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GLOBAL
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1

g P O L I T I C S r e e n

EDITED BY
ANIL AGARWAL, SUNITA NARAIN & ANJU SHARMA
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Science versus nature

For the past two years, I have been following the articles in *Down To Earth*. I was particularly interested in the article about TELCO misinterpreting the World Health Organization guidelines (*Down To Earth*, Vol 8, No 12; November 15).

However, I feel that the debate and concern about the safety standards and emission control somehow misses the point that the present paradigm of science is built on the quest and exploitation of nature, rather than coexistence. Therefore, science necessarily takes a stance against nature. Thus, standards, thresholds and legislations are mere safety valves that only help to anaesthetise and distract the population from this fundamental problem. To quote Claude Alvares, "The scientific method itself has become not only anti-rational, it has become culturally and socially oppressive and generally anti-life." It is ironic that in the same issue you pointed out that many countries are destroying dams to save the salmon. If one can destroy dams to save the salmon, cannot one also recognise the danger posed by such technology on humans? Or must humans come close to extinction before the scientific community and society at large take notice?

The need of the hour is to infuse science and scientific methods with the values of life, history and culture.

RAKHAL GAITONDE
Bangalore

Going bananas

The article 'Fruits of science' (*Down To Earth*, Vol 8, No 13; November 30) made interesting reading. It also raises the important question of whether it is right to interfere with nature under the umbrella of scientific research. To delay the ripening process of a banana is one thing, but the safety aspect is an important one. It is stated that colour and taste may differ in the fruits of transgenic crops. Moreover, trying to improve the shelf life should not lead to some other problem. It is better to go slow on such research and not introduce transgenic food crops for mass cultivation without years of field trials.

D B N MURTY
Bangalore

Powered to pollute

This is with reference to the article 'Power to pollute' (*Down To Earth*, Vol 8, No 8; September 15), which talks about pollution from 1,000 megawatt (mw) thermal plants. According to an estimate, "the annual environment impact of landuse for a 1,000 mw coal-fired plant is 3,680 hectares (ha) if the coal is deep mined and 5,650 ha if it is surface mined. Besides, 65 ha is required for processing; 895 ha for transport and 390 ha for ash storage and five ha for coal storage."

"In addition, this generation unit annually produce 99,109 cubic metres of ash, 0.35 million tonnes of sulphur dioxide and 4.8 million tonnes of carbon dioxide." One can imagine the pollution when, plants with a larger capacity of more than 10-12,000 mw are set up.

LAXMI NARIAN MODI
New Delhi

Nilgiris under threat

Grasslands and the sholas, the twin eco-system of the Nilgiri hills, are a major source for many perennial streams and rivers. But today this whole ecosystem is under threat from film crews who come to shoot for Bollywood films.

A team of environmentalists

who visited the sites where the film shootings usually take place observed that constructing huge sets was spoiling the topsoil and is denuding the grasslands. Powerful lights and the sound of generators disturb animal movement. Compounding the problem is the use of large amounts of urea on the grasslands for a "greener" landscape. Excess use of urea is contaminating the reservoirs.

It is interesting to note that the indigenous people of the Nilgiris, the Todas, support the film crews as they provide them a source of livelihood, even if it means that their habitat is getting degraded. The government must take measures to stop this destruction and ban film shootings in this sensitive environment.

S JAYCHANDRAN
Coimbatore district,
Tamil Nadu

Yeoman service

I am amazed by the information put in every issue of *Down To Earth*. The Centre for Science and Environment is doing a great service by informing us of our cultural heritage that relates to the environment. I am particularly impressed by *Gobar Times*, as it is directed towards children and shapes their attitudes towards the environment.

CHARU UPPAL
Received on email

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Down To Earth welcomes contributions from readers. You can send your contributions to Anil Agarwal, Editor, *Down To Earth*, 41, Tughlakabad Institutional Area, New Delhi - 110 062.

Facts and figures

With reference to the article 'Strangers in their own land' (*Down To Earth*, Vol 8, No 13). Certain information about the Great Himalayan National Park (GNHP) is not true. This park is one of the few national parks where the tribals and the local people share an amicable relationship. Moreover, the park receives aid from the World Bank for conservation and development of ecotourism that would provide employment to the local people. Further, the morale of forest officials is the highest in India and the department has conducted trips to Nepal to observe resettlement processes that can be undertaken in similar situations. This has been done to give the local people a feel of the way resettlement can be done. India's only bird collaring programme is in process in the park and this has been possible only due to the encouragement of forest officials. Further, at Sairopa (near Banjar) the forest department has a nursery that houses herbs and tree species that are found in the park.

There is also a rare collection of endangered butterflies at Sairopa. This proves that studies are conducted on a regular basis in the park. I suggest that negative reporting on the park must end. We must strengthen the hands of the forest people of this park since they are the ones who are preserving the flora and fauna of this unique ecosystem.

ADITYA MANN
Chandigarh

I have serious objections to the article 'Strangers in their own land'. The article quotes me as saying that: "They will have to give up pastures, sell off their livestock or eat them." This is untrue. I never said anything to this effect.

Moreover, the author has incorrectly said migratory shepherds have been left high and dry after the final notification of the park. In fact, the compensation package has clearly made provisions of Rs 1.5 crore for settling of rights and Rs 7.5 crore (approx) for developing pastures, for-

est lands and areas for medicinal plants in the coming five years. More than half of the compensation money has reached the affected people living in the buffer zone (eco-zone) of GNHP. The article also glorifies the role of SAVE, a non-governmental organisation (NGO) and paints park officials as villains. SAVE was selected to collaborate with the park management on certain issues. The author has wrongly stated that till July 1999 park officials did not inform the affected people about the resettlement plan. The plan follows the rules laid down in the Wildlife Protection Act. The district administration and the GNHP management has directly collected information regard-



ing the settlement of rights from all villages coming under the resettlement plan and villagers were informed about it. The author also claims to have interviewed a forest guard named Tula Ram. However, there is no such person is employed with us.

In our country, we do not have many good examples of collaboration between NGO and park management. At GNHP we are trying to do so and balanced reporting will be appreciated.

SANJEEVA PANDEY
Director,
Kullu, Himachal Pradesh

Alka Sabharwal replies:

The popular belief that the local people were not displaced in the GNHP is wrong. They were involuntary displaced and their traditional rights have been curtailed. I discussed the issues written in the article with Sanjeeva Pandey, albeit informally. The article nowhere mentions that there was any formal interview. The monetary compensation cannot solve the problems that local grazers face after they lost their pastures. Since the customary rights over pastures are not recorded, therefore they are not compensated with other pastures that will accommodate 35,000 animals.

Moreover, I feel, letting people know about the notification is not enough. More importantly, the affected people should know the reasons of such an act. They have been unfairly asked to change their traditional ways of livelihood for a government package that wrongly claims to have been prepared by the people. The lack of local participation while preparing microplans is evident during visits to these villages and listening to the people staying there.

During my investigations, I found that the local people, especially the grazers are not prepared to leave their traditional occupation in the absence of viable alternatives. The GNHP authorities have been trying to convince people for the last four years and till now do not have anything to assure the people of a good future.

Moreover, the details of the notification were not made public till July and this information was provided to me by SAVE.

I did meet Tula Ram. He introduced himself as a forest guard near Sairopa. Since, it is difficult to check someone's identity, I relied on the information provided by the man. It is strange to know that Pandey is more interested in identifying the forest guard rather than the issues taken up in the article like: severe disinterest to carry forward the eco-development project of the GNHP.

Conspiracy to kill

This surely cannot be the India of our dreams. Dirty, filthy and deadly. And insane



THE total lack of interest and foresight that the Atal Bihari Vajpayee government is showing while dealing with the country's growing pollution is down-

right appalling, to say the least. An excellent indicator of this came recently when the government reconstituted the council on trade and industry to set up eight working groups ranging from good governance to education and health with the full participation of India's industrial leaders. But there was not one group that dealt with industrial growth and environmental pollution, almost as if this issue does not figure on the Vajpayee government's political agenda.

All over the world, experience has shown pollution rises extremely rapidly with industrial growth. A study carried out by the World Bank showed that when the Thai economy doubled during the 1980s, the total quantity of poisonous pollutants released went up ten times. The Centre for Science and Environment found that during the period 1975-1995 during which the Indian economy grew

by about 2.5 times, the total quantity of pollutants increased by eight times. Not surprisingly, almost every Indian town and city is choking because of vehicular pollution today.

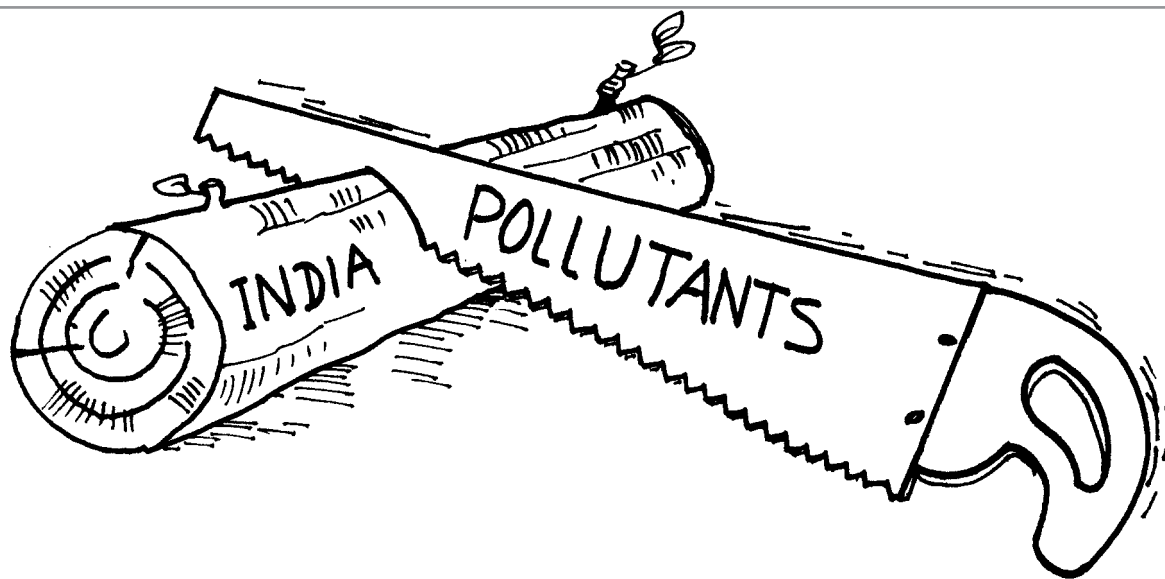
Most people tend to think that Delhi is one of the most polluted cities in the world. The high levels of deadly particles in Delhi's air probably make it the worst in the world. Mexico City looks like a kitten in front of Delhi. All this is relatively well known because the World Health Organization monitors air pollution in some 20 metropolises of the world and Delhi indeed comes out pretty bad in this sample of cities. The Indian media has also publicised this fact.

But what is not well known is that when Delhi's air pollution is compared with the air pollution in other Indian cities, this capitol polluted city appears quite clean. The Central Pollution Control Board has just released data on air pollution levels recorded in 90 cities in 1997. This data shows that Shillong is the only town that has clean air round the year. The Prime Minister's own constituency, Lucknow, suffers from pollution that is worse than Delhi.

Should all this be surprising? Not at all. Within just 15 years of what econo-

mists call the post-Second World War economic boom (1945-1960), a period during which the Western world created unprecedented material wealth, literally every Western city from Tokyo to London and Los Angeles began to gasp for clean air and every Western river from the Rhine to the Thames had become a sewer, much like our Yamuna. And Japan was reeling under unknown and crippling neurological disorders like the frightening Minamata disease. The same is happening in India today and, in fact, all across Asia.

The growing pollution in the West led to a powerful environmental movement that then forced Western politicians to take the matter seriously. They did two things. During the 1970s and 1980s, these countries poured in enormous sums of money to control pollution. According to one estimate, nearly 25 per cent of the industrial investment in Japan in the post-70s period went towards pollution control. And the governments strictly enforced their pollution control laws. As a result, the air and water had become a lot cleaner by the late 1980s and early 1990s, that is, in a period of about 20 years or one generation. The battle is, however, still not won. The



West still has to find ways to deal with carbon dioxide pollution of the atmosphere, disposal of hazardous industrial waste (which often gets shipped to developing countries), growing groundwater pollution and disruption of the nitrogen cycle because of largescale use of fertilisers and manure, among a number of other vexing problems.

The question that we need to ask ourselves is whether we will be able to see a turnaround in India in the next 20 years? It is extremely doubtful that this will be the case. India's economy is just beginning to grow. Industrial development, agricultural modernisation and urbanisation — all of which pump poison into the environment — are still at a nascent stage. We still have a long way to go. Therefore, we can see enormous quantities of poisons being produced in the decades to come. And on top of all this, at the turn of the century, India does not have the wherewithal to emulate the West of the 1970s. Firstly, India's current per capita income is still not even a fraction of Western per capita incomes of the 1970s. As a result, India will remain heavily constrained in investing in high quality, environmentally-sound technology. India will continue to use low quality, highly-polluting technologies for a long time.

Secondly, India's regulatory system is highly corrupt and incompetent in dealing with the new challenges arising out of pollution. And, finally, there is as yet no powerful popular movement against pollution, which can translate into votes and put the fear of God into our politicians.

What we, therefore, see is absolute mayhem in the years to come. What took the West one generation to control could take our already heavily polluted India as much as two to three generations to control, in other words, some 40-50 years.

What does all this mean for the Indian economy and Indian industrialists? The answer is 'Simply nothing'. Pollution will hardly have any effect on Indian industry and the Indian economy. They will continue to grow. But what will this mean for Indians - the country's common people who can least afford to deal with diseases like cancer, neurological disorders and so on when they still find it difficult to deal with malaria and diarrhoea? For them, it will mean a lot - in terms of an appalling quality of life

and premature death. Already some one million people die every year because of polluted water and some hundred thousand due to air pollution.

In other words, more than one million a year die unnecessarily because the government cannot ensure clean air and water. And in the years to come this number will rise further, unless strong steps are taken to start controlling pollution right away. If the turnaround takes two to three generations instead of one, we are talking of more than 50 million fatalities at the least because of the government's incompetence and political apathy.

In a nation where the population has already reached one billion and is still growing, one can even be cynical and say that 50 million deaths is hardly a big price to pay for economic development. The Vajpayee government appears to be giving us precisely this message with its inability to factor in

from happening.

A fine example of this kind of behaviour by industry was brought to the knowledge of the public when industry rushed in head over heels to meet EURO I vehicular pollution standards (imposed in Europe in 1992). All this was a result of the April 1999 Supreme Court order that made it mandatory to impose these standards in less than three months and EURO II standards in less than a year. Till then, all companies, Indian and foreign, from Maruti to Mercedes, had been merrily selling outdated technology because government regulations in India imposed EURO I standards from 2000 and EURO II standards from 2005. Even a joint sector company like Maruti was found way behind the times although it was exporting EURO II cars to Europe to meet standards imposed there.

Now in 2000, Indian companies like Maruti and foreign companies like

More than a million people die every year because the government cannot ensure clean air and water. In the years to come, this number will rise further, unless strong steps are taken to start controlling pollution right away

environmental concerns into its industrial development policy.

Yet all this mayhem can be prevented but only if the government develops some foresight on the issue and sets up an effective regulatory framework which gives industry the right incentives and signals to be environment-friendly. The work done by the Centre for Science and Environment, under its Right to Clean Air Campaign, has repeatedly shown that India's industrial leaders do not recognise that pollution is a serious problem. They also definitely do not want to take any proactive steps to control it in the absence of an effective regulatory framework. Industry's argument is that in a competitive environment no company will invest in more expensive environment-friendly technologies and competition will inevitably force it to the lowest common denominator unless government rules and regulations prevent that

Toyota and Ford will be selling EURO III compliant vehicles in Europe. But none of them will care to introduce these in India because they are not expected to do so under government regulations. Thus, Europe will get squeaky clean technology even though its skies are clean and India will continue to get outdated technology even though its skies are a deadly grey.

All this can begin to change rapidly. Just like changes brought about by the Supreme Court order, but only if the government decides that this is a task that it wants to undertake. If not, we should be prepared for a living hell. Our current crop of politicians, given their age, will disappear in the next 10 to 20 years, but they will leave behind an absolutely unliveable legacy for our children. They will find it hard to believe that India had such callous 'leaders'. ■

— Anil Agarwal

An open letter to the Prime Minister

Dear Prime Minister,



This is a year of severe drought in Gujarat and western Madhya Pradesh — an area that is well known for natural disasters of this kind. During the last general elections, your home minister, fighting for a fresh term from this region, had to face evocative slogans like “*Pehle Paani, Phir Advani*”. Sadly, he had no answers.

You have been quite vocal about the importance of water. You had waxed eloquent about the importance of drinking water in Parliament when it had debated the National Democratic Alliance’s (NDA’s) plan of action in 1998. You had pointed out, “Water can also catch fire. The problem of water is going to become even more complicated. The problem of water is not just limited to India. This has become a global problem. It is possible that the next major source of tension in the world will be water, not petrol. The pollution of water is increasing. The quantity of water is getting reduced. The water table is falling. We all see this in our constituencies. We feel disturbed by the problems people are facing. Sangmaji, we are not giving an assurance that we will do everything in five years. Only in the case of water, we would like to give this assurance, that in five years there should be clean drinking water everywhere. And this is our commitment.”

Those were such wonderful words. And we were absolutely thrilled to hear them.

But despite all these pious pronouncements we have not heard anything from your government that makes us feel confident that you can actually deliver your promise. It is not as if efforts have not been made to improve water supply in the past. Neither is the problem one of lack of water from Mother Nature. The problem is the highly bureaucratised state-managed paradigm. Simply throwing more money on the same paradigm will not pay you any dividends except to raise false hopes.

If you want to solve this problem, we strongly suggest you should visit the villages described in this issue of *Down To Earth* as a pilgrim in search of solutions. We are sure this *yatra* will transform you. Just like Digvijay Singh, chief minister of Madhya Pradesh, whose visit to Ralegan Siddhi showed him how he can start transforming the ecological and economic landscape of his state which suffers from enormous land degradation and drought.

For those villagers who have learnt the value of the millennial Indian tradition of managing their own rainwater resources, even this drought has become manageable. Life has remained bearable. The need to flee has gone down. And people feel proud of what they have achieved. There is social and economic stability.

