminated water, bunker oil and a variety of other liquid and semi-liquid wastes. Lots of plastics are also dumped into the sea.

UAE has banned the discharge of wastes within its territorial waters, but environmentalists complain that the law is scarcely enforced. Largescale dredging and reclamation works are destroying the sea life on the 90 km eastern coast of UAE. Many fish species are no longer found in these waters and the remaining ones have become smaller and lighter in weight. The use of non-biodegradable gear also endanger the marine ecology when they are abandoned in the sea alongwith dead fish which rot and contaminate the surrounding water.

PHILIPPINES: Members of the Asia-Pacific Economic

Cooperation (APEC) forum have agreed to liberalise global trade in information technology. The APEC nations will chalk out a common position on bringing down tariffs on computers, telecommunications equipment and other 'info-tech' products. This was agreed upon at an APEC senior officials' meeting held recently in Manila. The common stance would be presented at the World Trade Organization's ministerial meeting in Singapore in December.

APEC has yet to work out the timetable for tariff reduction and the details about the range of products to be covered. The proposal to make available low-cost access to information technology products was put forward by the US. Many information technology products such as personal computers, telephones and fax machines are produced by Asian nations. Eighty per cent of US imports come from Asian countries. But they also import other products such as software, microprocessors and advanced telecommunications equipment heavily.

CHINA: After Japan and the US, it is the turn of China. Months of secrecy later, Chinese health officials have confirmed that a certain brand of a common blood product called serum albumin, produced by a military factory, was contaminated with the AIDS virus. Four months ago, the ministry of public health ordered thousands of state-run medical institutions to stop using serum albumin.

The officials have not yet revealed the extent of damage done to public health due to the contamination. How-

ever, no specific cases of patients having contracted the AIDS virus through serum albumin, which is given intravenously, has been reported. The serum is used to increase immunity to diseases and to treat liver and kidney ailments. This is the first time that China has admitted contamination by HIV and the possibility of negligence by officials in the handling of blood products. It also confirms the suspicions that a large part of

blood and blood products in China are not screened for the presence of AIDS virus.

AFRICA

CENTRAL AFRICA: A long term plan for the protection of crops against civil unrest and drought is being drawn up by 12 African countries. Stocks of seeds will be stored by each country to fill up those of a neighbour struck by disaster. The directors of agricultural research of these

SOUTH ASIA

LOANED SUCCESS: In order to improve the condition of the urban poor and health care facilities in Bangladesh, the Asian Development Bank (ADB) will give US \$90 million as micro credit. According to ADB resident mission chief, Bhanuphol Horayangura, the bank would advance the credit in two parts — US \$50 million will be disbursed to different organisations including NGOs for reducing urban poverty, and the rest US \$40 million, for health care projects.



BETTER LIVING: The Bhutanese government has set up a new system of rules to improve water and sanitation systems to further the cause of urban development. The idea behind the scheme was to "ensure accountability, equitable access to safe and reliable water supply, and a clean and healthy living environment which is one of the prerequisites for sustainable urban development", according to Dasho Leki Dorji, deputy minister for communications. The new system will initially be implemented in six major towns of the country.

LAMBASTED! The wildlife department of the Sri Lankan government has come in for sharp criticism. *Biosphere*,



the bulletin of the Environmental Foundation, which has on its panel several distinguished environmentalists, has accused the department of negligence in monitoring the Handapanagala elephant herd, considered to be a priceless heritage. Environmentalists wanted that the drive to shift the herd to Yala be called off on account of less water there.

However, the elephants were shifted and to date there has been no information of the condition of these animals.

nations have formed a group called the Association for Strengthening Agricultural Research in east and central Africa.

The scheme takes off from the successful Seeds of Hope programme, which helped Rwanda restart its agriculture after the civil war of 1994 and saved many of its unique varieties of crop plants from extinction. Ten of the countries — Burundi, Djibouti, Eritrea, Ethiopia, Kenya, Rwanda, Somalia, Sudan, Tanzania and Uganda form the Greater Horn of Africa. Between 1979 and 1994, the region has never been entirely free of either drought or civil unrest. The other two countries are Zaire and Madagascar.

The plan envisages protection of indigenous varieties of crops, some of which have adapted to highly specific conditions and have developed a degree of resistance to local pests and diseases.

SENEGAL: The sea of Senegal is bearing the brunt of overfishing and pollution. The fishing policy of the European Union has worsened the problem of overfishing in these waters. The EU trawlers are crowding the African coastal waters and fishing them empty.

The European fish market gets 50 per cent of its catch from non-European countries. But the local population hardly gets any share of the profits. In many cases, nearly 20 to 30 per cent of the catch is dumped back into the sea if it is not of any economic interest. In case of prawns, as much as 50 to 90 per cent of the catch is thrown back. Serious damage is caused to the ecosystem by the methods employed by the European fisherfolk. For instance, in prawn fishing, the seabed is literally turned up in order to

UNITED NATIONS



With the world perilously close to a global crisis in infectious diseases, the UN health body has chalked out a 20-point programme on how to prevent it. WHO has admitted that the promised slogan of "health for all by the year 2000" may not after all be met considering the onslaught of new diseases and the revival of old.

While poverty has once again been reiterated as the cause behind a large num-

ber of deaths and the spread of disease and suffering worldwide, WHO states that political commitment to prioritise health would help in mitigating illness-related deaths.

More bad news. According to a recently released UN report *Cities At Risk*, typhoons, floods, earthquakes and landslides are affecting more people each year and the most at risk are city dwellers. Said Olavi Elo, UN director of disaster reduction, with more people migrating to cities, land demand increases and slums proliferate on hazardous areas like ravines, river banks, unstable slopes and reclaimed land.

catch prawns. As a consequence, the breeding grounds of many species of fish are destroyed.

The European trawlers freeze their catch and unload them in their home port. Hence, the local industry is left without any direct profits. The EU agreements also do not favour the employment of local fisherfolk. To solve these problems, local fisherfolk's organisations are campaigning for the amendment of EU laws.

LATIN AMERICA & THE CARIBBEAN

ARGENTINA: Thousands of broad-winged species of hawk known as Swainson's hawk, which make their appearance on the dry plains of Argentina every winter, may get a reprieve. Ciba-Geigy, the Switzerland-based chemical manufacturing group has agreed to recall monocrotophos, the pesticide which caused the hawks to die, from the markets surrounding the agricultural areas west of Buenos Aires, where the hawks converge during their sojourn. Farmers undertook the pesticide-spraying spree to control the burgeoning grasshopper population.

Ciba-Geigy has also agreed to buy back stocks of the pesticide from the dis-

tributors in the area. It also stated that it would encourage other pesticide-makers to take similar steps. The pact was arrived at in mid-October after consultations with American Bird Conservancy, a Washington-based advocacy group representing 56 environmental and ornithological organisations.

The numbers of Swainson's hawks, currently estimated at 4,00,000, declined after it was noticed that the hawks died either directly due to aerial spraying or after eating poisoned grasshoppers. Scientists are worried that farmers will continue to use existing stocks and thus poison more hawks which are expected to frequent Argentina this month.

BRAZIL: In an attempt to check the degradation of the Amazonian rainforests, Brazil's Chamber of Com-

merce will soon begin a nine-month investigation into various Asian logging companies operating there. Brazilian greens have for long maintained that logging has increased manifold and was primarily financed by companies which had poor environmental records.

The parliamentary investigation will conduct research trips into the Amazon to check the extent of the damage and also to devise ways to deter the proliferation of more logging companies. It will also seek testimonies from public and private officials who are involved in the logging process.

Said a government spokesperson, "In nine months, we will finish a detailed report and begin taking the measures we deem necessary to protect the environment and police these companies."

Rainforests on their way to sawmills



MARK EDWARDS

GERMANY / GENETIC ENGINEERING

Mean bean



ALTERED soyabeans from the us have raked up frenzied protests in both Switzerland and Germany. This has followed Europe's insistence that us segregate its genetically-engineered soyabeans from the conventional crop. Europe is due for its first shipment of genetically engineered soyabeans developed by us chemicals group, Monsanto, by the end of the year.

Meanwhile, the Anglo-Dutch food manufacturing giant, Unilever's German unit has vowed that it will not use this year's us soyabeans crop. Nestle's German unit has also taken a similar pledge. Switzerland's two biggest food retailers, Migros and Co-op Schweiz also demanded that us identify its altered beans in its exports. Stating that consumers want to know what gets into their food, Migros stated, "We are urging our suppliers to push for a separation of genetically altered soyabeans".

Greenpeace has joined the protests stating, "The soyabeans will be mixed up with normal beans, so consumers will not be offered a choice and that is just not acceptable." ■

NEPAL / DAMS

Stop it!

A WRIT petition has been filed in Nepal's Supreme Court against the ratification of the controversial Mahakali treaty which was approved by the joint session of the Nepalese Parliament in September this year. Five individuals including lawyers and journalists have jointly filed the petition urging the court to invalidate the Mahakali treaty, claiming that the Nepal-India Integrated Development Treaty on the Mahakali river, signed by the two countries in February this year, was unconstitutional. The first hearing of the

case is to take place on December 4.

A systematic campaign has been launched against the treaty by a number of NGOs who term the project as disastrous for Nepal. The Supreme Court petition is part of the campaign (*Down To Earth*, Vol 5, No 11). It is alleged that mega-dams including Pancheshwar, that will be built as part of Mahakali treaty in ecologically fragile and earthquake-prone Himalaya, will bring both environmental and social disaster to the region. Going ahead with the huge 6,480 MW project without complete studies and action plans can only bring untold misery on all concerned, feel the anti-treaty protesters. ■

INDIA / FOOD

Green sees red

IF PREDICTIONS of a recent study are to be believed, India is facing widespread famine. According to the report, *In the Famine Trap*, overpopulation, degradation of arable land and India's push to become a food exporter are threatening the country's food security. The report has been commissioned by The Ecological Foundation, a Delhi-based environmental group and the UK Food Group, a coalition of development aid groups.

The study's author, Devinder

Sharma, an independent agriculture specialist says, "India is only one or two bad monsoons away from a terrible crisis." The report suggests that instead of promoting food exports, India should improve its contingency plans to deal with a failed harvest. The government has, however, dismissed these predictions.

The country now maintains a buffer stock of about 27 million tonnes and in recent years has been exporting rice and wheat to international markets. The main threat, says Sharma, is posed by land degradation in the farming states of Punjab and Haryana due to poor water management. ■

I N D I A

India achieved another milestone in nuclear research when *Kamini*, the mini nuclear reactor using uranium 233 as fuel, attained criticality last month. With this, India became the only country in the world to use uranium 233, derived from thorium, as a fuel in a nuclear mode.

In a bid to reduce pollution in the Ganga, a cabinet committee has sanctioned Rs 400 crore for setting up sewage treatment plants for townships situated all along the Ganga. The Ganga-Yamuna basin covers six states, with more than hundred municipalities.

Each hour, on an average, 91 Indians

die of heart diseases and 68 due to cardio-vascular strokes. This was revealed by a recent study conducted by the National Congress on Health and Dietary Fats, New Delhi.

The large number of lives claimed by the dengue epidemic in Delhi has prompted the state government to set up an independent centre for year-round disease monitoring and epidemic warning. The centre would be established on the lines of the world famous Centre for Disease Control at Atlanta, US.

Faced with severe criticism over the neglect of sanctuaries in the country, the Union environment minister Jai Narain Prasad Nishad has ordered the review of all mining leases located within protected areas in the country.

It has been discovered that illegal mining operations were going on within the limits of national parks and wildlife sanctuaries.

Despite contrary claims by the state government, malaria continues to rage on in Rajasthan with the death toll reaching beyond 500. According to official figures, 34,144 people had been affected by the disease in the state till October 15. Most lives have been lost in eastern Rajasthan.

The Indian tiger may yet be saved, thanks to the Hyderabad-based Centre for Cellular and Molecular Biology. It has started a project that aims to produce the endangered species through test tube births in collaboration with the city-based Nehru Zoological Park.

INDIA / CONSERVATION

Saved at last?

THE recent tirade launched by international conservation organisations has at last forced the Indian government to wake up to the prevailing state of the Indian tiger. The ministry of environment and forests (MEF) has acknowledged that a "serious crisis" threatens the Indian tiger. MEF has also accepted the fact that much more than simple conservation has to be done in order to protect the tiger.

The minister of environment and forests, Jai Narain Prasad Nishad, announced at a recent meeting of the Tiger Crisis Cell that experts would be sent to tiger habitats throughout the country to assess the problems of the forest department personnel at the ground level. He said that Prime Minister H D Deve Gowda would be requested to address the nation on television about the tiger crisis. The Cell was also given the mandate to implement the recommendations made by the Subramaniam Committee report in 1994. The minister, however, declined to make a commitment to stop and remove all developmental projects which could pose a threat to tiger habitats. ■

INDIA / WILDLIFE

The ugly side

INDIA recently took an important step towards preventing cruelty against animals when it banned the mandatory testing of cosmetics and toiletries on live animals. It became the first country in Asia to do so. The ban was announced at a recent meeting of members of the cosmetics sectional committee, the panels for microbiological and

INDIA / HEALTH

Iodine blues

A RECENT study has revealed that iodine-deficiency is widespread in the country. It stalks not only the Himalayan region but also sub-Himalayan terai areas, riverine areas and even the coastal regions of the country. Out of more than 15 billion persons in the world at the risk of iodine deficiency disorder (IDD), an estimated 167 million are Indians.

Iodine deficiency affects the development of foetus and the growth of human beings at all ages. It results in abortion, stillbirth, mental retardation, deaf-mutism, squint, dwarfism, goitre, neuromotor defects and such other diseases. The survey conducted by the Central and state health directorates, the Indian Council of Medical Research, New Delhi and medical institutes, states that not even a single state or union territory was free from the problem of iodine deficiency disorders.

About 54.4 million persons are suffering from endemic goitre and about 8.8 million from mental handicaps, says the survey. Of the 255 districts surveyed so far, in 222 districts IDD is a major public health problem. ■

dermatological testing of cosmetics, including representatives of major cosmetics companies. It is now up to the manufacturers to exercise the option of conducting tests on animals.

The decision was later endorsed by the Bureau of Indian Standards and the ministries of health and environment. The ban, however, does not extend to "novel ingredients or products formulation", in which case, the manufacturers have to continue with the usual testing on animals. As per the Drugs and

Cosmetics Act 1941, each batch of cosmetics like lipsticks, mascaras, eye-liners, creams and shampoos had to be compulsorily tested on animals such as squirrels, monkeys and rabbits. Some of these tests entailed blinding of these animals, feeding them lipsticks which contain a high dose of arsenic and killing them after the tests. ■

IN COURT

MUTUAL AGREEMENT: US haemophiliacs who contracted the AIDS virus from contaminated blood-clotting products have decided to accept a tentative US \$650 million class action settlement of the lawsuit brought against the companies involved in the issue. Nearly 6,500 haemophiliacs have decided to join the settlement plan, of whom about 800 had earlier initiated legal action. Meanwhile, about 380 haemophiliacs have filed fresh lawsuits. However, the concerned companies, including Baxter International Inc, Bayer AG and Rhone-Poulenc Rorer Inc, have yet to decide about joining the settlement plan.

SAVE THE LUNG: The Supreme Court of India recently expressed concern over the growing number of industrial units in Dahanu, the 'green lung' of Mumbai. It ordered the Union government to set up an environment authority for the implementation of the coastal zone regulation notification and the regional plan to protect the ecologically sensitive area, located 150 km off the metropolis. A public interest petition filed in the court alleged that more than 380 industries including a thermal power plant, are being set up in the area. Moreover, these units do not have pollution treatment plants and have not met environmental standards.

BRIEF RESPITE: More than 39,000 industrial units in Delhi got a breather recently when the Supreme Court agreed to stay the shifting of these units until the Delhi government draws up an action plan for their relocation. In an earlier order, the court had ordered the closure of these industries — located in non-conforming areas — if they failed to move out of these areas before the end of the year. The court was requested by the Delhi government to grant time for relocation of these industries. The government has also sought permission to develop 1,620 ha of industrial land in the city.



VISHWAJYOTI

IN FOCUS

Human genes are not for the asking, thus intoned the International Bar Association (IBA) and about time too. For, the field of human genome sequencing, though only five years old, has seen an almost runaway kind of research explosion.

It was at the instance of the Human Genome Organisation (HUGO), a network of scientists working worldwide on cracking the human genetic map, that the IBA set about drafting an international convention aimed at establishing minimum legal standards for the use of human genetic information. The basic gist of the convention requires that there will be no discrimination on the basis of genetic characteristics and genetic technology will not be used to prevent births within any group of humans genetically disposed to conditions like sickle-cell anaemia or Down's syndrome.

It also recommends rules on what should form the key element of genetics and sets standards for the use of human genome information in developing new healthcare treatments and therapies. The convention will come into effect after it is approved at the UN, where it will be presented in June next year. It was recently approved during IBA's annual conference at Berlin, Germany. IBA will send copies of the convention to its 170 bar associations around the world.

Once governments approve the convention, they will be required to adopt laws which will guarantee that all human genetic research in their countries will be conducted according to internationally accepted medical, scientific and bio-ethical standards. Remarked Martine Rothblatt, chairperson of the IBA's bio-ethics committee, "The Human Genome Project is only about five years old and already there are numerous instances of abuse being reported. The purpose of the treaty is to make sure that all the people in the world have the benefit of legal protection."

INDIA / AGRICULTURE

Fostering fecundity

WITH a view to boosting productivity of foodgrains, the government recently announced a country-wide scheme under which the entire agricultural land would be covered for soil testing. Expressing concern over the declining quality of soil, Chaturanan Mishra, the agriculture minister, said that after thousands of years of continuous farming on the same land, it was time to do

something to improve soil quality. Before modernising agriculture, soil-testing should be conducted in all farming land, he said.

The soil testing will be done with the help of Krishi Vigyan Kendras (KVK) or agriculture science centres. Such Kendras would be set up in all the districts of the country. At present, there are KVKs in 253 districts of the country. The process of soil testing had already begun on a small scale in West Bengal with the assistance of Indian Council of Agriculture Research, New Delhi. ■

INDIA / DISEASE

Seeing yellow

CLOSE on the heels of the dengue, yellow fever is threatening to break out in India, according to the World Health Organization. The *Aedes aegypti* mosquito which spreads the dengue fever can also carry the yellow fever virus, said the Heart Care Foundation of India, New Delhi. However, Pradeep Seth, head of the department of microbiology

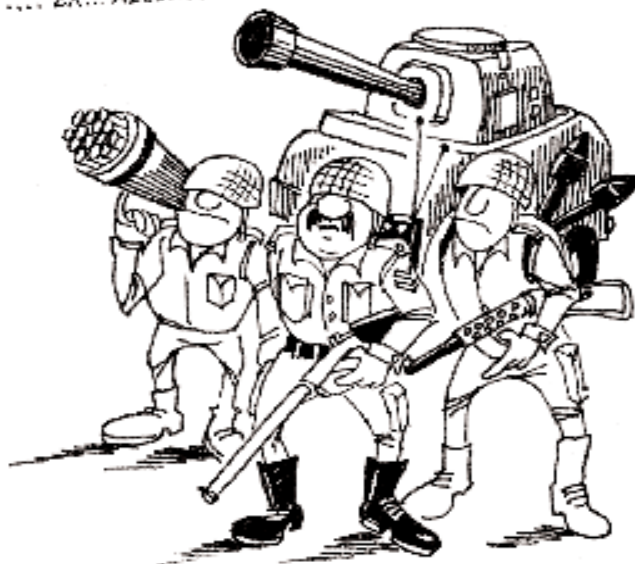
at the All India Institute of Medical Sciences, New Delhi, ruled out the threat, saying that since the dengue and yellow fever viruses belong to the same family, people develop cross immunity by contracting one of the diseases. Yellow fever is initially marked by fever, weakness, back pain, nausea and vomiting. Subsequently, the patient develops jaundice, cardiovascular instability, reduction in the amount of urine and haemorrhage. In severe cases, the fever can lead to seizures, stupor and coma. ■

COMMENT

ARMY CALLED TO FIGHT DENGUE IN DELHI

BOYS! THE ENEMY...

... ER... WELL... A MOSQUITO!



RUSTAM VANIA

Water alarm

A study highlights the serious contamination of groundwater in Delhi due to excessive use of fertilizers

A YET unpublished paper on groundwater quality in Delhi, conducted by scientists of the Nuclear Research Laboratory (NRL), of the Indian Agricultural Research Institute, indicates that 33 per cent of the groundwater shows nitrate contents exceeding the general acceptable limits (20 parts per million; ppm), and 15 per cent crossed the maximum permissible limit (45 ppm). The study shows that indiscriminate discharge of wastes on land and in drains has also contributed to high levels of nitrates, in certain places.

According to the study, *Assessment of groundwater contamination from fertilizers in Delhi area*, groundwater accounted for nearly 50 per cent of Delhi's domestic and industrial supplies. The study adds that the extent to which fertilizer application adds to the nitrate problem in Delhi is not known. Groundwater, moderately to highly saline in all parts of Delhi, was also found to contain high levels of potassium.

"There is a possibility that nitrate in drinking water may get converted into nitrite in the gastrointestinal tract with the subsequent formation of nitrosamines. Some nitrosamines are known to be carcinogenic, and health effects on long-term exposures are potentially serious," states P S Datta of the NRL.

Application of nitrogen fertilizer in Delhi in the last decade has increased significantly and now stands at above 300 kg/ha (*Fertilizer Statistics 1993-94*). The fertilizers used are urea, ammonium sulphate, calcium ammonium nitrate, diammonium phosphate and ammonium chloride. This creates a blanket non-point source of nitrate (a non-point source is one that cannot be pinpointed. For example, in the case of water

pollution in a river, a point source is a drain. But run-off, all along the river banks constitute a non-point source). Flood irrigation and rains accentuate this entry.

The study states that other sources of nitrate are waste-water drains, cattle-sheds, recharge of groundwater, nature of vegetation cover, microbial reactions in soil and human activity. "Seepage of nitrates from the western Yamuna canal

agriculture could minimise the requirement of inorganic fertilizers and would be helpful in protecting groundwater from further degradation. This would also bring down the cost of cultivation, through appropriate management of fertilizer application.

Of the total geographical area of Delhi (1485 sq km), half remains agricultural land. In this area, groundwater irrigation has shown an upward trend, primarily because irrigation canals have not been regular sources of water. The geohydrology of Delhi is such that drainage to the east of the Ridge enters the Yamuna, whereas to the west, drainage is to the natural depression in the southwestern part. A large part of Delhi already has alkaline and saline soils (alkaline soils contain sodium



Noxious nitrates enter the groundwater through dirty waste-water drains

and other drains has been found to be another source. Nitrate levels of domestic waste-water range from 18-28 ppm. The sub-soil structure indicates that this contaminated groundwater from the source areas migrates towards the urbanised Delhi," says D L Deb, of the NRL.

Pointing out to the fact that there are not enough plants to take up nitrates produced naturally, the scientists add that significant quantities of evaporated irrigation water infiltrate along with fertilizer nitrate to the groundwater system. They recommend that application of this nitrate-rich water for

bicarbonate and carbonate among soluble salts, while saline soils are impregnated with sodium chloride and sulphate as the main soluble salts). Additional salts from fertilizers, therefore, make the situation worse.

Interestingly, another study by the NRL, *Major Ion Chemistry of Groundwater in Delhi Area*, finds excessive calcium sulphate in groundwaters of the Alipur and Nangloi blocks. This indicates calcite weathering by sulphuric acid. "Sulphuric acid maybe produced by sulphur-dioxide (SO₂) emissions from power stations and automobile pollution," the study notes. ■

Abuse of the used

Nigerian environmentalists protest against the import of second-hand vehicles from Europe

ABIODUN RAUFU NIGERIA

FOR almost a decade, indiscriminate import of vehicles from Europe into Nigeria had gone unchecked. Encouraged by the absence of any definite policy, there was mass dumping of all kinds of *tokunboh* — local slang for imported second-hand vehicles — into Nigeria. Very few were in good shape.



Majority were dis-used '70s models, notorious for their worn-out engines high carbon emission.

Worried by the environmental and health implications of the indiscriminate influx of these vehicles, Nigerian environmentalists took up the challenge, calling for stricter import regulations.

"There is an urgent need for government to take concrete action to dissuade unchecked importation of such vehicles because more than 60 per cent of the vehicles cannot satisfy minimal safety standards," Dipo Adekanmbi, an environmental scientist said. Environmental experts said that the thick dark smoke in many Nigerian cities can be traced to the large number of old and poorly

maintained vehicles in the country.

The government did take some decisive measures last January which were widely hailed. They decided to put a blanket ban on the importation of vehicles which are more than eight years old. Since then, there has been reduction in the number of un-roadworthy vehicles that enter Nigeria. But environmentalists say that it still needs to be seen that the government strictly enforces these regulations.

Also locked in the battle are local auto-makers whose sales have dwindled considerably as a result of the boon in the second-hand vehicles business. Most Nigerians, unable to afford the prohibitive prices of brand new cars found succor in the second-hand vehicles market. Operating under the aegis of the Nigerian Association of Motor Manufacturers, the local auto-makers are calling for higher import duties to curb importation. Today, the local auto-makers have been producing at between five to 10 per cent of installed capacity, which has resulted in massive downsizing of their operations in order to stay afloat.

The campaign against imported second-hand vehicles has, however, not gained much public support, quite to the disappointment of environmentalists. This is because almost everyone agrees that their presence has greatly helped ease the chaotic and inadequate transport system in the country.

The trade in second-hand vehicles was hitherto a negligible part of the Nigerian auto business. The scene changed with the introduction of the structural adjustment programme in 1986. The Nigerian currency was massively devalued, precipitating inflation, resulting in a sharp increase in the prices of brand new cars. With the prohibitive prices of new cars, the Nigerian middle class' appetite for personal cars was sharply curtailed. Soon enough, importers of second-hand vehicles filled the void by bringing in used cars from markets in Antwerp, Brussels and London. ■

Butterfly effect

A recent study shows how a species reacts to warmer temperatures across the entire range of its habitat

IN WHAT experts are calling the first direct biological consequence of global warming, a delicate species of butterflies is being driven north through California to escape rising temperatures, Santa Barbara, a researcher at the University of California has found.

Known as Edith's checkerspot butterfly, the insect is prized by collectors for the distinctive orange and black patterns on its wings which folded together are the size of a pair of postage stamps; and by ecologists because it is especially sensitive to subtle changes in climate. The butterfly is rarely noticed among the hillside snapdragons and figworts on which it feeds, but it can be found at sites from Mexico to Canada, often living and dying confined to a habitat no larger than a few hundred square yards.