But you will be able to find an answer only if you stop listening to your bureaucracy and start searching for solutions yourself. Decentralisation of water management will mean loss of power. It will also mean a lot of loss of “pocket money”, both for your political colleagues as well as for a lot of bureaucrats. You may be aware that the biggest cuts are made in construction activity. Therefore, you will have to take the lead yourself. And you will have to humbly tell the people of India that neither the vast state that you preside upon nor your political colleagues are capable of delivering water to the people in a sustainable and satisfactory manner. You will have to tell them that it is only they who can manage their water supply. And that all you will or can do is to help the people help themselves.

It was the centralised state of the Western world which first came to believe that it could take on the responsibility of supplying everyone with water. Which was totally different from our own millennia-old tradition. And, not surprisingly, when adopted by us, the paradigm has proved to be a disaster.

You will, therefore, have to promise that you will personally work hard to redefine the role of your water bureaucracy. Their job will no longer be to supply water. But as good public servants, their job will be to serve the people to help them manage their own water resources. And that, in other words, your government will start a people’s movement to manage water. Thus, Making Water Everybody’s Business.

If you do all this, Indians will never be short of water. And you would have delivered your promise.

Anil Agarwal
Editor, Down To Earth

INDIA / DROUGHT

Riots for water

Faced with a severe drought, the Gujarat government decided to reserve water from a dam for the town of Jamnagar. Rural folk of Saurashtra protested. In the ensuing riots, three people died

MANISH TIWARI JAMNAGAR / RAJKOT

HERE is something for those who would not believe that the wars of this century will be fought over water-related issues. Three people died and 20 were injured on December 14 in Falla village, 28 km from Jamnagar town of Gujarat, when the police opened fire on a mob of about 300 people from the neighbouring rural area. The people had gathered to protest against the state government's decision to reserve water from the nearby Kankavati Dam for Jamnagar town — a decision favouring urban people at the cost of rural folk. The dam has become the only source of water for about 60 villages near Falla, and has very little water. This year, the rainfall recorded in this area was 148 millimetres (mm), compared to the annual average of 550 mm. People of the area point out that the groundwater has become saline due to overextraction (see p30: *Standing the test of drought*).

But the most worrying part of the situation in Saurashtra region of the state is that summer is a good four months away, and nobody seems to have a clue as to how the administration will deal with water scarcity when the problem is unmanageable in the winter. Already, 14 villages including Hadiyana, Limbuda and Jodiya are being supplied water from the dam by tankers.

On December 20, more than 15,000 farmers assembled in Falla to condemn the deaths. The meet was called by the Bharatiya Kisan Sangh (BKS), a farmers' association that joined the agitation nine days after people of Falla decided to begin a protest fast on December 2.

The BKS is affiliated to the Bharatiya Janata Party (BJP), which is in power both at the Centre and in the state. The BKS leaders blamed the state government for taking a wrong decision favouring Jamnagar town, while ignoring the villagers' need for drinking water. After the

incident, the state government has reversed its decision and will reserve the water for the villages. "The decision has come only after a great loss to our village. We never knew that we will have to sacrifice three lives to ensure that we get drinking water for the water-scarce villages near the dam," said Veljibhai Dhamsania, vice-president of the Falla gram panchayat (village council), who has been at the forefront of the movement against the government decision.

Reeling under a drought

"After two months, when the water in the dam is finished, even Falla may face a severe water crisis. For the villages here, there is no other source of drinking water for the next six months," said Jethalal R Aghera, president of the Jodiya block panchayat in Jamnagar district. "This year, the demand is not for irrigation water but for drinking water. We know that the water in the dam is not enough to even meet our drinking water needs," said R Kanani, former vice-president of the Falla village council. "We are surviving only by God's grace. If there are no rains next year, we will have to migrate from the village," said Dhamsania.

"Several governments came to power. Several water projects were formulated. But the water scarcity in the region has only been getting worse," said Gokulbhai Patel, president of the district



Kamlesh Raghavjibhai, 21, (above) and Bhavanjibhai Patel, 55, who died in the police firing in Falla village of Jamnagar, Gujarat, on December 14



PHOTOGRAPHS: BHUPAT MARVANIYA

unit of BKS. The people of Falla complain that none of the parties that came to power in the past 20 years have taken the water problem seriously and that the government only talks about bringing water from the Narmada dam project.

While the administration is supplying drinking water by tankers, other uses of water like irrigation have taken a backseat. "Tankers can only supply drinking water. But from where will we get water for cattle and irrigation?" asks a resident of Falla.

A political opportunity

The residents of the area as well as the district administration blame politicians for the unfortunate turn of events. "This conflagration is a result of the conflicts among leaders of the BJP. Parmanand Khattar, the state's urban development minister, was trying to get water for Jamnagar town which he represents. On the other hand, the minister in charge of Jamnagar district, Murubhai Bera, and Chimanbhai Sapadia, the road and building minister (*panchayat* department), have been trying to get the water for the villages," Dhamsania observed.

Those in touch with the politics of the district and the state point out that Khattar had his eyes set on the forthcoming corporate elections, and wanted to get the maximum mileage for his candidates. Sapadia and Bera, on the other hand, had been trying to win the confidence of the rural folk to better the chances of their candidates in the approaching *panchayat* elections for the village, block and district level. People of Falla also blame Narottam Patel, the state's water resources minister, for not taking a timely decision.

"They were consolidating their vote banks, and I lost my son," rued Raghavji Parshottam, 46. His 21-year-old son, Kamlesh Raghavjibhai, was killed in the police firing. Several officials of the Jamnagar district administration also believe that politicians are trying to take advantage of the situation and are hardly bothered about the core issue of water. They agree that the main fight is between BJP politicians who are thinking about the coming *panchayat* elections. "There

are no clear-cut instructions from the government to the district administration about how the issue should be tackled. Unless there is a political will to solve these problems, they will continue. But politicians are hardly concerned," says a senior official, asking not to be named. "I think that in March-April 2000, there will be more water riots in the district and other parts of Saurashtra region," says another official.

But is the district administration without blame? Says Dhamsania: "When we went to the district magis-

Girish Murmu, district magistrate of Jamnagar. The government has ordered an enquiry by a retired judge.

The unrest in Rajkot

A senior district administration official in Rajkot said water scarcity is likely to pose a serious law and order problem. C J Ruparelia, chief engineer of the Gujarat Water Supply and Sewerage Board pointed out that Rajkot town is being supplied drinking water for 20 minutes in two days.

Sudhir Joshi, a Rajkot-based leader of the Congress, said, "Come February-March and water riots are bound to take place across Saurashtra. Right now, the unrest is not so apparent as the BKS (which is at the centre of the struggle in Falla) is affiliated to the BJP. "The people of several villages such as Alamtra, Gauridada, Mitana and Bedi have punctured the pipeline coming from Wankaner to Rajkot," he pointed out. A district administration official confirmed this.

However, Vijay Anadkat, deputy executive engineer, Rajkot municipal corporation, denied these reports, saying that the breaches had to do with technical snags. He pointed out that the administration was digging borewells as deep as 1,800 feet (about 550 metres) in the catchment basins of Aji, Nyari and Lalpari dams. "We also buy water from privately-owned bores that still have water," said Ashwini Kumar, sub-divisional magistrate, Rajkot. "Had it not rained in October in Rajkot, we would have had to invest about Rs 6 crore for providing drinking water through tankers in the city," said Anadkat.

The present drought has made it clear to the people that the only long-term solution to the water crisis lies in rainwater harvesting and watershed management. The people of Falla pointed out that they have recently demanded the construction of five check dams in the village to stop rainwater. Kunwarjibhai Yadav, national president of the BKS, said the association is planning to take up watershed development projects on its own, without seeking the government's assistance, concluding: "We have to catch water right where it falls." ■



Women of Falla village on a one-day fast against the government decision; and (below) Veljibhai Dhamsania (left), vice-president of the village council



trate, he told us that the government has decided to supply water to the villages through tankers. We asked him what would be the source of the water when water from the dam is supplied to the town. He said there is no alternative. Moreover, the administration made false statements in the press that we had stopped a gas tanker and were trying to overturn it. We know how dangerous it is to overturn and burn a gas tanker; it can destroy the entire village. We have more than 200 gas connections in the village. We are not morons."

The administration, however, is not accepting the responsibility for the police firing on December 14. "The police opened fire in self defence. They did not seek any orders from us," said

CANADA / ENVIRONMENT

State of the Great Lakes

A SET of environmental indicators used in a Canadian government report gives a clear picture of the health of the Great Lakes. The report, *The State of the Great Lakes*, gives information based on 19 of 80 indicators developed by scientists, said participants at the 1998 State of the Lakes Ecosystem Conference (SOLEC) recently held in Buffalo, New York.

The 19 indicators that have been selected, represent 80 other indicators

that the parties will be reporting on biennially. "Indicators have been used to assess the state of the Great Lakes before. However, people at previous conferences said they needed a more rigorous process. Therefore, they had proposed this new set of 80 indicators. Initially, only 19 of those indicators were used to assess the state of the lakes, but now we hope to use 25 or 30 of them by October 2000. By 2004 we will hopefully be reporting on all of them," Harvey Shear, science advisor to Environment Canada, Ontario region, told reporters. ■

UK / TECHNOLOGY

Fingerprinting plants

THE "fingerprinting" of all plants, fungi and bacteria found in the United Kingdom is being developed by Molecular Nature Limited (MNL), a subsidiary of the Institute of Grassland and Environmental Research, to assess their potential in developing new drugs. The company plans to compile a unique reference library categorising novel or rare compounds found in plants.

If fingerprinting reveals the presence of such chemicals they will be isolated, purified and assessed for their suitability

in developing new medicines, animal health products, food additives and crop protection-agents. It is hoped that such expertise will enable new high-value crops to be introduced for UK farmers. "Hitherto, much attention has been focussed on tropical plants as sources of new natural products but more recently, temperate plants have provided most of the commercially valuable compounds that have been identified. These include etoposide, the anti-cancer agent from *Podophyllum spp* – a hardy green flower; artemisia annua (anti-malarial agent) from mugwort and Taxol now used to treat ovarian cancer which comes from yew trees," said Maria Injs Chicarelli-Robinson. ■

US / POLLUTION

Hybrid cars

CONSUMERS in US have pledged to buy gasoline-electric hybrid cars if carmakers manufacture them. The pledge was made in an internet petition as a part of the Natural Resources Defence Council's (NRDC) "earthsmartcars" campaign. "Automakers will not get really serious about building hybrid cars unless they think there is a market for them," said Jacob Scherr, NRDC senior attorney. "We're going to show them that the demand exists. Both Honda and Toyota are about to sell hybrid cars here and US automakers are fully capable of building such vehicles."

Hybrid cars can be refuelled at ordinary gas stations and they are less polluting. "Putting this petition online reminds us that Detroit still relies on old-fashioned, inherently dirty and wasteful internal combustion engines," said Scherr. ■

UK / WILDLIFE

Saving voles

IN A bid to save the endangered vole, the Wildlife Trusts (wt) have launched a conservation campaign to safeguard the mammal's future. Riverside building and changes in farming practices have contributed to the extinction of the furry-tailed, chestnut-brown vegetarian. Its demise is largely due to the American mink — escapees from fur farms who inhabit the same rivers, streams and canals. The natural defences of voles — swimming and bank burrowing — are ineffective against the female mink which hunts its prey underground where it devours the voles and their young. Operating through local bio-diversity Action Plans, the wt's are negotiating with local water authorities on the sensitive treatment of river banks and wetlands to encourage the vole's rehabilitation. These animals live on reeds, sedges and grasses and wt's are ensuring that habitats are provided at all their riverside sites. In Staffordshire, Volehabs have been introduced on a canal bank where the height of the sheet metal piling has been lowered. While still protecting the riverbank against erosion it gives voles access to their burrows. ■

JAPAN / WILDLIFE

Return of the storks

IT HAS been twenty-eight years since the Oriental white stork disappeared from Japan. The birds stopped inhabiting the Japanese countryside due to the overuse of agro-chemicals in paddy fields that killed the loach, a staple food for the birds. In the hope of seeing the birds in

Japan again, the Hyogo prefectural government has earmarked a park for these birds hoping that they would nest there. According to experts, the main reason for the disappearance of the wild Oriental white stork seems to be a breakdown in the balance of nature. Dragonflies, butterflies and aquatic insects such as Japanese diving beetles have all died, while loach have been driven away. Birds no longer approach paddy fields, and only rice continues to grow even after agro-chemicals have transformed the chemical balance. The shores of many rivers are now concrete and a number of marshlands where birds once went to feed have been reclaimed. Although the areas are still surrounded by greenery, many living beings have gradually been unable to survive there. ■

Overuse of agro-chemicals drove the storks away



RANJIT MANDAL/WMF

THE SOUTH

ASIA & THE PACIFIC

SOUTH KOREA: South Korea, the world's 11th largest emitter of carbon dioxide (CO₂), is coming under increasing pressure from other countries in the world, especially the US, to reduce its carbon emissions. With international negotiations on climate change, under the mantle of the 1997 Kyoto Protocol,

not something that is done on an unilateral basis. Our stance is that we will start to make binding obligations in 2018," said an environment ministry official. Meanwhile, the foreign affairs and trade ministry said the government takes the US request as an "expectation", rather than a compulsion.

The government is reviewing the feasibility of a

worldwide industry leaders, may be ready for reduction programmes. "Prime export industries, such as automobiles and semi-conductors, are being pushed from the international market side to take action," says Chung Yemo, chief researcher with the Samsung Global Environment Research Center. On the other hand, energy-intensive industries, such as petrochemicals and iron and steel are not taking measures, he says.

AFRICA

TANZANIA: The sarcoptic mange (an itching disease that afflicts hairy and wooly animals) epidemic that killed several infant chimpanzees a few years ago in Tanzania's Gombe National Park is "most likely over", according to the director of chimpanzee research there.

Shadrack Kamenya of the Jane Goodall Institute told the African Wildlife Update that the worst out-



AKHILESH

gaining momentum, calls to cut down on the use of fossil fuels are intensifying, say government officials.

A report published in the daily Korea Herald said US president Bill Clinton has sent a letter to South Korean president Kim Dae-jung asking Seoul to set its greenhouse gas reduction target at 2008, 10 years earlier than what was initially proposed under the protocol. According to the protocol, 38 developed countries will have to reduce carbon emissions by 5.2 per cent below 1990 levels during the period 2008 to 2012.

Seoul responded to the pressure, announcing that it would begin reducing emissions on a "voluntary, but non-binding" basis in 2008. However, Seoul representatives said, "Negotiation is

domestic emissions-trading scheme by business houses, which is scheduled to be launched after 2001. Since 1998, the ministry has been overseeing a programme in which scores of businesses have voluntarily pledged to cut CO₂ levels by 8 per cent and adopt other energy-saving measures over the course of five years.

The government is also considering levying an emissions tax. But the timing of implementing these administrative programmes is a vital determinant to the health of the nation's economy, ministry officials say. So, Seoul wants to set its own timetable in meeting CO₂ reduction obligations. Business analysts say that some sectors, such as automobiles and semi-conductors, which are already

SOUTH ASIA

AIR POLLUTION: With very few non-polluting micro-buses plying on the roads of Kathmandu, the Nepal government might soon review its pro-environmental decisions. Sources at the ministry of population and environment said that the government might make announcements after discussing a fresh technical report that has been prepared by a team of government experts. This report has already been submitted to the ministry. Meanwhile, entrepreneurs said very few micro-buses have been imported as the vehicle markets in neighbouring countries do not have such micro-buses.



WASTE MANAGEMENT: The Punjab environment protection department in Pakistan has directed six city hospitals to manage their waste properly to help check the incidents of hospital-acquired diseases among the general public. "We have asked the management of these hospitals, three each from public and private sectors to take necessary steps for the safe disposal of the waste generated by them every-day," Punjab environment secretary Safdar Javed Sayed said. He added that the Metropolitan Corporation of Lahore has been asked to allocate special bins for the infectious waste from hospitals.



GREEN ROADS: Engineers in Bhutan will now use eco-friendly techniques to build roads in the country. The National Environmental Commission has introduced guidelines for road and bridge construction. "To do this we have to change our traditional methods like using bulldozers and cutting into hillsides. Instead, we will now use excavators and retain the walls," said Kunzang Wangdi, superintendent engineer, road divisions.

breaks might be over, though “the sarcoptic mange parasites probably continue to exist in some members of the community”. The most recent case of mange involved a 40-year-old chimp named Fifi, who showed mild signs of the skin disease on her ankle few months back. She had also suffered a slightly more serious outbreak in 1998 when she was pregnant. “In both cases, we think (Fifi’s) immunity was relatively low and that is when the mange signs become noticeable,” said Kamenya. “Most chimps have probably developed some sort of immunity or tolerance against the lower levels of the sarcoptic parasites.”

The Gombe chimps have been the subject of one of the longest field studies of wildlife ever, begun by Jane Goodall in 1960. This is the first time that mange has afflicted the chimpanzee population at the Tanzanian park. According to Kamenya, “The first sign of the disease are small bumps on the skin of the hands, forehead, buttocks, feet and other areas. The bumps create intense irritation in these areas, causing the chimps to scratch themselves to the point of hair loss. The skin becomes pale or whitish and powdery, and the infected chimps spent so much time scratching they could not feed properly, nor mix with others.”

Scientists first saw chimps with thinning hair and signs of physical distress in February 1997, but did not discover the cause until skin and organ samples were taken from an infant who died in July that year. The samples were sent to laboratories in Kenya and the US, and all came back with the same diagnosis: a mite from the genus *Sarcoptes*. Twenty

UNITED NATIONS



The United Nations Food and Agriculture Organization (FAO) in a recently-released report says that some 1.6 million people in Sub-Saharan Africa are facing starvation due to drought and long-running civil conflict. In Somalia, the report says, “the effect of the drought was compounded by civil strife.”

The 15 countries facing food emergencies of varying intensity are: Angola, Burundi, the Democratic Republic of Congo, the Republic of Congo, Eritrea, Ethiopia, Guinea-Bissau, Kenya, Liberia, Rwanda, Sierra Leone, Somalia, Sudan, Tanzania and Uganda.

The report says, dry spells and erratic rains have reduced cereal production in

Kenya, Uganda, Tanzania and Ethiopia. In Sudan, despite good harvest prospects, two million people are still dependent on emergency food assistance. Meanwhile, Rwanda has seen an overall increase in food production last season but even with this there are about 900,000 refugees who need urgent assistance, while in some other areas food shortages continue.

According to FAO, in West Africa, the Sahel region, comprising a number of countries, has harvested bumper crops despite some serious localised flooding in The Gambia, Senegal, Mauritania, Mali, Niger and Chad. However, the situation is improving in Sierra Leone and especially in Liberia where a range of interventions in agriculture has led to a improvement in food production. These two countries, the report added will continue to rely heavily on international food assistance for several years to come.

chimpanzees have thus far been affected by the disease. Most were older chimps (both males and females) and nursing mothers. According to Kamenya, “Young males and older juveniles were unaffected by the disease, even ones who had very close contacts with the severely afflicted ones.” Gombe National Park has three communities of chimpanzees: the Kasekela, Mitumba, and the Southern community.

LATIN AMERICA & THE CARIBBEAN

BRAZIL: Environmentalists in Brazil won a major victory when a legislative proposal to open more areas to logging and harvesting was put on hold till March. If the Congress approved the bill, it would have been “the largest known setback for Brazilian environmental laws”, said Andre Lima, a representative from Brazil’s Social Environmental Institute. “This outcome was possible thanks to the work of hundreds of people and institutions and was mobilised in record time,” World Wildlife



A new Brazilian law on agricultural land has been stalled

Fund for Nature director Garo Bamanian said in a statement.

The bill, backed by Brazil’s powerful farm lobby, wanted to increase the amount of land available for agriculture. But, environmentalists said it would threaten the Amazon tropical rainforest — the world’s largest — by reducing the area of forest protected from farming and logging. It would also permit the substitution of native woods for non-native species, they said.

Last week the US-based Environmental Defence Fund wrote to the country’s treasury secretary Lawrence Summers urging him to

express his opposition to the bill. “We are gravely concerned with recent proposals that the government of Brazil has negotiated with large landowners to drastically weaken the forestry code,” the letter said.

The letter argued that the changes would have contradicted commitments undertaken by Brazil under the US \$280-million Amazon protection effort funded by the world’s seven richest economies.

Environmentalists estimate that 20 per cent of Brazil’s tropical forests in the Amazon and along its Atlantic coast have been destroyed.

FOLLOW UP

If fresh rains hit central coastal Vietnam again it will spell doom for the region, say meteorologist. This area is already struggling to recover from last November's devastating floods that killed around 730 people (*Down To Earth*, Vol 8, No 13).

Meteorologist in Hanoi said weather patterns remain complicated and more rains are likely. The floods have been a huge natural disaster for these provinces," Kiet told *Reuters Television*. The floods are threatening the coastal areas because of widespread illegal logging all along the mountain ranges. However, experts say that there is a growing concern at the provincial and national level about flood prevention in central regions. Officials have put the damage at US \$50 million.

Floodwaters have been receding across the region, which stretches for about 650 km and is home to eight million people. Central Vietnam, the country's poorest region, does not make a major contribution to economic output but relief workers have expressed growing concern about how people would support themselves over the next three to six months. John Geoghegan, head of delegation for the International Federation of Red Cross and Red Crescent Societies in Vietnam, said thousands would be vulnerable over this period because the planting of the next rice crop was in doubt.

"Our people have been in remote areas and seen whole villages destroyed," Geoghegan said. Of greatest concern was the situation in Quang Nam, Quang Ngai and Binh Dinh provinces, he said, although plenty of food and plastic sheeting was getting in. The government was distributing rice and rice seedlings, but it was unclear if farmers would be able to sow the current crop. "People are getting the basics. We have to form a bridge between now and when their next rice crop is due whether that is in March or in June," he said.

INDIA / COP

Cautious waste disposal

INDIA has called for a strong protocol on liability and compensation to encourage countries to be more vigilant in the trans-boundary movement of hazardous wastes. Speaking on the Control of Trans-boundary Movements of Hazardous and other Wastes at the 5th Conference of Parties (COP) held in Basel recently, Union minister of environment and forests T R Balu stressed on the development of projects and financial strategies for setting up treatment

facilities in the developing countries.

"Till date, there is no consensus on the criteria to be adopted to judge if a particular process or technology for disposal or recycling could be categorised as environmentally sound," Balu said. "This will not be conducive to environmentally-sound management of wastes which is the primary objective of this convention," he added. India had ratified the Basel Convention in 1992. The objective of the convention is to reduce trans-boundary movements of hazardous and other wastes and to dispose of them in an environmentally sound manner. ■

INDIA / AGRICULTURE

Rubber cultivation

INTRODUCED during the 1950s in the Northeast, rubber is proving to be a valuable cash crop for the tribal people who live on shifting cultivation. "The Rubber Board's experience in the Northeast has already proved that tribals pursuing shifting cultivation can be

settled by raising rubber plantations," says development officer P C Goswami.

He said the area being rainfed, was not suitable for other crops and rubber can thrive well even in marginal soils with suitable agro-management practices. Moreover, he added, that cultivation of rubber in the region is known to have improved ecology as the plantation enriches the soil's organic matter status by litter recycling. ■

COMMENT



RUSTAM VANIA

Domesti(cat)ed?

Domestic cat gives birth to a wild one, raises hopes of bringing back extinct species

NATURE played into the hands of science recently when researchers at the US-based Audubon Institute Center for Research of Endangered Species transferred a frozen embryo of a rare African wildcat to the womb of a domestic cat. Later, the feline mother delivered successfully. "If extinction happens in the wild, the technology will be there to bring the species back," said Ron Foreman, chief executive officer of the institute.

However, some scientists were quick to point out that this technology is not a substitute for conservation. Rebecca Spindler, a researcher at the National Zoo's Conservation and Research Center at Front Royal, Virginia, USA, said, "I think we have to be careful how we use this. People tend to believe that we can bring species back. This is not necessarily true," she said, preferring to call the announcement an exciting breakthrough.

Now, the spotlight predictably has shifted to the domestic cat, Cayenne. According to reports, she is acting like any typical feline mother: protecting the kitten from strangers, nursing her and



objecting loudly when the offspring is picked up by scientists. And, the baby wild cat, named Jazz, is equally at ease with her surrogate mother. "Cayenne thinks she has the ugliest baby in the world, but she takes care of it," said Betty Dresser, the research centre's director. Jazz was born on November 24, about 70 days after scientists had taken the sperm from a male African wildcat named Sid and the egg of a

female named Sheena and implanted the embryo in the domestic cat.

Because of its size ranging in weight from 1.5 kg to 3.5 kg, the African wildcat was considered to be a good match for a domestic cat. Cayenne was chosen because she had proven herself capable of carrying kittens to term. She already had had nine litters. Dresser and C Earle Pope, other researchers at the centre, produced a kitten from *in-vitro* fertilisation. In this case, an embryo was kept in an incubator for five days and then frozen for a week.

Researches implanted eight embryos into Cayenne hoping that at least one would survive. The freezing process, not a necessary step in embryo transfers, was done to advance the idea that extinct species might be recreated years later by thawing frozen embryos when a suitable surrogate species is found. Scientists are not sure yet how long frozen embryos can be kept, but Dresser said they might be good for hundreds of thousands of years. "If this technology had been available during the age of the dinosaurs, we might have dinosaurs," she said. ■

To fix the hole...

...India to get \$82 million to phase out production of CFCs, an ozone-depleting substance

Under the Montreal Protocol of 1987, India will receive US \$82 million over the next 10 years to help phase out the production of chlorofluorocarbons (CFCs), of which India is one of the largest producers.

The amount was sanctioned at the 29th meeting of the Montreal Protocol held in Beijing, China, recently. The beneficiaries will be CFC producers SRF Ltd, Navin Fluorine Industries, Gujarat Fluorochemicals Ltd and Chemplast Ltd. The money is expected to be spent on developing CFC alternatives.

The issue of how much aid India should be given was being debated upon for the last four years. India had requested for \$250 million, while the World Bank had estimated the amount required to phase out the substance at

\$179 million. At the Beijing meet, developed nations were not ready to shell out more than \$59 million, even though India brought down its demand to \$101 million. Finally, the bargain was struck for \$82 million.

However, analysts say even this amount is a gain for India. China produces 50,000 tonnes of CFC has got only \$150 million, while India, which produces 23,000 tonnes has been given a grant of \$82 million. India will get \$12 million now and \$22 million over the next two years. From 2002 to 2009, India will get \$6 million each year for the phase out.

Union minister for environment and forests T R Balu, environment secretary Vishwanathan Anand and director of the ozone cell Atul Bagai attended the meet.

Saving species

At a recently-held wildlife meet in Cape Town, delegates draft an action plan to conserve migratory species of wild animals



Sixty-five countries discuss ways to save migratory species, such as turtles

WHILE climate change negotiations hogged media reports in international environmental negotiations, another global meeting in the same month quietly held its own and bore many fruitful results for its participants. On its 20th anniversary, the sixth conference of parties (COP-6) to the Convention on Migratory Species of Wild Animals (CMS) held in Cape Town, South Africa, from November 10-16, participants discussed ways to maintain CMS' sudden spurt in activities. Not only have the number of agreements under the convention increased, but membership has also grown. The convention currently has 65 members.

During the course of the discussions, delegates drafted a wildlife conservation plan, which has four key objectives — to promote the conservation of species through both official and unofficial agreements; prioritise conservation measures through channels such as scientific research; extend global membership of CMS to at least 85 countries by the end of 2002; and improve CMS implementation by means such as increased funding and strengthening links with organisations involved in similar issues.

The meeting also highlighted key shortcomings of the convention, one of them being the issue of equitable representation in its membership. As of now,

majority of its members are from Africa and Europe. Delegates emphasised the need to involve countries in Asia and the Americas as well.

Some delegates also highlighted the need to raise the convention's international profile and garner more political support. However, a few participants emphasised that CMS is a scientific and not a political treaty. "Somehow they are happy not to be as controversial as Convention on International Trade in Endangered Species (CITES). On the other hand, they would like to raise their profile," said Juan Ovejero of the Belgium-based Africa Resources Trust.

The convention — also known as the Bonn convention after it was adopted in Bonn in 1979 — came into force on November 1, 1983. Its primary objective is to protect migratory species (terrestrial, marine or avian) from overexploitation or change in habitat, throughout their range of migration. The convention provides a framework within which countries can protect and conserve migratory species.

However, in spite of these resolutions, the convention still has far to go. Some participants felt that CMS requires more than dialogue to tackle the 'real' problems, especially on issues such as habitat destruction. "Habitat depends on how the land is used according

to socio-economic considerations," explains Ovejero.

"The most competitive way of using land, especially in developing countries, is cattle, mining or agriculture... CMS has a bio-centred approach that ignores all these issues and believes that by listing species and the countries banning its use (of migratory animals), species will recover. In the meanwhile, nobody deals with habitats, not even national governments." ■

New gimmick

A cigarette company launches smoking prevention programme

KAMALIKA BANERJEE SAN FRANCISCO

IN A bid to improve its public image, US tobacco giant Lorillard Tobacco Company has launched a nationwide smoking prevention programme for the youth. Under the national tobacco settlement that was reached last November by 46 US states and territories and the major players of the tobacco industry, the latter has committed to a multi-billion dollar youth smoking prevention programme.

The new programme comprises a series of national broadcasts and print advertisements directed at both children and parents, and includes websites, educational materials and tours to various US cities. It encourages parents to talk to their children about the hazards of smoking tobacco. "Parents play a critical role in a child's development and, so as a part of this campaign, we have turned to parents and teen experts to give information on how to talk to their children," said Ron Milstein, director of Lorillard's Youth Smoking Prevention Program.

Lorillard's new campaign is seen as part of the tobacco industry's ongoing effort to overhaul its image. Last year, Brown & Williamson Tobacco changed its corporate site to put a "friendlier face" of the industry. Philip Morris, another tobacco giant, recently launched a new website focusing on public health education, which, though

applauded by some, has also been criticised by many. It was alleged that Philip Morris was attempting to legitimise itself by pretending to collaborate with the public health community.

But these are desperate times. In recent years, not only have tobacco companies been asked to pay billions of dollars as compensation to the victims of smoking and have had major restrictions imposed on the way they market and promote their products, but their credibility among the public has also taken a beating.

Lorillard itself was under a lot of fire when it was uncovered, during the tobacco trials, that its officials had for long known that their customers smoked because they were addicted to nicotine and high school students were the core of their customer base. Lorillard had studied ways to elevate the delivery of nicotine (referred to in the company memos as the “nicotine enrichment project”) and considered developing a brand aimed at image-conscious teenagers. ■

In a quarry

Goa pays a price for unchecked mining, says a study

PAMELA D'MELLO PANAJI

EXTENSIVE iron ore mining combined with inadequate control measures has degraded an area of about 520 sq km in

interior Goa. According to a study by the Tata Energy Research Institute (TERI), New Delhi, conducted on behalf of the Goan government, to assess the mining industries' impact on the environment, land, air and water pollution is very high in most of these areas. The human population is about 100,000.

The levels of suspended particulate matter was found to be very high in the areas around the mines and along the road networks used to transport the ore. The report also says that wastewater and run off from huge mounds of ore residues have silted rivers, streams and nullahs.

Goa's mining belt, which covers roughly 700 sq km and almost 20 per cent of its land area, is located in the four talukas (blocks) of Bicholim, Sattari, Sanguem and Quepem. The process involves the extraction of ore from open cast mines, which is transported to treatment plants and then to loading points on rivers. From here, they are hauled onto barges, which transport them to bigger ships that take the ore to Europe, Japan, South Korea and China. But while these operations have brought foreign exchange and heavy profits for private mining houses, the social costs have been heavy. Once the mines are exhausted, the pits resemble huge craters, surrounded by ore rejects.

Of the 57 villages in the study area, the ambient air quality in 12 is very poor, the reports says, adding that run-off from mounds of ore residues has contaminated fields and irrigation canals. This has affected the soil quality and reduced agricultural production, by

as much as 50 per cent in some areas.

From 1988-1997, an estimated 2,500 hectares (ha) of total forest area have been affected by mining. Another 100 ha is likely to be leased out to mining companies in the near future.

The TERI study has recommended construction of check dams, filter beds, and settling tanks to decrease pit discharge water, reclamation of degraded land and rehabilitation of tailing ponds.

Other measures include improvement of mine and public roads, dust control measures, alternative roads for ore movement. However, the report recommends that rehabilitation of old waste dumps and abandoned mines along with de-silting rivers or streams should be made the government's priority. ■

Trouble in Mexico

Mayans may lose traditional knowledge to a US-funded project

DESPITE demands by 11 indigenous peoples' organisations to suspend the US \$2.5 million US government-funded bioprospecting programme, the University of Georgia has refused to wind up its activities in Chiapas, Mexico. The objective of the five-year project is to study thousands of plants and microorganisms used for medicinal purposes by the Mayan communities.

Collectively known as the Council of Indigenous Traditional Midwives and Healers of Chiapas (CITMHC), the 11 Mayan organisations have denounced the project and are asking the local people to refuse to cooperate with the researchers.

The project is led by the University of Georgia in cooperation with El Colegio de la Frontera Sur (ECOSUR), a Mexican research centre, and Molecular Nature Ltd, a biotech company based in Wales, United Kingdom.

Entitled “Drug discovery and biodiversity among the Maya of Mexico”, the project is being funded by the US government's International Cooperative Biodiversity Groups (ICBG), a con-

Extensive mining in Goa has led to land degradation and water and air pollution



DARRYL ANDARDE

Gore goes green

Many environmentalists doubt Al Gore's green concerns

In a bid to appease the environmental groups, US vice-president recently announced that president Bill Clinton would sign an executive order, necessitating environmental assessments to be part of all new trade agreements.

Gore stressed on the need to end subsidies and eliminate trade barriers that prevent the US from exporting cutting-edge technologies that could help other countries clean up their air and water, he said.

While some environmental groups have called the order significant as it would put environment concerns at par with business concerns, not all are convinced of Gore's intentions.

Robert Mendelsohn of the Yale School of Forestry and Environmental Studies has challenged Gore's understand-



Image building

ing of environmental problems. In the last decade, our understanding of the effects of climate change, for instance, has undergone a "near revolution" because the natural sciences and economic analyses have altered dramatically, says Mendelsohn.

Gore's supporters have also been accused of "relishing" environmental threats, only to expand the government's domination over all issues. In a recently-concluded meeting between Gore and other environmental leaders, the vice-president's stance was thought to be "unusually pleading".

The greens expressed concerns over the administration's lack of commitment to an array of environmental issues — from protection of salmon in the Pacific to efforts to avert the threat of oil spills.

sortium of US federal agencies that gives grants to public and commercial research institutions that conduct 'bioprospecting' programmes in the South.

The tropical mountains of Chiapas are one of the richest repositories of plant and animal biodiversity in the world. Over the centuries, the Mayans have developed a rich medical knowledge. An estimated 6,000 plant species thrive in the area, thousands of them used by the Maya to treat illnesses.

All promising biological samples will be screened for treatment against cancer, diseases associated with HIV/AIDS; central nervous system, cardiovascular disease, gastrointestinal, respiratory/pulmonary and skin diseases and for contraception. Under the project, a comprehensive botanical survey of the Central Chiapas Highlands will also be undertaken along with sustainable harvesting and production of selected species indicating high potential for economic development.

It has been estimated that approximately 2,000 unique compounds will be identified by the end of the project. The compounds will be chemically profiled by Molecular Nature Ltd and a duplicate set of plants will be deposited at the University of Georgia's herbarium in Athens, Georgia.

All this has outraged the indigenous people. They contend that their knowledge will be used for the sole purpose of producing pharmaceutical products

while the communities that have managed and nurtured these resources for thousands of years will share no benefits. The privatisation of their knowledge that may follow in the form of patents is totally alien to their culture. The project also has the potential to create conflicts within the community as some individuals will collaborate with researchers in return for a petty payments or tools. ■

Changing notions

Who were the first people to use the alphabet? Semitic people of Egypt, says a fresh discovery

EGYPTOLOGISTS have found limestone inscriptions in the desert west of the Nile, probably the earliest-known examples of alphabetic writing. The discovery may fix the time and place for the origin of the alphabet. Carved in the cliffs of soft stone, the writing, in a Semitic script with Egyptian influences, has been dated between 1900 BC and 1800 BC, two or three centuries earlier than previously thought. The first experiments with alphabet thus appeared to be the work of the Semitics

who lived deep in Egypt, and not in their homelands in the Syria-Palestine region.

But the inscriptions are yet to be translated. Interestingly, alphabets were probably invented by the common people and this helped in democratising the process of writing. Moreover, this meant that it would remain free from the clutches of elite official scribes. As such, alphabetic writing was nothing short of a revolution, only comparable to the invention of the printing press.

Alphabetic writing emerged as a kind of shorthand by which fewer than 30 symbols, each one representing a single sound, could be combined to form words for a wide variety of ideas and things. This eventually replaced writing systems like Egyptian hieroglyphics, in which hundreds of pictographs had to be mastered.