Camille Parmesan, a research fellow at the university's National Center for Ecological Analysis and Synthesis surveyed 151 locations throughout western North America where the

Woes on three wheels

Over the last three months, nearly 10,000 auto-rickshaws have been taken off the roads of Ahmedabad, ostensibly to check pollution within the city. As a result, many auto-rickshaw drivers were rendered jobless and have remained so till date. According to civic authorities, the impounded auto-rickshaws used to mix kerosene with petrol to cut down on fuel expenditure. The emission resulting from the burning of the mixture had a remarkably high percentage of carbon monoxide, raising the pollution level of the city to a large extent. Concerned by this, municipal authorities of Ahmedabad cracked down on the rickshaws about three months ago.

The rickshaws have yet to be returned to

butterfly traditionally flourished. She found that rising temperatures were killing off the butterfly at the southern extremes of its range, while at the same time allowing it to expand into cooler climes to the north. Populations in Mexico were four times as likely to be extinct as those in Canada, Parmesan discovered.

She also found that in those southern areas where the butterflies persisted, the insects had shifted to higher elevations, where temperatures would be slightly cooler. "It is an excellent climate-sensory canary in a coal mine," said Stanford University ecologist Paul Erlich.

There is broad agreement among scientists that the Earth has gotten warmer by at least one degree during the past century. But there is considerable controversy over what, if any, effect it has so far had on the flora and fauna.

Speaking on the biological effects of climate change, John Harte, an expert at the University of California, Berkeley, said the study appears to confirm the prevailing theory of how global warming will alter wildlife. Harte, however, believes that most plants and animals rely on too many local factors, from soil microbes to air quality, to simply shift northward. "If her study is true, it really points to the validity of the conventional and, to my mind, implausible picture of how plants and animals will respond to climate change," he said. "I think it is an exciting and thought-provoking work." ■

Genetic patriotism

Ecuador enacts a law for the protection of its genetic resources

ECUADOR, the tiny Latin American nation flanked by Peru and Columbia and traversed by the Andean ranges, has ventured into an area that very few countries in the world have explored. Its government, which came to power in August 1996, has enacted a law asserting its 'rights' over the country's genetic resources: plants, animals and microorganisms which will henceforth be "con-

a member nation must first put in place a national biodiversity law, protecting its bioresources, if it hopes to use this 'right' as an effective weapon to keep off the outsiders.

The government at Quito was driven by the need to keep the US at bay. It came up with this 'law protecting biodiversity in Ecuador' primarily to thwart attempts made by the US government to gain access over the treasure trove of medicinal and other exotic plant varieties found in abundance in Ecuador. In July, 1996, in connivance with the erstwhile regime, it tried to push through a treaty which would have made it obligatory for the Ecuadorian government to recognise patents issued by the US authorities on plants and microorganisms available in Ecuador. The pact



Jungles in Ecuador may now be saved by the country's new law

sidered as national property". The law also stipulates that any commercial exploitation of these resources will be subject to regulation (by the government).

By taking this step, Ecuador has availed of the opportunity that the Convention on Biological Diversity (CBD) — a global treaty to save the planet's plant and animal resources — offers to all its 160 member nations. The CBD recognises 'countries of origin' of living resources, and gives them sovereign rights over these treasures. In other words, it says that if any external party wishes to access the resources it can do so only with the prior consent of the country where they are found. However,

made no mention of the contributions of the native communities, nor did it make any provisions for sharing the benefits arising out of the commercialisation of these bioresources with the country of origin, that is, Ecuador. In other words, a party hailing from the US — it could be an individual, a business house or a research institute — could access the resources, develop them commercially and then apply for patents on them, without giving the Ecuadorians anything in return. On the contrary, they could, by exercising their patent rights stop the locals from using these resources for their own use in the future.

The treaty, when placed for ratification before the Congress in July, met

the drivers. "The problem is that most of the rickshaws that have been seized were rented by the drivers to earn a livelihood as auto-rickshaw owners rarely indulged in mixing petrol with kerosene," says Ela Bhatt, director of the Ahmedabad-based Self Employed Women's Association. "Now these poor drivers are at a loss on how to earn their living."

The authorities have imposed a heavy fine of Rs 3,000 to Rs 4,000 on the concerned driver if he wants his auto back. "This huge fine is the major reason for the delay in getting the rickshaws back," says Bhatt. "Very few of the drivers have been able to pay up the money." Desperate auto drivers have urged the municipal authorities of Ahmedabad to release their impounded vehicles. But, in a rare show of strictness, the city authorities have turned a deaf ear to the pleas.

with vehement opposition from all quarters. Environmentalists based in Quito, indigenous peoples' groups, pharmaceutical lobbies and political leaders joined hands to launch a tirade against this blatantly pro-us accord. And they succeeded in blocking it. The new government assumed office in August and on September 2 it came up with the radical bill, which has now been officially enacted as a law. ■

The big farce

The World Bank has once again come out defending its big dam-centered policies



HIMANSHU THAKKAR

IN A study titled, *The World Bank's (WB) experience with large dams: a preliminary review of impacts* dated September 1996, the Operations Evaluation Department (OED) of the WB has concluded from a desk assessment of 50 Bank-financed large dams that the WB should continue to conditionally supporting the development of large dams. The conditions require that the projects comply strictly with the new Bank guidelines and the design, con-

Clean bowled by smog

The English said it before. And the Australians have said it now. But the fact remains that New Delhi continues to display its polluted profile to visiting cricketers, so much so that the Australian cricket team has vowed not to have the capital city in its itinerary as a future venue for tournaments.

Said the Australian team manager and Cricket Board director Cam Battersby, "The pollution in Delhi is such that we should give serious consideration before coming back to play any more cricket here," and added cuttingly, "I have heard it said that Delhi is the fourth most polluted city in the world — if that is so, I would like to see the other three." According to a report in *The Australian*, a newspaper published from Sydney, the visiting team members have suffered from eye and respiratory problems while staying in the city.

Reacting with undue alacrity, environment officials were quick to

defend the air in Delhi and trotted the clichéd retort that the Australians complained of pollution only after losing to India in the test match and that such statements were simply not cricket. Instead of accepting that the capital's air had gone from bad to worse, Delhi's environment secretary D S Negi said that Delhi, compared to other cities in the world, fared similarly with respect to carbon dioxide or carbon monoxide pollution. The tag that Delhi so ignominiously bore about it being the fourth most polluted city in the world was more due to suspended air particles, a direct result of the presence of many industries, felt Negi.

Earlier, it was the turn of the English cricketers to complain of perennial 'smogscreens' during the 1992-93 series with India (*Down To Earth*, Vol 1, No 20). It is indeed a matter of shame that Delhi's citizens and tourists from abroad are forced to inhale polluted air while the mandarins in the environment ministry continue to adopt an indifferent stance.

struction and operation of new projects take into account the lessons from previous experiences.

The critics are not impressed, as the record till date shows that these conditions are almost always violated. Says Patrick McCully, campaigns director for the International Rivers Network in the US, "The sources of data have been the dam agencies themselves, so the answers are not surprising." Thus, the study, that was commissioned "to deal with the fundamental issues that underlie the controversy", is unlikely to be of much help to the WB if it was looking for excuses to push ahead with funding more big dams.

Most revealingly, the report does conclude that only a quarter of the projects that have been reviewed were implemented so as to comply with the Bank's current criteria. But the report finds solace by putting forward a hypothetical and theoretical proposition that mitigation of the adverse social and environmental consequences of large dams would have been both feasible and economically justified in 74 per cent of the cases. This still means that at least in

26 per cent of the cases reviewed, even by present standards, the social and environmental impacts would not have been mitigated. In any case, if the history of WB funded projects in India including Sardar Sarovar, Upper Krishna, Suvernarekha or Indravati is anything to go by, the record of implementation of "Bank's current, more demanding criteria" is dismal.

Robert Goodland of the WB's environment department in Washington says, "I'm fighting like hell to make sure that we keep financing hydro-dams." Goodland has set up elaborate guidelines to test if a dam should be built or not. However, as the September issue of international journal *Infrastructure Finance* says that "few existing dams could pass these tests". In spite of the statement by the WB President James Wolfensohn when he visited India recently that "what has happened in Sardar Sarovar is a tragedy and I get distressed when I hear about it", it is clear that the Bank management is bent on pushing ahead with the big-dam-centered water and power policies. ■

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Against the haze

Delhi's Centre for Science and Environment starts a fiery campaign against smoke emanating from vehicles

THE smog is out of the bag. *Slow Murder: The Deadly Story of Vehicular Pollution in India*, a Centre for Science and Environment (CSE) study, was released by the Vice-President K R Narayanan at his residence on November 1. The study exposes the dreadful conditions of Indian metros due to the fatal cocktail released by the ever-growing vehicular craze, amply supported by poor fuel quality, bad vehicular technology and non-existent traffic planning. The Vice-President stressed on inculcating environmental values in our culture.

According to the study, in Delhi alone the total emissions per day are 2020 tonnes, two-thirds of which is accounted for by vehicular emissions. On November 5, some of the details of the study were presented to a 500-strong audience at FICCI auditorium, for a panel discussion chaired by chief election commissioner (CEC) T N Seshan. The panellists included editor of *Business Standard*, T N Ninan, Delhi assembly leader of the opposition, Jag Pravesh

Chandra, Central Pollution Control Board chairperson, D K Biswas, and Supreme Court lawyer, Anil Dewan. The effort was to drive home the hidden fact, in Dewan's words, that "if we don't do anything now, we will not only be fellow victims but also fellow conspirators in murder".

At the discussion, CSE director Anil Agarwal said, "We all want to live like the Americans. But very few of us realise that the western economic dream is actually a highly toxic dream." He made it quite clear that the average citizen is bearing the brunt of the government's total apathy on the issue.

Quoting from *The Cost of Inaction: Valuing the Economy-Wide Cost of Environmental Degradation in India*, a study conducted by two World Bank staffers who took the 1993 data on air pollution in Delhi and fed them into a US epidemiological model, Agarwal said that the study revealed 7,491 premature deaths and 3,990,012 hospital admissions. "Although we can argue that the

US model is not valid for India, the study can only err on the conservative side, since nutrition levels in India are lower than in the US and, hence, the health impact would be higher." He urged the people to take the first step in controlling vehicular pollution, "Tell your MP that his or her political career is at stake if this matter is not dealt with expeditiously."

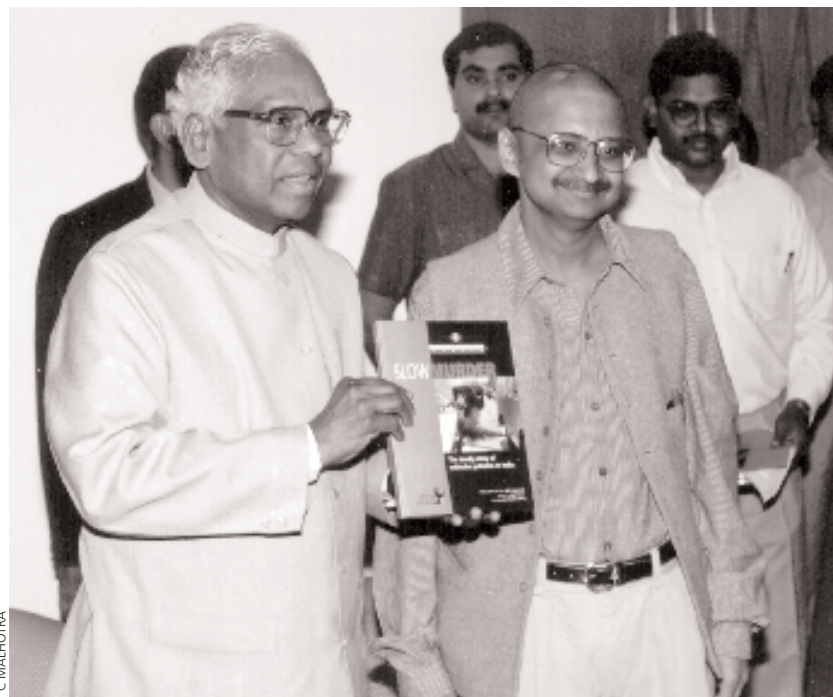
Most of the panellists felt that the lack of systematic urban development was yet another reason for vehicular pollution. CPCB's Biswas said that the transport departments at the Centre and in states are not doing their job at all. "There is no proper traffic planning," he held. Referring to the Mass Rapid Transit System (MRTS), which has been hailed as a viable alternative to surface transport, he said, "Even if the cities are equipped with MRTS, majority of the people will still depend on overland transport systems as they cannot afford MRTS."

In this connection, Ninan suggested that a cess should be imposed on private vehicles. "If you were to put two per cent or five per cent tax on the cost of private vehicles, a lot of extra money can be collected which can then be used to finance a public transport system."

Seshan reminded that expanding cities themselves is a cause of most of the noxious air that we breathe. "There is pressing need to decongest cities. If we go back to Gandhiji's ideal of 'small is beautiful', then a large number of our problems will be solved," he said. He also advocated the creation of "small cities, self-sufficient in themselves throughout the nation." This, he felt, would lighten the load on metros like Delhi. Seshan emphasised that a philosophical approach is the need of the hour. In the public debate that followed, a large number of people from all walks of life shared their views.

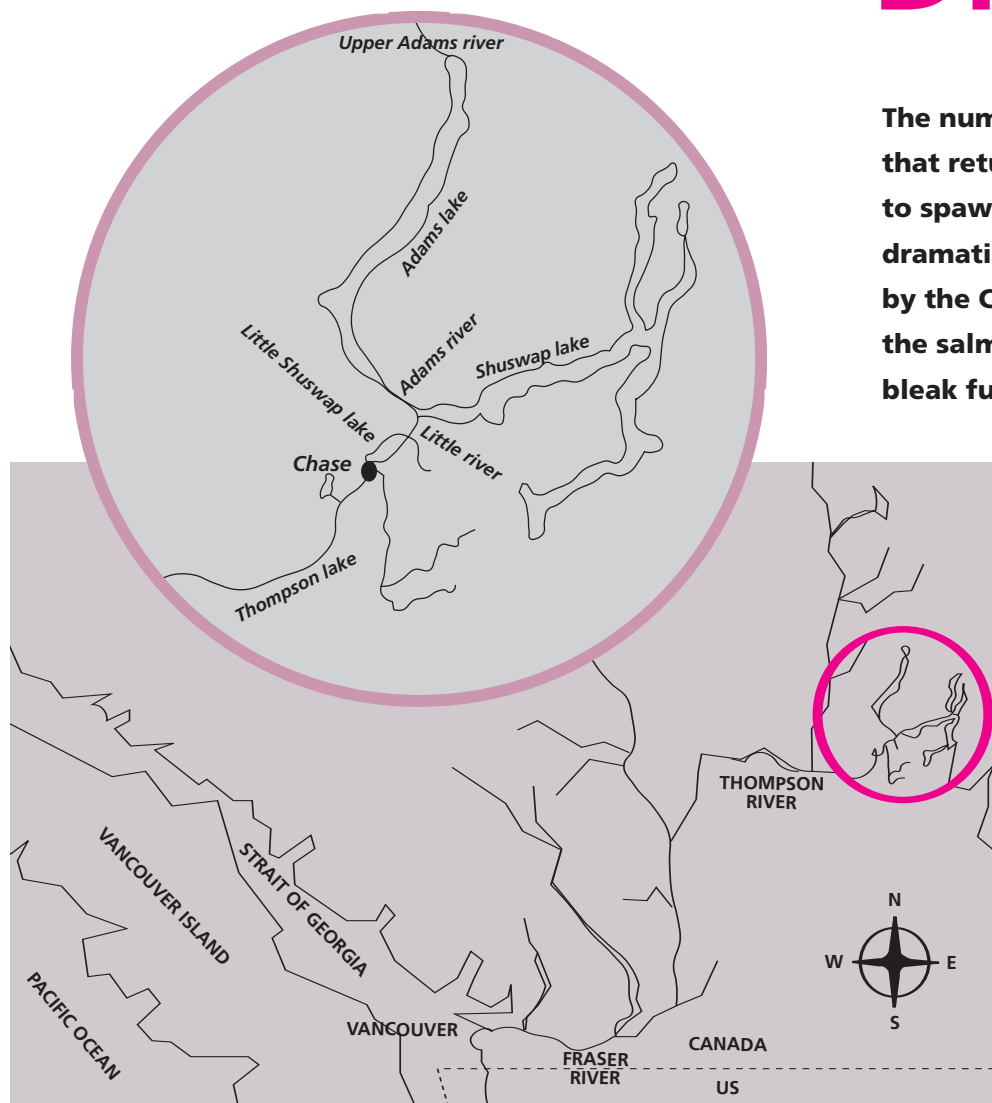
An exhibition on vehicular pollution was also inaugurated by Seshan at the National Museum of Natural History. The exhibition, which will be on till November 20, pulls no punches in depicting the polluting nexus that exists between the government and the industry and its noxious effects on people. From an auto-rickshaw declaring "Pradushan karne wale tera muh kala" to a human skeleton wearing an anti-pollution mask, the exhibits tell the gruesome story of slow murder. ■

The Vice-President releasing a book on vehicular pollution by CSE; on his right is the director of the Centre, Anil Agarwal



Dry run

The number of Pacific salmon that return to their birth place to spawn is decreasing at a dramatic rate. Despite efforts by the Canadian government, the salmon population faces a bleak future



was to a large extent based around the salmon. The Columbia, a large-volume river like the Fraser, once also had salmon runs of similar magnitude, supporting a strong fishing industry. However, extensive dam building since the '40s has caused such a decline in the numbers of salmon native to the Columbia and its tributaries that many are now on the US list of endangered species. As a result, many American fisherfolk have turned to the salmon returning to the Fraser river as they pass through American waters.

Fisherfolk have protested the Canadian government's plans to halve the

fleet size, occupying the offices of the government department of fisheries and oceans in a number of Pacific coastal towns in May 1996. They say that the cuts will hurt small operators and leave commercial fishing licenses concentrated with a few large corporations, while providing inadequate training and compensation for fisherfolk who lose their livelihood.

Canadian government policy is influenced by the economic devastation experienced by Canada's Atlantic provinces following the collapse of fish stocks. The fishery there has now been closed to Canadian boats to allow stocks to recover, and an agreement reached with the European Union to prevent

PHILIP CARTER

THE future of the sockeye salmon, which return every year to the Adams, one of North America's most important salmon rivers, remains uncertain despite efforts by the Canadian Federal government to cut the large commercial fishing fleet to half. The number of salmon returning to the river has dramatically decreased in recent years, with only 1.4 million sockeye expected to return in 1996 to the Fraser river, of which the Adams is a tributary. This will be the lowest number in 40 years, with overfishing, pollution and habitat degradation all playing a part.

The method by which salmon can

return to the stream of their birth to spawn and die following years in the open ocean is not well understood. It has been shown that salmon have an extremely acute sense of smell, capable of distinguishing the scent of their home river, and yet more than smell is at work. Scientists believe that they can also detect the earth's magnetic field, and that awareness of changing day lengths helps to determine the timing of the salmon migration.

The Fraser in Canada and the Columbia in the US were historically two of the world's great salmon rivers. There may have been runs of up to 100 million fish in the Fraser before this century, supporting the natives whose culture

their boats from catching the last remnants. The agreement followed Canada's arrest of a Spanish fishing boat which was fishing with an illegal fine mesh net in the summer of 1995.

The David Suzuki Foundation, a Vancouver-based environmental group, says that the kinds of net used to fish for salmon have to be changed. In a report released following the unexpectedly small Adams river salmon run of 1994, the Foundation said that it is necessary to "greatly reduce or entirely eliminate the use of gill nets, one of the most destructive and wasteful fishing gears ever invented and the only gear that precludes live capture and selective release of fish."

A clear blue-green river flowing from Adams lake in central British Columbia province, the Adams river supports a salmon run that is one of the most spectacular and economically important in the world. The young sockeye salmon are hatched in its gravel beds in the early summer before being swept downstream into Shuswap Lake. Covering some 30,000 ha, this large body of water acts as a nursery for the hatchlings for about a year, feeding on insects and acting as an important food source for trout. After a year, the salmon begin the journey through the Thompson and then the Fraser to the Pacific, where they spend three years before returning.

The salmon run on the Adams river is a four-year cycle, with the largest number of salmon returning in 1986, 1990, 1994, etc. — the year of the "dominant run". Returning to the Adams, an extremely high percentage of the fish are caught by an efficient network of fishing fleets. In order to get to the mouth of the Fraser river, sockeye salmon have to first circumnavigate Vancouver Island, either to the north or south. To the north, this means taking the extremely narrow channel in Johnstone Strait between Vancouver Island and the mainland, where Canadian fishing boats with seine nets can effectively block the route. To the south, the salmon pass first through American waters where the US fleet is waiting in the Strait of Juan de Fuca.

According to Wayne Sato, a Canadian government fisheries biologist, in recent years, "between 70 per cent and 80 per cent of the fish are caught and 20 per cent to 30 per cent of the fish successfully escape to spawn".

This is, in fact, an improvement over earlier years, where according to Sato, between 75 per cent and 85 per cent of the fish were caught and 15 per cent to 25 per cent were allowed to escape.

The warming of the Pacific ocean, known as the El Niño effect, has also had a considerable effect on Fraser's sockeye stocks. One reason for this is that large schools of mackerel move north with the warmer water, eating many of the young salmon shortly after they have reached the sea. Extremely warm water conditions in the Pacific in 1992 and 1993 are considered a factor in the low numbers of sockeye returning for the dominant run in the Adams in 1994.

A major river diversion proposal by the aluminium company Alcan was stopped in 1995 by the British Columbia provincial government, who said it was a threat to Fraser salmon. The project to divert the Nechako river, one of the source streams of the Fraser, was to be the second phase of a power generating project for aluminium production. The Nechako, an important salmon spawning river, was already 40 per cent lower than its original level due to the Kenney Dam diversion project by Alcan in the '50s. The decision was made despite threats by Alcan to launch a lawsuit seeking millions of dollars in compensation for what it said was a broken contract by the government.

The Fraser's relative freedom from dams and diversion projects is in stark contrast to the Columbia river. Since the late '40s, a total of 17 major dams have been built on the Columbia, completely blocking it except for a 30 km stretch of free flowing water near the Hanford nuclear weapons facility. It is an irony that Hanford is also known for an extremely high level of radioactive groundwater contamination which some estimates place as taking more than 50 years to clean up.

Despite the dams, salmon still survive in the Columbia, although at a fraction of their previous population. One technique for enabling salmon hatchlings to bypass the dams on the Columbia has been that of transporting them around dams in barges. This has been criticised as interfering with the

salmon's ability to imprint the scent of their home river and enabling them to return.

Early this century, a legendary Canadian salmon run from the upper Adams river was rendered extinct due to a dam, in an event which foreshadowed the tragedy of the Columbia. The present Adams salmon run is from salmon returning to the river below Adams lake (see map), but prior to 1907, a distinct sub-species of salmon passed through the lake to spawn in the upper Adams river, which enters the lake at its northern tip. In 1907, the Adams river Lumber Company made a dam across the southern outflow of the lake, blocking the access of salmon to upper Adams. Every year, water was released from the dam in sudden violent floods to float logs downstream, which also disrupted the spawning salmon in the lower Adams river and damaged their nests in the gravel.

While the lower Adams river population has recovered, the unique species which returned to the upper Adams has

been lost. Intensive efforts to renew this run since the '50s have proved extremely difficult. It was not until the early '80s that the first real success was achieved, with a run of 3,000 salmon returning. In the case of the Columbia, it has been estimated that 95 per cent of young salmon fail to negotiate the dams, killed in dam turbines or else, unable to find a way around. Extinction faces these fish. A striking

example is the autumn run of Chinook salmon to the Snake river, the Columbia's main tributary, which reduced to 300 in 1994 from around 72,000 in the '40s.

According to the David Suzuki Foundation report, it may take 30 years for Pacific salmon stocks to recover if action is taken immediately. The spectre of the collapsed fishing-based economy of Canada's East Coast, and the tragedy of the Columbia river salmon remain as reminders about the consequences of doing nothing. ■

Philip Carter in a freelance journalist living in British Columbia, Canada

It may take 30 years for Pacific salmon stocks to recover if action is taken immediately

Cultivating a turn-around

Depredations of a virus, public outcry and strictures of the Supreme Court combine to make the aquaculture industry sit up and take note of its own misdemeanours

MAX MARTIN COCHIN AND MADRAS

LARGESCALE shrimp farmers on the Indian coasts have become a wiser lot. The much-hyped “semi-intensive” mode of aquaculture has become a dirty term. Lesser stock, lesser profit — that is the new style, according to the latest directives issued by the Central promotion body Marine Products Exports Development Authority (MPEDA). This pruning of ambitious entrepreneurs’ ambitions has been brought about by a virus, variously identified by scientists as necrovirus, baculovirus and China virus. The virus wiped out the east coast farms, gulping down Rs 200 crore in 1994, forcing a crop holiday the following year and cutting down a steadily growing marine products export figure in 1995-’96. Also, a Supreme Court (sc) ban on new farms and protests against environmental damage caused by aquafarms, has put the business in suspended animation, with banks refusing to support a “risky venture”.

Consequently, the entrepreneurs have become cautious in the use of chemicals and substandard feed. Says president of the Madras-based Aquaculture Federation of India, M Sakthivel, “We have learnt a lesson; we have to be slow, careful.”

Not just careful but caring as well. The recommended don’ts for shrimp farmers include greed (overstocking), gluttony (overfeeding), ignorance (overnutrition of ponds) and callousness (spilling effluents). The MPEDA now advises “minimum stocking densities” aiming at production of only half-a-kg or one-two tonnes a ha.

Thanks to the sc strictures, the industry is learning the basics of environment friendliness as well. As per a pathbreaking legislation in Tamil Nadu, every new project will have to be cleared by a district council, comprising the district collector, pollution control board (PCB) representative, state fisheries offi-



Aquaculture: the virus took a heavy toll

cer and other concerned officials. Andhra Pradesh (AP) is planning a similar law. As for rest of the country, the ministry of agriculture may soon deliver a set of guidelines conceived two years ago. But all this is subject to sc’s judgement on shrimp farming, due to be announced by mid-December.

Aquafarmers are eagerly awaiting the sc verdict. Says Sakthivel: “There is lot of uncertainty. Commercial banks stopped financing even the existing projects though nobody told them to do so.” The MPEDA is worried — with good reason. Between 1993-’94 and 1994-’95, the growth in seafood exports was 26 per cent by quantity and 43 per cent by value. By 1995-’96, the exports declined by four per cent (by quantity) and two per cent (by value). With a production of about 83,000 tonnes (t), aquaculture accounted for one-fourth of the country’s total shrimp (the main export item) production.

However, the virus took a heavy toll. In West Bengal, the disease wiped out 2,400 t. In AP, it affected 3,400 t; and the crop holiday that followed caused a loss

of production of 14,500 t. In Tamil Nadu, aquafarmers lost 600 t to the disease and 15,000 t to the crop holiday. In 1994, the MPEDA had issued several warning circulars about the disease; later, the advice for crop holidays went unheeded too till the disease spread all over.