"These are the earliest alphabetic inscriptions, considerably earlier than anyone thought likely," John Coleman Darnell, an Egyptologist at the Yale University told *The New York Times*.

After examining the evidence Frank M Cross, an emeritus professor of Near-Eastern languages and culture at Harvard University, judged the inscriptions as "clearly the oldest alphabetic writing and very important". He said that enough of the symbols in the inscriptions are identical or similar to later Semitic alphabetic writing to conclude that "this belongs to a single evolution of the alphabet". ■

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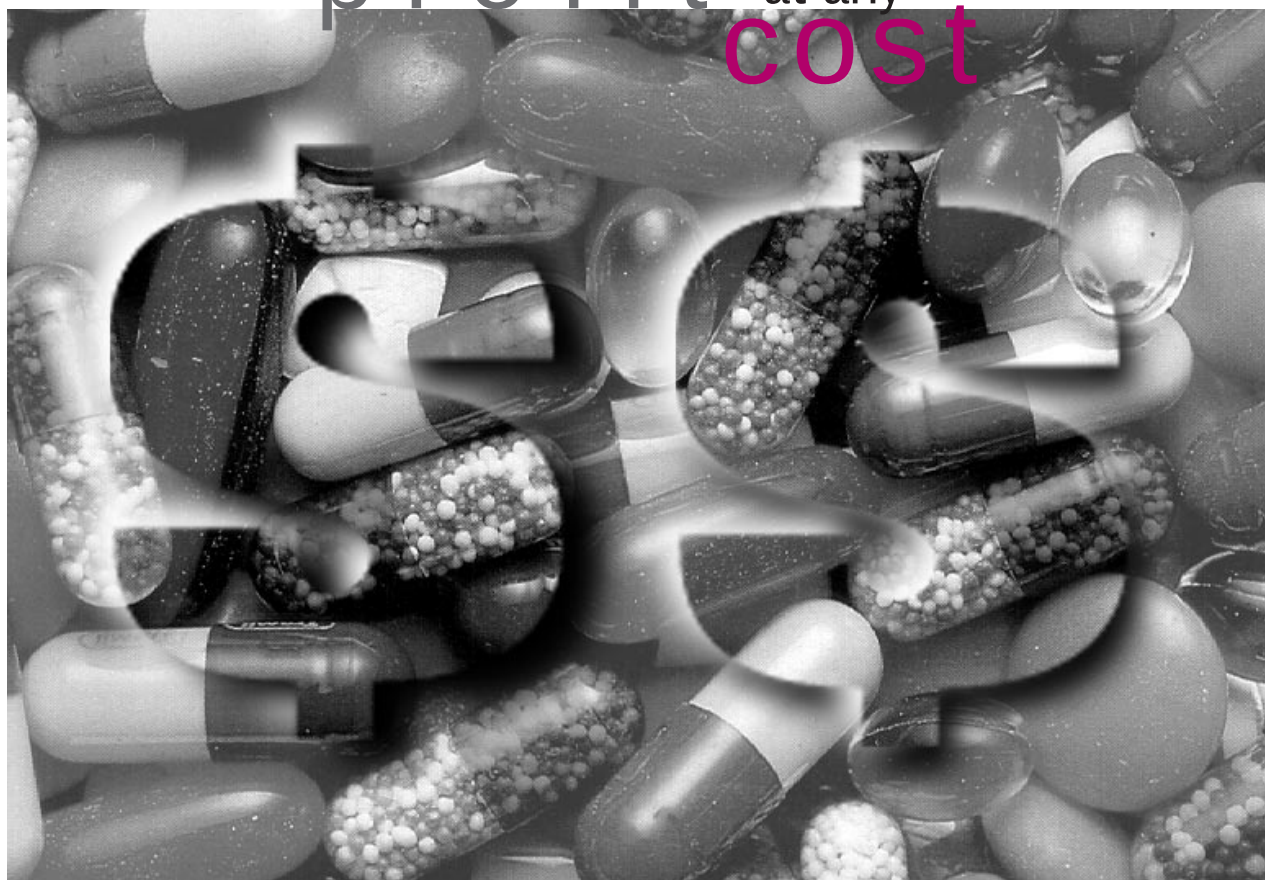
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profit at any cost



The US pharmaceutical industry wants to maintain its monopoly over drug pricing — a move that will not only pinch the pockets of millions but also delay the production of cheaper drugs

IT IS an issue that affects millions of consumers in the US. At stake are the interests of the pharmaceutical companies, insurance companies and the government. For years, the pharmaceutical industry was profiting from a friendly government and non-powerful consumer organisations. Not anymore. Now, protests are beginning to be heard.

At the heart of the problem is the cost of prescription drugs, prices of which have been rising at a whopping 12 per cent every year. This is because many companies have been getting extensions on the patents for their drugs, thus preventing the production of cheaper generics — drugs that are not protected by a traditional trademark. The effect of this is being felt by the people, especially the elderly, who are finding it increa-

singly difficult to afford them.

The American Association of Retired Persons reports that one-third of the elderly have no prescription drug allowances in their Medicare coverage. One-fourth of American citizens over the age of 65 shell out at least US \$500 every year out of their pockets for prescription drugs and 12 per cent pay more than US \$1,000. Michael Fedyna of the Empire Blue Cross and Blue Shield, an insurance company, says that his company is now paying more for prescription drugs than for hospitalisation.

Looking for loopholes

In 1984, the US Senate passed a Bill which tried to regulate drug prices by injecting competition into the market. It permitted the entry of generics of old drugs into the market. It also

encouraged research and development of new drugs by extending drug patents for five years. This law gave drugs that were already in the approval pipeline, such as the popular allergy remedy Claritin, a two-year extension on their patent lives. But drug companies are trying to exploit this law, by asking for longer patents on these “pipeline” drugs and also additional extensions.

The pharmaceutical industry is leaving no stone unturned to find ways to maintain patents of a particular drugs. Many companies are trying to extend patents on a handful of brand-name drugs. A case in point is the move by Schering-Plough, a pharmaceutical major, which is lobbying for an extension of its patent on Claritin in the US Congress. The annual sales of Claritin fetches the company a huge profit of US

\$2 billion. One dose of the drug costs us \$2.50 or more. Its patent expires in 2002. If generic drug makers, who say that they could produce an equivalent pill for us \$0.50, are allowed to manufacture the drug, Schering-Plough will lose its most profitable product.

The company is now lobbying for a three-year extension. It is also funding the campaign expenditures of politicians standing for elections next year. It donated nearly us \$500,000 to political candidates and parties in 1998. It intends to donate even more this year. To win support in the Congress, it has increased its lobbying expenditures from us \$1.9 million in 1996 to us \$4.3 million this year. It has even roped in powerful lobbyists such as Howard H Baker Jr, the former Senate Republican leader and Peter Knight, a close friend and fund-raiser of vice president Al Gore to campaign for its cause.

But when the company felt that the move to push for an extension of the patent in the Congress would not be approved on a straight vote, the supporters of the company in the Senate tried to sneak in a Bill in the last days of the Congressional session as a must-pass spending bill. This move was, however, blocked by vigilant legislators. With no luck from the Congress, the company now wants the issue to be decided by the us Patent and Trademark Office hoping that it will give a favourable decision. According to a study conducted by the University of Minnesota, such an extension could cost consumers us \$7 billion.

It is interesting that Claritin which has already got four years of additional patent life, two years from the 1984 law and another two as a result of a world trade agreement, will get another six-month extension by saying that it will run paediatric tests on the drug.

Addicted to profit

The us pharmaceutical industry is highly competitive and profitable. According to the *Fortune* magazine, this industry is the most profitable of all the nation's industries based on equity, revenue and assets, even though pharmaceutical stocks rose only slightly — from 34 per cent in 1997 to 40 per cent in 1998. For example, Schering-Plough reportedly made a profit of us \$1.8 billion in 1998, an increase of 22 per cent over 1997.

Trade tactics

How a pharmaceutical company keeps profiting?

- ▶ Lobbies for extension of patent rights, thus preventing the production of cheaper generics
- ▶ Increases lobbying expenditures and contributes to parties' campaign funds, thereby warding off government interference
- ▶ Introduces cheaper generics just when its patent is due to expire, thus making profits from both the original and the generic copy
- ▶ Plays on people's psychology: knowing fully well that even if they increase prices, customers will purchase the product they trust, even if it costs more
- ▶ Finances research on new drugs, findings are exaggerated to benefit them

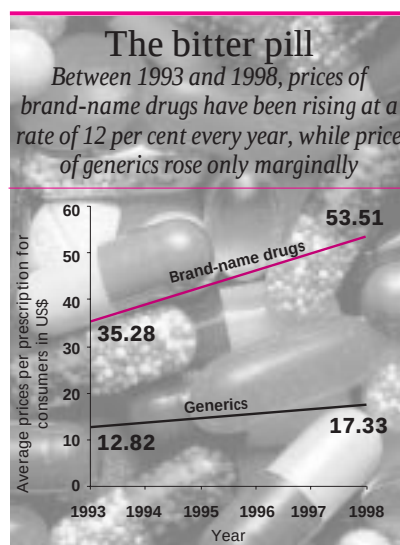
However, the pharmaceutical industry, in its defence, says that a large part of its profits is invested in research on improving drugs. Says Richard Jay Kogan, chairperson and chief executive of Schering-Plough: "Only one in every 5,000 chemical compounds ever reaches the us markets. Bringing a drug to the market takes 12 to 15 years and costs up to us \$500 million." Any effort to control drug prices will have a disastrous consequence of stifling invaluable research, says Mark Grayson, a spokesperson for the Pharmaceutical Research and Manufacturers Association. He says that many Americans go to Canada to buy prescription drugs.

Stopping at nothing

The drug companies are perpetually adopting clever ways to keep increasing profits. When the patent for a particular prescription drug is due to expire, the company introduces its own generic

alternatives a few months in advance. It then increases the price of the original branded drug. Morton I Kamien of Northwestern University, USA, and Israel Zang of Tel Aviv University, Israel, in their recent article in the *Southern Economic Journal* say that drug companies know they will lose a large part of sales to generic manufacturers when a patent expires. However, by producing their own generics before that happens, they can gain a dominant position in the generic market, thus reaping the profits from both the original product and their generic copy. And even when they increase the price of the original drug, the marginal sales that they will lose will only go to their own generic drug. Some analysts feel that drug makers increase the price of their product because they know that a number of doctors and patients prefer to stick to the branded drug they know and trust, even if it costs more.

Until recently, the pharmaceutical industry has held its own against complaints from consumer organisations. But now they are feeling the heat. A recent report in the *Journal of the American Medical Association* described how research on new drugs is often exaggerated in medical journals to benefit pharmaceutical companies that finance them. The consumer organisations have also become better organised and are demanding a cut in prices. To minimise government interference, the industry has resorted to increased expenditure for lobbying and giving generous campaign contributions. As a result neither the government nor the politicians, who pass laws, have been able to provide cheap drugs to all sections of society. And, till the time their monopoly is broken, poor consumers will have no option but to suffer in silence. ■



Source: Generic Pharmaceutical Industry Association, quoted in USA Today, 1999, a division of Gannett Co Inc, November 17

dirty RICH

It will take \$3.8 billion to clear the thick haze of dirty particles in the Hong Kong air

TOURISTS in Hong Kong are usually enthralled by the view of the territory from the top of the island. But often they are dismayed and disappointed by the thick blanket of smog that envelopes the cityscape. "Is it always this hazy?" wonders Margaret Martin, an Australian teacher visiting Hong Kong's "Peak" for a view of the city's harbour and the surrounding islands. No, usually the haze is much worse.

Hong Kong suffers from the malady that has affected most Asian cities: rapid economic growth and population boom with absolute neglect of the environment. Today, Hong Kong's environment has deteriorated to abysmal lows despite the city being one of Asia's richest. "It is the only high-income place in the world that is acquiring a Third World environment," says William Barron of the Center of Urban Planning and Environmental Management at the University of Hong Kong. According to Barron, unless the authorities pay attention and take steps to improve the environment, the hilly, densely packed city of 6.8 million population will be "unlivable" in 15 years.

Fortunately for Hong Kong, the days of lax laws and official complacency over the environment are over. The reason being quite simple: pollution is starting to cost Hong Kong residents a tidy sum of money every year. "It is high time we face up to the problem," says Tung Chee-haw, Hong Kong chief executive. In October, Tung had proposed a plan that included improved sewage systems, recycling waste and cleaning up the environment. The sum he quoted for the project is a whopping \$3.8 billion

A costly proposition

Much of Tung's \$3.8 billion plan, which is awaiting the approval of legislators,

centres on extensive spending to clean up sewage systems, install waste incinerators, improve water quality and initiate recycling programmes. Notably, despite the city's affluence, almost 75 per cent of its sewage is dumped in the neighbouring waters without any prior treatment.

To tackle air pollution, Tung feels it is important to upgrade vehicular traffic. As of now, about a third of Hong Kong's vehicles operate on diesel, compared to four per cent in the US. Tung aims to replace Hong Kong's 18,000 diesel taxis, and maybe its 6,000 diesel mini-buses, with vehicles that burn cleaner liquefied petroleum gas in order to cut respirable particulate levels by 80 per cent by 2005. For the 123,000 diesel buses and trucks, he wants the city authorities to help bear the costs of equipping them with particulate traps or catalytic converters.

Hong Kong added 30 per cent more vehicles between 1991 and 1997. To check that trend, it needs better rail service, more electric trolley buses and walkways, the city's environmental activists say. Further, a third of Hong Kong's air pollution is caused by factories in bordering China. No measures have been chalked out by the city authorities to tackle industrial pollution.

Besides the role of the government, it is also important that the residents of Hong Kong are made aware of the importance of improving their environment. They must also change their attitude on such issues as recycling and transportation if the new spurt of activism is to bring results. Luisa Tam, working for Greenpeace in China, recalls looking on dismayed as a bakery clerk put three croissants in individual bags before placing them all in yet another bag. "This is still the mentality," she says.

"It is high time we face up to the problem"

— Tung Chee-haw



CITY

“People who are bright won’t want to live here”

— Toms Masterson

Poisonous air

Hong Kong’s air is long overdue for a scrubdown. It is about 40 per cent dirtier than the air in Los Angeles in terms of what scientists call “respirable suspended particulates.” These particulates are generated in particular by diesel exhaust and they are toxic in nature. The city’s past record of dealing leniently with polluting diesel vehicles explains the present levels of particles in the air (see chart: *Major reasons for Hong Kong’s air pollution*).

Though difficult to establish given the absence of substantial evidence, there is, however, proof that the high level of particulate pollution in Hong Kong’s air has resulted in increasing health complications. According to government officials, acute respiratory and cardiovascular diseases linked to air pollution are estimated to cost Hong Kong approximately \$50 million a year in medical expenses and lost productivity. The cost for chronic ailments such as asthma is much higher, they add.

Hong Kong officials further say that the severe air pollution also leads to 1,900 premature deaths each year. Taking into account the dangers posed to health, Hong Kong authorities have already stepped up measures to clean the environment.

Spreading awareness

Doing so won’t be easy — or cheap. That Hong Kong’s chief executive has

even spoken about the environmental hazards comes as a shock to many. This is, after all, a place where anti-pollution laws are so slack that even officials in charge of environmental issues concede that the strictures are ineffective. Take for instance the administrative stance regarding vehicular pollution in 1995. Then only four out of 59 legislators were ready to boot out the diesel vehicles that Tung now says are the primary source of much of Hong Kong’s polluted air.

The scenario at present is much different and Hong Kong wants to move into the 21st century with an economy built on what Tung calls a “knowledge-based society” like that of California’s Silicon Valley. To achieve that purpose Hong Kong will require highly-skilled workers. But, unless its air is cleaned up, “people who are that bright won’t want to live here,” says Toms Masterson, head of environmental affairs for the Hong Kong branch of the American Chamber of Commerce.

The bad air is already keeping some residents away. “It is the reason that we won’t go back,” says Jeffrey Schultz, 49, a former Hong Kong public relations executive. While living here several years ago, his daughter suffered severe asthma attacks. Her asthma, however, disappeared after the family shifted to a pine-forested area in France, he says.

Meanwhile, with growing awareness of the detrimental health effects of a degraded environment, Hong Kong residents, too, are expressing concern. A survey in July by the university-based Hong Kong Transition Project revealed that almost 70 per cent of the residents were either “very worried” or “fairly worried” about pollution.

Among administrative heads, even those legislators who support enhanced commercial activities and business establishments are raising concerns about the environment. Non-governmental organisations (NGOs) say the common people are awakening to the issues of environmental hazards and are beginning to pay heed to measures for reducing pollution. Although at present a part of communist China, people in Hong Kong have more freedom, including the right to join activist groups. ■

Major reasons for Hong Kong’s air pollution

Reliance on diesel vehicles

HONG KONG	(30%)
JAPAN	(19%)
BRITAIN	(10%)
USA	(4%)

Emissions from factories situated in neighbouring China, many of which were moved from Hong Kong in the 1980s and 1990s;

The city’s skyscrapers and hilly topography, both of which restrict air flow and dispersal of pollution;

Lax enforcement of laws against polluting vehicles; and

No restrictions against idling engines.

Source: Hong Kong government

Do(o)med species

The black redstart, *Phoenicurus ochruros*, is protected under Britain's Wildlife and Countryside Act, 1981. The legislation, however, only covers the bird during the breeding season. First noticed in 1926, their numbers increased significantly during the 1940s. But now extinction threatens the bird. Besides nesting sites, the birds need places supporting a wide range of plants and insects. London, after the bombing in 1940, provided the desired environment for the birds to flourish. Since redevelopment has destroyed its habitat, they now depend on new projects, such as the Millennium Dome. The London Wildlife Trust has advised local authorities to ensure that the bird's needs are protected (*Urban Wildlife News*, Vol 16, No 4).

Cuts on catches

The warming of the Atlantic waters may be responsible for the significant decline in stocks of cod and other white fish off the coasts of Europe. This despite the fact that, in the last two decades, fisherfolk have cut their catches by a third. Though the number of mature fish have gone up, young fish are still disappearing. Robin Cook of Scotland's Aberdeen Marine Laboratory is now calling for a 40 per cent cut in North Sea cod catches. Europe's fisheries ministers are expected to take a decision on the cuts soon (*New Scientist*, Vol 164, No 2213).

What's ticking?