The ravages of the disease on the west coast was less devastating. In Kerala and Karnataka, most farms are traditional (upto 500 kg/ha/crop) or modified-extensive (one-two t/ha/ crop). Said A Laxminarayana, officer-in-charge of the Central Institute of Brackishwater Aquaculture (CIBA) unit in Narakkal, near Cochin, “Modified-extensive is the ideal way in Kerala.” The virus still had its way there, as no aquafarm is an island. Laxminarayana points out that “the disease might have come through shrimp seed from AP or Tamil Nadu”.

The MPEDA has issued guidelines to the farms. These guidelines, prepared after a consultation service by Nagpur’s National Environmental Engineering Research Institute (NEERI), include initiatory acts (to begin the operation) like the following:

- Removing the top black soil
- Applying lime for soil disinfection
- Cutting down on organic manure
- Caution in the use of chlorine.

For restarting operations after a crop holiday, the farmers should:

- test culture in a small area;
- adapt low stock density
- set up effluent treatment plants (ETPs)

The industry is reluctant to go in for ETPs — a matter of cost, not just discipline. Even when NEERI was finalising the recommendations last year, there was pressure from the industry to cut down on ETP costs. NEERI’s final ETP design accepted and distributed by MPEDA is a watered down version of the original design; NEERI had advised a series complex system for aeration of effluents; but the final design has just one aerobic pond. ■

Who'll bell the cats?

Bellary in Karnataka, targeted by industrial houses for 'development', death and devastation, needs an organised resistance to the mayhem

KEYA ACHARYA

"THE last thing this place needs is an environmental journalist," a senior secretary of Karnataka's mining department had said, referring to Bellary. Situated in mid-eastern Karnataka, drought-prone Bellary district is home to the mineral-rich Sandur hills. Extensive deposits of

iron and manganese ores, besides those of red oxide, platinum, copper, asbestos, dolomite etc make the region a veritable gold-mine. Besides minerals, another natural resource the region boasts of is the waters of the Tungabhadra. Mindless exploitation of these resources is dealing the district its death-blow.

Iron ore mining began in the region in the early '60s; today, an area of 150 sq km in the three taluks of Bellary, Hospet and Sandur are under mining leases. The National Mineral Development Corporation, one of the lessees, takes pride in the environmental award granted it by the ministry of environment and forests in 1995. But the award is relative — a matter of choosing the best of the available lot. And the state of the available lot is abysmal.

The entire range from Bellary to Hospet is marked by opencast mining 'overburden' of laterite soils, destroying the Sandur forest ecosystem. Mining wastes are very high. An environmental impact assessment of mining in the area done by Saratchandra of the Karnataka state council for science and technology states that 6.5 million tonnes (mt) of iron ore recovered in 1992 produced an overburden of 30-35 mt.

The implications are serious: the ore overburden and the topsoil comes down in the rains into the Tungabhadra dam and other tanks. Villagers using the



The Bellary Steel and Alloys Limited: the company has been pinpointed as one of the ravagers

water complain of stomach ailments (as in Hirehalli in Bellary) and soil infertility (in Kamalapura at Hampi). Though rules stipulate land reclamation and benching methods in mining, there is widespread flouting in practice. Mine owners dispense with matters related to the environment through a one-time Rs 20,000/ha compensatory afforestation amount given to the forestry department. The increase in mining has not been concurrent with any level of socioeconomic improvement; about 25,000 mining labourers in the private sector work 14 hours a day for Rs 60 a week.

Out of the 35 mega units which have been given permission for setting up operations in the state in the last 18 months, nine iron and steel units are slated for Bellary alone. New steel units that will withdraw water from the dam (for an annual production of 6.6 mt of steel, a minimum of 237.6 million litres of water is required daily) will affect about 65 per cent of the district's agriculture. Besides the dam waters, another source of water being exploited mercilessly are underground wells; the Bellary Steel and Alloys Limited (BSAL) is one of the culprits. The company, a sponge-iron and steel rolling mill about to undergo a Rs 900-crore expansion, is planning to use inbed wells to draw 36 cu m per day of water from Hagiri river, one of Bellary's

Towards more concrete responsibilities

- Compulsory afforestation by lessees
- Blanket ban on mining in forest areas
- Revision of mining royalty rates concurrent with steel prices
- Mandatory ecological measures on industrial lands such as groundwater recharging measures
- Mandatory social welfare schemes
- Incentives for R&D in conservation technology

already insufficient water sources.

There is considerable apathy with respect to installing pollution control equipment as well. High power costs, insufficient supply, and the total absence of any interest in the part of the government or the industry to encourage indigenous research in pollution control give industry ample excuses for non-compliance.

The question of power consumption also raises some serious environmental issues. Some units like the BSAL are looking to the new 500 megawatt coal-based thermal power plant coming up at nearby Daroji for fulfilling their requirements of power. Transporting and using coal that has a 30 per cent waste content (giving rise to increasing sulphur dioxide), the plant has been located threateningly near the recently sanctioned Daroji sloth bear sanctuary.

Given the government's penchant for dissipating issues into a plethora of working committees, one way of making recommendations stick could be through public involvement and awareness. The district's feisty collector, Gauri Trivedi, has taken a tentative step in that direction by convening a seminar recently, but there is no environmental movement or non-governmental organisation working in the region on ecological issues. That being the case, who then will bell the cats of Bellary? ■

Keya Acharya is a freelance journalist based in Bangalore

Towards transparency

Microbiologist R S Upadhyay and his student R K Maurya from the Banaras Hindu University have isolated two fungal and one bacterial strain which are capable of removing dyes and heavy metals from polluted water. Banaras, a sari and carpet-making centre, loads its water bodies with large amounts of azodyes containing toxic heavy metals.

Calling the strains RKM-1, RKM-2 and RKM-3, the duo are confident of developing a cheap and effective water treatment technology based on these microbes. While RKM-1 and 2 belong to the filamentous group of fungi, the third belongs to the bacterial species of *pseudomonas*.

The long and short of it

By measuring the thickness of forest canopies, scientists get a fair idea about the species of animals and plants present therein. Earlier, ecologists took canopy measurements from the ground using a visual procedure called the MacArthur-Horn method. Researchers at the University of Virginia in Charlottesville, US, have hit upon an alternative: a new technique using a laser radar or lidar, that makes the job easier. Carried in a plane flying overhead, the solid-state laser fires infrared pulses at the forest canopy and sensors in it spot reflections from each layer and from the ground. Providing 100 profiles per second, the technique can collect data on forest structure more quickly and cheaply.

Top of the charts

According to the latest red list of endangered species brought out by the World Conservation Union (IUCN), mammals top the list of animals facing extinction. This runs contrary to the generally held assumption that birds are the most threatened class of creatures. Interestingly, the new list suggests that 11 per cent of bird species are threatened with global extinction, while 25 per cent of mammal species face a similar fate.

ENVIRONMENTAL SCIENCES

Lead the way out

Many cities of the world reel under severe lead pollution as they continue using heavily leaded petrol. The case for the phasing-out of lead is stronger than ever before

FRED PEARCE LONDON

BESIDE the Mersey estuary, in northwest UK, is located a factory that manufactures 80 per cent of the world's lead additives for petrol — a product that the World Bank (WB) has recently called the "greatest environmental threat" to many cities throughout the developing world. Lead has been added to petrol since the '20s, to increase octane number and improve engine performance. It is also said to reduce wear of engine valves in older cars, such as India's Oxford Ambassador fleet.

When leaded petrol began to be phased out in North America, Europe and Japan, it was presumed that the market for lead additives was bust. Most manufacturers shut-down operations. But, "far from petering out," as a profile of the company published in the *New York Times* last year noted, "the demand for leaded gasoline has remained far stronger than anyone predicted". And Octel Associates turns out bumper profits for its owner, the US-based Great Lakes Chemical Corporation.

Until recently, lead poisoning from traffic had been regarded as a problem of the rich industrialised countries. It was assumed that since developing countries did not have as much traffic, they had less lead in the air. In any case,

it was thought that the Third World had more serious problems to tackle, such as infectious diseases.

But this is no more the case. Lead pollution is increasingly being recognised as a global problem. Other sources of lead in the urban environment include dust from lead smelting works and battery-breaking yards, flaking leaded paint and lead plumbing. According to a WB paper called *Why lead should be removed from gasoline* — published last December — even though only one in 50 tonnes of lead used in the world goes as additives in petrol, it accounts for as much as 90 per cent of all emissions to the atmosphere, in many cities of the world.

Lead in petrol is supposed to find an express route into children's bodies because it is emitted from vehicle exhaust pipes in the form of very tiny particles that can remain in the air for weeks and travel hundreds of kilometres before settling onto the ground or being absorbed by the lungs, where it is absorbed into the blood. "Lead impairs the mental and physical development of children even at low levels of exposure," says the WB report. "A highly-significant association has been found between the exposure of children to lead and their IQ." Children also lose the ability to concentrate and can become socially maladjusted. These disabilities could be permanent, continuing into adulthood. The US National Academy of Sciences also concluded in 1993 that blood-lead levels in children measuring more than 10 micrograms (a microgram is a millionth of a gram) per decilitre (a decilitre is one-tenth of a litre) caused irreversible damage to their physical and mental development.

"Far from petering out, the demand for leaded gasoline remains strong"



SHABU CHATTERJEE

By removing lead from most of the petrol consumed, the US has in the past 20 years cut the average blood-lead level of its citizens to less than five micrograms. Many cities in Western Europe and Japan have achieved the same. But average blood-lead levels in many cities of the Third World and eastern Europe are well above these levels, suggesting that the majority of the population in most of the world's large cities, is significantly poisoned by lead. Some of the values quoted by the WB report include Bangkok, where the average is 40 micrograms, Cairo, which averages 30 micrograms and Budapest and Mexico City, which average 25 micrograms each. Studies in Bangkok conclude that exposure to lead cuts down the IQ of the average urban child by four points, by the time she/he turns seven.

A recent study by Jerome Nriagu of the University of Michigan — who has studied lead poisoning for more than 20 years — found that childhood lead poisoning is a surprisingly widespread urban health problem throughout Africa, the continent with the lowest density of cars. Africa has just 12 per cent of the world's population, but is responsible for 20 per cent of human-made lead emissions — a four-fold increase since 1980. The reasons for this are its extensive lead mining and smelting industries and also because it burns some of the world's most heavily leaded petrol. A table of more than 80 countries compiled by the Washington-based Alliance to End Childhood Lead Poisoning, found that a litre of petrol at the pump in most African countries contained more than 0.5 gm of lead and in Zimbabwe, Uganda, Namibia and Ethiopia, it was found to be more than a gram.

Studies have shown that children with sickle cell disease, widely prevalent in Africa, are more likely to suffer from lead poisoning. "Many African children are also short of iron, which encourages their bodies to absorb lead," says Joel Schwartz, public health professor at Harvard University. And "lead poisoning can be a promoter of common endemic diseases in Africa," says Nriagu. What goes for Africa holds true for several other regions of the world, including South Asia.

The Alliance has called for a phasing-out of leaded petrol by the end of the decade. "Leaded petrol," it says is

the "single greatest source of human exposure to lead worldwide". The WB's argument is that removing lead from petrol would be the most cost-effective way of improving children's health and intelligence. And, despite the claims of some industrialists, there are no insuperable technical problems to banishing lead from petrol. Claims that lead is essential to protect valves made of soft metal from wear are rather exaggerated. The cost of modifying refineries and, where necessary, to manufacture substitute additives to maintain high octane number rarely amounts to more than one to two US cents per litre. Brazil, Canada, Colombia, Slovakia, Sweden and Japan have done it. India and Mexico, along with the US are planning to do the same. The WB is planning a major investment programme to help countries modernise their refineries.

Back at Octel Associates in the UK, the company's external affairs manager Bob Larbey agrees that lead would eventually be phased-out, but not yet. He argues that the use of possible substitutes like benzene has its own risks, including causing cancer. But the known extreme hazards of lead ought to be tackled first. ■

Killed for pills

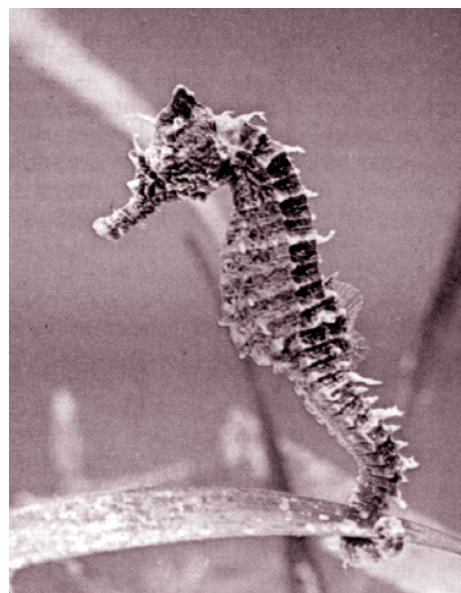
Their unique biology and widespread use in ethnic medicine makes the conservation of seahorses difficult

AMONG the 30 to 40 species of seahorse identified worldwide, many face an uncertain future due to the increasing numbers claimed by traditional medicine, pollution and habitat loss. It is estimated that at least 20 million dried seahorses are sold every year for traditional Chinese medicine and as curios, while hundreds of thousands more live seahorses enter the aquarium fish trade each year. A survey conducted by the Seahorse Nature Aquarium in the UK suggests that the demand for seahorses has soared in response to China's rapid economic growth. Used to treat ailments ranging from asthma and arteriosclerosis to impotence and incontinence, seahorses are highly valued. They are also victims of the destruction and degradation of seagrass, mangroves and

coral, which comprise their habitats (*Marine Conservation*, Vol 3, No 9).

Seahorses are found in most temperate and tropical coastal seas. There are two different species of seahorse: *Hippocampus remulosus* and *Hippocampus hippocampus*. Both are voracious predators of small shrimps and prawns, consuming up to 50 per adult per day. With a length of 15 cm from top to tail, seahorses are easy to identify with their bristling manes of appendages, dark, almost black face and a body colour that ranges from grey/black to an olive brown.

Unfortunately, their biology makes seahorses quite vulnerable to fishing pressure because like many other inshore fishes they have low reproductive rates and very structured social and spatial patterns that are easily disrupted. A rather unique feature about the species is that it is the males that get



The seahorse: living on the edge

pregnant. The female transfers eggs to the male's brood pouch, where they are fertilised. The embryos are then protected, given oxygen and nourished until the male goes into labour to release the offspring. Such a system of reproduction does hold relevance for the conservation of the species because the male can produce only a few offspring after each lengthy pregnancy.

Their resilience to exploitation is also limited by the practice of monogamy whereby one male and one female mate repeatedly and exclusively. If one were to die or vanish, the surviv-

ing partner takes time to find another mate because they are not very mobile creatures. For the same reason, it could take rather long to recolonise areas that have been depleted of seahorses.

The current levels of exploitation cannot be sustained. Seahorse populations are declining by as much as 50 per cent over five years, in the case of some fished populations. Moreover, seahorses are getting smaller in size, so every kilogramme of dried seahorse now consists of more animals. The demand is such that even juveniles now find ready markets.

Although the animals are in urgent need of being conserved, investigators believe that a total ban on seahorses is unlikely to prove practical at present, because too many people depend on them for their livelihoods and on medicines derived from these. Instead, all that could be aimed at is a reduction in demand. Also, alternative remedies in Chinese medicine that do not require the use of threatened animals and plant species could be promoted. Adoption of more selective fishing practices that do not net juveniles or pregnant males and increasing the number of seahorses through captive breeding and aquaculture are yet other recommendations.

Meanwhile, field projects in the Philippines and Vietnam being sponsored by the Zoological Society of London — that are developing such diversified approaches to seahorse conservation and management — are coming up with early and encouraging results. ■

Screening smoke

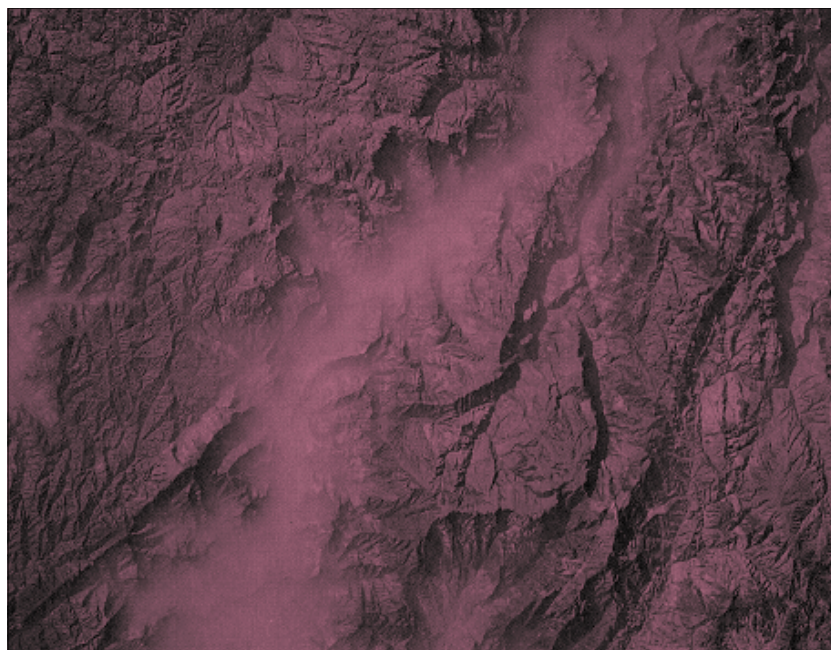
Unexpected photography from aboard a space shuttle reveals patches of sulphate aerosols which keep some industrial pockets cooler

CREW members on the American space shuttle Columbia may have been at a loss when a tethered satellite broke free and drifted away. But for Robert J Charlson, an atmospheric scientist with the University of Washington, Seattle, the aborted mission was a blessing in

disguise. The astronauts now had the opportunity to dispatch some photographs of the Earth which has helped Charlson unravel the effect of atmospheric pollution on the world's climate. Although Charlson and his colleagues know that a large part of the haze is made up of sulphates, they have been unable to determine its exact composition. But sulphate haze, normally considered to be a greenhouse gas, is now

dioxide, which spreads throughout the atmosphere, sulphur dioxide stays put and only the areas engulfed by it are cooled.

Till now, attempts at quantifying the extent of cooling have been based on theoretical calculations and computer modelling, but the results have varied significantly. The scientists hope that more chemical data on the composition of the haze could make possible precise



Capturing the haze over China's Yangtze river valley on reel, from space

known to cause climate cooling. Photos of the haze hanging over some industrial areas of our planet have helped Charlson confirm the geographic extent of air pollution in these areas (*Scientific American*, Vol 275, No 3).

Sulphur dioxide, a gas commonly emitted by various industries forms sulphate aerosols under clear skies. Sulphates are found to lower the temperature in two ways. They reflect away incoming solar radiation and are also responsible for boosting the number of cloud droplets, thereby increasing cloud reflectivity. These reactions take place in the troposphere, the part of the atmosphere that extends from the earth's surface up to about 10 km. Sulphates could cool to such an extent that they could perhaps effectively counter regional warming caused by such greenhouse gases as carbon dioxide and methane. However, it is important to note that the temperature-lowering effect of sulphate aerosols is only regional. Unlike carbon

quantification.

Some of the photographs taken were of the Yangtze river valley in China. Decades of radiometric measurements had shown that the amount of sunlight hitting the area had steadily decreased as the population increased. But it is the photographs that implicate increased levels of sulphate smog as the reason for this. Coal burning in the region is the main generator of the smog. The camera also focussed on other kinds of aerosol clouds, such as the ones that hovered over California's central valley. These clouds were found to contain dust and smoke particles caused by the burning of wood and agricultural waste. Such particles deflect sunlight and increase cloud reflectivity to a greater degree than do sulphate clouds.

Apart from cooling, the haze imparts two other effects that are not so cool: it creates acid rain and depletes the ozone layer. ■

Facing a Silent Spring...

Pesticides. Ecological devastation. And cancer. The story of an environmental victim



AMIT SHANKER / CSE

A young patient of cancer at New Delhi's All India Institute of Medical Sciences

ANIL AGARWAL

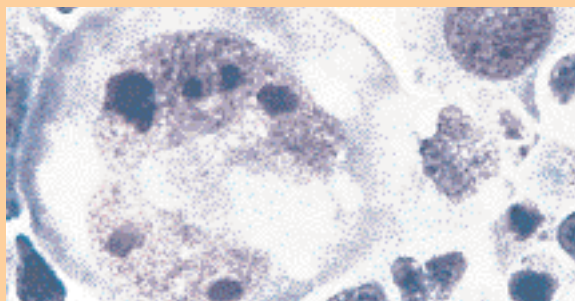
AS AN environmental activist and writer, I have tried for years to promote nationwide concern about the deteriorating state of our environment. The idea of writing about my own travails as an environmental victim had, however, never crossed my mind. But obviously, I could not have escaped what was and is happening all around me.

Cancer is a frightening word. It means a terminal disease with

periods of excruciating pain. And the treatment, full of poisons, is often as horrific as the disease itself. So how would you feel if you are told that you are suffering not just from cancer, but from such an extremely rare form of it that there is hardly any treatment available? That it has already invaded both your eyes, formed a small tumour in the centre of your brain so that it cannot even be surgically removed without cutting up the brain completely and has even reached your spinal cord? And that as the cancer grows in the eyes, the mass of cancerous cells will pull out the retina in

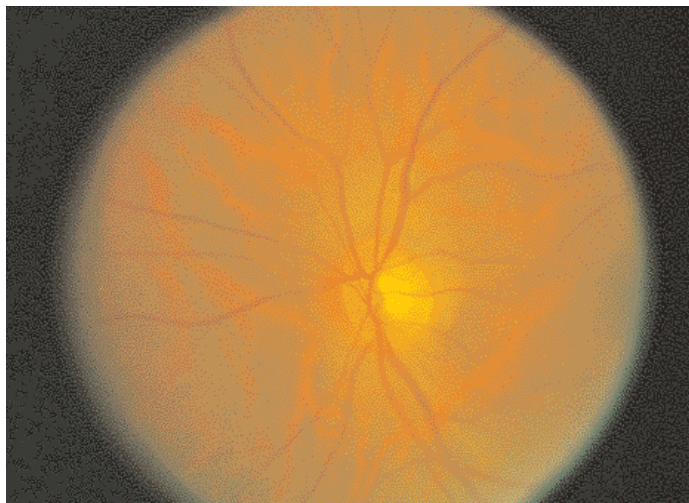
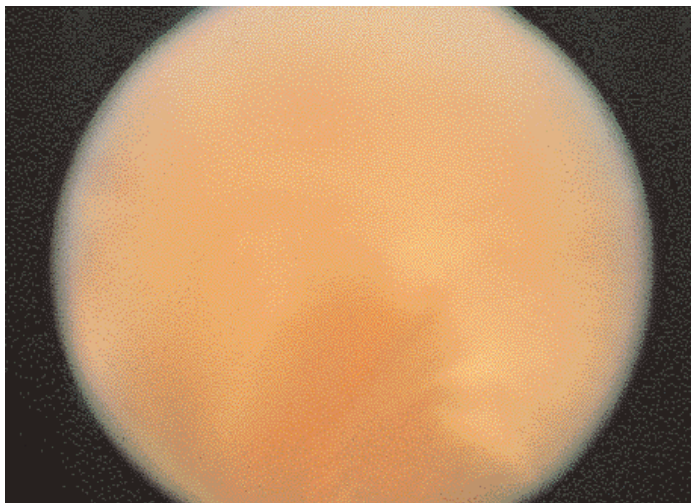
What're lymphomas?

Lymphomas are cancers that develop in the lymphatic system. They are parts of what are called lymphoid malignancies — lymphomas and leukaemias. The most common type is called Hodgkin's disease; the rest are Non-Hodgkin's Lymphomas. The lymphatic system is part of the body's immune system, consisting of lymphatic vessels carrying lymph, a watery fluid that contains infection-fighting white blood cells or lymphocytes.



both your eyes and make you go permanently blind; the tumour in the brain will grow to put pressure on the brain and cause strokes, among other things; and the malignant cells in the spinal

— in India, I was finally referred to the National Eye Institute in USA, whose scientists after diagnosing ocular and central nervous system Non-Hodgkin's Lymphoma (NHL), referred me to



Fluorescein angiogram of left eye before treatment (left): a cloud over the retina — sheet of cancer cells — hides it and makes the author blind in the left eye. Following chemotherapy, vitrectomy and radiation treatment, retina can be seen again, making vision possible

cord could affect the various nerve endings attached to the cord any time and cause you acute pain and/or irreversibly paralyse parts of your body? The end of all this suffering will, of course, be death. Maybe not more than a year later, but a large part of that year could be spent in bed groping in darkness and pain.

Terrifying prospects, as you will agree. These were the prospects I faced in early 1994. And they were enough to make me think how merciful was God to those whom he let die peacefully in their sleep.

Failing to find even a diagnosis for the symptoms in my eyes — black lines inside my left eye so that I could hardly see from it

their prestigious sister institution, the National Cancer Institute (NCI). I learnt that the black lines in my eyes were cancer cells which had formed a sheet in front of the retina.

Fortunately, doctors at NCI had an experimental chemotherapy for the disease. They first pumped in fatal doses of a cancer drug so that it could break past the blood-brain barrier and enter the otherwise well-protected central nervous system and eyes in quantities sufficient to kill the cancer cells. They had to immediately follow up with an antidote to save me from dying. The treatment gave me an year's blissful 'remission' (a period without measurable cancer). After an year, in late 1995, the cancer cells

In early 1994, I faced the prospects of blindness, neurological disorders and death

Table 1 Placing cancer

Age-adjusted cancer incidence rates (per 100,000 persons)

Year	Bangalore		Mumbai		URBAN CENTRES Madras		Delhi		Bhopal		RURAL CENTRE Barsi	
	M	F	M	F	M	F	M	F	M	F	M	F
1982	100.2	129.0	119.9	111.2	81.6	108.1						
1983	92.5	116.2	116.5	106.3	88.7	121.9						
1984	90.6	116.3	123.9	113.8	87.6	120.0						
1985	98.7	108.7	129.5	122.9	92.2	128.3						
1986	97.0	115.9	128.5	120.9	101.3	135.7						
1987	110.7	129.5	130.4	118.8	104.4	133.4						
1988	114.6	132.3	129.6	122.7	125.2	129.7	116.8	133.5	98.1	98.7	55.4	52.2
1989	112.2	124.7	130.4	120.4	118.5	135.0	118.8	140.7	106.2	100.1	57.6	52.2
1990	113.9	139.8	138.9	124.9	116.5	136.2	125.1	143.6	107.5	101.2	56.2	58.3
1991	115.7	144.6	132.9	130.8	121.11	131.4	119.1	137.1			55.5	67.3

M: Males F: Females

Source: National Cancer Registry Programme (NCRP)

Table 2 Placing NHL
Age-adjusted NHL incidence in India (per 100,000 people)

Year	Bangalore		Mumbai		Madras		Delhi		Bhopal		Barsi	
	M	F	M	F	M	F	M	F	M	F	M	F
1982	3.1	1.4	2.6	1.8	2.3	1.0						
1983	3.1	1.6	3.4	2.0	1.8	1.2						
1984	3.4	1.7	3.3	2.4	2.0	0.8						
1985	2.9	1.0	4.1	2.0	3.2	1.3						
1986	3.2	2.5	3.6	2.3	2.7	1.8						
1987	1.7	2.0	4.4	2.8	3.4	0.9						
1988	4.2	1.3	3.1	2.6	3.5	1.7	5.0	2.3	0.5	1.1	0.0	0.0
1989	3.1	2.1	4.0	3.0	3.9	1.8	5.1	2.4	0.5	0.5	1.9	2.0
1990	5.0	2.4	4.4	2.4	4.2	2.1	4.5	3.3	2.1	1.7	0.6	0.0
1991	3.7	0.5	4.0	3.1	3.6	2.2	4.8	3.3			1.1	1.2

M: Males F: Females

Source: NCRP

Delhi has the highest incidence of Non-Hodgkin's Lymphoma (NHL), followed by Mumbai

returned. I was faced once again with the prospect of blindness, neurological disorders and death.