An unknown tick species may be responsible for a variant of Lyme disease that has not been detected by standard tests so far. Michael Felz and his colleagues at the Medical College in Georgia in Augusta, USA, examined 23 patients suffering from eye rash that is characteristic of the disease. Sixteen of them showed no signs of infection with the spirochete, *Borrelia burgdorferi*, which is said to be responsible for the tick-borne disease in North America. Even those who tested positive were infected by a version of the organism with a different protein make-up (*New Scientist*, Vol 164, No 2213).

ENVIRONMENTAL SCIENCES

Where there is smoke...

Forest fires could have unexpected effects on the world's climate



AKHLESH

SCIENTISTS studying the effects of forests fires have, so far, focussed on the cooling that occurs when smoke blocks sunlight. It was reported that smoke particles help in forming water droplets. However, it was not certain how this would affect rainfall. Now Daniel Rosenfeld, an atmospheric scientist at the Hebrew University of Jerusalem, Israel, has shown that smoke from forest fires can, in fact, stop clouds forming raindrops. In other words, smoke tends to prevent rainfall.

Rosenfeld studied simultaneous visual, infrared and radar observations from the National Aeronautics and Space Administration's Tropical Rainfall Measuring Mission (TRMM) satellite as it passed over Borneo in March 1998, when half the island was covered with smog. He found that dense smoke completely turned off normal tropical rain. The smoke filled the clouds with tiny particles that made water vapour condense. However, the moisture was divided among so many droplets that they were too small to fall

as rain. At the same time, smoke-free clouds over the other half of the island produced ample rainfall (*New Scientist*, Vol 164, No 2208).

Rosenfeld believes forest fires are at least partly responsible for the decline in rainfall in the tropics over the past century. "For certain types of clouds, heavy smoke blocks precipitation altogether," he says, adding that smoky tropical clouds can yield some rain only if they rise high enough for water to freeze.

Experts warn that this may lead to disastrous effects on the world's climate. Similar effects seem to be occurring elsewhere, says Christian Kummerow, a TRMM project scientist at Goddard Space Flight Centre near Washington, USA.

Anything that effects the rainfall pattern is important. Besides increasing the risk of droughts or floods, about two-thirds of the energy that powers the planet's weather system depends on the formation and fallout of precipitation, says Hans Graf of the Max Planck Institute for Meteorology in Hamburg, Germany. ■

Less acidic rain

Calcium particles neutralise acid in the atmosphere

IN THE 1970s, western Europe, Sweden in particular, was in the grip of a severe environmental crisis: acid rain. Eastern USA faced the same phenomenon in the 1980s. Ever since, many developed nations have undertaken efforts to avert the threat of acid rain. However, a number of polluted areas around the world are still subjected to the phenomenon. Belo Horizonte Metropolitan Region (RMBH) in Brazil's Minas Geras state is one such area.

But, besides pollutants from vehicular and industrial sources, RMBH is also subjected to prevailing winds from an area where intensive calcareous exploitation occurs. Large emissions of sulphur dioxide (SO_2) and nitrogen oxide (NO_x) gases react with water vapour in the air to form sulphuric and nitric acids, which come down with the rainwater.

But, on the other hand, these winds contain alkaline dust generated by wind erosion, calcareous dust from cement and lime processing units and ammonia gas emissions neutralise the acid rain.

Debora Vallory Figueredo, a chemical engineer and a senior researcher at Fundacao Centro Tecnologico de Minas Geras in RMBH, Brazil, has reported on how calcareous soil particulates influence acid rain in the region.

Rainwater samples were collected from three sites of RMBH — Belo Horizonte, Contagem and Betim cities. Belo Horizonte, capital of RMBH, is engulfed by vehicular emissions, while Betim and Contagem suffer from industrial pollution. The large calcareous area is located near the sampling stations and, therefore, all of them are influenced by the prevailing winds (*Ambio*, Vol 26, No 6).

Ninety-one rainwater samples (32 from Belo Horizonte, 25 from Contagem and 34 from Betim) were collected during the wet seasons of October to February. Almost half the samples (48 per cent) were found to be acidic.

Sixty-five per cent of the samples from Bentim and 30 per cent of the samples from Belo Horizonte and Contagem stations were found to be acidic.

The primary conclusion arrived at was that the most polluted and industrialised area of Minas Geras state, RMBH, is subjected to acid rain. However, the rainfall in RMBH is a dilute solution of minerals and acids, primarily sulphuric and nitric acids. It contains five major ions — calcium, sulphate, ammonium, nitrate and hydrogen.

Since the calcium ion is the major component of RMBH precipitation, the acid-neutralising capacity by calcium particulates becomes enormous. In the dry periods, these alkaline particles (calcium, for instance) are continuously emitted into the atmosphere and neutralise the acid gases from the industries

and vehicles. Therefore, the acidity of the first rain is considerably low. However, the removal of these alkaline particles from the atmosphere by frequent rains reflects directly in the increase in rain acidity. ■

Death by trash

In nests made of junk, Mongolian raptors die unusual deaths

A STEPPE eagle nest in extreme northwestern Mongolia comprised mostly of long bones of domestic animals. It also contained an iron piston rod, a 30-cm section of a hay mowing sickle bar, a rubber fly swat and a flattened metal food can.

On four expeditions (1994, 1995, 1997 and 1998) through Mongolia, David H Ellis of the USGS Patuxent Wildlife Research Center, Maryland, USA, and James W Lish of the Oklahoma State University College of veterinary Medicine, Oklahoma, USA, found many such nests made up of trash gathered by birds as part of the nest-building process (*Ambio*, Vol 28, No 6).

The scientists have reported two kinds of mortality associated with the raptors — though observations were limited to only three species, the golden eagle (*Aquila chrysaetos*), the saker falcon and the upland buzzard. The first was death due to entanglement. For instance, on July 1, 1995, a 35-day-old nestling was found with coarse gauze twisted around its legs. Used by the nomadic herders to strain milk and thereafter discarded, gauze fabric is common in raptor nests in Mongolia. During the process of collecting nesting materials, the wide fabric is very often stretched and folded into a narrow band that can snare a leg.

The second cause of death involved abandoned golden eagle eggs after they were concealed by trash, presumably brought as nestling materials by the adults. On June 3, 1998, the scientists came across a single leaking egg under a thin layer of plastic and paper.

Across much of Mongolia, trees and perennial shrubs are rare. Therefore, raptors use cloth, bones, paper, wire and twine as primary components of their nests. However, it has been noted that the use of trash is not essential because raptor nests in areas far from human habitation normally have no trash. ■

On looking down: an ancient statue eroded by acid rain in Sweden



CHRISTER ÅGREN



Earth Day 2000

CSE invites you to join us in making Earth Day 2000 the beginning of a new chapter in the environmental history of the Earth.

In addition to the world wide energy campaign the network will lead focused campaigns on some of the most critical issues like:

- Biodiversity and Habitat
- Population and Consumption
- Clean Air
- Clean Water
- Creating Sustainable Communities
- Genetic Engineering
- Debt Relief

People, who believe in environmental conservation, are requested to join the Network and campaign for Earth Day 2000. Please let us know what you plan to do so that we can let everyone else know. For any suggestions and further details, contact:

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E-mail: jagdeep@cseindia.org

As we all know, the Earth is being ruthlessly exploited which is leading to environmental degradation. For this, only we alone are responsible. To save the Earth a powerful network has been set up. Earth Day 2000 Network is committed to achieving the change necessary to reverse the damage and sustain life on Earth. Earth Day 2000 can build networks, empower activists and bring citizens together to demand change. So far more than 2,500 groups in 162 countries have already joined the Earth Day 2000 campaign, and the network grows every day. The Centre for Science and Environment has been asked to coordinate the Earth Day Network activities in India.

Earth Day 2000 will be the largest environmental event in human history. Earth Day 2000 has six objectives;

1. To mobilize and empower citizens around the world who care about the environmental challenges facing us.
2. To create global networks that magnifies the impact of environmental organizing.
3. To facilitate communications and enable citizen groups with similar interests to compare strategies, exchange ideas and develop potent alliances.
4. To highlight innovative strategies and policies that communities are pioneering.
5. To catalyze change in countries and institutions on critical millennial issues, including the need for clean, renewable energy.
6. To inspire the economic, political and individual actions necessary for significant cultural shifts to occur.

Our partners around the world are defining campaign objectives in the following areas:

Clean Energy : Invest in clean and renewable technologies for power generation, especially in developing countries that are poised to leapfrog over dirty, outdated energy generation methods.

Smart Energy : Adopt higher national standards and programs for energy efficiency to stop the waste

Safe Energy : Halt construction of all new nuclear power plants and take existing ones off-line.

Smart Transportation : Establish innovative transportation systems that provide for mobility while minimizing air pollution.

Clean Investments : Increase investments in clean energy projects by the World Bank and other publicly supported aid institutions. Rapidly phase out funding for fossil fuel projects.

Safe Land : End the exploration and development of new oil, gas, and coal reserves in pristine areas and the homelands of indigenous people.

Smart Climate Action : Secure national commitments to reduce greenhouse gas emissions to Kyoto levels and beyond.



LEFT TO DIE



RAJESH BEDI

Life for the double-humped Yarkandi camels in Ladakh changed with the closure of the 'silk route'. Once feted by traders for their transportation utility, today the camels are dying out in the area

THERE was a time when the double-humped Yarkandi camel served as a vital means of transport on the 6,400-km historic 'silk route'. Camel caravans carried tea, silk and porcelain of China to the bazaars in the Middle East and as far as the Byzantine empire and Rome. Traders from Central Asian countries also used the camels to carry their merchandise to Ladakh and the adjoining cold desert regions via the Karakoram pass.

But following the Chinese aggression in 1962, when the Indian border with Tibet was sealed, the existence of the Yarkandi camel in South Asia was restricted to the cold desert of the Nobra Valley in Ladakh. Today, the camels are a neglected lot and their population has

dwindled to around 68. The number is fast decreasing given the innumerable odds of their harsh habitat. Moreover, the construction of roads have rendered them practically useless for transportation purposes and local people show little enthusiasm in rearing them.

Besides India, double-humped camels are found throughout the highlands of central Asia from Turkistan to Mongolia and their total population is around 20 million. They were first introduced in Kashmir by Hazrat Mir Sayeed Ali Hamdani, a revered Sufi saint. When he, along with 700 companions, travelled to Kashmir for the first time in 872 AD, they used these camels to cross the cold desert from Iran via the silk route that stretched from

Sian in China to Antioch in Syria. Subsequent trips in 874 AD and 876 AD were also made on these animals. Due to the absence of roads, the camels became the ideal mode of transportation. Later, tribes like the Barcha, Chonjor, Kalon, Shanku and Shaban on the Indian side of the border also bred and maintained the animals and used them extensively for carrying goods and merchandise.

"With the closure of traditional trade routes to Central Asian countries in the early 1950s, the camels remained in Ladakh. Even after closing of the Karakoram route connecting Yarkand in northwest China, these animals were used for transport across Changla via Durbook and the Changtang part of Tibet," says Farooq Ahmad Kaloo,

“An adult Yarkandi camel yields an average of 2-4 kg of fine wool and 3 kg of coarse wool annually, which is used extensively in the manufacture of caps and sweaters”

extension officer in the publicity wing of the animal husbandry department in Kashmir. He has done extensive research on the Yarkandi camel.

Equipped for the desert

The double-humped camel draws its zoological name *Camelus bactrianus* from the Camelidae family and the Bactria region of west Asia. This animal is a native of the Gobi desert. In fact, the single-humped Dromedarian (*Camelus dromedarius*) camel found in Rajasthan, Arabia and north Africa is generally believed to have evolved from the double-humped Bactrian species.

The Bactrian is quite different from its single-humped counterpart. For one, the double-humped camel has more water-retaining capacity than the Dromedarian. Besides, the Dromedarian is longer-legged than the Bactrian, has a shorter coat and is generally more lightly built.

Along with its enhanced water-storing capacity, Bactrians can also store more food than the Dromedarians in their two humps. Also, its double hump makes riding through the treacherously cold and arid desert safe and comfortable. “The animal has a body frame smaller than that of the single-humped camel. It has a very sure foothold on the sandy, uneven ground and traverses it with much ease. The animal is hardy and can survive without water for days. The humps are storehouses of energy and consist of fatty tissue. The animal utilises these fats during the times when it is unable to find food,” says Kaloo.

He further points out that the animal’s load carrying capacity varies between 500-600 kg as against the 60-70 kg by a pack pony. Commercially, the camel is very profitable. “Nature has gifted this wonderful animal with a very thick coat of hair and wool to help it

fight the cold and harsh winter. An adult camel yields an average of 2-4 kg of fine wool and around 3 kg of coarse wool annually, which is used extensively in the manufacture of caps, sweaters and mufflers,” Kaloo notes.

The average life span of the double humped camel is 25-30 years, attaining puberty at the age of two and a half years. The camel’s breeding season begins in December and lasts till March. “The animal’s gestation period extends for about 14 months,” explains Kaloo.

Beginning of the end

However, according to Kaloo, following the Chinese aggression in 1962, the

camel lost its importance. “The presence of roads undermined the utility of the camel as a mode of transport, and rearing and maintaining them became increasingly unprofitable in and around Leh. Eventually, the animals were shifted to Nobra Valley, which is rich in foliage. In all, about 60 camels were shifted to Nobra from Leh by 1965,” he says.

In the successive years, the animals suffered total neglect and their population fell over time. By 1986, the number of double-humped camel had dwindled to 45.

“Most of these animals were abandoned by their owners and left in the open to graze on the banks of the Siachen and Shayok rivers. Eventually, these animals developed a taste for leaves of *Hypophia*, a thorny plant, causing damage to the plants and also endangering their own lives. Worse still,

A bleak existence: a double-humped camel crosses the Indus river in Ladakh



RAJESH BEDI

60 camels were shifted to Nobra Valley in 1965. By 1986, their number had dwindled to 45

many of them were maimed by local people who considered the animals dangerous to the fragile ecology of the region,” Kaloo observes.

Meanwhile, the inhospitable terrain posed a severe threat to the camel's existence. The newborn camel calves, unaware of their surroundings, were often drowned in the Shayok river. Those that survived frequently fell prey to wolves.

Besides, there is also an increased rate of ectopic pregnancy (extrauterine pregnancy) in such animals, which further restricts growth of their population.

Considering their present population and the threat to their existence, wildlife experts warn that if proper



KUNAL VERMA

“Many camels were maimed by the local people who consider the animals dangerous to the region's ecology”



and immediate measures are not taken, the double-humped camels will disappear altogether from India.

Ineffective measures

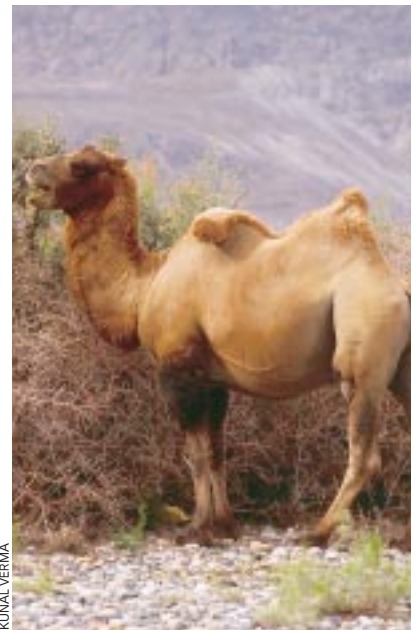
Alarmed by the rapid decline in double-humped camel numbers, a number of measures were initiated both by the state government as well as local organisations to rejuvenate the Yarkandi camel population. Unfortunately, most measures were either abandoned midway or proved ineffectual.

According to the state animal husbandry department's records, the first survey of Yarkandi camels and the people who reared them was carried out by a working group on development of cold desert in September 1986.

It was a door-to-door survey that sought to encourage the local people to rear the animal. Local residents showed little enthusiasm towards the proposal as maintaining the animals outweighed their utility. Finally, the survey had to be dropped.

A couple of years after this survey, in 1988, the animal husbandry department purchased four camels from local breeders at the rate of Rs 1,500 per animal in an attempt to raise these camels and help them multiply. But this exercise also failed as the scientific programme needed to preserve the breed did not follow.

The latest project towards saving



KUNAL VERMA

Living in isolation: abandoned by their owners and refused shelter by the local people, Yarkandi camels (above and below) are usually seen in singles

the camels has been taken up by the Field Research Laboratory (FRL), a unit of the Defence Research Development Organisation (DRDO).