The doctors said that this time they had caught the recurrence so early that they were sure the 1994 treatment would get me back in remission, but they were also certain the remission would not last even a year. I needed something more definite, something with a higher probability of cure — “such that you can live till 70 or beyond till only old age kills you”, as one of the doctors who was very fond of me put it. She and others knocked their heads together and came up with a solution: medicos in Paris were experimenting with bone marrow transplants to cure NHL. “After we put you into remission, you must immediately go in for this treatment,” they recommended.

Bone marrow transplant is one the most invasive medical procedures developed by modern science. I went through it in mid-1996 and hope that I have finally gotten rid of the disease. That, however, is something that only time will tell. Meanwhile, I will keep praying that some medical scientist somewhere, will continue to look for a simpler, less horrifying and more definitive cure for this rare disease.

My cancer, like most cancers, is related to environmental pollution

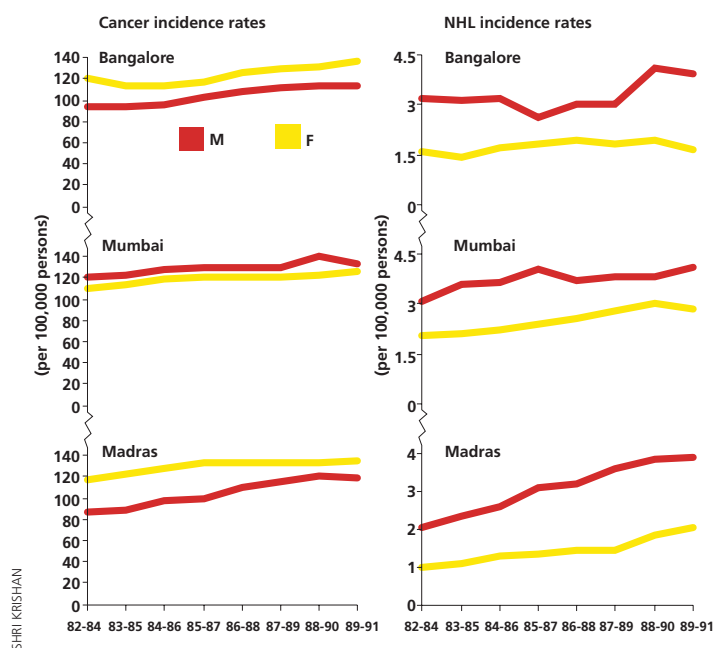
People as statistics

But why should this story of an individual cancer patient be of interest to anybody in a large and growing nation like India? Individuals are, after all, mere statistics. My case, however, is instructive because it represents today the scale of life-threatening and destructive processes that we are inflicting upon ourselves. My cancer, like most other cancers, is deeply related to environmental pollution — an issue, on which, ironically, I have written numerous articles and books, given lectures and made films to increase public awareness of the threats we face. Therefore, I feel a sense of moral responsibility for going on.

The poor, naturally, suffer more than the rich from

Incidental comparisons: cancer and NHL

Age-adjusted incidence rates and growth (bottom table) : 3-year running averages (1982-91)



	Cancer		NHL	
	M	F	M	F
Bangalore	20.65%	13.17%	23%	23%
Mumbai	11.63%	13.53%	33%	37%
Madras	38.07%	15.05%	92%	103%

Incidence of Non-Hodgkin's Lymphoma is rising faster than general cancer incidence. In Madras, it has doubled in 10 years

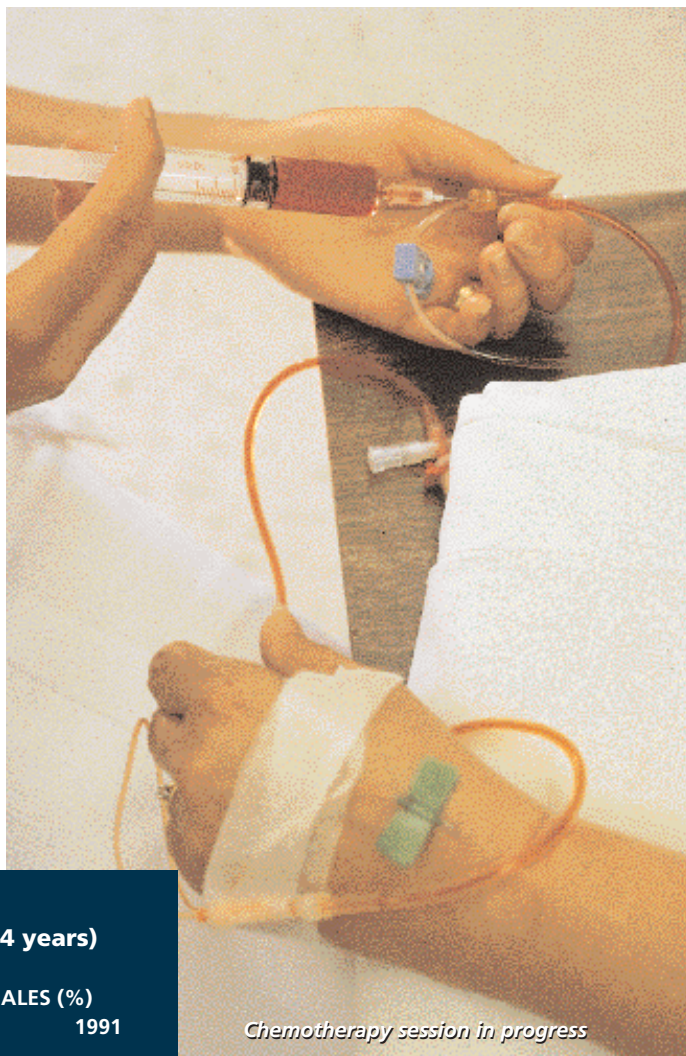
One of every 10-15 people living in metros are potential cancer victims

environmental degradation. However, at least the powerful urban middle and upper classes — we had thought — were intelligent and self-indulgent enough to try and protect themselves and moderate the impact of environmental destruction on their own lives. That theory has proved to be a total chimera. The elite of our nation have failed to internalise the ecological principle that every poison we put out into environment comes right back to us in our air, water and food. These poisons slowly seep into our bodies and take years to show up as cancer, as immune system disorders, or as hormonal or reproductive system disorders — affecting even the foetus.

Is it, therefore, not imperative for a society to find a way that balances its urge for economic growth and material comforts with the requirements of its natural and human health? Isn't this something that we owe to ourselves and to our children?

Cancer as statistics

Although cancer statistics in India — relatively poor — probably understate the extent of the disease, what they tell us is terrifying. There are six hospital-based cancer registries in India — five in Bangalore, Mumbai, Madras, Delhi and Bhopal and one in the rural area of Barsi near Pune — which give us an idea of urban and rural cancer incidence in India (see Table 1). The data shows that age-adjusted cancer incidence rate per 100,000 people in the five urban centres varied between 101.2 (Bhopal)



Chemotherapy session in progress

Table 3 A lifetime of death

Cumulative (lifetime) cancer incidence rates (0-64 years)

	MALES (%)		FEMALES (%)	
	1990	1991	1990	1991
INDIA				
Bangalore	6.66	6.59	9.92	9.90
Mumbai	7.08	6.83	7.79	8.52
Madras	7.54	7.68	9.88	9.85
Delhi	7.59	7.33	10.56	10.08
Bhopal	6.70	—	7.79	—
Barsi	2.97	2.78	4.88	5.55
WORLD				
Connecticut (USA)-White	15.21 (1978-82)	15.8 (1983-87)	16.49 (1978-82)	17.3 (1983-87)
Oxford (UK)	13.15 (1979-82)	13.1 (1983-87)	14.10 (1979-82)	14.7 (1983-87)
Finland	12.27 (1977-81)	13.9 (1982-86)	10.54 (1977-81)	13.1 (1982-86)
Miyagi (Japan)	11.27 (1978-81)	8.79 (1983-87)	13.3 (1978-81)	9.8 (1983-87)

Source: NCRP

to 143.6 (Delhi) for women in 1990, whereas for males it was between 107.5 (Bhopal) and 138.9 (Mumbai). This incidence was twice the incidence rate of 56.2

The author being prepared for radiotherapy



CSE

With their worsening environmental conditions, Indian cities are headed the same way as their counterparts in developed nations

in Barsi, which shows that living in our polluted urban centres more than doubles our chances of developing cancer.

There is another way of looking at this data by asking the question: what is the chance that I will be affected by cancer during my lifetime? The answer is stunning. If you are living in one of the four metros — Bangalore, Mumbai, Madras or Delhi — the chance of your catching cancer during a lifetime is as high as seven-11 per cent. In other words, one out of every 10-15 people living in these cities is going to become a cancer victim during his/her lifetime. Or, assuming an average household size of five, it means every second to third

In India, cancer is still largely regarded as a relatively insignificant threat to public health

household in these metros will have a member falling victim to the disease. However, if you were living in Barsi, the chances of cancer in a lifetime would go down by half — only one out of 20-36

persons will get cancer in their lifetime.

In industrialised nations like Britain or the US, the average lifetime cancer incidence rate in the late '70s was one out of every six to eight persons. With environmental conditions rapidly worsening here, there is no reason why Indian cities will not get there very soon.

But while cancer is an issue that impinges on national consciousness in the West, it does not do so in India. Experts in US argue that what is occurring in their country is nothing short of a 'cancer epidemic'. The concern for cancer shared by millions in the public has strongly fuelled environmental regulations for control of air and water pollution and toxic wastes. In India, cancer is still largely regarded as a relatively insignificant threat to public health. Yet one conservative estimate puts the total number of national cancer cases by the year 2001 at 806,000. This figure, of course, does not include people who probably cannot even reach hospitals and get diagnosed, especially amongst the vast population of rural and urban poor.

Let me look at statistics about the cancer I am suffering from Non Hodgkin's Lymphoma. In 1990-91, NHL was listed amongst the eight most common forms of cancer in Delhi, Madras and Bangalore amongst males and in Delhi, amongst females, too. But there are less than 200 medically recorded cases worldwide where NHL has affected the eyes; I am probably the first case of ocular lymphoma diagnosed from India.

Causes of NHL

It is impossible to pinpoint why a particular individual gets cancer. Carcinogenesis can result from stress (which depresses the immune system), bad diets, environmental toxins like pesticides, air pollutants and industrial chemicals, waste products and even genes. While diet and stress are factors more associated with personal lifestyles, environmental contamination is a societal problem and, therefore, needs greater

The study says it all ICMR's "withdrawn" research points to pesticides-cancer connection

When I first pointed out to friends in India that scientific studies suggest exposure to pesticide residues as a strong cause of my cancer, many of them wondered how could I — living the protected life of a middle class Indian — have been exposed to pesticides. The findings of a seven-year study by the Indian Council of Medical Research (ICMR) called *Surveillance of Food Contaminants in India*, released in 1993, provides enough answers. Some 2,205 samples of cow and buffalo milk, collected from 12 states, were studied.

- Detectable residues of alpha, beta and gamma isomers of HCH (or BHC, a highly poisonous pesticide) were found in 87, 85 and 85 per cent of the samples. The percentage of samples exceeding the scientifically determined tolerance limits were 21, 42 and 28 in the case of alpha-, beta- and gamma-HCH, respectively.

- The worst contamination was in the states of Andhra Pradesh (AP), Bihar and Uttar Pradesh; dietary intake of beta-HCH was about twice the acceptable daily intake (ADI) amongst populations with high incomes in urban areas of AP.

- DDT residues were detected in about 82 per cent of the samples. About 37 per cent contained DDT residues above the tolerance limit of 0.05 mg/kg. The maximum level of DDT residues was found to be 44 times above the tolerance limit — 2.2 mg/kg.

- Maharashtra had 74 per cent samples with DDT residues above the tolerance limit, Gujarat 70 per cent, AP 57 per cent, Himachal Pradesh 56 per cent and Punjab 51 per cent.

- Industrial milk — infant formula, for instance — also had pesticide residues. Out of some 186 samples of 20 commercial brands of infant formula, 70 per cent showed DDT residues and 94 per cent revealed the presence of HCH-isomers. The dietary intake of beta-HCH by an infant fed on infant formula was 90 per cent of the ADI.

On its release, the report had claimed the attention of the media and the Parliament. But in mid-1996, the ICMR refused to give this author a copy of the study saying that it had been "withdrawn" and was being "reconstituted" because "it had faults in its data and analysis", and that it would not be available until 1997.

Risk of lymphatic cancers increases when the body's immune system gets affected

attention and regulation.

In the US, where NHL incidence has increased by over 65 per cent between 1973 and 1990 — the second fastest increase in cancer incidence rates of all human cancers in the US in the last 15 years — there is considerable effort to identify the causes and quantify their impact on the increase of NHL. Says Sheila Hoar Zahm of the NCI, "NHL is increasing not just in the US but in all industrialised countries. Overall, we may be making gains in cancer, but because NHL incidence is small compared to the mega-cancers,



say breast cancer or lung cancer, figures for the latter cancers tend to swamp the overall cancer statistics.”

In India, the meagre data collected by NCRP for different cities shows a steady increase. In Madras, there is literally a

Programmes for ill-health

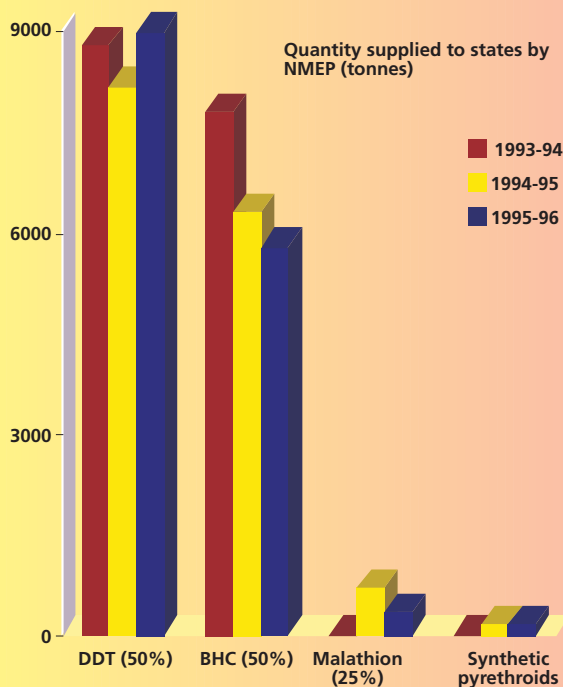
Indian public health programmes use toxic pesticides with impunity

Indian planners doggedly persist in using DDT in their spraying programmes, though several nations have banned its use. Part of the government's obduracy is the result of the worst form of 'state capitalism': the major manufacturer of DDT in India is a state-owned company called the Hindustan Insecticides Ltd.

Even as late as 1995-96, some 9,000 tonnes (t) of DDT were supplied to state governments by the National Malaria Eradication Programme (NMEP). Though the government has begun phasing out the use of another dangerous insecticide, BHC, 5,784 t of it were used in 1995-96. Use of alternatives like malathion and synthetic pyrethroids, that began in 1969 and 1995-96 respectively, has remained restricted because of high costs — which shows how little money the government is prepared to spend on safe public health programmes.

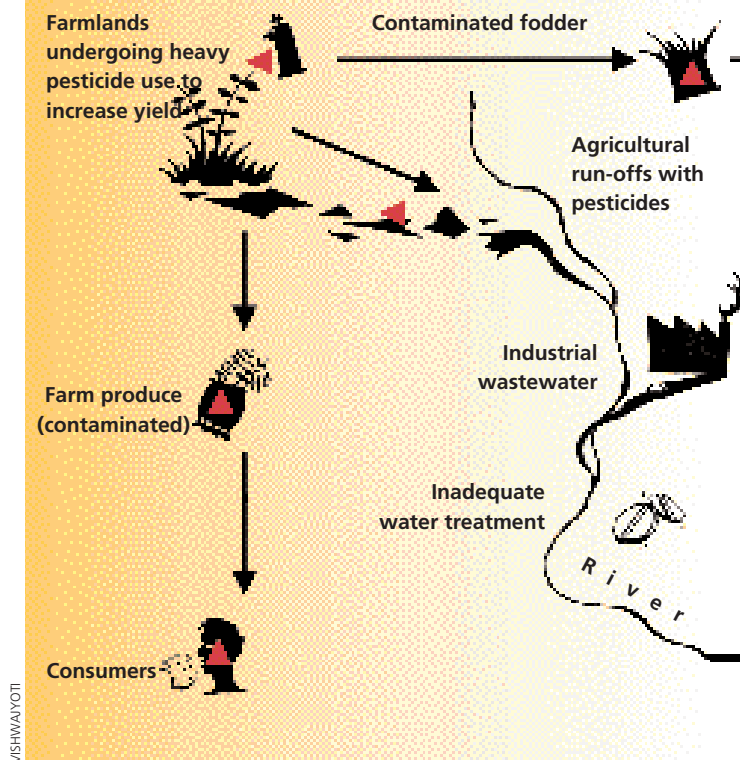
Even though some excellent work has been done by institutes like the Malaria Research Centre, New Delhi, and the Vector Control Research Centre in Pondicherry on environmental control of disease-spreading insects, policy-making and implementing agencies like the ministry of health and the NMEP have paid no attention.

Use of insecticides under NMEP



Source: NMEP

How pesticides



doubling of incidence in 10 years between 1982 and 1991 amongst both males and females, besides substantial increases in Mumbai and Bangalore. While the database for Delhi and Bhopal is too small to identify any trend, the statistics do show that Delhi has the highest incidence amongst both males and females followed by Mumbai. Interestingly, a comparison (see:

The reach: Is

In human adipose (fatty) tissue

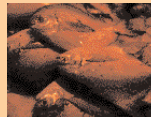
(Ahmedabad, Calcutta, Delhi, Lucknow, Bangalore and Gujarat)

In human milk

(Ahmedabad, Lucknow and Chandigarh)

In human blood

(Coimbatore, Delhi and Jaipur)



In foodstuffs like
pomfret fish (Mumbai)

In crabs
(Malnad)

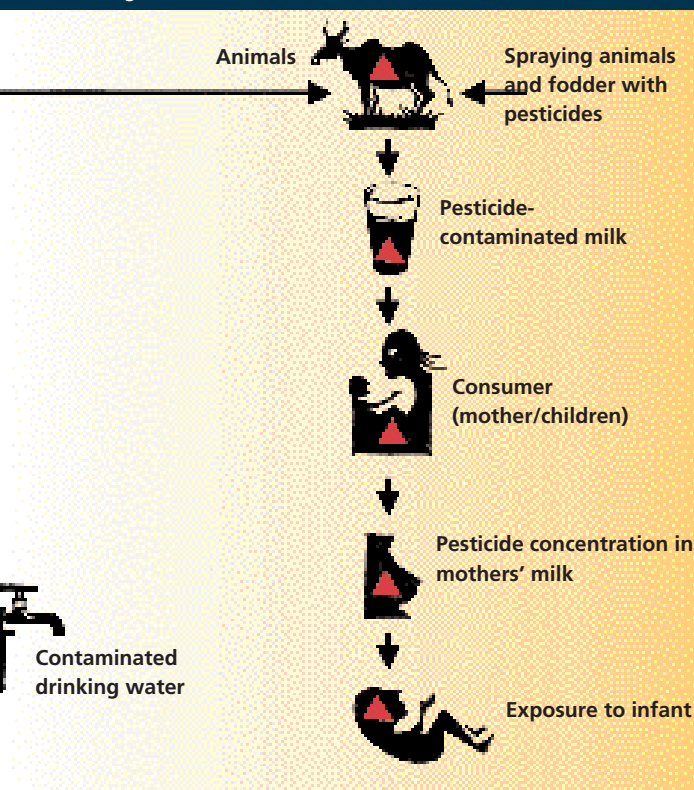


In sheep meat
(Jaipur and Srinagar)

In eggs (Mumbai
and Lucknow)



affect you and me



'Incidental comparisons') clearly shows that NHL incidence is rising faster than overall cancer incidence; in Mumbai and Madras, the difference in increase is quite dramatic. However, in a conspiracy of silence, almost all specialists at the Tata Cancer Memorial Centre in Mumbai interviewed by Ambika Puri, a CSE researcher, replied in the negative when asked if

NHL was increasing in India.

Cancer experts believe that risk of lymphatic cancers including NHL increases when the body's immune system gets affected or suppressed. Says N K Mehrotra, head of the environmental carcinogenesis laboratory in the Industrial Toxicology Research Centre (ITRC), Lucknow, "The causes of lymphoma are as yet unknown, but it mainly occurs due to cumulative effects of pollutants and reduced immunity in the body." A number of NHL cases in the US occur in people who have been affected by HIV, the dreaded AIDS virus. In India too, the spread of HIV will definitely boost the incidence of NHL. But the NCI does not believe that the HIV virus, or cancer-causing viruses like human T-cell leukaemia virus-1 or the Epstein-Barr virus, play an important role in the increase of NHL. Neither do dietary factors, according to it.

The NCI says that certain immunosuppressive genetic syndromes can play a role in causing NHL, but that they are too rare to bring about any major increase in cases. Similarly, 50-fold increases in risk of NHL have been observed among organ transplant patients, because they receive powerful immunosuppressive drugs on a long-term basis; but again, these conditions affect very few people. A detailed statistical study in the US concludes that accuracy and completeness of diagnosis, the impact of HIV and occupational exposures leave unexplained an 80 per cent rise in incidence among white men. The NIH study also argues that improved diagnostic facilities and recent reclassification of other cancers into lymphomas account for a tiny fraction of the increase in NHL.

The menace: pesticides

The key factor which is, therefore, attracting worldwide interest amongst epidemiologists is environmental pollution. Several studies carried out in Canada, Sweden and the US have shown a strong correlation between the risk of NHL and use of pesticides.

High levels of pesticide residues are present in every necessity of life

there anything at all that is uncontaminated by pesticides?



In butter (Hissar, Chandigarh, Delhi, Lucknow, Ludhiana, Pantnagar and Gujarat)



In fruits and vegetables (Lucknow, Calcutta, Delhi, Ludhiana and Mysore)

In processed ghee

(Lucknow) and animal milk (Lucknow, Pantnagar and Ludhiana)

In condiments (Calcutta)

In infant milk preparations

(Mumbai, Chandigarh and Gujarat)

In vegetable oils

(Delhi, Lucknow, Sitapur and Gujarat)

In goat and buffalo meat (Lucknow)



In soils

(Chikmagalur, Delhi and Pantnagar)

In animal fats and oils (Calcutta)

In drinking water (Lucknow)

In foodgrains like wheat, rice and pulses (Mumbai, Calcutta, Lucknow and Gujarat)



In the air (Ahmedabad)



Frequent use of herbicides, particularly 2,4-dichlorophenoxyacetic acid (2,4-D) has been associated with a 200-800 per cent (two-eight times) increased risk of NHL in Sweden. According to one study, the association between NHL and phenoxy acid herbicides may be because of contamination by dioxin, a highly poisonous immunosuppressant. The NCI study argues that though the number of people working in agriculture occupationally exposed to these and other pesticides is not large enough to explain the overall increases in NHL, the general population is also at a heightened risk because of the use of these pesticides in homes, lawns and golf courses. Dogs whose owners have used 2,4-D, for instance, have a heightened risk of contracting malignant lymphoma.

Since the use of pesticides, particularly phenoxy herbicides (2,4-D, 2,4,5-T or 2,4,5-trichlorophenoxyacetic acid, and MCPA or 2-methyl-4-chlorophenoxyacetic acid) and organophosphate pesticides has increased over the last 40 years, the NCI argues that they could have played a significant role in contributing to the rising incidence of NHL.

According to a book written by ITRC's N K Mehrotra, there are several pesticides which cause cancer of the lymphatic system in experimental animals (rats and mice).

The general population can be exposed to pesticides in three ways:

- through vector control
- through residues in environment
- through residues in food

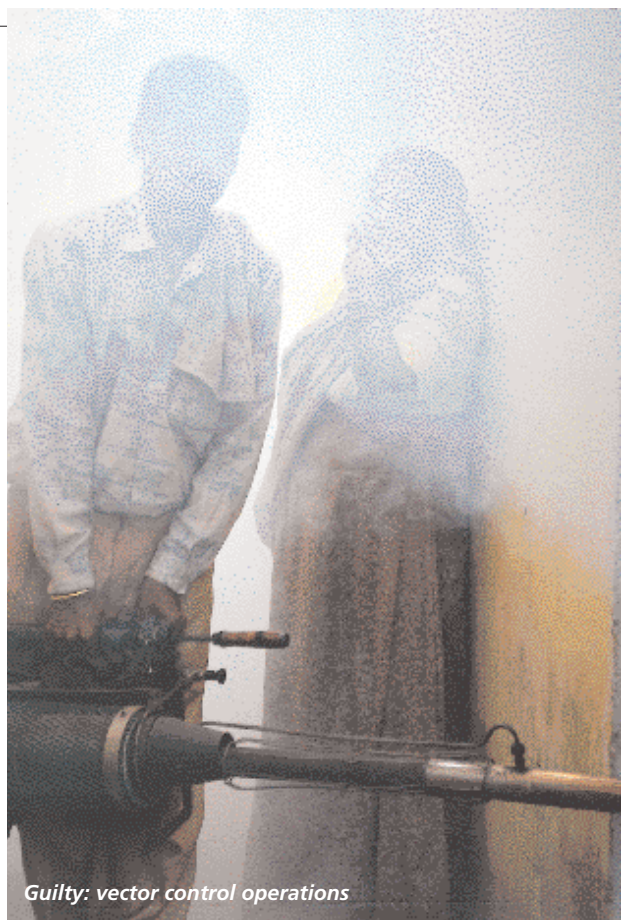
This segment of population tends to have only a low-dose, chronic exposure, but larger doses can be transmitted if the exposure is persistent and bioaccumulative. Persistent pesticides move through air, soil and water, finding their way into living tissues where they can bioaccumulate up the food chain into human diets. Roughly 85-90 per cent of pesticides applied agriculturally never reach target organisms, but disperse through the air, soil and water. People who can be exposed to high levels of bioaccumulated pesticides include

- habitual consumers of fish, livestock and dairy products;
- fetuses and nursing infants whose mothers' bodies have

People in Delhi have one of the highest levels of DDT in their body fat

- accumulated persistent pesticides; and,
- sick people who metabolise their fatty tissues (which contain bioaccumulated pesticides) while ill.