In collaboration with the Indian Camel Research Institute in Bikaner, Rajasthan, FRL has established a camel breeding farm in Pratappur, Leh. Here, plans are afoot to breed the double-humped Yarkandis scientifically and rear them in-house with great care. ■

Written by Ishfaq-ul-Hassan with inputs from Arundhati Ahuja



R A I N W A T E R H A R STANDING THE TEST OF

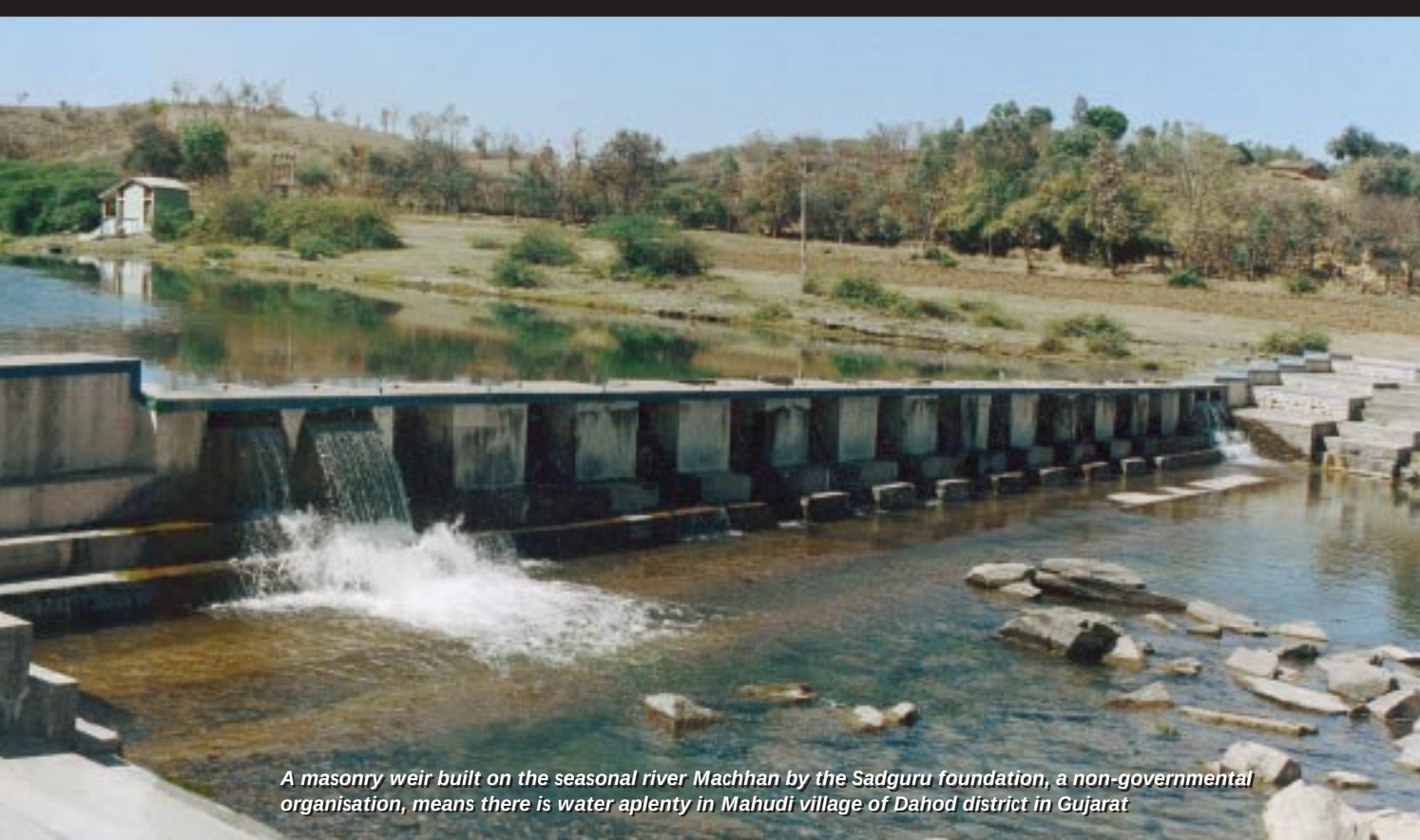
After the 1999 monsoon failed in several areas of Gujarat and Madhya Pradesh, there is a serious drought. Summer is a good four months away, and already there are reports of riots and deaths over water. But several villages are well equipped to face the water scarcity. While travelling through the region, a *Down To Earth* reporter found that the villages that have built water harvesting structures do not have a drinking water problem, and some even have enough for irrigation

MANISH TIWARI DAHOD (GUJARAT)

THE story echoes the fable of the industrious ant that stocks foodstuff for winter and the lazy grasshopper that is left without food. Women and children dig the dry bed of the Sukhi river near Dahod town of Gujarat. Sitting aside one-metre-deep holes, they wait for life to seep into the holes in the form of water — all other sources of drinking water have dried up completely. “It takes at least one hour for us to get one pot of water. But we are forced to do this as there is no alternative,” says Lasan Bhilwad, a tribal woman from the nearby Rentia village.

Barely 25-30 km from Rentia, all the wells and handpumps of Thunthi Kankasiya and Mahudi villages have plenty of water. The seasonal river Machhan, which flows past these villages, has enough water even for irrigation. The N M Sadguru Water and Development Foundation, a non-governmental organisation (NGO) functioning in Dahod district that is known simply as Sadguru, and the residents here have constructed a series of concrete check dams to collect rainwater for irrigation. Moreover, watershed management (WM) measures have been adapted for recharging wells and handpumps. Their past efforts are bearing fruit today.

As Lasan Bhilwad stands on the riverbed with her four children, one can understand why it is difficult to find a family in this region that is willing to marry its daughter to someone from a water-scarce village, no matter how agreeable the



A masonry weir built on the seasonal river Machhan by the Sadguru foundation, a non-governmental organisation, means there is water aplenty in Mahudi village of Dahod district in Gujarat

SADGURU

V E S T I N G F DROUGHT

prospective groom may be. They do not want their daughters to undergo the agony of seeing water trickle into a hole, even as people trickle out of the village to look for greener pastures. Water means prosperity — its scarcity means poverty, regardless of material wealth. And these are particularly 'poor' times for hundreds of villages in Gujarat. The reason is summarised in one word: drought.

"This is the worst drought I have ever seen in my life," says the 48-year-old Bhilwad. The rainy season has just ended, yet there is little water. Nobody knows how the residents will survive till the next monsoon. The portents are all there to see in the deserted Piyaka village of Mandvi taluka in Kachchh district of Gujarat. All the 550 people from 21 houses have left Piyaka for good. "We were forced to leave because we could no longer face the water crisis," says Argi Badra, 44, who was on a one-day visit from Mumbai when he spoke to *Down To Earth*.

Most reservoirs in the Saurashtra region in southwestern Gujarat have only 9 per cent of their capacity of water, which will last for only two months, according to the Gujarat Water Supply & Sewerage Board (GWSSB), Rajkot. The board says the region received a mere 356 millimetre (mm) of rainfall this year till October 30, as against an annual average of 530 mm. People in Rajkot city are getting drinking water supply for half-an-hour every day. "We really do not know how we will meet the drinking water demand in our district in April-May 2000. Already, we are supplying drinking water through

tankers in several areas where there are no pipelines," says Ashwini Kumar, sub-divisional magistrate (SDM) of Rajkot district. In the Kachchh district, rainfall this year has been around 133 mm, much less than half the annual average of 266-417 mm. Already, riots are taking place in the state due to water scarcity (see p7: *Riots over water*).

Drought is nothing new here, but this year's water scarcity has been particularly devastating. Apart from Saurashtra and Kachchh, the districts of Dahod and Panchmahals in Gujarat as well as Jhabua and Dhar in the neighbouring Madhya Pradesh are facing a serious drinking water crisis. With little water for irrigation, the first casualty has been agriculture. After the *kharif* crop (harvested in autumn) failed to a large extent in these areas, there are already signs that the *rabi* crop (harvested in spring) will suffer a similar fate. "Rainfall was low this year and distributed in such a way that there was no run-off. So, harvesting of water did not take place. Yet many watershed areas, where rainwater harvesting and soil-water conservation measures have been implemented, are better off in terms of water availability," says Harnath Jagawat, director of Sadguru.

Water scarcity: the region's history

Water was easily available in the region 10-15 years ago. But overexploitation has depleted underground aquifers. The groundwater table in these areas has fallen below 300 metres, says G F Joshi, executive engineer with the public health works division in Rajkot. Seawater has ingressed into the underground aquifers in a major part of Kachchh region, according to a recent report of the Gujarat Ecology Commission.

"The presence of 700,000 dugwells in Saurashtra region indicates the presence of extensive groundwater aquifers throughout the region. This means there is one well for less than 20 people, or one well for every 9 hectare (ha) of land or

SOME DROUGHT-AFFECTED DISTRICTS



one every 1,000 feet (304 metres),” according to Ashvin A Shah, a US-based engineering consultant who conducted a survey in 1998 on water availability in the region. However, the use of pumpsets for water-intensive agriculture over the past 30 years has lowered the groundwater table from about 9 metres to about 46 metres, he says, indicating that the capacity of the same aquifers is still available to store water.

In the area underlain by Bhuj sandstone in Kachchh, the depth of dugwells was 9-30 metres and water level was 2-21 metres in the 1960s, according to a paper prepared by K C B Raju, adviser, Shri Vivekanand Research and Training Institute in Mandvi, Kachchh district. Today, the depth of dugwells is 30 metres or more and the depth of the bore in them is between 30 metres and 100 metres.

There are about 30,000 dugwells/borewells and about 350 tubewells tapping the underground aquifers in Bhuj and Manchar. The utilisable groundwater resources of the district estimated in 1991 are about 517.07 million cubic metres (mcum). However, more than 55 per cent of the water has already been extracted, and 57 per cent of the land area of Kachchh has been occupied by the saline mudlands of the Rann of Kachchh, which will not contribute to groundwater recharge, notes Raju. He quotes data from the agriculture department of Gujarat to say that the cropped area in Saurashtra and Kachchh has declined by

35 per cent in parts affected by seawater intrusion.

Shamjibhai Antala of Saurashtra Lok Manch, an NGO based in Dhoraji village of Rajkot, says the number of wells and borewells in Saurashtra and Kachchh has increased 16 times over from 25,854 in 1961 to 425,000 in 1998. The groundwater table was about 12-15 metres below the surface in most areas of Saurashtra and Kachchh, while today it has dropped to 215-305 metres, he says. The story from Dahod in Gujarat and Dhar in Madhya Pradesh is much the same.

Impact of this year's drought

The water problem became a political issue in Gandhinagar during the September-October general elections. The candidate from the state capital was home minister L K Advani, and the slogan doing the rounds was “*Pahele Pani, Phir Advani*” (Water first, then Advani). According to GWSSB, 73 per cent of the villages in Saurashtra and Kachchh (3,774 out of 5,181) are expected to face drinking water scarcity this year, apart from 60 cities. About 4,730 villages of these areas are included in the “no-source” category, meaning that drinking water has to be supplied from outside to these villages.

“There is a limit to which the government can provide water through tankers. Had it not rained in the first week of October 1999, as we had feared, we might have faced serious consequences. Now, at least we have been able to catch some rainwater, which is adequate to meet the drinking water needs of the district for another four months,” says P B Trivedi, district magistrate of Rajkot. “It would have been very costly for us to provide water for four months to water-scarce areas in the district through tankers,” says Ashwini Kumar.

In Jhabua district, the total *kharif* crop yield of 1999 is estimated to be 60 per cent lower than in 1998 (106,735 metric tonnes as against 265,036 metric tonnes), according to Wasim Akhtar, collector of Jhabua district. Moreover, the *rabi* crop yield this year is expected to be 93 per cent lower than in 1998 (9,966 metric tonnes as against 141,099 metric tonnes). Jhabua recorded a rainfall of 536 mm this year, the second lowest in the past 25 years, according to the district administration. The average annual rainfall in Jhabua in the last 25 years has been 886 mm.

In Dhar district, the rainfall recorded this year was about 665 mm, as against the average annual rainfall of 840 mm. “Of the total 227,000 ha of the *rabi* area, we expect to harvest only about 150,000 ha. This is less than 35 per cent of the *rabi* crop last year,” says Rajesh Rajora, Dhar’s district magistrate. The district has 244 irrigation tanks, out of which only 12 tanks have water up to 90 per cent of their capacity, while 155 tanks have either half their capacity or less.



Holding their own

Villages which have harvested rainwater are faring quite well in the face of drought

Water harvesting systems have certainly benefited a large section of society in the Saurashtra and Kachchh regions. There is no way better than such systems to optimally tap water resources,” says R C Trivedi, former chairperson of Gujarat Pollution Control Board, who lives in Ahmedabad.

Manibhai Padmabhai Patel of Dhoraji village in Rajkot district, says: “After I started recharging my well, not only can I cultivate crops even during drought but the crop production has also increased several times over.” Mohanbhai, also of Dhoraji, started recharging his well ten years ago. Since then, his total cropped area has doubled. Another resident, Dayabhai Premjibhai Patel, says his crop area more than tripled after he began recharging his well four years ago.

According to Shamjibhai Antala, who has done yeoman’s service in creating awareness about recharging of wells in Saurashtra, “The farmers today realise that the government will do nothing for them. So, farmers are now building water harvesting structures on their own.” Antala recalls picking up the idea of recharging wells from a vigilant Dhoraji farmer, named Ramjibhai Manjibhai: “From 1985 to 1987, there was scarcity of water. In 1998, the rains were good. This farmer made efforts to divert rainwater from a nearby stream into his dry well. The experiment was successful and Ramjibhai’s well was the only one which had water in the summer.”

“Preliminary reports from Dhar district of Madhya Pradesh show that in areas where watershed management (wm) measures have been taken, crops and the groundwater table have not been affected as adversely as areas where no soil-water conservation measures were taken. The number of handpumps and wells that have dried up in wm villages is definitely lower than in non-wm areas,” says Rajora.

To investigate the impact of the drought, the district administration randomly selected 25 samples each of areas where wm activities have been undertaken and areas where these have not been adopted. “We found that the loss of *kharif* crop in non-wm areas is around 40 per cent, as compared to just 10-12 per cent in wm areas. I think moisture control [in the soil] has played a role in mitigating the damages,” he says. Preliminary reports say the situation is much the same in Jhabua district. “Nearly 20 per cent of the total area of Jhabua, which is covered under wm projects, is in a better position in terms of water availability. Crop loss has been 10 per cent less in areas with such projects,” says Sachin Sinha, additional collector of Jhabua who is also the chief executive officer of the *zila panchayat* (district council).

The impact of the wm measures can be assessed in terms of seasonal migration for employment (see table: *Staying put!*). “The migration rate has not reached the proportion that were

expected. In October, nearly 274,986 children received polio vaccination. This month again, we have reached very close to this figure. Normally, a family takes along its children when it migrates. As the number of children receiving polio vaccination this month is nearly the same, it indicates that the rate of migration is not high,” says Wasim Akhtar, collector of Jhabua. He adds that in areas where stop dams are successful, in Jhabua tribal people are reaping crops of 40 quintals per hectare, making them the second highest wheat producers in the state.

“We have taken up micro-watershed projects in around 40 villages in the past 4-5 years. We found that wherever water harvesting works have been carried out properly, the drinking

Staying put!

Despite the drought, seasonal migration from block *panchayats* in Jhabua district has been quite low this year

Name of block <i>panchayat</i>	Number of people who have migrated so far this year	Number of families below the poverty line	Number of people who usually migrate from the block
Petlawad	578	18,669	3,863
Thandala	7,178	11,526	10,648
Meghnagar	3,964	12,607	19,050
Jhabua	19,871	14,850	23,731
Rama	4,348	9,588	12,817
Ranapur	7,915	8,976	19,473
Udaygarh	5,990	5,210	12,546
Bhabhara	10,563	5,120	12,546
Jobat	816	4,796	7,293
Alirajpur	10,925	7,067	8,588
Sondava	9,975	7,806	26,038
Kathivada	3,000	9,041	18,635
Total (district)	85,123	115,256	180,286

Source: Compiled from reports of the district administration of Jhabua, Madhya Pradesh

water problem has been solved to a great extent,” says Anil Shah, chairperson of Development Support Centre (DSC), an NGO based in Ahmedabad.

“This year’s drought has worked as a catalyst in increasing awareness about the importance of rainwater harvesting to deal with water scarcity. The people are realising the importance of wm. In fact, villages that do not have wm projects are demanding such projects now,” says Rajora. “We have received many applications from non-watershed villages to bring them under watershed projects now,” says Sinha. Mohan Singh, *sarpanch* (head) of the Umari panchayat in Jhabua district, says after suffering severe crop damages and drinking water crises, people in Umari are demanding wm projects. *Down To Earth* takes a look at some villages that are shining examples today.

“This year’s drought has worked as a catalyst in increasing awareness about the importance of rainwater harvesting with water scarcity”

— Rajesh Rajora
District magistrate, Dhar, Madhya Pradesh



This check dam has captured more than enough water for irrigation till the next monsoon

“When I discussed the idea to work on water problems in this area, many government officials and politicians laughed at me”

— Harnath Jagawat
Director, Sadguru



THUNTHI KANKASIYA (DAHOD) A TURNAROUND

The people of this small village of Bhil tribals in Dahod district had been facing a serious water crisis. About 78 per cent of them used to migrate for at least 10 months. There were no wells in the village. The farmlands were of no use; there was no water. “We used to walk four to five km in search of drinking water,” recalls 70-year-old Madia Fatha. Things changed for the better in 1994. Today, the people are confident about weathering any drought. This has only been possible due to WM projects and the construction of a series of check dams with the assistance of the Sadguru foundation on the seasonal river Machhan.

According to Harnath Jagawat, director of Sadguru, “When I discussed the idea to work on water problems in this area, many government officials and politicians laughed at me. They asked where would I work when there was no water in the area. They did not realise that I was thinking of rainwater.” The residents organised a meeting in February 1994, requesting Sadguru to build a check dam on the Machhan. The dam was completed in April-May 1994 within a record 85 days, such was the level of people’s enthusiasm. The engineers of Sadguru worked out the technical details.

Later, a series of dams were built all along the Machhan to slow down the run-off and impound the water for irrigation. The Sadguru foundation has also carried out an intensive watershed project by stone trenching and bunding, terracing and planting trees in the area. Since then there has been a total transformation (see table: *Making themselves prosperous*). After the construction of the check dam, a reservoir has been created that has a capacity of 453,070 cubic metres. The river that used to dry up four months after the rainy season has enough water to meet the irrigation needs despite the drought. “This has been possible only because of constant recharging of groundwater through watershed interventions,” explains Rakesh Pandey, deputy director of Sadguru, who led the team that worked out the technical aspects of the water harvesting structures. “The ‘cascadal reservoir model’ has been very successful,” says Pandey, explaining that it involves building small dams near the source of the river and the construction of a series of small irrigation structures downstream. The water

trapped in the dams recharges groundwater. Jagawat points out that the water in the Machhan is from last year’s rain as there was no run-off this year. The rainfall this year was a mere 350 mm, compared to the annual average of 830 mm, Pandey points out. Yet, all the 23 wells have enough water to meet their drinking water requirements. The farmers will cultivate three crops as there is enough water to irrigate 135 ha of land. The water is accessible to all 154 households of the village.

Today, the residents are entirely responsible for managing the dam. Jagawat estimates that almost the entire population of the village is now above the infamous ‘poverty line’, with the average household income rising from Rs 8,000-9,000 per year to Rs 35,620 per year. Sadguru has constructed another check dam on the Machhan near village Mahudi. Farmers here are now growing wheat, sugarcane, gram, maize, tomatoes and other vegetables. Says Ramjibhai Katara of Mahudi: “Earlier, I had to work as a labourer hundreds of kilometres away from home. Today, I employ labourers in my field.”

Making themselves prosperous

Thunthi-Kankasiya village adopted soil-water conservation measures in 1994. Several parameters show the difference it has made

Thunthi Kankasiya village	Status prior to (1991)	Present status (1999)
Perennial drinking water wells	Nil	23
River dams	Nil	1
Water availability (months)	4	12
Irrigation coverage (in hectares)	Nil	135
Land under cultivation (in hectares)	85	153
Number of crops per year	0-1	2-3
Annual agricultural production (quintal/hectare)	900	4,000
Migration rate	78 per cent	5 per cent
Average duration of migration period (months)	10	2
Income per household (in Rs/per year)	8,590	35,620

Source: Harnath Jagawat 1999, *The impact of integrated micro watershed development programme of Sadguru*, N M Sadguru Water and Development Foundation, Dahod, Gujarat, mimeo

"All the 280 wells, 5 handpumps and 35 borewells have water. The surface water is available for at least 10 months now"

— H B Jadeja
Head of village council



A check dam built at Raj-Samadhiyala village provides water for agriculture even during drought

RAJ-SAMADHIYALA (RAJKOT) LEADING BY EXAMPLE

About 20 km away from the district headquarters of Rajkot, this village shows how environmental management can bring about a socio-economic turnaround. According to Narayanbhai Limbasia, a 70-year-old farmer: "Around 15 years ago, people were unwilling to marry their daughters to grooms in this village due to the water crisis." More than 75 per cent of bores in the village yielded no water, says Hardevsinh Balwantsinh Jadeja, head of the village council.

About 10 years ago, the village was declared a desert area and put under the arid zone development programme of the state government. In 1986-87, the residents undertook WM projects. Jadeja led the villagers to construct 12 check dams between 1986 and 1988 (see box: *Man with a mission*). The villagers planted thousands of trees, and undertook stone-trenching, bunding and terracing in their fields on the lines of WM. The state government launched a WM project in 1995-96 in this village, and the District Rural Development Agency (DRDA) allocated Rs 17 lakh. Since 1998 the villagers have implemented around 50 micro-watershed projects (a micro-watershed project is within an area of 500 ha).

Today, there is ample water. Farmers have sown cotton, wheat, groundnut and vegetables. Even though there was only 316 mm of rainfall this year — against an annual average of over 500 mm — the groundwater level in most of the wells is about three metres, and is 1.5 metres in some wells. "All the 280 wells, 5 handpumps and 35 borewells have water. The surface water is available for at least 10 months now," says Jadeja. There are 51,000 trees in the village today, as against just 1,600 in 1988. The farmers are now developing wastelands.

The farmers' earnings have increased significantly. The residents point out that they earn around Rs 2.5 crore more than the neighbouring villages of Aniyala, Pada, Hadmmatiya Golida, Dhandhiya and Shadan, which do not have water harvesting structures. Raj-Samadhiyala sells vegetables worth Rs 50 lakh every year. "In 1990, when water was scarce, my father used to earn Rs 1.5 lakh from his farms. Today, I earn around Rs 10 lakh from the same land," says Jadeja. Says Devsinhbhai Bhavanbhai Kakadia, 60: "I used to earn Rs 5,000-10,000 per year from my 6.4 hectares. Today, my

income is about Rs 1-1.5 lakh. I am confident of earning at least Rs 50,000 even during the present drought."

Jadeja points out that water has not only brought about prosperity but social well-being as well. He claims there is no crime in the village, no police case is registered at present against anyone from the village and that people leave their houses open and unguarded.

Before 1988, most of the families used to migrate in search of livelihood. Migration for employment has ceased now. Today, there are just 50 families below the poverty line, as compared to 138 in 1988. Ashwini Kumar, SDM of Rajkot, says Raj-Samadhiyala received the prize of Rs 25,000 as the best village *panchayat* in Gujarat.

Man with a mission

The credit for the socio-economic turnaround of Raj-Samadhiyala village in Rajkot district of Gujarat goes to Hardevsinh Balwantsinh Jadeja, the 48-year-old head (*sarpanch*) of the village council. He thinks that rainwater harvesting is the only solution to deal with the grave water crisis in the Saurashtra region of the state.

In 1985, Jadeja, a post-graduate in English literature, was selected for the post of deputy commandant in the Central Reserve Police Force, a rank equivalent to deputy superintendent of police. At the same time, Jadeja was also offered the post of *sarpanch* by the village development committee. He opted for the latter, a courageous decision as he was forswearing the comfort and security of a government job. "If you are strong as a person prosperity comes to you. You do not need to run after it. Today, I lead a life of comfort and luxury in my own village along with my neighbours," Jadeja observes.

In 1986-88, Jadeja organised the village to take up 12 watershed management (WM) projects. He also initiated a drive to plant trees. Today, the village is one of the most prosperous ones in the area.



People of Gandhigram constructed this check dam with a bank loan and voluntary labour

“Even officials of the Geological Survey of India failed to get water from a borewell a few years ago. We have to find our own solutions”

— Bhimji Chaudhury,
President of the Gram
Vikas Mandal



GANDHIGRAM (KACHCHH) TAKING LOANS TO HARVEST WATER

This village in Mandvi taluka of Gujarat’s Kachchh district has embarked on rainwater harvesting and wm quite recently. For the past 10-12 years, the residents have been facing a drinking water crisis. “Even officials of the Geological Survey of India failed to get water from a borewell a few years ago. They left this area never to come back. But we cannot leave. We have to live here and we have to find our own solutions,” says Bhimji Premji Chaudhury, president of the Gram Vikas Mandal (GVM, the village development group) of Gandhigram. The groundwater table has fallen below the sea level due to overextraction. The seawater has now seeped into the underground aquifers, making them saline.

At present, Gandhigram is supplied drinking water through pipelines. But the villagers do not know how long they will get this water. They want to be on the safe side. Last year, they took a bank loan to construct their own check dams. “We borrowed Rs 15 lakh from a local person and took an additional loan of Rs 5 lakh from a bank. We have also contributed Rs 5 lakh to the project in the form of *shramadan*

(voluntary labour),” according to GVM members. Six months ago, the residents constructed a dam on the Khari river which flows nearby. There are about 400 people in the village, of which 25-30 people have migrated this year due to the drought. The village has decided to reserve whatever water is left in the dams for drinking water. Apart from the dams, the people of Gandhigram have also undertaken a micro-watershed project. The DRDA is carrying out a watershed project in Gandhigram with the Shri Vivekanand Research and Training Institute as the implementing agency.

Lalji Vishram Chaudhury, the 68-year-old chairperson of the watershed committee, says: “We have received Rs 28 lakh from the government. With the help of this money we have constructed 4 big dams, 30 small dams and plugged 31 *nullahs*.” He says the results are showing: “Gradually, we are getting more returns. From one acre (0.405 ha), we can now fetch Rs 1,000-2,000, which was impossible a few years ago. With the help of water harvesting structures, we have around 400 ha of cultivable land, most of which was barren.”

The residents have realised that the solution to the water crisis lies in recharging wells, as shown by the message painted on the wall (right), and not on the irregular supply of water by government agencies



"I started recharging my well six years ago. It has not dried up since then. Today, it is possible for us to cultivate *rabi* crop despite the drought,"

— Rasikbhai Patel
Farmer, Mandlikpur



The water in the underground tank has been collected from the roof of this Mandlikpur house

MANDLIKPUR (RAJKOT) LIFE WITH RECHARGED WELLS

In the past six years, the 3,500-odd residents of this village in Rajkot district, which falls in the Saurashtra region of Gujarat, have come a long way. After a prolonged water crisis, the village is well on its way to solve the problem through recharging of wells. Shamjibhai Antala of the NGO Lok Manch, who has helped recharge around 700,000 wells in Saurashtra, says: "Recharging wells is the lifeline for farmers here." Of the 150 wells in Mandlikpur, farmers have recharged about 110, most of the work being done by individual farmers. Residents are also capturing rainwater through roof-top harvesting systems. Rasikbhai Patel of Mandlikpur says he can now store 10,000 litres of water every season. It is enough to meet the needs of his family of five throughout the year. This is the same village where there are four 300-metre-deep borewells, Antala reminds.

"I started recharging my well six years ago. Since then, it has not dried up, as it used to earlier. Today, it is possible for

us to cultivate *rabi* crop," he points out. Patel's two wells are 24 metres and 16 metres deep respectively. "You can irrigate 4 ha of land after recharging one well," Antala says.

Before the village took to capturing rainwater, hundreds of families used to migrate every year to Surat, Ahmedabad and Mumbai in search of employment. But the rate of migration has come down. Even in the current drought-affected year, very few families have left the village. "Going by the experiences of my neighbours, I have also decided to harvest rainwater through my well. I am constructing a *kundi* (a covered tank) this year," says K V Khat of the nearby Pedla village.

There are varied techniques to recharge a well. Some have made slopes to direct the water to their farms. Some others, like Chimanbhai Radadia of Dhoraji, have laid pipelines for the purpose. Says he: "We have recharged our well by constructing a 106-metre-long pipe that is three metres deep. In the past five years, crop production has almost doubled."



The example of roof-top harvesting Mandlikpur is being replicated in the nearby Pedla village (left). Even though the groundnut yield was low, the crop did not fail





What used to be barren is now clothed in greenery. The village has found the answer to poverty in soil-water conservation

GHELHAR CHOTI (JHABUA) PARTICIPATORY SUCCESS

A micro-watershed management project was launched under the Rajiv Gandhi Mission for Watershed Development in this village of Jhabua district in 1996. Since then, a lot has changed. The underground aquifers have been recharged and all the eight handpumps in the village yield water throughout the year, says Bhurji Bhawar of the village's watershed committee.

According to R K Gupta, additional chief executive officer of the *zila panchayat* (district council) of Jhabua: "This change has only been possible because of people's participation. Most people who used to migrate from this village do not leave now. They have found employment here itself." Even in the face of the present drought — it only rained about 439 mm against the annual average of 980 mm — they are doing quite well. They are confident that their handpumps are not going to dry up very fast. "In the past four years, we have been able to catch enough rainwater through the micro-watershed projects in this area," says Kasani Bai, president of the village's *Baira ni Kuldi*, a women's self-help group. Earlier, even normal years proved to be difficult as there was no water in the area. Today, not only has the cultivable area increased due to water availability but their yield per hectare has also doubled, says

Gupta (see table: *The watershed boom*).

Mohan Singh, sarpanch of Umari *panchayat* which is about 30 km from Ghelhar, told *Down To Earth* that after facing severe crop damages and a drinking water crisis, people in Umari have realised the importance of wm projects. "They are now demanding wm projects in their villages. They know plenty of water is available in areas under wm," he says.

The watershed boom

In Ghelhar Choti village, watershed management measures have brought about a turnaround in agriculture

	In 1996	In 1999
Area under irrigation (in hectares)	13	91
Area under wasteland (in hectares)	161.27	44.01
Kharif* area (in hectares)	112.84	203.10
Rabi** area (in hectares)	68	141.60
Kharif yield (per hectare)	2.30	4.10

Source: R K Gupta 1999, additional chief executive officer of the Jhabua district council, Jhabua, November 21, *personal communication*

NOTE: * - Kharif is the crop harvested in autumn; ** - Rabi crop is harvested in spring

Farmers of the village now go for high-value crops like papaya and people getting together for a watershed committee meet



The need of the hour

Experts all over agree that rainwater harvesting is the best way to improve the lot of villages

Some really serious issues face Gujarat and Madhya Pradesh today, and the present drought has highlighted them. "Water-related disputes are gradually increasing in rural areas. They are expected to surpass land disputes in the next 10 years," Rajora fears. And it is quite clear that the government cannot supply water to every village in rural India when it fails to supply water in cities, where political pressure to provide civic amenities is much greater than in villages. If the government fails, people have to take the matter in their own hands. Rainwater harvesting is the only solution.

The Gujarat government is not realising the magnitude of the present problem, complains Antala. "The state government is still focussing mainly on extraction of groundwater in Saurashtra and Kachchh regions," he says. He points out a recent plan of the state government to dig 120 borewells with an investment of Rs 70 crore in Wankaner taluka of Rajkot for supplying drinking water to Rajkot city (see box: *Short-term plans, long-term disasters*). In Saurashtra, it has become a business for big farmers to own deep borewells and sell water to small and marginal farmers. The government has no data to show the actual number of wells and borewells in the region. "After observing the state government's reluctance, people have started managing their water on their own," he adds.

"Many government officials are complacent about water harvesting projects because they think they will be able to bring water from the Narmada to Saurashtra and Kachchh regions. It is merely a plan, nothing else," says Antala. He points out that even if the Madhya Pradesh government allows to increase the height of the Narmada dam and the water comes to Saurashtra and Kachchh, it will never benefit the people. This, he reasons, is because the government has already issued licences to 10 sugarcane mills, which will lead to cultivation of sugarcane, which is water-intensive and will eat into the water supplies.

But there are a few positive signs in Gujarat. The government has sanctioned 1,577 micro-watershed management projects in the state by July 1999. "The reasons for the failure

of water harvesting structures in some regions are poor site selection and works done by contractors who try to save money. Most government water harvesting structures have failed because of these reasons," says P P Bhatt, the Ahmedabad-based project officer of Bochasanwasi Shri Aksharpurshottam Public Charitable Trust, which is involved in WM activities. The state government has failed to implement its plans properly because it has not promoted the concept of participatory development in WM programmes, Bhatt says.

Even in Madhya Pradesh, not all WM projects have been successful. There are 1,200 stop dams in Jhabua and 600 in Dhar. A senior state government official, asking not to be named, pointed out that almost one-third of water-harvesting projects in Jhabua and Dhar are useless. This, he explained, was because of improper site selection. The main reason, he cites, is the implementation of these projects on political criteria and

not on technical criteria. "During this year's drought, water harvesting structures have failed to yield beneficial results only in those regions where the projects have not been implemented on technical criteria but on some political criteria," he says.

The Madhya Pradesh government is considering a legislation which would let the communities regulate and utilise groundwater resources. A welcome step by all means as a state government is now actually accepting the

limitations of the administration in managing groundwater and planning to use the inherent potential of communities in India to take care of groundwater.

The way in which some villages of Gujarat and Madhya Pradesh have made light of the current drought makes it clear beyond any reasonable doubt that the answer to most problems in rural areas lies in rainwater harvesting. "The water resources of Kachchh are dependent entirely on rain. The water harvesting project implemented during the past 10 years in this area shows that it is possible to arrest the further deterioration of the groundwater regime of the area," says K C B Raju. According to Antala, "Water harvesting can easily be done by people themselves. There is no need for any



Structure of hope: a check dam built by the Sadguru foundation in Dahod, Gujarat, shows what the future depends on

SADGURU

"The role of the Union water resources ministry is merely that of a public relations officer who liaisons between state governments"

— C P Thakur
Union minister of water resources

Short-term plans, long-term disasters

The government of Gujarat has launched a project worth Rs 70 crore to dig 120 bores in the Wankaner taluka of Rajkot district to supply drinking water to Rajkot city. At present, the city is supplied water for 20 minutes every two days. According to P V Trivedi, district magistrate of Rajkot, the project is part of a 'short-term' policy. But there is great resistance to it among political circles.

Digvijay Singh Zala of the Congress party, who was deputy minister environment in the Union cabinet from 1982 to 1985, has filed a case in the Ahmedabad High Court against the plan, saying it will have a negative impact on the ecology of the region. The area is one of the few patches where underground aquifers still have water. Zala fears the groundwater would be depleted even in this region if the plan goes through. However, Trivedi says that this is a forest area and there would be a natural recharge of the groundwater. According to a senior district

official, the plan was laid down even before a proper study was conducted. It was made just on conventional grounds that there is potable water available at 61 metres.

Narottam Patel, irrigation minister of Gujarat, was quoted in some local newspapers as saying: "We have to provide drinking water to Rajkot at any cost. We will also face the case in the court but we will provide the water. We should not discuss ecological concerns at this moment because water is important for people at the present. This is the priority for my government."

"The only live source of drinking water from Rajkot to Junagarh is the Bhadar River and the Phofal dam. As we are drawing water from the Phofal dam for four cities, including Dhoraji, we cannot draw more water for Rajkot. Otherwise, the dam will dry up in another two months. So, we required some solution to meet the drinking water crisis till the next monsoon," says Trivedi.



Drought is a myth: a young boy draws water in Ghelhar Choti village, Jhabua

government help. For this, we need to create public awareness. The message will not spread by mere lectures. Even if we harvest one-fifth of the total rain falling in Saurashtra and Kachchh, there won't be any water scarcity."

In an interview with *Down To Earth*, the Union minister for water resources, C P Thakur, said in the present scenario, "the role of the water resources ministry is just that of a public relations officer who liaisons between state governments. "Rainwater harvesting will be a priority of my government. The water harvesting concept has shown good results in areas where it is implemented properly," he said.

Technical soundness

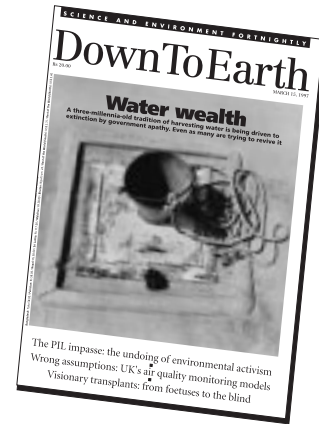
According to Antala's calculations, even if an average of 550 mm of rainfall is harnessed in the Saurashtra region, there would be no shortage of water for drinking and irrigation. "If we are serious about the issue then it is important to raise the groundwater level in Saurashtra. For this, artificial recharging is important. And recharging wells and borewells is the most effective way of doing this. There are about 700,000 wells in the region. If we recharge all the wells then we will be able to irrigate about 720,000-800,000 ha of area every year, he says.

"The need for harvesting rainwater in Gujarat is greater as it is surrounded by sea on three sides and 65 per cent of Saurashtra's land is below the sea level, in some places as much as 46 metres below sea level. So, when the groundwater level goes down the seawater will enter the aquifer," Antala says.

The collected water could be stored underground by directly injecting it into open dug wells to replenish the depleted groundwater aquifers, explains Ashvin Shah. He calculates: "The population of Saurashtra is 12.3 million. The average annual rainfall is around 530 mm falling over 64,000 sq km area or a quantity of 34,000 million cubic metres (mcm) per year.... Assuming 20 per cent of the rainwater is collected, the total quantity of rainwater collected annually would be 6,820 mcm

per year or about 1,500 litres of water every day per person. Considering the fact that many people do not get even 125 litres per day, the quantity the United Nations considers minimum for domestic use, the rainwater harvesting potential is indeed very high or 12 times the drinking water need. Groundwater restoration should be a priority and we should find out ways to quickly recharge the groundwater," Shah points out. He estimates that as much as 6,096 mcm of water can be put into the ground if recharging work is taken up all over Saurashtra.

The figures speak for themselves. And India has a great tradition of harvesting rainwater. Several villages are still showing the grit that has seen human civilisation through over centuries. The present challenge is about combining the common sense of the past with the best of modern science. If India fails to do this, there will be countless women like Lasan Bhilwad, digging dry riverbeds for a pot of water. There will be an increasing number of riots over water. The choice is between rainwater harvesting and a parched, violent future. ■



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A DREAM COME TRUE

PHOTOGRAPHS: KAZIMUDDIN AHMED / CSE



A check dam at Mahur village

The people of several villages in Pune district of Maharashtra were a helpless lot, until Vilasrao B Salunke, a visionary, stepped in

KAZIMUDDIN AHMED PUNE

EVERYTHING is picture perfect in Mahur village, about 75 km from Pune in Maharashtra. Acres of marigold and lilies in full bloom, teak trees and a variety of crops conceal its unpleasant past. This huge tract in the Western Ghats was, till the mid-1970s, barren and untended. Even vast expanses of tilled lands did not guarantee a harvest worth talking about. Then Vilasrao B Salunke, then a young engineer who owned a factory manufacturing precision instruments in Pune, stepped in.