According to an ITRC survey of studies on pesticide residues, high levels of residues of BHC, lindane, heptachlor, endosulphan and dieldrin have been found

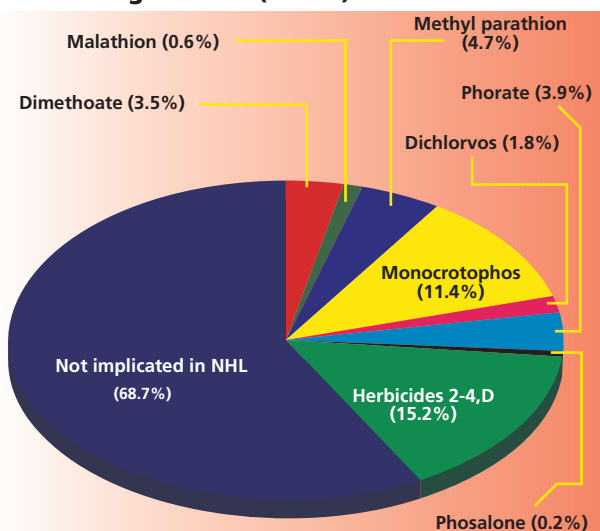


Guilty: vector control operations

AMIT SHANKER / CSE

List of suspects

NHL implicated pesticides and their consumption in Indian agriculture ('93-94)



SHRI KRISHAN

Nearly 40 per cent of pesticides consumed by our farms are possible causative agents of Non-Hodgkin's Lymphoma

Pest controllers

Pesticides which cause lymphatic cancer in rats and mice

1. Toxaphene (organochlorine, general name Camphechlor)
2. Hexachlorocyclohexane (organochlorine, used as gamaxine)
3. Trichlorophenol
4. Strobane (organochlorine)
5. Perthane
6. TCDD (Dioxin) (a chlorophenoxy herbicide, which is often found as a contaminant in trichlorophenol, hexachlorophene and 2,4,5-T)
7. Dieldrin (organochlorine)
8. DDT (organichlorine)
9. 1, 2 Dichloroethane (DDE, breakdown product of DDT)
10. Heptachlor
11. Picloram

Home truth

Environmental pollution does not spare even those concerned about the environment

Official statistics show that every seventh to 10th person living in Delhi, Mumbai, Madras and Bangalore is likely to fall prey to cancer during his lifetime. I was keen to check whether this rate applied to people I know personally — among the board members of the Centre for Science and Environment (CSE).

I found that the lifetime cancer incidence rate in this group was, sadly, on the higher end of the officially predicted range. What is worse is that as many of the board members are still young, the full story has not yet been told. Since 1980, CSE has had a total of 45 board members. Of these, 34 have lived for long in the four accused metropolises listed above. Of them, five have already been stricken with cancer — one from brain cancer, one from breast cancer, one from prostate cancer and two from Non-Hodgkin's Lymphoma — leading to a lifetime incidence rate of slightly more than one in seven.

in just about everything necessary for life from food to water.

The list does not even include tea whose DDT residues are so high that Germany is refusing to import Indian tea.

How do these residue levels compare with residues in industrialised countries or with acceptable daily intake (ADI) standards? Badly, at best. A report published in 1992 in the *Journal of Agriculture and Food Chemistry* by K Kannan and A Subramaniam concludes: "Significantly high levels of food contamination with HCH, DDT, aldrin and dieldrin were evident throughout India...The average daily intake of HCH and DDT...were higher than those observed in most of the developed nations. The dietary intakes of aldrin and dieldrin exceeded the acceptable daily intake recommended by WHO/FAO...." Studies have shown that people in Delhi have one of the highest levels of DDT bioaccumulated in their body fat. Another study of 1991 on pesticide residues in Delhi by A Nair and M K K Pillai reports that DDT and HCH residues were present in Delhi's water, soil and fauna. Human breast milk samples in Delhi show DDT and HCH levels comparable to those found in Punjab, an area of intensive farming. Infants ingesting this breast milk receive roughly 12 times the allowable daily intake of DDT.

Adding to the concern about carcinogenic effects of pesticides are the latest findings of a new discipline of science called immunotoxicity, which studies substances with a negative impact on the immune system. A recent review of over 100 primary experimental studies of immunosuppressive nature of pesticides reports that the large majority of these studies reveal various types of immunosuppressive effects. Reduced immunity influences cancer incidence. A weak or devastated immune system allows cancerous cells to escape and form a tumour. One can only imagine the kind of havoc pesticides can play in a country where a large percentage of the population is malnourished and, hence, suffers from immunodeficiency.

Organic solvents and other industrial chemicals

According to NCI, exposure to organic solvents also leads to increased risk of NHL. According to Shiela Zahm, "There is

now a strong feeling amongst scientists that apart from pesticides, organic solvents play an important role." Organic solvents are widely used in the paints industry, in dry-cleaning and woodcrafts, and large numbers of workers are potentially exposed to them. Among the solvents which are suspected carcinogens are chlorinated hydrocarbon solvents, methylene chloride, trichloroethylene, chloroform, formaldehyde and benzene. A Swedish study also lists styrene, trichloroethylene, perchloroethylene and chlorophenols as substances whose exposure heightens the risk of NHL. A British study shows heightened risk of NHL amongst those exposed to wood dust and epoxy glues.

The maximum likelihood of exposure in my case is through food and water

Says Zahm, "The general population is also exposed to these carcinogens through commercial products and contamination of drinking water sources." Enquiries in India conducted by researchers of CSE reveal that no study of contamination of drinking water sources by these solvents has been conducted so far. Studies, however, have shown that the following solvents were present in effluents of the paint industry:

Tenuous links

On NHL's associations with ailments like asthma

According to National Cancer Institute (US) scientists, "Weak associations (with Non-Hodgkin's Lymphoma or NHL) have been noted for some common (medical) conditions... like asthma, allergies, rheumatoid arthritis, rheumatic fever, tuberculosis and infectious mononucleosis, and commonly taken steroidal drugs. Some conditions that warrant further investigation include asthma and steroid use."

Steroids are known to be immunosuppressive; asthma too is an immune system disorder. Asthma — known to get exacerbated by air pollution — cases have been rising in many countries lately. In the US, 10 million people — four per cent of the total population — suffer from asthma. I have been an asthmatic for more than 30 years now and Delhi's growing air pollution has definitely not helped much. Still, these are weak associations suggested by epidemiological studies, and US scientists continue to look for other major causes of increase in NHL.



Eco-mandarins: a no-show

The MEF is non-functional as far as controlling hazardous pesticides is concerned

What does the baby of environmental concern — the much-hyped Union ministry of environment and forests (MEF) — do to protect human beings from harmful pesticides? Precious little, it seems.

The ministry has neither restricted the use of hazardous pesticides and monitored pesticide-induced pollution nor studied the health or overall environmental impact of pesticides. The agriculture ministry is responsible for approving pesticides. The MEF, says a senior official, acts only if an accident were to occur in a pesticide firm, a la Union Carbide in Bhopal.

Says R R Khan, the scientist in charge of MEF's technical unit dealing with safety aspects of pesticide use, "We only have an advisory role. We offer advice to the ministry of agriculture regarding safe use of pesticides. We also conduct regular training programmes for pesticides industries as well as users." Period. This is the state of environmental governance in India. If the ministry closed down tomorrow, it would make no difference to mine or your health. Then why should we pay taxes to this incompetent government?



They throw, we use

Pesticides are good for you as long as you are an Indian



The Indian government persists in allowing the production of a variety of deadly pesticides, even after many of them have been banned or severely restricted abroad. In 1983, the UN had produced a *Consolidated List of Products Whose Consumption and/or Sale Have Been Banned, Withdrawn, Severely Restricted or Not Approved by Governments*. When Sunita Narain of the Centre for Science and Environment compared the pesticides listed in this report with those approved and used in India, she found that in terms of tonnage, an amazing 70 per cent of all pesticides used on Indian farms were banned or severely restricted in Western countries and identified by the World Health Organization (WHO) as hazardous. The proportion of such pesticides used in public health programmes was even higher.

In 1996, even after a decade of environmental regulatory institutions, I found that the figure in agriculture was 54.25 per cent: 46,826 tonnes (t) of pesticides out of a total of 86,311 t used in 1994-95 had been restricted or banned in the West. In public health, the figure was 94.5 per cent. Since I am still looking at the 1983 UN list, the figure is lower as many restricted pesticides have not been included. If an updated list becomes available, India's extraordinary record in taking care of its people would plunge further.

These pesticides include, besides DDT, carbofuran, dimethoate, endosulphan, lindane, methyl parathion, monocrotophos, mancozeb and paraquat. A number of other pesticides which are currently under special regulatory review on health grounds in the US — for instance, carbamates like aldicarb and carbaryl — are widely used in Indian agriculture. A number of pesticides implicated in the causation of NHL are also in use, including 2,4-D (1,200 t in 1993-94, about 15 per cent of total herbicides consumption in India).

The truth, maybe, is that the Government of India is the most persistent pest in India for which we need a truly deadly pesticide.

PESTICIDES BANNED/RESTRICTED IN THE WEST, BUT USED IN INDIA (1994-95) (TONNES)

PESTICIDE	USE IN AGRICULTURE	USE IN PUBLIC HEALTH
BHC	24,000	6305.00
Carbofuran	280	
DDT	—	8181.25
2,4-D (Dichlorophenoxyacetic acid)		1,200
Dichlorvos (DDVP)	1,500	
Dimethoate	1,900	
Endosulphan	4,600	
Lindane	50	
Methyl parathion	2,600	
Monocrotophos	6,296	
Mancozeb	4,000	
Paraquat	400	
	46,826	14,486.25
Total use of pesticides	86,311	15,327.25
Percentage of use consisting of banned or severely restricted pesticides	54.25	94.5

2,4,6-Trichlorophenol	Benzene
2,4-Dichlorophenol	Chloroform
2,4-Dinitrophenol	Methylene
4,6-Dinitro-o-cresol	Chloride
Pentachlorophenol	Trichloroethylene
Phenol	

What is frightening is that not all these contaminants can be removed by existing wastewater treatment processes in India, thus leading to the contamination of natural water sources which ultimately provide us with drinking water.

Growing horde

The Indian pesticide industry today has an installed capacity of 1,16,000 tonnes (t) per annum, of which about 70,000 t is in the organised sector, whereas the rest is in some 500-odd units belonging to the smallscale sector. It is doubtful that the smallscale sector has any appreciable control over contamination by pesticides. In 1994-95, India produced almost all the pesticides it consumed — some 83,000 t in the agricultural sector alone. Imports are currently about 2,000 t only. With liberalisation, controls on creating additional capacity for pesticide formulations has been lifted and there is no restrictions excepting six pesticides (aluminium phosphide, dimethoate, quinalphos, carbaryl, phorate and fenitrothion) for which licensing is compulsory. A Planning Commission study has projected pesticide consumption by 2000 AD at 1,18,000 t — 97,000 t for agriculture and 21,000 t for public health. It is interesting to note that most of the growth in the world pesticide industry is in developing nations. In value terms, growth in the pesticide industry between 1987 and 1993 in Latin America and Asia (outside Japan) was more than twice the global average.

Like the pesticides industry, the Indian paints industry has also been growing rapidly. Between 1950 and 1982, production increased from 40,000 t to 190,000 t (107,000 t in the organised sector and 83,000 t in the smallscale sector) — the smallscale sector increased production eight-fold compared to the organised sector's slightly over three-fold increase. The smallscale sector is particularly notorious for its poor or non-existent wastewater treatment facilities. Following liberalisation, a lot of hazardous paint and dyestuff industry has moved to India because of growing environmental controls in the West and inadequate controls in India. K R V Subramaniam, managing director of Colour Chem, a large paints company, said in an interview to the *Economic Times* in 1993, "Large Indian companies by and large meet pollution standards. But many others, who contribute 40-50 per cent of our exports, do not."

More questions

There are countless questions that keep crossing my mind. Why did I get afflicted with this disease? How cancer-prone are we becoming as a nation? Who is responsible? What should we do about it? It is clear from the sum total of the evidence available that environmental contamination could have been a key cause of my cancer. As I am not an agricultural labourer or a farmer spraying pesticides, the maximum likelihood in my case is of exposure through food and water.

Shame

An Indian institute is accused of callousness

A telling indictment of India's native cancer treatment facilities was recently brought forth through the 'Letters' column of a leading national daily. A patient undergoing chemotherapy for cancer of the lymph nodes in the capital's prestigious Rajiv Gandhi Cancer Institute and Research Centre died; the deceased's family members allege that the extremely low haemoglobin count of the patient following chemotherapy was treated with total indifference by the institute's specialist. Besides, administrative delays in readmitting the patient and providing blood transfusion apparently led to death. The institute, of course, contends that the patient died despite the "best possible treatment", and not due to lack of efforts on the hospital's side.

My principal interest in writing this article is to inform the Indian people that they must not remain ignorant and nonchalant about the acute threats they face to their own health and to the health of their children. I find no concern in India about clean air, water or food, all of which are not just bacteriologically but also chemically contaminated today. At a seminar organised by a leading Delhi-based NGO on Delhi's drinking water supply system in 1995, I had to point out that while there was so much talk about the inadequacy of water supply, there was almost none about its quality. What good is lots of water if it is so contaminated?

Bacteriological contamination shows up in acute epidemics and hence, often leads to a hue and cry amongst the public and in the media. But chemical contamination takes years to show up in the form of cancers or hormonal and reproductive disorders, and hence unless there are good epidemiological studies carried out on a regular basis and a constant effort made by the medical profession and a vigilant media to inform the public about the health threats it faces, there will be no pressure whatsoever on the regulatory authorities to do anything to protect the environment.

Ignorance is bliss for the politician and the bureaucrat. Apart from the influence of industrial lobbies which may operate underhand, India's overt governance systems themselves are incompetent. An excellent illustration of this is the fact that the ministry of environment and forests has no team working on the dangers posed by toxins like pesticides that permeate the environment and food systems.

Summing up, I can only say that had not fate, friends and well-wishers and committed scientists from various parts of the world not intervened to help in my case, it would have been a Silent Spring for me in the prime of life. I can only hope and wish that that no fellow citizen has to suffer the same fate. And that Indian civil society can, one day, force our misguided government to come to its senses. ■

(The author is grateful for inputs provided by Ambika Puri, Madhumita Dutta, Ambika Sharma, Max Martin and Sunita Raina, and the time provided by Sheila Hoar Zahm)

The MEF has no team working on the dangers posed by toxins like pesticides

C O M M E N T S



"Statistics say that incidence of cancer in urban areas is almost double that in rural areas, which proves that cancer cells thrive in a polluted atmosphere. We cause pollution in the name of progress, as automobiles contribute significantly to it. Developing countries should, as a matter of policy, encourage public transport to keep pollution to the minimum. Pesticides are another

major cause of cancer. Use of pesticides has grown in the present era of increased agricultural productivity. What causes the problem apparently is the residue of pesticides; this means the quantity of pesticides used needs to be reduced and their strength should be reviewed downwards.

"There is another aspect of the problem. MNCs introduce products which have been banned in countries of their origin, into our markets. The fact of the ban is probably carefully concealed. There is a growing shift of such hazardous products following a mistaken belief in industrialisation and liberalisation. It may be difficult to persuade commercial ventures to be more socially conscious as they look to profits. But non-government organisations will have to be more vigilant."

Madhu Dandavate, deputy chairperson, Planning Commission

"Coming from a person who has suffered from this dreaded disease, the article rightly brings out the elements which threaten humankind. The deteriorating state of our environment — brought about by chemical and bacterial contamination — is by far the most dangerous cause of cancer."

Abid Hussain, vice chairperson, Rajiv Gandhi Institute of Contemporary Studies, New Delhi



"Reading the travails of Anil should be enough to move any rational mind to search for remediation. But would it happen here? I visualise a second cancer — a cancer of the mind promoting the first, the cancer of the body. How otherwise did a country not refuse products of Union Carbide, even after the company caused Bhopal? MNCs are now selling 'environmental technology'

to the poorer world because they don't have markets in their own countries. To do this, they are equipping themselves with appropriate international trade regulations; this act is dished out as niceties in trade and environment linkage. Meanwhile, we continue to give lip-service to sustainable lifestyle, remaining steadfastly indifferent to the wretched and deprived millions, and allow business decisions to rule the next century. History, till then, will continue to be one of sustainable impoverishment."

Dhrubajyoti Ghosh, trustee, eastern region, World Wide Fund for Nature-India



"We are caught in a difficult cycle of population, poverty, development and environment... Four decades ago, how many policy-makers expected Delhi to grow to its present size? Even today, we continue to debate for a mass transport system which would reduce pollution and absolve Delhi of the dubious distinction of being the most polluted city... How much do we know about

the way pollutants like sulphur dioxide play havoc with people's health? Precious little. I remember a paper published in 1964-65 on the loss of ability of eggs to produce chicks in sea-gulls. The eggs were found to contain BHC derivatives. The world did not care to ban BHC at that time, and continued on the path of development. It is possible to overcome the problems raised by Anil partially, provided that we do not go berserk on the bug of commercialisation and trade. We need sincere and committed scientists who can speak plain facts and educate our politicians."

S K Sinha, national professor, Indian Council of Agricultural Research, New Delhi



"While Anil points at politicians and bureaucrats, he does not spare me and my colleagues either. For he accuses the Indian scientific community of playing down serious issues of public interest — a 'conspiracy of silence'. I must, unhappily, concur. Scientists along with others in the organised services — like industry — constitute the country's omnivores, the all powerful consumers. We are

collectively engaged in equating development with state-sponsored resource-flows for our own benefit, even if it is at the cost of the environment and the rest of India's population. Consider chemical pesticides. The state provides largescale subsidies for supply of pesticides to farmers. Not all of these actually reach the farmers; politicians and bureaucrats share in the misappropriated spoils. The pesticide industry has its sales boosted by the subsidies and profits in the protected sellers' market. Undoubtedly, it kicks back part of these profits for being allowed to set up a unit. The green revolution farmers, too, do well under the system... The agricultural scientists find it profitable to with the pesticide industry — to get research contracts or post-retirement jobs. The chemists too are either allied with the chemical industry or are busy pursuing problems in fashion in the West. Thus, we have built up a high-cost, low-quality economy, and we have an environmental regime which builds up the world's highest level of pesticide residues in human bodies, while maintaining one of the world's lowest levels of pesticide consumption. Only a radical restructuring of our system of governance, to render it transparent and accountable and to stop pampering a narrow elite at state expense will get us out of this mess. But will we omnivores ever agree?"

Madhav Gadgil, Centre for Ecological Sciences, Indian Institute of Science, Bangalore

"Besides pesticides, indiscriminate use of hazardous drugs have destroyed the immune system of the body. On the other hand, bacteria and pests have developed immunity against drugs. The nexus of politicians, bureaucrats and businessfolk in India have no consideration for clean air, water or food. Because of their apathy and self-interest, our country has become the dumping ground of hazardous and toxic wastes of the developed world. During the last two years, US, Australia and Canada exported 11,859 tonnes (t), 9,034 t and 7,270 t of hazardous wastes respectively to India alone. It is time that a vigorous campaign of awareness of toxic materials and contamination should be carried out amongst the people. Our right to a pollution-free environment should be guaranteed."

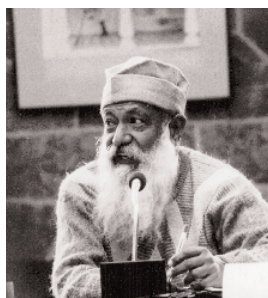
Banka Behary Das, president, Orissa Krushak Mahasangh



"The post-World War II period has been one of synthetic compounds, totally alien to our biosphere and to biochemical cycles of our planet. This led to the publication of a remarkable book — *Silent Spring* — by Rachel Carson in 1962. Perhaps the compelling reason for Carson to write the book was that, like Anil, she too suffered from cancer, and wanted to forewarn others. Our

biosphere has no capacity to degrade the human-made unnatural compounds, and these accumulate, biomagnify and cause a host of problems. The regrettable part is that governments and the industry have underplayed these aspects. Human being in its present form is the most unnatural species of the biosphere — involved in a war against the biosphere and committing ecological sins against its only home, the earth. The moral from the ordeal faced by Carson and Anil is that we must dedicate ourselves to a life of voluntary simplicity, and must relentlessly fight for our natural environment and reject all that is alien to our biosphere so as to ensure safety for those who will follow us on this planet."

T N Khoshoo, distinguished fellow, Tata Energy Research Institute, New Delhi



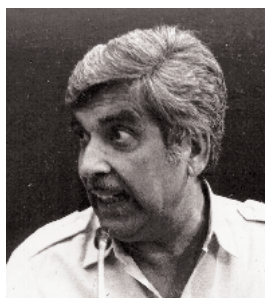
"There can be no denying either the horrifying nature of cancers in general and lymphoma in particular, or the growing prevalence of cancer in our country, particularly in congested and polluted urban areas. Nor are there any doubts about statistical associations between incidences of cancer and concentrations of toxic pollutants in the environment and the

consequent risks to human health and welfare, or the serious public concern the above should cause in our country, which considers economic poverty and improper distribution of wealth as its only two problems...

"In the activated sludge process of biological wastewater treatment, the most dreaded condition that fouls up the system is called 'sludge-bulking'. With all the research and knowledge behind us, no one is still able to say what causes

'sludge-bulking'. To me, it seems cancers are similar to sludge-bulking. And what does one do to avoid such a condition? The only alternative is to ensure balanced and stable operation, in line with the original assumption of the design. In my opinion, awareness and concern for the hazards posed by toxic chemicals and processes that were not part of the original assumptions of the design of the human body, are a must. Such awareness should lead to a willingness to live without the facilities or products that application of these delivered. For such chronic, systematic ailments caused by imbalance or pollutants, the treatment has to be as horrific as the disease. The only desirable and practical course to avoid such suffering would be serious curtailments of our needs and lifestyles, not just on individual but on community and national levels."

G D Agarwal, ex-member secretary, Central Pollution Control Board



"There can be a clinical description of environmental toxicity, carcinogens and malignance. However, the essence of the matter is the human being. Statistics and environmental sciences do not dilute the essential human context in which this article has been written. This relates to a set of issues. Firstly, the Indian city is rapidly declining. I stay off and on in Delhi. The degradation of Delhi as a

city is far more obvious to an individual who sees it after a number of years. One of the other key features of the Indian scene has been a rapid deterioration in the nature of information given by different sources. This is true of land and its characteristics, besides areas like demographic indicators, health indicators and morbidity. Anil Agarwal picks out his facts and carefully marshals them in directing his ire at 'experts', who discuss the problem casually. Is somebody listening out there?

"His resume of the current pesticide scene and the injection of carcinogens into human bodies, mothers' milk, daily foods, etc is devastating. I had written a similar article in the *Economic and Political Weekly* and showed that while the absolute level of pesticide application was still low, in some groups and regions (paddy and cotton, for instance) it had reached intolerable levels. At the policy level, there was the same wooden-headed response. Excessive controls — not for reaching objectives — excessive protection of domestic vested interests, and an inability to master the great technology changes taking place were also there. Nobody was willing to respond to knowledge. Fifteen technical grade pesticides were put on the open general licence, but industry got the finance ministry to withdraw the initiative. Urbanisable India is not required to obey any laws — because in many cases they are not there. Luxury bungalows and high-rise houses come up without any sanitation, roads or water supply; cesspools emerge; sewage mixes with drinking water; we get the plague and the dengue. But there are no reliable morbidity statistics... How many more people have to die before individual hedonism and myopia will give way to social concern? You had better heed me, dear reader, for as Anil Agarwal says, it won't be him the next time."

Y K Alagh, minister of state for planning and programme implementation and science & technology

Lifting heart's burden

Heart diseases have been on the rise in the recent past but now a new research says that the trends can be reversed

Double attack

The growing global menace of drug resistant germs compounding the problem of infectious disease control has been traced to economy measures in hospitals. Jerome Schentag, University of Buffalo, New York told the American Society of Microbiology that in view of the high cost of antibiotics, physicians prescribe only a few less expensive medicines. Schentag believes that using several antibiotics to wipe out infections would be a better strategy rather than just prescribing a single antibiotic. Other suggestions of his team include cycling between drugs, switching over from intravenous to oral mode which also help in reducing cost besides being effective (*New Scientist*, Vol 150, No 2033).

Breakdown

According to a research in the US, women suffering from depression are at serious risk of bone fractures in later life. A team at the National Institutes of Health near Washington DC studied 24 women with a history of depression and found that 10 had a bone density so low that there was a high risk of broken bones in subsequent years. Depression is known to lead to higher levels of the steroid hydrocortisone, which can take minerals out of bones. But the extent of the effect was unexpected. David Michelson, who led the study says, "We are surprised by the magnitude of the difference."

Risking fertility

Infertile men who go in for intracytoplasmic sperm injection (ICSI) techniques to have children may risk having sons with infertility. ICSI involves the injection of a single sperm directly into a mature egg. David Page and his group of the Massachusetts Institute of Technology in Cambridge have discovered that a gene was missing from a Y chromosome of men with very low sperm counts. Page says that deletions in this gene called azoospermia factor could be transmitted by ICSI and "would probably result in infertile sons" (*New Scientist*, Vol 151, No 2043).

SOME time back heart attacks were considered a problem of only advanced countries. Not any more. Countries like India are fast catching up with the developed countries. For example, in the United States the most frequent cause of death in men over 35 and women over 65 is cardiovascular disease. In India, cardiovascular disease is currently the third largest killer and according to some estimates, is expected to shoot up 20 times by the year 2000. Which means we will hold yet another dubious record; every second person dying of heart disease the world over will be an Indian.

Of the estimated 50 million heart patients in India, about three million die every year due to heart attacks, while three to four per cent of the 30-plus population suffer from coronary heart disorders. According to Venkata S Ram of the North-Western Medical Centre, University of Texas, a renowned expert on hypertension, about 11 per cent of the Indian population suffer from hypertension in general, the risk increasing four-fold in urban Indians.

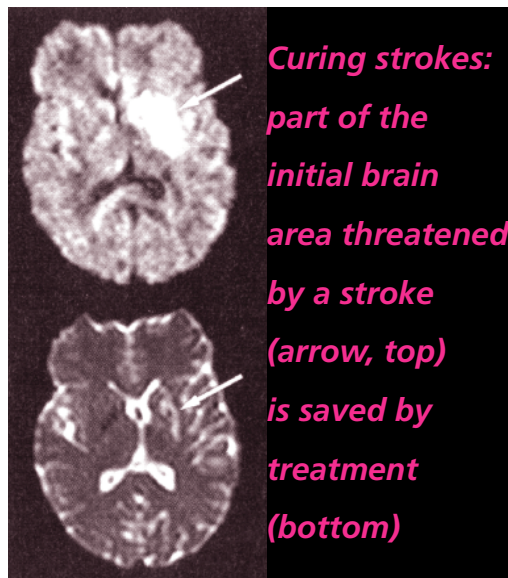
Against such a grim scenario, the claim (*Science*, Vol 272, No 3262) that cardiovascular diseases may well be gone with this century is welcome news

indeed. The optimism centres around four decades of solid progress in our understanding of cholesterol and the lipoproteins that carry it in the blood plasma. Giving an overview of this area Michael S Brown and Joseph L Goldstein, professors of molecular genetics from the University of Texas Southwestern Medical Centre, Dallas, claim that heart diseases may lose their notoriety early in the next century. "Exploitation of recent breakthroughs — proof of the cholesterol hypothesis, discovery of effective drugs and better definition of genetic susceptibility factors — may well end coronary disease as a major public health problem in the next century."

Take for example, atherosclerosis, which begins when plasma lipoproteins of intermediate and low density (LDL) are deposited in artery walls. While LDL carries cholesterol to the cells, high density lipoproteins carry it away to the liver to be excreted.

The trials done in Scandinavia, North America and Scotland have used drugs called statins, which inhibit 3-hydroxy 3-methylglutaryl coenzyme-A reductase, a key enzyme of cholesterol synthesis. Statins slow down cholesterol

production and enhance receptor-mediated removal of LDL from plasma. These three studies between them enrolled over 15,000 patients studied over a period of five years. While the Scandinavian (1994) and North American (1996) trials enlisted people with coronary heart disease, the Scotland study (1995) enrolled asymptomatic individuals with high cholesterol. All the trials yielded similar results. Plasma LDL fell by 26 to 35 per cent and the heart attacks declined by 25 to 31 per cent. In the Scandinavian Simvastatin Survival Study Group trial,



**Curing strokes:
part of the
initial brain
area threatened
by a stroke
(arrow, top)
is saved by
treatment
(bottom)**

the heart attack deaths were down by a hefty 42 per cent and deaths from all causes also fell by 30 per cent. In these three trials, statins were taken by 7,500 people for five years without significant increase in deaths from non-cardiac diseases.

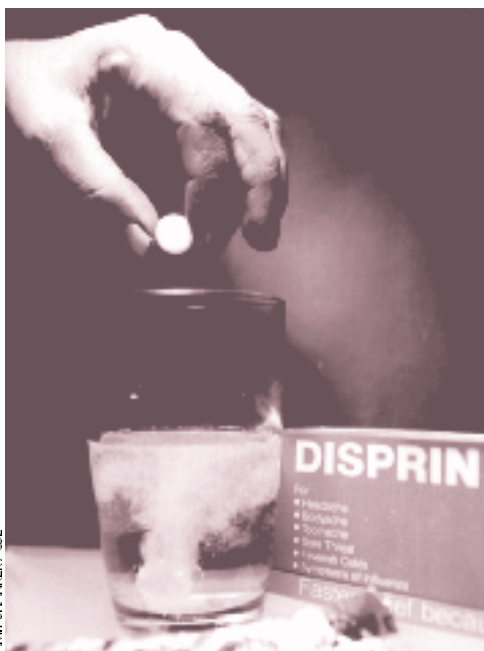
Stroke is another condition that has received considerable attention from researchers in recent months. Interestingly, unlike heart attacks, stroke, brain's equivalent of heart attack, is not considered a medical emergency, simply because there was no effective treatment for stroke, as all that doctors could offer a stroke victim was rehabilitation to help him gain some lost functions. As University of California, San Diego neurologist Patrick Lyden says, "We were all trained to think, well the damage is done, so put the patient somewhere in the corner and we will get them admitted and do some physical therapy when we get around to it."

This may no more be the attitude as physicians may have to rush to the emergency room to attend to patients suspected to have suffered a stroke. The National Institute of Neurological Disorders and Stroke, Bethesda, has just announced the results of a large clinical trial which show that the clot busting drug called tissue plasminogen activator (TPA), if given within three hours of stroke's onset, can boost the percentage of a patient's ability to walk off with no permanent disability by 50 per cent. And TPA is first of the several drugs on the anvil that aim to rescue the stroke victims from permanent disability. ■

Righting the target

Clearer understanding of an enzyme's role could lead to pain killers with less acute side-effects

LATEST research on anti-inflammation drugs may make it possible to replace the formulation which is the most commonly used today, and is probably also the most damaging: aspirin. Few people know that it can be dangerous. The chronic and indiscriminate use of aspirin can lead to stomach bleeding, kidney failure, liver damage and occa-



Side-effects outweigh its benefits

sionally can be a killer too. In the United States alone these and other side effects kill over 7,000 people every year and ten times as many are admitted to the hospital. In fact, misuse of this pain killer has reached such a level that leading members of European Headache Federation have just called for their governments to commission research to discover the extent of this problem.

Aspirin belongs to a class of compounds called non-steroidal anti-inflammatory drugs (NSAIDs) that essentially work by subduing a key enzyme involved in triggering inflammation and pain besides stifling a nearly identical enzyme that helps maintain tissues such as stomach lining. Although, this Jekyll and Hyde behaviour of aspirin has been known for sometime, our understanding of the enzymes involved has been rather poor. New research is unraveling the mystery on the near-identical enzymes and steps are underway towards designing 'super aspirins' that would just target the enzyme(s) associated with pain, sparing the one that maintains tissue integrity.

Traditional aspirins and other NSAIDs block the activity of cyclooxygenase (COX) enzymes. These enzymes create prostaglandins — hormones that have local or temporary effects on pain, inflammation or fever which are triggered off by injury or infection. In addition, COX enzymes in the long term also protect stomach lining against acidity

besides maintaining a proper balance of electrolytes in the kidneys.

Of the COX enzymes known, COX-1, familiar to researchers, produces 'good' prostaglandins that act in the stomach and other tissues. The other COX enzyme(s) responsible for troublesome prostaglandins synthesised in response to injury have eluded researchers until 1991. But once the gene for COX-2 was cloned independently by three laboratories, it set off a race for compounds that selectively block COX-2 without interfering with the vital role of COX-1.

The race to synthesise a new molecule for this purpose essentially went on two parallel tracks. New compounds

were tested in the age-old trial and error methods against the two enzymes independently, the objective being essentially to inhibit COX-2. The other group of researchers were looking at the molecular biology of the COX enzymes to determine their three dimensional structure and see if such an analysis in natural structure will help in the rational design of drugs which would stop COX-2 in its tracks without interfering with the function of COX-1.

In fact, it was the rational design strategy that eventually got a boost in 1994 when Michael Garavito and others at the University of Chicago, solved the structure of COX-1. Matching data from COX-2 came this April from Michelle Brown from Roche Bioscience, Palo Alto, California. Simultaneously, Ravi Karumbail, an x-ray crystallographer at Searle in St Louis, Missouri also unraveled a detailed view of the structure. Not to be outdone, the third competing pharmaceutical group — Merck-Frost Research Centre, Pointe Claire, Quebec, Canada, offered glimpses of similar data with a full report released at the Tenth International Conference on Prostaglandins and Related Compounds at Vienna in the last week of September.

When placed side by side, COX-1 and 2 structures show very similar features along with the sites where NSAIDs bind the enzyme. "There is at least one important amino acid difference," says

Brown. An isoleucine in the COX-1 binding site is replaced by a slimmer valine in COX-2. This amino acid difference seems to help the inhibitor molecule presumably bind more readily to COX-2 than COX-1.

The excitement is contagious even as the competition is no-holds barred. After all, the global market for NSAIDs currently exceeds US \$5 billion. Researchers at Roche, Searle and Merck are racing towards designing next generation inhibitors which have a stronger preference to site on COX-2. "If super-aspirins live up to the promise of early data, there's the potential to really revolutionise therapy and replace NSAIDs," says Peter Isakson, who heads the anti-inflammatory research group at Searle (*Science*, Vol 273, No 5282). ■

Preferential assault

A new research proves a common observation, that mosquitoes are selective in biting

IT IS an experience most of us would have had many times. How come mosquitoes and other winged creatures are partial in their biting habits? They seem to have distinct favourites, whose blood is selectively devoured. While scientists always suspected that it is something to do with one's skin or, more specifically, its secretions emitting odour, supportive evidence has been forthcoming only since the past few years.

The first conclusive evidence that people may vary in attractiveness to mosquitoes has been reported from Tanzania by Burt G J Knols and colleagues from the Department of Entomology, Wageningen Agricultural University, Wageningen, Netherlands. Field trials have shown that men are distinct favourites particularly those with large body-size; mercifully, children are targeted less frequently as compared to adults (*The Lancet*, Vol 347).

In the study of Knols, three volunteers slept in separate tents outfitted with a mosquito entrance and two exit traps. The volunteers slept in the same tent, in the same bed and under the same unimpregnated bed net for some days. Then over the next nine nights



they moved between these three different sites. Analysis of mosquitoes collected by the trap showed that one of the volunteers is significantly less attractive to two anopheles and one culex species than were the other two. Knols *et al* conclude that three of the mosquito species that they collected during the study period must have selected their hosts on their specific body odour.

The effect of expired carbon dioxide, a known mosquito attractant, was effectively discounted since the three volunteers were of approximately the same weight, size and age. The mosquitoes that were studied included *Anopheles gambiae*, *Anfunestes giles*, *Culex quinquefasciatus* and *Mansonia spp* in north east Tanzania. While the anopheles species causes malaria, the culex and mansonia cause Japanese encephalitis.

Other recent experiments which have used wind tunnel bioassay, suggest that the bacteria and other microflora present in the human skin may be responsible for attracting the mosquitoes. The human body odour secreted by the two million odd eccrine sweat glands on the skin that release odourless sweat and a sparser number of apocrine glands which secrete substances which vary from human to human in respect of smell or stink, as the case may be. In fact, these scent glands produce a milky

secretion that reacts with bacteria on the skin.

Some studies on black-flies, considered the national insect of the Canadian wilderness, have suggested that sweat, especially secreted by body parts below waist, particularly feet and ankles, was found to be especially attractive to these flies. Since trousers were found to be more attractive to flies than shirts, it has been suggested that the apocrine glands of the groin region might be involved in producing the attractant compounds. Scientists are trying to zero in on the composition of the secretions and have found L-lactic acid and as yet unidentified compound(s), isolated from acetone washings of human skin. The differen-

tial attractiveness of humans to *Aedes aegypti* (which causes dengue and dengue haemorrhagic fever) was found to be related to the amount of L-lactic acid skin washings, although lactic acid alone was not attractive without a carbon dioxide component in the air stream.

In fact, Knols and de Jong are using this feature of attraction of odour to mosquitoes to develop odour-baited traps (*Parasitology Today*, Vol 12). They have chosen a particular typical and distinct odour of human feet caused by the resident skin microflora and the environment frequently described as 'cheesy'.

Research on the odour-based traps would help solve the vexed issue of reliable sampling of mosquito population of a particular area, so vital for planning mosquito control operations. Knols and de Jong foresee the development of odour-based mosquito traps which might be used *en masse* to reduce mosquito density in a village or even a bedroom to divert them from the occupants. Until such a time, if you are a well endowed male with an irresistible odour, especially panting hard while jogging in dark colored shorts through a mosquito infested area, better watch out. You are likely to provide the mosquitoes the main course for dinner. ■

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Aurora in the air

Ganymede, the Jovian moon, has two planet-like features which were discovered last year: a magnetic field and the trace of an atmosphere. New data from the Hubble Space Telescope reveals that it might have a third planetary feature, an aurora at the poles. Doyle Hall and his colleagues of the Johns Hopkins University in the US have detected a very faint aurora.

The basic mechanism is thought to be the same as for planetary auroras: the magnetic field channels high-energy particles into polar regions where they collide with gas molecules to give off (in this case) ultraviolet radiation.

Creating impressions

Holography with laser beams is commonplace. Now, F Shimizu and others at the NEC Fundamental Research Laboratories in Tsukuba, Japan, have used waves of neon atoms to form a small physical image. The image is coded as an interference pattern between two laser beams (a reflected and a reference beam) and is then read by another beam. In this experiment, the letters NEC were etched out on a membrane using electron beam lithography.

No time to lose

The Internet has even changed the way we compute. Search for Extraterrestrial Life (SETI) is planning to send the data gathered by the radio telescope at Arecibo, Puerto Rico, to the general public. The data and the relevant software will remain in one's machine and whenever the machine is idle, it will run to look for patterns in the radio data. These patterns could provide clues to extraterrestrial life. After analysis, the data will be automatically sent back to the SETI site through the World Wide Web for further study. By doing so, a lot of valuable computer time would be saved. Also, the general public would get the unique opportunity to participate in a fascinating project (*Science*, Vol 272, No 5276).

PHYSICAL SCIENCES

The grain of the matter

The study of a new kind of structure called oscillon could enhance our understanding of the granular system and even lead to an universal theory of matter

PATTERN formation in nature is an almost universal phenomenon, be it biological, like patterns on animals or geological, like striations in rock formations. Though the physical interactions leading to development of patterns may differ, the evolution and dynamics of patterns could be provided an universal mathematical description. Paul Umbanhowar and his colleagues at the Centre for Nonlinear Dynamics and the department of physics at the University of Texas in Austin, US, have reported a new kind of structure which emerges from the behaviour of a layer of minute brass balls that are excited in a certain fashion. Strange but well-defined structures are displayed when the exciting force reaches a critical value. Though observed only in this system comprising

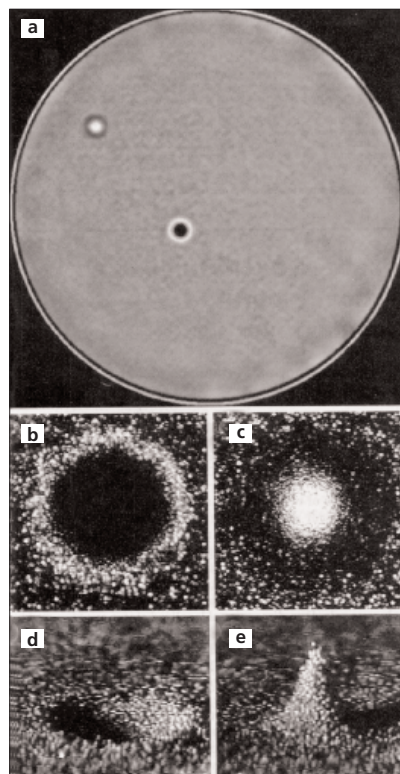
of a sand-like layer of metallic balls, the discovery is important in that it may be relevant for a whole variety of different non-linear systems (*Nature*, Vol 382, No 6594).

For their experiment, Umbanhowar and his colleagues used an evacuated, upright and cylindrical container, driven in the vertical direction at a known frequency. A granular material (in this case, brass balls) was spread at the bottom of the container. These macroscopic grains can interact only by means of contact forces which means that each ball can interact only with another with which it is in contact. Previously, the same group had discovered that depending on the strength of the excitation, many interesting structures like squares or hexagons form in the layer, with sizes which are many times the size of the grain itself. In the present experiment, the team has observed a different kind of structure which it calls the oscillon. Oscillons are highly localised, particle-like excitations which are stable and have an oscillating frequency which is exactly half the driving frequency. Furthermore, there are two kinds of oscillons and these can interact to form chains and other patterns. Although they do not propagate, they do drift slowly and randomly in the container.

Granular media, used to observe oscillons, are known to have peculiar properties which are still not completely understood. But such media do exhibit properties typical to both solids and liquids. For instance, sand can heap unlike a liquid and once heaped, could collapse and start flowing if the amount of sand is greater than a certain critical value. Interestingly, only a thin layer near the surface flows while the rest of the heap remains in place.

Also, granular media are dissipative. Therefore, some source of energy is needed to maintain movement. A layer of sand is an example of a dissipative non-linear system which can be driven

'Oscillonamia': two oscillons with opposite phase (a); an oscillon viewed from above (b, c); view from the side (d, e)



to various states. In the case of most systems, once the driving force exceeds a critical value, they undergo abrupt changes called bifurcations which are characterised by a well-defined mode. As the force increases, the system undergoes further bifurcations.

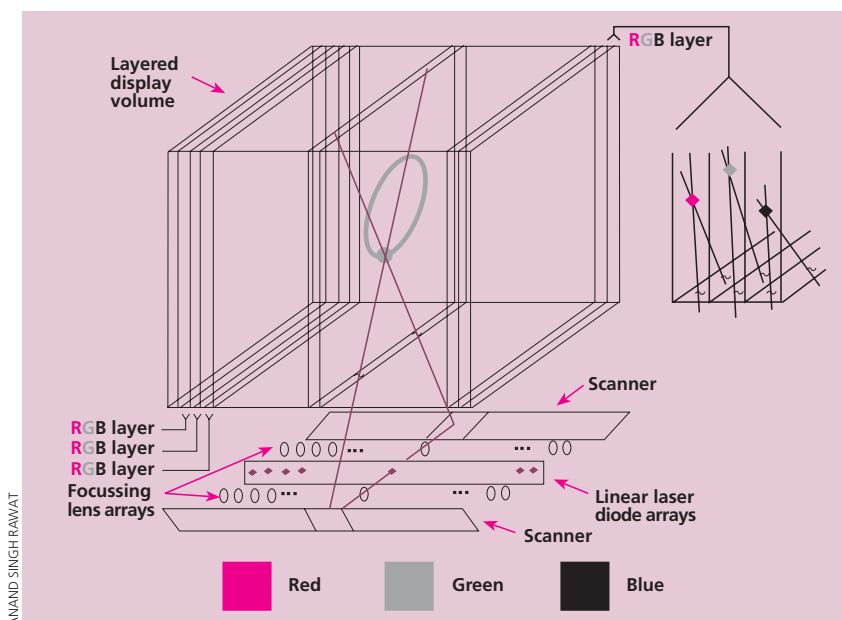
However, dissipation in such systems is global and not confined to a single region in the system. But there are numerous examples of non-linear systems which have highly localised structures called solitons. Solitons are stable and are observed in many non-linear systems (for instance, light waves in a fiber optic cable), whose characteristic is little or no dissipation. The experiment of Umbanhowar and his team indicates that such localised, stable structures could occur in dissipative media like sand as well. In fact, the dissipative nature of the media seems to be essential for the formation of these structures. Though such structures have only been observed in this particular system, it is believed that they could be universal.

Interestingly, scientists have recently observed propagating localised states in highly dissipative fluids. The discovery of oscillons, which resemble the states found in fluids, has encouraged researchers to believe in a possible connection between the two. It is hoped that we will soon have a proper theory of oscillons that would lead to a better understanding of the fundamental nature of granular systems. ■

Genuine stuff

Lasers passed through a fluoride glass doped with rare elements could end the search for genuine three-dimensional images

THREE-DIMENSIONAL (3-D) images — rather, the illusion of viewing them — holds a certain fascination for us. Whether it be special glasses to view stereo vision in cinema halls or the present-day virtual reality headgear, much effort has gone into creating 3-D effects. There are now reports of genuine 3-D images being traced out by lasers inside a small cube made from special materials. Elizabeth Downing of Stanford University, California, US, and her colleagues report the demonstration



When the crossing of a pair of lasers is scanned through a fluoride glass doped with rare earth, a three-dimensional image results

of a three-colour display in a rare earth doped metal fluoride glass (*Science*, Vol 272, No 5279).

The underlying idea is almost a decade old. According to it, if a pair of infrared lasers are crossed in a suitable transparent material, they could excite a fluorescence. The process is one of the absorption of two infrared photons from the lasers by an atom and then emission in a single photon of visible light. The materials that exhibit this property are rare earth elements like erbium which absorb at two different frequencies and then emit in the green region of the spectrum. The trick is to scan the crossing point of the lasers through a cube of glass doped with rare earth and trace an image in three dimensions.

The device consists of a centimetre-sized cube of fluoride glass which is multiply sliced. Each slice has a different rare earth dopant which fluoresces in red, green and blue. An array of lasers with movable mirrors are arranged around the cube and these scan the whole volume of the cube.

The whole process hinges crucially on a compact, solid-state laser which produces the exact infrared wavelengths which can be absorbed and the fluorescent material itself. The transparent substance should not dissipate the energy absorbed into vibrational energy. For the same reason, ordinary glass is not suitable for the purpose. The

recent development of powerful compact lasers and more importantly, of fluoride-based glass in the '70s, provided the impetus needed to perform the experiment.

The fact that a simple device operating at room temperature, using commercially-available laser diodes, can produce these images and can be viewed under ordinary room lighting conditions, is a significant step forward. ■

Encounter with the future

The newly-discovered method of lasing in conjugated polymer microcavities may herald bright possibilities for the electronics industry

LASERS, like integrated circuits, are now an important part of many devices and techniques. Their unique properties like coherence and their non-dispersive nature help them play a crucial role in research in areas like quantum mechanics and communications. N Tessler and his colleagues at the Cavendish Laboratory in Cambridge, UK, have reported experiments that indicate lasing (the process of inducing laser) in a new medium, conjugated-

polymer microcavities (*Nature*, Vol 382, No 6593).

Conjugated polymers are a subclass of polymers (materials which have chain-like organic molecules linked in a well-defined sequence) that allow charge mobility and excitation in the optical frequency range. These polymers are finding many applications in the semiconductor industry. For instance, they are used in flat display units and optoelectronics. The basic phenomena occurring in these materials is electroluminescence: the emission of light when charges are injected into the material. Electroluminescent diodes, devices which allow injection of charges, can also be sandwiched between mirrors. This creates a microcavity which can be used to create a laser. Several inorganic materials have already demonstrated lasing in the microcavity. Tessler and his team have now shown that lasing is also possible with polymers.

The team used conjugated polymer microcavities, a material which was shown to have electroluminescence in 1990. A 100-nanometre (nm) (a nanometre is one thousand-millionth of a metre)-thick layer of the conjugated polymer p-phenylenevinylene (PPV) was sandwiched between a 60-nm-thick upper mirror and a 100-nm-thick bottom mirror. The device was excited by using a laser with a central wavelength of 355 nm. Three phenomena which indicated lasing were observed. Firstly, the device coupled to a specific mode of the driving laser. Secondly, the emission spectrum was very narrow and finally, the directionality increased with increase in intensity of the pumping laser.

This demonstration of lasing in conjugated polymer microcavities holds tremendous potential for finding certain applications. The conversion of this optically (laser)-driven device to an electrically-driven one is considered fairly simple. The development of low-cost electrically-driven lasers with wavelengths across the visible spectrum and extending to near ultraviolet frequencies will be an important step. The resultant lasers are miniature and tunable. Though commercial developments seem a long way off, improvements in the performance of such devices may force industry to take a closer look at these lasers. ■

Short-lived independence

Scientists may have had their first glance of a rare state of matter — a quark-gluon plasma

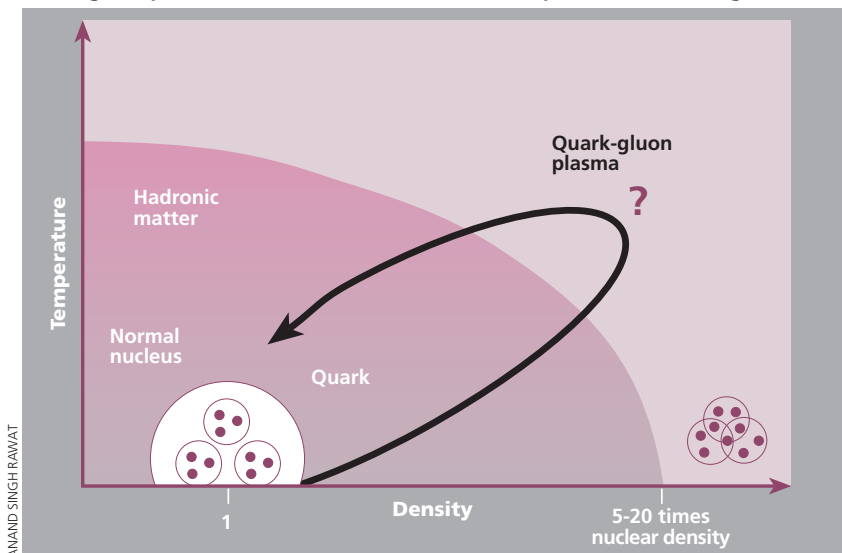
INTERACTIONS between quarks and gluons is a key area which presents gaps in our understanding of the nature of matter. Quarks (the smallest particles comprising matter) and gluons (massless particles that carry a strong nuclear force) are usually not seen by themselves. In ordinary matter and under normal circumstances, these are always seen in the garb of more complex particles like protons or pions. This process called confinement — whereby naked quarks cannot be seen — is still not completely understood. But under certain conditions, it is possible that quarks and gluons exist outside these complex particles. Unfortunately, this state of matter, called the quark-gluon plasma is possible only under extreme conditions (densities that are 10^{20} times larger than ordinary matter). The quark-gluon plasma is conjectured to have existed in the early universe, a few microseconds after the Big Bang. At that time, temperatures were very high and the densities extreme (*Science*, Vol 272, No 5281).

However, recent reports from CERN, the European particle physics laboratory suggest that researchers may have succeeded in getting their first glimpse

of this elusive state of matter. The NA50 detector at the super proton synchrotron (SPS) at CERN has reported results that indicate the possible formation of a quark-gluon plasma. The SPS accelerator fires heavy ions like lead into stationary targets. The energy of the collision is large enough to create conditions for the formation of the quark-gluon plasma.

However, detecting the plasma, which exists for all but a fraction of a second (10^{-23} seconds) before it recombines with ordinary particles, is quite another matter. Nonetheless, there is a method by which the formation of plasma can be gauged. A certain particle, called the J/ψ particle plays an important role in detecting it. The J/ψ is a particle made up of a charm quark and its anti particle. The J/ψ s present would initially melt into their constituent quarks which would fly apart. When the plasma cools off, these will not be able to recombine because they are too far apart. Other particles also face the same fate, but they are made up of up-and-down-quarks which are around in the plasma in abundance and so they can recombine. Thus, the key to the detection of the quark-gluon plasma would be the missing J/ψ s. A dramatic reduction in the J/ψ s — indicating a possible formation of the quark-gluon plasma — has been noticed. Although the scientists are still not claiming to have seen the plasma, there is a lot of excitement in the community. Some other experiments at CERN, like the HELIOS III and CERES have also reported results which point towards a quark-gluon plasma. ■

Quark-gluon plasma occurs when nuclear collisions squeeze matter to high densities



Change in cycles

Disasters occur in cycles, suggests a recent study. A discovery by researchers at the National Geophysical Research Institute in Hyderabad, lends force to their earlier finding that geological and biological calamities including climate changes, sea-level changes and mass extinctions operate cyclically. It has been found that dolomite rocks in deep sea undergo changes in cycles. Analysis of dolomite samples from 127 oceanic sites from all over the globe reveals that changes in dolomite deposits occurring every 24.5 million years coincide with marine biological mass extinctions in the past that happened every 26 million years.

Distant eyes

Yet another addition to the fleet of satellites peering down on earth is Japan's Advanced Earth Observing Satellite (ADEOS). Bristling with sensors for measuring everything from stratospheric ozone to ocean turbulence, the satellite launches Japan into the upper realms of remote-sensing science. Carrying eight instruments from Japan, France and the US, the satellite will gather data on basic earth and ocean processes, global climate change and climate degradation and regeneration over the next decade. If everything goes according to plan, ADEOS will be joined by three more earth-science satellites by 2000 AD.

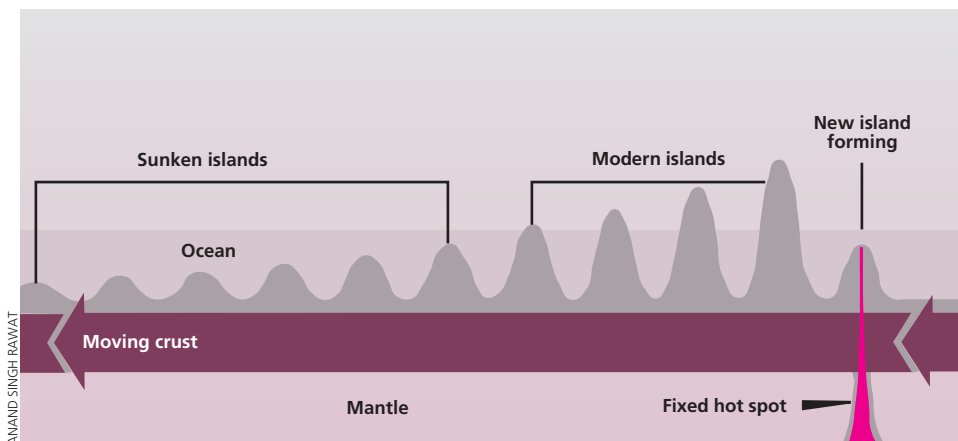
Icy quakes

Antarctica, which till 1960 was considered an aseismic area, now supports seven seismic observatories. India will also set up an observatory near its permanent station *Maitri* during its 16th expedition to the continent towards the end of this year. The aim of the broad-band digital seismic observatory is to monitor and study seismic activity in and around Antarctica to determine hypocentres of earthquakes occurring throughout the world. This is in line with India's research programme in Antarctica which had incorporated geophysical investigations right from the initial stages.

EARTH SCIENCES

Gaea's youngest

For the first time, scientists beheld the unusual phenomenon of the birth of an island from an undersea volcano in the Pacific ocean off Hawaii



Submarine activity: islands are created when the crust moves over hot spot

A JET of molten lava arises from the womb of the earth, pierces through the seabed and gives rise to islands amidst a turbulent ocean. In a rare feat of scientific endeavour, the birth throes of an emerging island in the ocean were witnessed for the first time by scientists recently. Loihi, the young, undersea volcano 30 km south-east of the main island of Hawaii, has suddenly become one of the world's most active volcanoes.

Riding a submersible, a team of explorers under Alexander Malahoff of the Hawaii Undersea Research Laboratory at the University of Hawaii, dived into the dark churning waters of the ocean. The aim was to probe the cause of thousands of earthquakes that shook the area in the past months. The research ship carrying Malahoff and his colleagues dove to the recesses of the undersea volcano and discovered that so much debris had been thrown out by the eruption that they could hardly see more than a metre ahead.

But the most striking discovery was that the turmoil at the volcano's top had collapsed its summit, creating a crater more than half-a-mile-wide and 1,000 feet-deep. Pete's dome, an area on the southern rim of the volcano that previously had been considered very stable, had simply vanished. Scientists discov-

ered a riot of landslides, toppled rock formations and bus-size volcanic boulders strewn around. The collapsed crater had vents spewing a mixture of superheated water, dissolved minerals and microbes that thrive in the seabed's rocky substrate.

"The tumult is part of the volcano's upward growth," say scientists. Lava-flows build it up and avalanches and cataclysmic explosions knock it down. This widens the crater, creating a larger base for the next stage of building. "The fight is between construction and destruction," says Malahoff. The team estimates that the collapse of the summit took two to three days and the slow collapse prevented generation of a huge tsunami, or tidal wave, that could have caused largescale destruction in the adjoining islands.

The process by which islands are formed in this zone due to volcanic upheaval is dynamic. The great heat engine within the earth stirs a sea of hot plastic rock that melts through the crust in places. A vast majority of this action takes place in the hidden darkness of the deep sea. In certain places, the interior heat gives rise to jets or plumes of lava that are stationary in relation to tectonic plates that move slowly overhead. The gigantic plates that make up the earth's crust move at the rate of a few centimetres

a year, or about as fast as fingernails grow. As a result of this slow movement, a single jet can, over the ages, leave a trail of extinct volcanoes in the plate tens of thousands of years before Loihi's fiery summit rises above the waves. ■

The slower, the safer

Geologists in the US have discovered that earthquakes can also occur slowly causing minimal damage

EARTHQUAKES hit an area with a ground-shaking intensity. Therefore, a 'slow earthquake' seems a contradiction of sorts. Yet, US geologists have detected a quake on California's San Andreas fault that lasted 10 days (*New Scientist*, Vol 151, No 2047).

Occurring when rocks slip suddenly, earthquakes trigger sharp vibrations. As the quake advances, the fault surfaces slip by several metres. The more slowly the fault slips, the less efficiently it generates seismic waves. If the fault slip is slow enough, no waves are radiated and the earthquake is silent. If all earthquakes were slow they would not be very hazardous.

Researchers led by Alan Linde of the Carnegie Institution, Washington DC, studied data from strain gauges placed five km apart in San Juan Bautista, about 20 km inland from Monterey Bay in California. On the north of this region, the fault remains locked and inactive for years on end. On the south of San Juan Bautista, tiny quakes are caused due to the smooth movement of the tectonic plates past one another. According to Linde, the whole pattern makes up a single, slow earthquake. It released as much energy as a powerful quake of 4.8 magnitude.

Linde and his team were equipped with borehole strain gauges at the time the slow quakes occurred. The fault slipped by just a few centimetres, which could hardly be detected by the most powerful satellite positioning systems. He believes that some slow tremors may be precursors to major earthquakes. But until someone collects systematic data on slow quakes, Linde says, "I don't know if there is a real connection". ■

Sooty symptoms

The role of marine life in mitigating global warming takes a knocking as new findings link carbon on the ocean floor to forest fires

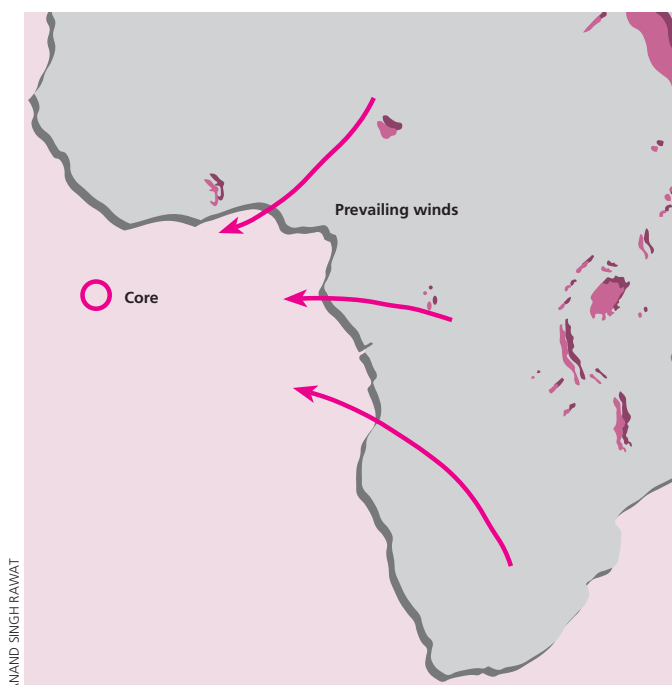
IN VIEW of a recent discovery, the models used to estimate earth's response to climate change stand for a rethink. While studying the effect of marine life on global warming, scientists found that the role of oceans in carbon fixation had actually been overestimated. The new findings suggest that half of the carbon found in ocean sediments may not have been removed from the atmosphere by marine life but, in fact, came from forests. This shatters the long-held assumption that plankton and other marine organisms play a major role in regulating the amount of carbon dioxide in earth's atmosphere (*New Scientist*, Vol 151, No 2047).

In a bid to estimate the effects of global warming, David Verardo and his colleagues at the University of Virginia in Charlottesville, US, decided to explore how the planet dealt with large climate changes in the past. A core of sediment was drilled from the bottom of Atlantic ocean to study the organic matter in it. Preliminary tests revealed that during the ice ages, around 200,000 years ago, the amount of carbon in this part of the ocean increased.

At first, scientists assumed that a proliferation of life in the ocean might have helped pull carbon out of the atmosphere, cooling the planet further. But Verardo and his team decided to confirm this. A technique was developed to analyse the form of carbon present in the sections of the sediment.

Scientists were surprised at the form of carbon residue left after breaking down the organic compounds in the sediment using nitric acid. Amazingly, about half of the carbon in the core turned out to be charcoal, a carbon form that could in no way come from marine life.

Scientists traced the origin of this carbon form to charcoal dust from forest fires. As charcoal accounted for as much as 90 per cent of carbon in some of the sections, Verardo concluded that "it is a lot of carbon to be flung off into the deep ocean". They believe that high winds generated by large temperature gradients created by huge ice sheets, transported an unusual amount of debris and charcoal dust from forest fires far out to sea. Researchers support this preposition by the fact that the sediment was removed from an area where winds blowing off north, central and south Africa converge. This could mean that an unusually large amount of charcoal has been



Strong winds carry soot from forest fires to the seabed

deposited in the area in the region.

Meanwhile, researchers have begun to test whether core samples from elsewhere in the Atlantic contain similar amounts of charcoal. If further studies corroborate these findings, scientists will be forced to redesign the computer simulations currently used to model the response of earth to climate change. ■

Sounds phony

People will soon be buying CD-quality music by downloading it over a phone line, courtesy American company AT&T, which has applied to patent an administrative set-up that will ensure that publishers and musicians still receive royalties. The 'vendor' is any company which offers to send music down a phone line on order. The role of a 'referee' is played by another independent trade body which issues a permit to customers each time they pay a vendor to send a piece of music. The permit combines the music and the customer's player number, ensuring that the music can be de-encrypted and played only on the player owned by the person who has paid to receive it.

Delivering fast

Japanese port authorities will soon manufacture the world's fastest cargo vessel. The Techno Super Liner (TSL) is designed to be the ocean-going equivalent of the Bullet train — a cross between a hovercraft and catamaran that virtually flies above the water. The TSL has successfully completed its seaworthiness trials and will carry 1,400 tonnes of cargo at speeds up to 90 kmph — even in 20 ft waves. This is more than twice the speed of conventional cargo ships. The aim is to develop a network of routes for a fleet of TSLs so that fresh produce is delivered to Tokyo within a day of it being picked in the remote provinces. The TSL is powered by four gas-turbine engines. The operational craft will be 450 ft long and 130 ft wide.

Choice from voice

A new navigation system that uses voice-recognition technology is now available in the US. Developed by Amerigon of Monrovia, California, the Interactive Voice System (IVS) is not speaker dependent, so you do not have to train the programme to respond to your voice. You simply spell out one word in the street or landmark your plan to drive to, and the system audibly presents you with a choice of possible destinations. IVS then gives you directions, distance and estimated time to your destination, which you can access as many times as you wish.

INDUSTRY & TECHNOLOGY

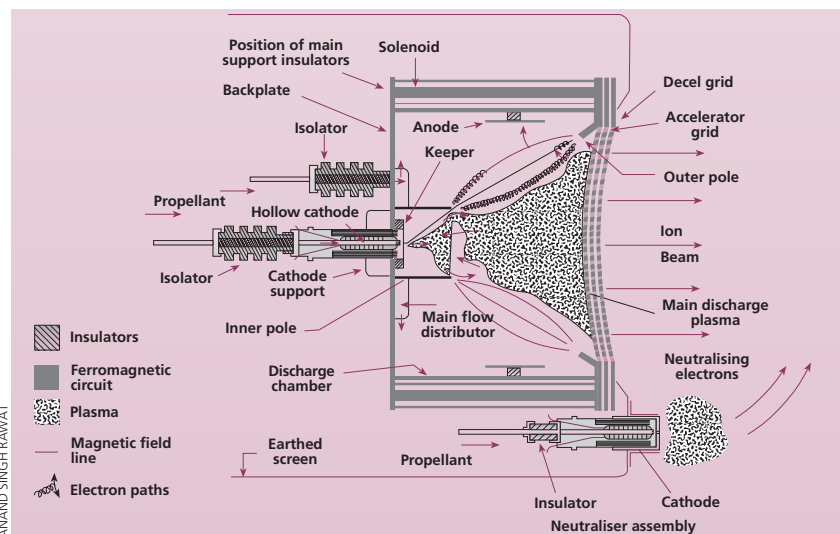
Less fuel, more fire

A new research, currently in an experimental stage, could be the propelling force behind the future rocket

THE speed of a rocket is determined by an old law: every action has an equal and opposite reaction (Newton's third law of motion). Current rocket technology is dependent on the speed of the exhaust gases emitted from its nozzle. If this speed could be increased by accelerating the gases in an electric field, then the amount of fuel a spacecraft would have to carry would be greatly reduced. British scientists are using this idea to

a spacecraft, the thrust of an ion engine can be maintained for years.

Using conservation of momentum, change in spacecraft speed = exhaust speed $\times \log e$ ($\log e = \text{mass of fuel} + \text{spacecraft} / \text{mass of spacecraft}$). The key term in the equation is $\log e$, which requires large ratios of fuel mass to spacecraft mass to achieve even a small change in spacecraft speed. If the change in speed is to be equal to the exhaust



The UK-10 ion engine

develop a new engine for an experimental communications satellite for the European Space Agency (ESA). Xenon gas is ionised in a plasma discharge and accelerated by a voltage applied to a grid system to increase the speed of chemical rockets by 10 times.

Increase in exhaust speed is needed for space travel. This is where ion thrusters come in, because exhaust speed is achieved by accelerating gas particles in an electric field which is only limited by the applied voltage. The obstacle is that, for the electric field to work, the particles have to be electrically charged — the gas molecules have to be turned into positive ions, a process which takes a lot of energy. Whereas a standard rocket may burn only for a minute or two to change the velocity of

speed, then mass of fuel must be 1.7 times the mass of the spacecraft.

The UK-10 ion engine, developed by the Defence Research Agency at Farnborough in England chose xenon as the fuel because its large atomic mass maximises the momentum ejected, and is chemically inert, thus avoiding chemical reactions on the surface of the spacecraft. The gas is fed into the engine through two ports. One leads into a hollow cathode discharge which starts the ionisation. The electrons produced are accelerated out of the discharge and trapped in the magnetic field lines which run from the inner cathode structure to the outer polepiece.

The ions are accelerated out of the engine by 1,140 volts between three concave grids across the outlet. The effective

exhaust velocity of the engine, including propellant losses, is approximately 33 km/s. Such an engine would require 300 kg of fuel to take a one tonne spacecraft from Earth orbit to Mars orbit. In normal rockets, two chemicals are mixed together and burnt in an exothermic reaction which heats the combustion products to a high temperature. These hot gases escape from the rocket nozzle at a speed which is proportional to the square root of their temperature. To reach twice the exhaust velocity, the mass of fuel should be six times the mass of the spacecraft. So in this case, a one tonne spacecraft from a low Earth orbit into a Mars orbit requires approximately 12 tonnes of fuel with an exhaust velocity of 3.3 km/s.

The first application of this ion thruster would be in an experimental project with important commercial benefits. An ion thruster being constructed by Matra Marconi Space Centre at Portsmouth, southern England will be tested on the ESA experimental communications satellite, Artemis, for north-south station keeping. The lifetime of geosynchronous satellites is limited by the amount of fuel they carry. Reducing the mass of the fuel required would extend their operational lifetime. Doubling the lifetime could halve the overall cost. Artemis will be launched in 1997 and a successful demonstration of the UK-10 thruster's capabilities could bring a bright future for the novel device and its inventors. ■

Fast option

Researchers are optimistic of developing a superfast switch with the help of a hopping electron

COMPUTATION might take a giant leap in its race against time, by storing data in single molecules that can transmit signals in femtoseconds (fs; 10^{-15} seconds). Even the fastest of today's

silicon-based computers rely on switches a million times slower, registering information in nanoseconds.

Although there are some experimental switches that operate in trillionths (10^{-12}) of a second, the system built by Michael Wasielewski and his colleagues at the Argonne National Laboratory in Illinois is a thousand times as fast. It operates by pushing an electron through a single molecule with two pulses of laser light. "To the best of our knowledge, it's the first time anyone has developed fs control of a charge shift device." Each bit of information could potentially be stored in the molecule by a single electron. This is moved from zone to zone with separate laser pulses.

The first laser pulse, which has a wavelength of 416 nanometres (nm, 10^{-9}), pushes the electron from the storage zone to the central, priming zone. The second pulse, of wavelength 480 nm, shuttles it within just 400 fs into the final zone of the molecule, where it could be read.

In order to make all this possible, the electron has to be siphoned off into an electrical circuit. Such an action is impossible with the existing molecule, because within 600 fs the electron flips back to the original storage zone, bringing the molecule to its original stability. Wasielewski compares the laser pulses to "pushing an electron up a cliff" in two separate stages. He hopes to add a further zone that captures the electron in an energy "well", at the top of the cliff to make reading easier. This would allow more time for the electron's position to be detected.

For practical purposes Wasielewski is attempting to make arrays of the molecules that could serve as miniature electronic devices. One possibility is to anchor the molecules to metal or glass surfaces, which would feed electrons into electrical circuits. The experiment was described as "extremely elegant" by David Vass, leader of the applied optics group at the University of Edinburgh.

But Vass does not expect practical applications to be possible for several years. "It requires parallel developments in laser technology," he says. The light sources must be fast-acting enough to keep up with the speed of the electrons (*New Scientist*, Vol 151, No 2049). ■

This one understands

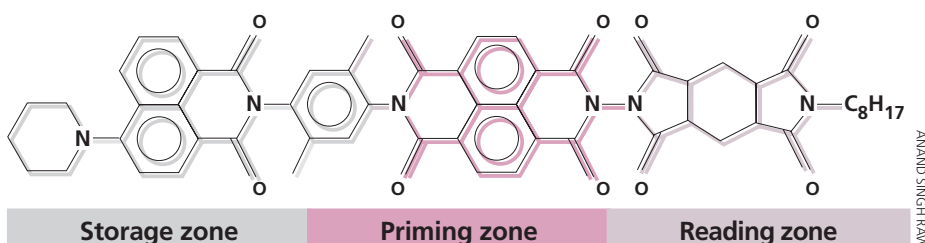
No need to type out your messages; this new technology is adept in deciphering whatever you scribble

INDIAN computer manufacturers are vying with each other to obtain transfer of technology collaborations from Japan for local manufacture of machines that can 'read' handwriting. A major bottleneck to the further spread of PCs remains the keyboard. It is difficult to carry the keyboard everywhere and many people simply cannot type.

Speech recognisers could be a potential solution to the keyboard problem. But speech recognisers have to be trained to respond to individual voices and are easily confused by background noise. This makes them unsuitable for use in many working environments. For such applications, machines that can read handwriting are an attractive alternative. For long the subject of intensive research in the laboratory, these machines are in successful use in Japan for the past three years. According to Japan Export Trading Organisation Newsletter (Aug/Sept 96), Tokyo, Canon, the Japanese camera and office equipment specialist, markets a notebook-size machine called A1 note. This, Canon claims, uses the techniques of artificial intelligence to enable it to recognise letters, numbers and *Kana* (Japanese syllabic writing).

With a blunt plastic pen, the user writes individual letters on top of a small window. Beneath the pressure sensitive window is a liquid crystal display of the type that calculators use. It displays what was written, then the machines' inbuilt software guesses which letter the writer intended. If the guess is wrong, a stroke of the pen by the writer deletes it.

The pad, which weighs 740gm and costs \$550, is only available in Japan. For the moment its intended applica-



ANAND SINGH RAWAT

tions are much the same as those of a personal organiser — mainly storing addresses and appointments. But this is a very competitive market. Last year, Sanyo had responded to Canon's product with a less interactive but cheaper (\$ 450) organiser that could also recognise handwritten input.

The first US handwriting recogniser to emerge from the lab is by contrast intended to penetrate a new niche. Last year, Grid Systems, a California-based subsidiary of Tandy, introduced Gridpad, a hand-held machine aimed at workers who have to fill in forms on the go. A publicity picture issued by the company shows a highway policeperson using the pad to make out a traffic offence *challan*. In addition, the company (whose track record includes some of the basic patents on laptop computers) envisages nurses and delivery drivers as potential customers for its IBM-compatible Gridpad.

About the size of a large writing pad, the US machine is both larger and heavier (two kg) than Canon's notepad. Its bigger screen allows a feature that the Japanese machine lacks — by tapping twice on the writing area, the user can summon up a picture of a keyboard as

an alternative method of entering letters (for those whose handwriting is truly indecipherable). But Gridpad also carries a very expensive \$3,000 price tag, making it more expensive than some laptops.

If handwriting readers are to gain widespread acceptance then they will have to become cheaper. They will also have to get smarter. As yet, the machines are sluggish in response and can only accept capital letters. ■

Super storage

A new technology is set to boost the storage capacity of CDs by 1,000 times

DIGITAL and analog information — words, music, and pictures — would no longer be limited to the surface of CD. Instead, they would be stored on hundreds of layers within it. The new CDs would use photons instead of electrons to acquire, transmit, store and process data. Researchers at the State University of New York, Buffalo, (UB) impregnate cheap, clear plastics with light-sensitive

dyes that can be turned on or off by an infra-red laser beam. In this process, called 'two-photon absorption', a molecule pumped with light of sufficiently high intensity absorbs two photons of light.

The presence of the dye enables the polymer to strongly absorb infra-red laser light due to the two-photon absorption, and this absorption can be confined to a very precise area by tightly focusing the laser beam, says Jayant Bhawalkar of the UB Photo Research Laboratory.

The absorbed light causes a tiny point of the dyed polymer to change properties, such as its colour of fluorescence. In an example of one mechanism for doing this, the spot where absorption occurs gets bleached, that is, the fluorescence is removed. This is the 'writing' process where bleached spots become the data that can be 'read' by an infra-red beam. This mechanism results in a 'write once/ read many times' operation. Other mechanisms can produce many reversible 'read/write' operations. The new technology permits digital-data storage and analog-image storage, enabling large quantities of pictures, photographs and other visual information to be collected. ■

APPOINTMENT

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Just (w)right!

Removing their blinkers is what scribes should do in order to promote an international environmental communication order that is fair and just

S FAIZI

ENVIRONMENT does not respect political boundaries and, therefore, environmental journalists are truly internationalists, or they ought to be. This privilege at the same time calls for certain responsibilities. One key responsibility is to create a just communication order.

A sense of justice is central to the environmental concern. But have Western journalists, who control global information, been applying this sense of justice in their professional practice? Let some examples speak for themselves.

Distorted viewpoint

Western reporters are deeply concerned about the fictitious or actual nuclear bombs of India and Pakistan while the stockpiles of nuclear bombs owned by Western powers are a non-issue. The World Health Organization resolution asking the World Court on the legality of using nuclear weapons, and the subsequent introduction of a broader resolution in the UN General Assembly by G-77 (developing countries and China), although crucial global initiatives, were not worthy of mention to Western media practitioners.

Environmental reports concerning Zimbabwe unfailingly blame the people for habitat degradation, but when it comes to the issue of land reforms that would provide land to the poor peasants, these reports are vocal in their disapproval as that would harm white interests. That an equitable distribution of farmlands is the key means to reverse the trend of biodiversity loss bears no meaning for them.

The examples are numerous and varied. However, the pattern is the same: delegitimise the developing countries and their genuine concerns and tacitly promote Western interests through false assumptions and pushing pseudo-solutions. The extent of the malady is so great that this genre of media professionals could justly be called 'sewage scribes'.

Media in the developing world is also fraught with its own kind of prejudices. In India, for instance, the print media is owned and operated largely by the dominant but minority group in the hereditary-based social order in the country. In Indonesia, the media is under eternal censorship; in Pakistan, the press is an extension of the battleground of provincial rivalries; in the Arab world, the press is barely tolerated; in Brazil, the Afro-Americans and the native Americans are an anathema for the press...

Mending ways

Over the past decade, a large number of professional associations of environmental journalists have sprung up in several countries and perhaps these bodies could make a meaningful contribution towards a just communication order. While its members are committed to objectivity, they champion the cause of justice. Such a conviction should lead environmental journalists to vigorously advocate a just and balanced communication order, at least in the area of environmental information.

I have reasons to believe that a democratic collectivity of journalists, in contrast to their corporate media commitments, could make a difference. When as a mark of protest against Japan's import of huge quantities of plutonium from France, I boycotted the first world congress of science and environment journalists, held in Japan in 1992 where I was invited as a guest speaker, I received a large number of letters of support from journalists attending the congress, a good number of them from the mainstream media entities in the West. You may recall that the Western media coverage of this hazardous venture between two G-7 countries was confined to the typical drama associated with the Greenpeace protest, in sharp contrast to the cacophony they raise when a developing country is involved in a nuclear issue.

The 'withering away of state' that Karl Marx had predicted as the evolutionary culmination of a socialist system is ironically now happening in the capitalist world. As the people increasingly become disenfranchised, their only hope remains the media, although it is unrealistic to expect that the media, a cause as well as product of the system, would display altruism. Nevertheless, a committed group of people can make a difference. ■

S Faizi is a consultant ecologist on international environmental policy



Disjointed and confused

Because it means too many things to as many people, joint forest management in India will remain elusive to all

NANDINI SUNDAR

JOINT Forest Management (JFM) is a laudable concept. However, before it can take on the multiple responsibilities that have been assigned to it, it must first resolve the severe identity crisis it is undergoing. Officially, JFM refers to cooperative agreements between village communities and the local forest department to protect a particular patch of (state-owned) forest land and share the final harvest. Since the government of India circular of June 1, 1990, 16 states have passed resolutions regarding the implementation of JFM and one estimate suggests that 10,000 to 15,000 village forest protection and management groups are currently protecting over 1.5 million ha of state forest land.

In practice, however, JFM refers to a cluster of phenomena rather than one easily identifiable process. Each state resolution has varying rules regarding the constitution of forest protection committees, their legal status, the kind of land they are given to protect, the shares involved, etc. Apart from this, differences in culture, ecology and in the organisational structure of the forest departments have introduced variations in actual practice. For instance, in Orissa, JFM might more

degradation, genealogy of attempts to reverse the process and the main purposes of JFM. Forest officers largely tend to view it as a strategy to regenerate degraded forest land. Deforestation is attributed to 'biotic interference', or the pressure of ever-expanding human and cattle population on a limited amount of forest land. The forest department staff portray themselves as much maligned but valiant defenders of the forest, functioning under severe limitations of personnel power and resources.

Activists and NGOs, by contrast, see in degraded or deforested land the hands of commercial exploitation, a corrupted forest department and an economic system which favours large industries and urban dwellers over the needs of village and forest dwellers. They argue that if all the forest land released to development projects and industries were taken into account, the picture of who is responsible for deforestation would change drastically. For many NGOs, JFM is a means for local communities to regain control over their proximate natural resources, as well as a harbinger of new social forms and modes of collective action. As recent efforts to reframe the proposed forest bill indicate, this perspective extends beyond forests to demand



accurately be called community forest protection, because the forest department plays only a marginal role, and villagers make their own rules about access and control. By contrast, in West Bengal the process has had much more direct forest department involvement, ever since forest officer A K Banerjee's experimental scheme in the Arabari Hills in the early '70s. The degree of 'jointness' in JFM is, thus, variable.

More significant than these variations, however, are the differences in views on what constitutes JFM. Different perspectives have different understandings of the causes of

decentralisation of management over the composite total of natural resources.

Some NGOs have used JFM as a way of resolving the tension between the forest department and villagers. For example, in a village in the Visakhapatnam district in Andhra Pradesh (AP), a local NGO, Samata, negotiated a deal whereby villagers agreed to stop *podu* (shifting cultivation) on gradient land and work on forest department plantations. In return, they retained their encroachment on level forest land. Similarly, in Netrang, the Gujarat government order on JFM came as a confirmation of what was already *de facto* occurring, that is, the reforestation

of degraded reserve forest land, with funds provided by the Aga Khan Rural Support Programme.

Those villagers who have long been alienated from control over local forests, yet remain highly dependent on them, are perhaps most interested in the immediate economic potential of a joint management strategy. Again, the motivation for protection varies depending on the specificities of site and culture, and within villages, the interests of rich and poor. For women, JFM may simply mean the forest area being policed by men of their own villages, rather than the forest department, or being forced to go much further distances in search of fuel and fodder.

Native ideas

But even prior to the implementation of JFM programmes, scarcity of fodder and fuel-wood had already led people to form committees on their own and patrol their forests, keeping out other users. They may find it ironic that the new policy they are being exhorted to follow is little different from the protection they have been practicing for many years against the indifference or even hostility of the forest department, as for example in Jharkhand, Bihar.

Elsewhere, like in Kangra in the Uttar Pradesh hills and Ulnar in Bastar, Madhya Pradesh, there were forms of local management and joint usufructs initiated by earlier governments. In such cases, current forms of forest protection may be continuations of these older schemes, albeit with breaks in between and further discontinuities introduced by the specific regulations of the JFM programme. Since villagers find themselves in a variety of situations, their vision of JFM is perhaps most influenced by local factors and the practice on the ground, as against the forest department, which could be said to have a somewhat more unified perspective on the issue.

Policy-makers and donor agencies, interested in developing socially and ecologically sustainable management strategies, see JFM as a possible means to achieve global or national objectives, such as contributing to global warming control or biodiversity targets. Simultaneously, it helps them to avoid the opprobrium of being anti-people and opaque in their policy making, accusations which have frequently dogged World Bank (WB) functioning in the past, for instance. In 14 externally aided forestry sector projects, nearly a third of the total outlay of Rs 17,621 million (US \$500 million), is earmarked for developing 'participation'. Thus, JFM generates, among other things, enough material for academics to research, for policy-makers to discuss at national and international conferences, for international consultants to garner fees advising villagers and foresters on what to do, and for trainers to jump into the fray and re-educate forest department staff. Quite apart from the liberal pleasure of cheering from the sidelines while villagers engage in the action, JFM allows a variety of people to feel needed.

As in many multi-faceted government programmes, other interested parties have also got into the act. One notable

example is the chief minister of AP, N Chandrababu Naidu who has attempted to extend JFM beyond merely the areas covered by the WB project. His earlier plan of establishing small protection committees of unemployed youth with ownership rights to particular patches and thus solve the unemployment problem was seen off only with difficulty by a forest department severely jittered by such blatant populism.

In a recent speech at the Workshop on Institutional Reforms in the Forestry Sector in Agra, a representative of the paper mill industry claimed that as the only party with sufficient resources to reforest several million ha of degraded land, they should be given captive plantations. NGOs and others argued in turn that this would deprive the rural poor of crucial common property resources and that industry would end up seizing good forest land as degraded lands would prove unviable. It would also mean that villagers would be subsidising industries through their protection efforts. A proposal by a former minister of environment and forests (MEF) to hand over degraded land to cooperatives for greening is somewhat more in tune with JFM as a policy objective but the speed with which it was followed by the idea of appointing a single *Van Adhikari* (forest administrator) puts in severe doubt the extent to which the MEF has internalised the participatory ethic.

Given the rapid pace at which new proposals are advanced and overturned, the basic point is that JFM is as yet not strongly entrenched in the national political programme. Quite apart from its several internal weaknesses, it is still susceptible to periodic threats from a variety of external factors, including sweeping political programmes, government legislation and industrial or development projects being set up near protected patches (for example, the Khinda coal fields as well as six thermal power projects in one of the most densely protected areas in Sambalpur, Orissa).

The differences in perspective between forest departments, NGOs and villagers regarding JFM and its goals is not merely an academic question, but is reflected materially in legal arrangements. If the goal is merely reforestation, then the forest department's emphasis on handing over degraded lands makes some sense. Villagers are then reduced to wage labour, as on any government scheme, with a few added incentives like development works thrown in. But if peoples' participation is seen as necessary for sustainability of the forest, then confining oneself to degraded land is ultimately limiting in the long run. There is no incentive to protect a good forest, and villagers, moreover, conversely acquire an interest in degrading good forest. What is needed perhaps at this stage of the programme is some recognition of this diversity of aims, and a negotiation of priorities. For JFM to mean all things to all people, it must at least mean the same thing to most people. Without even this basic agreement, the programme is bound to run into serious difficulties. ■

Nandini Sundar is a research fellow at Edinburgh University and coordinator of the Edinburgh University Research Project on JFM in India in collaboration with Indian Council of Forestry Research and Education, Dehra Dun

***JFM is still
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Uncertain future

If use of pesticides cannot be banned altogether and at once then, at least, some measures can keep them fenced out

DONELLA H MEADOWS

"HAVE you ever known a pesticide to kill anyone?" a neighbour asked me the other day. She is a good farmer. She uses pesticides lightly, only when she really needs them. I pick apples at her place, because on my own, where I use no pesticides, I do fine with every crop except apples. "No," I said, "other than deliberate misuse or accidents like Bhopal, I do not think pesticides kill people, not directly, not often." My concern has been ecological. I don't believe in poisoning all the creatures in the countryside just to eliminate one small pest, especially if I have invited that pest by planting large expanses of its favourite food.

Recently, however, I have read John Wargo's new book, *Our Children's Toxic Legacy* (Yale University Press, 1996), so now I am also worried about what pesticides may be doing to people. Wargo's book says that of the 325 pesticides that are legally allowed to remain as residues in food, one-third are suspected of causing cancer. One-third are known to disrupt the nervous system. A whole new bunch is coming under investigation for disrupting hormonal signals that guide the development of foetuses, the growth of children and the ability to reproduce.

Nearly 100 pesticides are legally allowed (in tiny quantities) in milk, which makes up 21 per cent of a toddler's diet. A child may encounter 13 different insecticides and fungicides on apples, 26 on grapes, 20 on oranges. Ten per cent of tested community water sources and four per cent of rural wells contain pesticide residues. Children are especially at risk, because they are more sensitive than adults to harmful chemicals. Wargo, a professor of environmental policy at Yale University, Connecticut, and a scientific advisor to the 'Kids Committee' (the National Academy of Sciences Committee on Pesticides in the Diets of Infants and Children), says that when government licenses pesticides, it is conducting a massive experiment on us and on our children. His book makes a convincing case that *no one knows* what our actual exposure to pesticides is or how these chemicals, either individually or in combination, affect us. So how can anyone responsibly assure us that they are safe?

Forewarned

Wargo is not a zealot like me, who would stop using pesticides. What he would like to see is a lot more public information about the risks we are being exposed to and a lot more democratic discussion about whether those risks are justified. He takes his research seriously and personally because of his

own two children, Adam and Kate. Here are some of the steps Wargo takes to protect his own family and would recommend to everyone to minimise the risk of pesticide exposure.

- Try to buy organic fruits and vegetables from a grower you know and trust. If that is not possible, ask your supermarket to carry organic foods. If it already does, ask how those foods are certified pesticide-free.
- Wash non-organic fruits and vegetables before using and peel off wax coverings (which can trap pesticides).
- Grow your own fruits and vegetables — especially if you have children. Discover, as millions of backyard gardeners have, that gardens are fun and educational, and you don't need chemicals to produce great crops (except maybe apples).
- Avoid using pesticides in your home — instead, check screening, keep floors, counters and cabinets clean, wash off house-plants outside, and try non-poisonous repellents (like citrus juice or borax).
- Reconsider lawn chemicals. It is not worth endangering your family's health to have a perfect lawn. If you walk across a lawn that has been sprayed, remove your shoes before going indoors.

● Check with your child's school or day-care centre to find out whether pesticides are used there. If they are, ask if it is necessary. Ask if there have been tests for residues and ask to be notified in advance any time there is an application.

● If you have a private well and anyone around you uses pesticides, have your drinking water tested. If you use public water, ask to see the results of testing. If there is a problem, install a filtration system.

● If your children swim in a public pool, check to see whether algicides are used in the water.

● If you are exposed to pesticides at work, change clothes before going home and do not wash those clothes along with other clothing.

- If there are plans to spray power-lines, forests, lakes or recreation areas near you, check it out.

Take these steps with special care if you are pregnant or have very young children. If all this sounds like a lot of work, it is the price of a political philosophy that distrusts government, treasures freedom and lets citizens fend for themselves. This is what fending for yourself looks like. If you don't like it, if you think freedom might perhaps include freedom from risk caused by other peoples' use of toxic chemicals, sound off. Ask questions. Demand answers. ■



VISHWAWOTI

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

"Many want to gain from India's experience"

While India's rule-of-the-fist wildlife conservation programmes focus on protection, UNESCO's Man and Biosphere Programme seeks to lay emphasis on the people. MIGUEL CLUSENER-GODT of the Programme spoke to ANJU SHARMA about the international network of countries which house biosphere reserves and the possible advantages India could derive from joining it

On the difference between a biosphere reserve and protected area in India:

A biosphere reserve is a concept that prioritises the human being. Protected areas or national parks simply concentrate on the conservation aspect and comprise of two parts: a core and a buffer zone. A biosphere reserve, on the other hand, contains three parts. The core zone — which is usually protected by state law — can be a national park, ecological reserve or a sanctuary. Around this is a buffer zone where activities that would not harm the surroundings are allowed. The largest area is the one around the buffer zone and is called the transitional or the developmental part. The emphasis is on including people in the activities of the reserve and giving them the message that the core area of the biosphere reserve is really their's and not the government's or the UNESCO's (the United Nations Educational, Scientific and Cultural Organization).

On how the UNESCO ensures that the views of the people are taken into consideration:

The Seville Strategy — adopted last year at an international meeting in Seville, Spain, to lay down guidelines for the formation and administration of biosphere reserves — states that decisions should be taken in consultation with the local people because they are the benefactors.

On the management procedures laid down for biosphere reserves:

The procedures depend on the country. We at the UNESCO can suggest the international framework on how the procedures should work but a biosphere reserve is clearly always a national exercise. However, our rules require that there be some sort of an administrative structure operating in a biosphere reserve. Whichever be the country, the first thing normally done is to remove it from under the jurisdiction of the forestry department and cancel national park authorisation. We encourage the management committee to include people from diverse disciplines including biologists, social scientists and even lawyers, as formation and management of a biosphere reserve could involve property rights. One should avoid the exclusion of the people to the greatest possible extent as they have



been part of the reserve area for hundreds of years. Local politicians, who happen to be the people's representatives, should of course be included.

On an example of how a biosphere reserve has managed to include the people:

The UNESCO is involved with a biosphere reserve in Madagascar whose total population is around 60-70,000. The reserve has two parks: a terrestrial park with tropical rainforests and a marine park with islands. Before the activities of the biosphere reserve began in 1987, the tropical rainforests were under severe threat. Initially, we went about drawing a plan and mapping and studying the resources and the causes of their destruction. We wanted to understand why the people were adopting the slash and burn technique to cultivate rice. Now, the forests are no longer destroyed. People sometimes go into the core to look for wood which I think is not so dangerous. The important thing is that the people know it to be a biosphere reserve and accept it the way it is.

On how the people have been provided with an alternative:

The development area of a reserve deals with improving agriculture. For instance, we have avoided the use of fertilisers in Madagascar. If a project that is initiated cannot be followed by the people later, it is useless.

Rice production in this country was not very high. The people were taught how to improve production by planting rice in rows (and not throwing the seed), by setting up nurseries and building dams (irrigation dams and not big dams). The project turned out to be a great success because the production of rice multiplied two-fold, sometimes even three-fold. Thereafter, we established tree nurseries to produce firewood. There has been an increase in awareness and this is very important. The forest is sometimes perceived as an enemy in Madagascar. The people are hesitant to go deep into forests for fear of spirits. We held a major environment awareness campaign to show that the forest was not an enemy but a friend which could be used in a practical way. A veterinary and a health programme was also conducted.

Many of the requirements listed out by him are already being met in the protected areas in India, particularly by the ecodevelopment programmes which claim to consult the people. But in reality, the government thrusts on the people what it thinks is right for them. On how the UNESCO Programme can help a country like India:

Although the idea of a biosphere reserve is already more than 20 years old, we are still learning. We seek to improve the system and are increasingly moving away from conservation-oriented goals and more towards the people. This is a good time for India to adopt it. The ecodevelopment system has not solved the problem. In fact, the problem cannot be expected to get solved in 20 years. One is constantly working on the system and trying to improve it. In my opinion, one of ways to participate in this network is to continue working on it. If there were a conflict between the local people and the government, it would help to include more actors in the process to make recommendations. These could be NGOs or anybody else who is unrelated to both parties. But this is up to the government and depends on what a country is looking for while constituting a biosphere reserve.

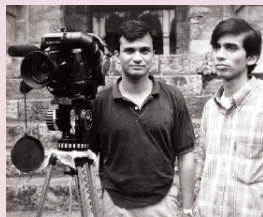
The benefit a country like India could derive is that when you participate in an international network, you are party to a great deal of combined work. You can share your experiences with other countries. Many look forward to gaining from the Indian experience because India is a big country. India probably has a lot to give and take, especially with the other two biggies in the world, Brazil and China. Such networks also help countries build their capacities. They can derive the benefits of technology transfers and funding facilities. ■

SPOTLIGHT

Making a green mark

Receiving a Wildscreen Panda award is perhaps much more than music to the ears of a team that started off in 1988 by making ad jingles. Eight years later, Nikhil and Niret Alva have bagged what is more popularly known as the green Oscar for the series their company, Miditech TV, has been producing: *Living on the Edge*.

A prime-time environmental serial beamed on Doordarshan, *Living on the Edge* is an attempt to present the flip side of development. The brothers intended it to be a coherent and straightforward approach to the subject rather than a



purely emotional one. The honour — bestowed on a young team whose average age is 25 years — is the highest recognition any environmental film or series can receive.

Says Niret, "The series has changed the lives of everyone making it, be it about leaving the lights on or smoking."

Being the sons of Margaret Alva, MP, may not exactly have opened doors for them and the years ahead, in their opinion would find the numerous TV companies around packing up unless they create niches for themselves. A green niche and the Panda award would certainly stand Miditech in good stead.

REVIEWS

BOOK

Changing course

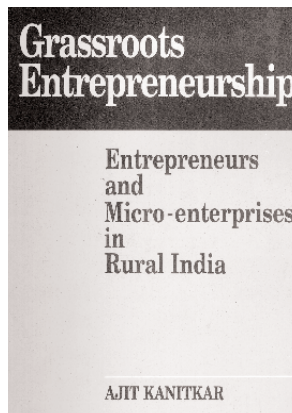
GRASSROOTS ENTREPRENEURSHIP
Ajit Kanitkar•Wiley Eastern
Limited•Delhi•1995

ARINDOM MOOKERJEE

THE accelerating growth rate of the rural non-farm sector (NFS) and its rising significance has necessitated the examination of the actors constituting it. Ajit Kanitkar makes a bold attempt at understanding the emergence and sustenance of rural entrepreneurship.

The importance of promoting non-agricultural economic activities, prompted the government to establish the National Bank for Agricultural and Rural Development, a funding agency encouraging rural enterprises. But, many income-generating schemes targetted at the rural poor have failed miserably. According to Kanitkar, for the promotion of the NFS and the entrepreneurs, one must understand the socio-economic background of the entrepreneurs well and study the factors facilitating and hindering their entry into the NFS. It is also important to study the choice of business and their management.

Field studies have revealed that it is more often than not an involuntary decision on the part of the entrepreneurs to enter the NFS. They are pushed into being their own masters due to the increasing pressure on land, the need to support large families, dwindling agricultural incomes and the burden of discharging family responsibilities. These were factors common to the backgrounds of 86 entrepreneurs



studied. The study also indicates a shift from the occupation pursued by the parents and the family of the entrepreneurs.

Launching a business on their own was typically based on 'unguided apprenticeship', where working and learning depended entirely on the individual. Many entrepreneurs evaluated the appropriateness of a particular opportunity. The factors which influenced the choice of business were the social, political and economic environment of the particular village, its geographical location and proximity to cities, and the area of its influence.

But, the management of these micro-enterprises faces a serious problem of debt recovery. This happens because they offer their customers generous credit at the beginning of the venture. The problem severely erodes the liquidity of these establishments and gives rise to recurrent shortages of working capital. Besides, as most of the businesses are service industries, their success prompts many more to enter the field, leading to greater competition. In extreme situations, the non-

fulfilment of promises and the lowering of profit threatens the very existence of the businesses.

Kanitkar aptly suggests that the solution to these problems may lie in 'guided apprenticeship', something that it is extended by institutes like the Industrial Training Institute. He also urges a restructuring of the manner in which financial institutes at the village level operate, as most entrepreneurs face the problem of obtaining credit from them. According to Kanitkar, there should also be consultants/counsellors to whom the small units could turn to for advice. ■

BOOK

Private and public poverty

POVERTY: A GLOBAL REVIEW
(HANDBOOK ON INTERNATIONAL
POVERTY RESEARCH)•Edited
by Else Oyen, S M Miller
and Syed Abdus Samad•
Scandinavian University
Press•1996

KISHORE JETHANANDANI

THE post-war consensus on poverty alleviation was shattered by a truculent critique



of the welfare state from the combative conservative right in US in the early '80s. Apart from the rising costs of welfare which impoverished the treasuries of governments, the liberal left had also to stomach the fact that the notion of equity had remained an illusion. The prodigious growth achieved by the countries of east Asia and the concurrent decline in poverty in these countries is clinching evidence against the equity-oriented economic policy of the developing countries.

The question is whether poverty alleviation should be left to the state or private charity be encouraged? In future, public policy will probably have to look for methods appropriate for specific segments of the population, instead of a single prescription for the entire country. The book under review misses on piecing together innovative ideas in poverty alleviation drawn from a variety of contexts. All the contributors have briefly reviewed the sources of information on poverty, the measures used for estimating it, trends in poverty, its determinants and public policy on poverty alleviation in each country. The result is a bland global review that reads more like a source book than a comparative view of public policy questions.

Strangely, the book entirely ignores the role played by private foundations and charity organisations in the removal of poverty. This is odd in a context where the role of the state is declining or complements the efforts of the private sector. International comparisons of the achievements and limitations of the state and the private sector would have been more relevant. ■

BOOK Of green and greenbacks

TRADING UP: CONSUMER AND ENVIRONMENTAL REGULATION IN A GLOBAL ECONOMY • David Vogel • Harvard University Press • 1995

ABHIJIT MUKHOPADHAYAY

CONSUMER protection and environmental regulations are quite an important part of the economic agenda of developed countries today. It is the pressure created by activists, environmental groups and various non-government organisations

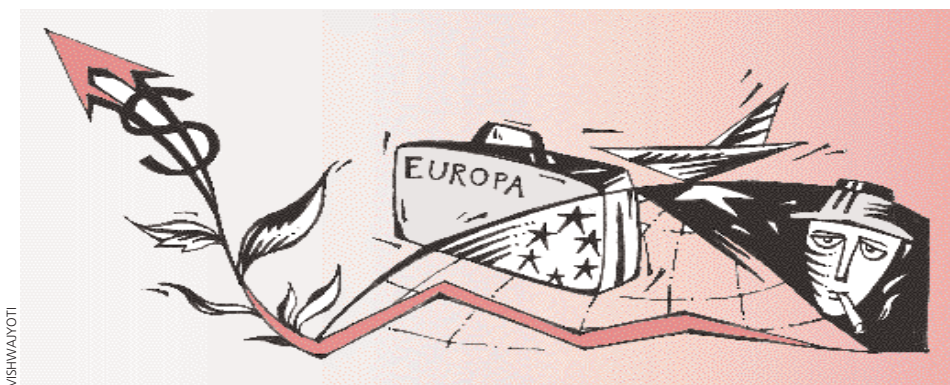
author calls the former phenomenon the "Delaware effect", the latter is called the "California effect". The former is associated with "baptists" and the latter is linked with "bootleggers". The environment would benefit if the actions of the two were to be unidirectional, even though they may be backed by different motives. As the author points out, "An important reason for the lack of success of anti-cigarette lobbies in the US was that no domestic industry stood to benefit by discouraging exports of this product: there were baptists but no bootleggers."

Judged from the point of

Trades (GATT), the EU has the authority to centralise decision."

But, as the author appropriately rationalises, the political colour of the issue cannot be missed: "Were the EU's richest and most powerful nations not also among its greenest, it is highly unlikely that the organisation's commitment to economic integration would have resulted in a steadily upward trend in environmental standards. Indeed, it might well have relaxed them."

The book should be praised for its comprehensiveness with respect to the chronological details given



that has brought about this shift. But in this age of free market economy and trade liberalisation, the dialectical relationship between free trade and consumer and environmental protection has become a highly contentious issue all over the world.

Confrontation emerges from the fact that regulations hamper the process of free trade. Although this may be true, protection or regulation does not always slow down the process of free trade. This is because the economic strength of the 'greener' nations, helps in the improvement of the regulation standard in other countries without deceleration in free trade. While the

view of performance, the European Union (EU) seems to have been the most successful in harmonising regulatory standards and free trade. "The EU has become a vehicle for exporting the environmental standard of Europe's greener nations to the rest of the continent." The key to the EU's ability to accomplish this lies in the degree of authority it has been able to exercise over both the trade and regulatory policies of its member states. "The removal of non-tariff barriers and the maintenance or the strengthening of health and safety regulations requires a strong international authority. Unlike the General Agreement on Tariffs and

and the explanations inserted at the right places. But, as a political scientist, Vogel could have made 'politics' his rallying point. He has analysed the politics of protectionism, but too much emphasis on details has made the book history-oriented. The book is rather well organised, but it would have been better if the case-studies had been approached from a more general, macro level, following which all the threads had could have been interwoven rather than having been separately taken up. But, it is all the same a well-researched, praiseworthy and pioneering effort that would be of use to a student of the environment. ■

Dead... naturally!

In the last two decades, the number of persons affected by disasters increased at the rate of six per cent per year, which corresponds to three times the annual population growth. There were nearly 600 natural catastrophes in 1995 which claimed about 20,000 lives, displaced millions and resulted in total financial losses of around US \$180 billion (the figures for 1994 were 580 disasters, 10,000 deaths and loss of \$65 billion). Out of the \$180 billion, the Kobe earthquake alone caused a loss of US \$96 billion. At the beginning of the century, less than one in three large earthquakes caused casualties. This number has gradually risen throughout this century, and in the '90s, two earthquakes in every three have been killers. With rapid growth of urban areas, it becomes necessary to ensure that urban communities suffer the least from the avoidable and unavoidable disasters that will strike them in the future. Although some areas are more vulnerable, no region on earth is hundred per cent safe from the threat of a sudden natural disaster. More attention is, therefore, needed for long-term planning to mitigate disasters.

Temblor trauma

Of all natural disasters in 1995, the Kobe quake was the biggest killer

EARTHQUAKES IN 1995			
Place	Magnitude*	Date	Dead
Japan	7.2	January	5,502
Colombia	6.5	February	34
Colombia	5.1	March	8
Russian Fed	7.5	May	1,825
Greece	6.1	June	26
Chile	7.8	July	3
China	6.4	October	20
Turkey	6.1	October	101
Indonesia	7	October	84
Mexico	6.8	October	40

*On the Richter scale

Gone with the wind

The year 1995 was the second worst hurricane season ever recorded

CYCLONES/HURRICANES/TYPHOONS IN 1995			
Place	Disaster	Date	Dead
Bahamas	Hurricane Erin	August	0
Cuba	Hurricane Erin	August	0
Caribbean	Hurricane Luis	September	5
Caribbean	Hurricane Marilyn	September	0
Philippines	Storm Sybil	October	35
Philippines	Tropical Storm Zack	October	88
Philippines	Typhoon Angela +floods	October	722
Philippines	Typhoon Zack	November	253
Bangladesh	Cyclone	November	0
Bangladesh	Cyclone	November	0

Watery graves

Among all the natural disasters, floods by far take the largest number of human lives

FLOODS/LANDSLIDES IN 1995				FLOODS/LANDSLIDES IN 1995			
Place	Disaster	Date	Dead	Place	Disaster	Date	Dead
India	Avalanches	January	63	Pakistan	Monsoon rains	July	451
Botswana	Floods	March	20	Morocco	Floods	August	230
Afghanistan	Landslides	March	350	Korea North	Floods	August	70
Bangladesh	Storms	April	119	Korea South	Floods	August	36
Indonesia	Floods	May	51	Philippines	Floods	September	48
Ethiopia	Floods	May	27	Myanmar	Floods	September	51
Bangladesh	Floods	June	66	Vietnam	Floods	September	85
Nepal	Landslides	June	85	Thailand	Floods	October	231
China	Floods	July	1,179	Turkey	Floods	November	62
Ghana	Floods	July	40	South Africa	Floods	December	161

Source: Retrospective DHA 1995

SEA-LEVEL RISE
POLAR MELTDOWN
GLACIER RETREAT
MORE DROUGHTS
DEVASTATING FLOODS
TERRIFYING STORMS
HEAT WAVES
MORE MALARIA
CROP LOSS
DISTRESS MIGRATION
SPECIES EXTINCTION

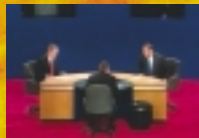
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