With the help of the villagers, Salunke not only brought water to the parched lands, but also instilled confidence and the will to survive among the people. He set up Gram Gaurav Pratisthan (GGP), a voluntary organisation, to prove a simple fact: success can be achieved with very little resources. Today, GGP is involved in 55 waterharvesting projects in 25 villages of Pune.

The genesis

A severe drought hit Maharashtra in 1972. In Purandhar taluka (block), thousands of people had migrated to the cities, where survival was no less an ordeal. The government, as an alternative, employed thousands of people as stone-cutters.

Curiosity led the young engineer to



the drought-prone areas. "I saw people breaking stones under the harsh rays of the sun, but I could not understand the connection between the drought and stone-breaking," he says. Salunke went to the commissioner of Pune with the query. The commissioner failed to provide any answer. The same question was put to the stone-cutters. He was met with blank stares.

Salunke then asked the villagers what they really needed. "The reply was 'water in the fields'," he says. The villagers said if rainwater is conserved, all problems would be solved. "They had the solution, but without resources, they said they were handicapped," says Salunke.

Says Laxman Kherkar, who has been involved with the watershed programme in the villages for 27 years, says, "The government did not have a solution to the irrigation problems because the villagers were never

asked about possible solutions."

Salunke understood the whole problem. "There was land in plenty, but no water," says Salunke, adding, "I realised that if water conservation, distribution and usage is done wisely, every family here can be given water security — an essential ingredient for food security."

Salunke started with Naigaon village in Purandhar. He met the villagers and explained his conservation plan. "For the villagers, somebody approaching them to discuss their problems and solutions was unbelievable. They were only used to government officials imposing things on them," he says.

The villagers agreed to give 16 hectares (ha) of land, which belonged to the village temple, on a trial basis. In the first year, Salunke managed to get some 500 villagers to work on constructing check dams to conserve rainwater. To prevent erosion, trees were grown in this patch of land. He also acquired an additional 80 ha of land from the villagers.

Soon, the results began to show up. The first monsoon, though scanty, completely irrigated the 16-ha land but only half the area was used for cultivation of foodgrains. The crop yield increased 10-fold. "It is then that we realised the importance of water. Even the government irrigation officials were surprised," says Kherkar. The groundwater table also started rising.

The five principles

With the first experiment bearing fruit, the next task was to hand over the rain-water harvesting project to the people themselves. "But, water being a scarce commodity, there was a problem in its distribution," says Salunke. To ensure that the project does not die, he formed water councils in the villages and made everybody a shareholder, and formulated the following five principles to help people retain what they developed:

- Water distribution would not be done in terms of landholdings. There would be per capita distribution of water.
- In times of scarcity, water would be given for the area that can be cultivated by the family members themselves without any outside help. Crops which require less water would be cultivated with the reserved water.
- The people realised that landless villagers were also entitled to water. So to put their quota to best use, land-owners who had excess land gave it to them for cultivation.
- Water rights were made non-transferable, that is, even if the owner decides to sell his land, he is not permitted to sell the water rights.
- Salunke asked the villagers to contribute 20 per cent of the cost of the project, the rest being paid by the government, to make them realise that it was their own resources they were conserving.

After the immense success of the first experiment, the movement spread to

other villages. "Although we knew that conserving water was the only solution to our problems, we did not know how to do it nor did we have the resources," says Satyaram Gole of Mahur village. His village's story is also unique.

A dam was constructed near Mahur in 1972. Another big dam, Vir, was built on the river near the village. But the villagers did not get any benefits from these projects. Though the villagers owned land, the lack of water forced them to work in the fields near the big dam as labourers.

Thus, when the villagers of Mahur heard about Naigaon's success story, they rushed to Salunke. After a discussion, they returned to collect Rs 32,000 — 20 per cent cost of the project. It took 30 people six months to collect the amount.

The work commenced in the early

"The government did not have a solution to the irrigation problems because the villagers were never asked about possible solutions"

— LAXMAN KHERKAR

who has been associated with the Gram Gaurav Pratisthan for the last 27 years

1980s. Today, a pump carries water to a well at the base of the Mahur highlands. Another pump carries the water to an elevation of about 40 metres. Water pipes, altogether 1,585 metres in length, provide water for irrigation in the plains as well as the highlands.

More importantly, people who had

migrated have started coming back to the village. Gole is one of them. He was earning Rs 15-20 a day as a textile mill labourer in Mumbai, the state capital. "In 1982, labour strikes in the textile mills had begun. But for the watershed programme, we would have starved to death," he says. Now some villagers in Mahur earn Rs 75,000 to Rs 1,00,000 per annum.

Mahur and Naigaon are just two examples of GGP's success. Since 1972, when the project started, GGP has spent Rs 6,00,000 on waterharvesting projects, a fraction of what is spent on big projects. However, the results are equally good, if not better. Better still, there are no cases of corruption.



Institutional development

Committees are set up for the management of water resources. For every project, there is one group leader and five executive members. The rest of the villagers are made shareholders or members of the committee. All the groups together form the *pani panchayat* (water council). The *panchayat* comprises 15,000 members at present.

While village groups meet regularly, the *pani panchayat* assembles only once a year. For emergency meetings, the groups can always approach the GGP. But, apart from counselling and providing technical guidance, the whole show is run by the villagers themselves.

As for Salunke, he is now working on several other projects in tribal areas, such as afforestation. Salunke's vision was to bring about a harmony between land, water and human beings. With the land filled with flowers, trees and crops, there is good reason to believe that the vision can come true. ■

Women work in lily fields in Mahur village. Sale of flowers earn the villagers a handsome profit



Losing teeth over money

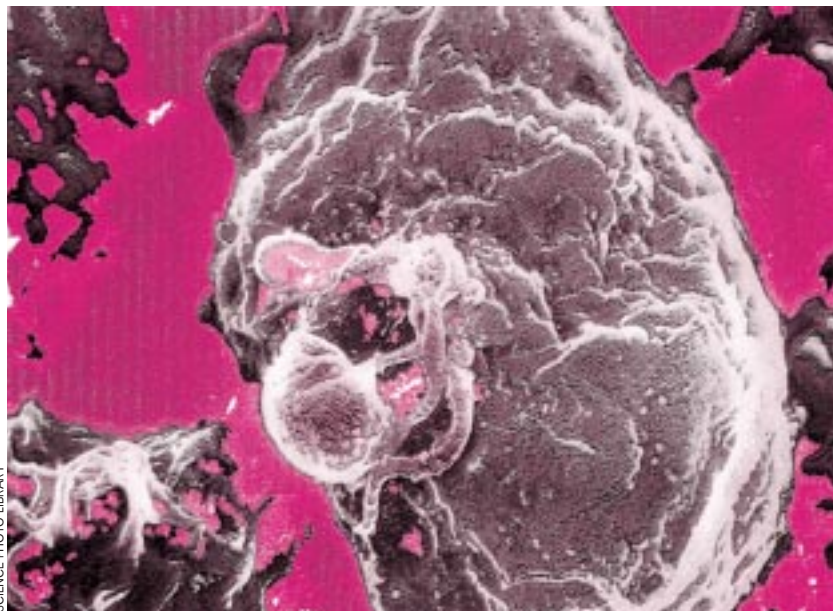
When parents tell their children that sucking a toffee would ruin their teeth, they can add one more warning — worrying too much about money could be more harmful to your teeth. R J Genco and his colleagues of the State University of New York at Buffalo, USA, studied stress levels of 1,426 people between the ages of 25 and 74. It was clear from the study that people with healthy teeth were those who could cope well with stress. In other words, people who reacted to stress by taking action to avert their problems, rather than by drowning their sorrows or ignoring them altogether, had the healthiest teeth. On the other hand, the risk for periodontal disease (caused by bacterial infection of gums) was greater in those with high levels of financial strain. In fact, so strong was this particular correlation that the more serious were people's money worries, the more tenuously were their teeth connected to their gums (*Journal of Periodontology*, Vol 70, No 7).

Daddy's girl

Young girls with close relationships with their fathers may enter puberty later than girls with distant or non-existent relationships with their father. According to Bruce Ellis of the University of Canterbury in New Zealand, good mother-daughter relationships were also found to delay puberty somewhat, but "in total, the quality of fathers' investment in the family emerged as the most important feature" of the puberty timing of daughters. They studied 173 girls and their families for eight years, when the girls proceeded from pre-school to the seventh grade. The exact mechanism behind the connection is as yet unknown, but it does "highlight the importance of early paternal involvement in the development of 'healthy' reproductive functioning in daughters" (*Journal of Personality and Social Psychology*, Vol 77, No 4).

The virus within

It may never be possible to eliminate HIV from infected people



The human immunodeficiency virus budding from a cell

IN THE last 18 years, HIV or the human immunodeficiency virus has evolved into a major health concern. As many as 11 drugs and drug combinations have been pursued to suppress the development of HIV-related disease, only to help those infected with the virus live longer, more productive lives.

Unfortunately, this optimism appears to be doubtful if a recent study by Line Zhang and his team from the Aaron Diamond AIDS Research Institute in New York, USA, is to be believed. The study suggests that it may never be possible to completely eliminate the virus from the infected. Small amounts of HIV may still hide in certain white blood cells, even in patients whose blood 'appears' to be free of the virus. Further, in some patients, these bits of virus continue to evolve and slowly replicate (*The New England Journal of Medicine*, Vol 340, No 21).

The researchers studied eight patients, who had been 'treated' with the powerful 'highly active antiretroviral therapy' (HAART) for at least two years. When this combination drug therapy first appeared, doctors had hoped that it would turn out to be a cure for the virus: if the viral levels continued

to decrease, the virus might ultimately be eliminated from the body. But, according to the new finding, while the virus appeared to be completely eradicated from the eight patients' blood-streams, all eight had traces of the virus lurking in certain long-lived white blood cells and two had copies that were showing signs of replicating.

The researchers carefully scrutinised individual white blood cells to determine whether there were lingering traces of the virus in people with no measurable virus in their plasma (the liquid portion of blood usually used to screen for viral load). Six of them had latent (or resting) copies of the virus, while in two patients the virus showed signs that it was evolving and replicating, Zhang reported. Researchers can tell if a virus is replicating by looking for mutations in the virus over time. As HIV makes copies of itself, it makes mistakes and changes to correct the mistakes.

Researchers compare what virus particles look like over time. If there are genetic changes, it means the virus is reproducing, rather than lingering in a latent state. The bottom line is that whether the copies of the virus are repli-

cating or asleep, they represent a persistent reservoir of HIV that is not being eliminated by the drugs, which are good at suppressing levels of free virus in the plasma.

"This is very sobering news. The goal of completely eradicating the virus from a patient becomes more problematic if there is a reservoir of virus that is continuously replenished," says Anthony Fauci, a leading AIDS researcher and director of the National Institute of Allergy and Infectious Diseases in Bethesda, Maryland, USA. ■

Gran's a mom

Is a cure for premature menopause in sight?

A SIGNIFICANT step towards halting the ageing process has just been achieved at least for women. Jonathan L. Tilly of Vincent Center for Reproductive Biology at Massachusetts General Hospital (MGH), Boston, USA, and his team report that they have engineered mice whose ovaries grow viable eggs and secrete oestrogen even at an advanced age (mouse equivalent of human centenarians).

The experiments were carried out by Tilly and his colleagues at MGH along with Stanley J. Korsmeyer of Dana Farber Cancer Center and associates at the Washington University in St Louis and the University of Maryland. The group was able to arrest what had seemed an immutable law of mammalian nature — inexorable depletion of ova or egg cells. Ovaries in all mammals obey a strict genetic command that causes ova to die at a steady rate throughout the lifespan until the supply is depleted (*Nature Genetics*, Vol 21, No 2).

Indications are that the geriatric mice maintain a strikingly youthful character without evidence of harmful estrogen-related effects. Their uteruses resemble those of much younger animals instead of the shrunken organs of normal-aged mice. The researchers were surprised to find that all it took to forestall the normal ageing of ovaries was to disable a single master gene, called *bax*,

which controls the rate of cell death.

The researchers knocked out the *bax* gene in mouse embryos, creating a gene defect that seemed to produce no harmful effects in the animals later in life. In fact, they live longer than normal mice. Egg follicles continued to develop in the ovaries of the 'bax-less' mice as late as 22 months — ancient by mouse longevity standards. However, the females did not become pregnant when caged with male mice, which Tilly thinks is due to shutdown of sex hormones from the pituitary gland in the brain. But when the researchers removed the eggs from their geriatric mice, they found they were capable of being fertilised in the test tube and of growing into normal-appearing embryos.

The new mouse strain, however, does not open the door to geriatric motherhood. One major reason is lack of certain hormones needed to sustain pregnancy in these aged animals. More importantly, as the ethical ramifications of inducing menstruation in older women are widespread, scientists are yet to try the same experiments on humans.

Nevertheless, these findings will certainly lead to treatments to preserve fertility in women who undergo premature menopause due to chemotherapy treatment, for instance. ■

Fat-free, dioxin-free

A fat substitute can speed up the removal of carcinogens

THE only cure for severe dioxin poisoning could be eating food meant for dieters. Eating snacks containing a fat substitute called Olestra can speed up the removal of dioxins and polychlorinated biphenyls (PCBs) from the body.

Michael MacLachlan of the Baltic Sea Research Institute near Rostock, Germany, and his colleagues are now using this treatment on two women suffering from severe dioxin poisoning.

Dioxins and PCBs are stored in body fat. Once there, it takes seven years for half the dose of the chemicals to be cleared from the body. Olestra, which the researchers believe can clear the chemicals much faster, is made by the US-based pharmaceutical firm Procter & Gamble. It tastes like fat but passes straight through the gut. Dioxins can leave the body by diffusing from body fat to fats in the blood and from there into the intestine, where they are excreted as faeces (*New Scientist*, Vol 164, No 2209).

MacLachlan's team reasoned that Olestra in the gut would absorb dioxins and create steeper concentration gradient between the gut and the blood, speeding up the removal of dioxins. They tested this by feeding people three 30-gramme packets of Olestra potato chips a day and measuring the amount of dioxins and PCBs in their faeces. Depending on the particular type of dioxin or PCB, Olestra can increase excretion up to eleven times. As 40 per cent of all dioxins normally leave via the gut, MacLachlan estimates that the snacks more than double the overall rate of elimination of the toxins.

Last year, two Austrian women were hospitalised with severe pimples and blackheads of chloracne, a symptom of dioxin poisoning. One of them had the highest recorded blood levels of TCDD, the most toxic type of dioxin. Doctors tried the Olestra treatment on them. Consumption of up to 90 grammes of crisps a day, increased the rate at which the women excreted dioxin. But though chloracne in one of them improved, it remained unchanged in the patient who was more severely poisoned. ■



Jumbo went fishing!

Elephants used to be aquatic mammals

PATRICIA GOUGH PERTH

A RECENT study emphatically suggests that the elephant evolved from an aquatic mammal. A 28-year-old Ph D student, Ann Gaeth, from the University of Melbourne, Victoria, Australia, obtained rare African elephant foetuses and embryos and, while examining them in a laboratory, came to this conclusion.

In 1993 and 1995, adult female elephants in Kruger National Park in South

presence of a 'Y'-shaped urethral opening, characteristic of an adult male elephant, was checked to determine the sex of the foetus.

There are two features that make the elephant unique. Firstly, it has the longest gestation period — 22 months among mammals. And, secondly, the presence of nephrostomes in the kidney of a foetus, a feature not seen in any other mammalian species.

Nephrostome is a funnel-shaped

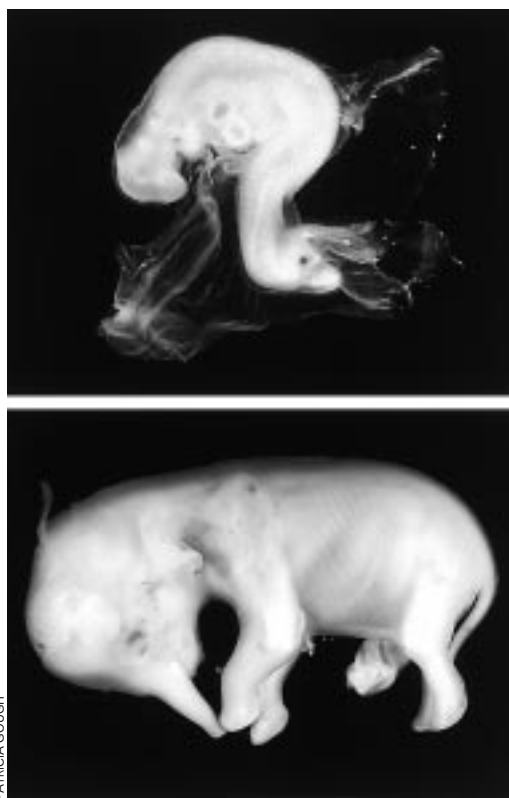
duct opening on the surface of the kidneys to the abdominal cavity. It enables an osmotic exchange to occur between the abdominal fluid and blood supply to the kidneys. Nephrostomes are a characteristic feature of the kidneys of freshwater vertebrates such as fish, whales, dolphins and frogs. When such vertebrates moved onto dry land, they preserved the aquatic environment of the embryo by encasing it in a fluid-filled amniotic sac. Functional nephrostomes are still present in the first stages of kidney development in egg-laying reptiles and birds.

Nephrostomes are extensively developed in the platypus (a small Australian egg-laying mammal). The echidna (which appears similar to a hedgehog) also has them. However, nephrostomes never develop in the kidneys of present-day mammals.

In the foetuses she examined, Gaeth along with her colleagues R V Short and M B Renfree found the:

- presence of nephrostomes in the kidneys of foetuses at all stages of development;
- intra-abdominal location of the testes; and
- development of the trunk.

These three findings, says Gaeth,



PATRICIA GOUGH

The 58-day-old and 166-day-old elephant foetuses that were studied to trace their lineage

Africa were killed as part of a culling operation to reduce their numbers. The foetuses were then collected and preserved in formalin, photographed, measured and later sent to Gaeth upon her request.

The embryos and foetuses ranged in weight from 0.04 grammes (gm) to 18.5 gm and the estimated gestation or pregnancy period was 58 to 166 days. The

Cancer class

Mina Bissell of the Lawrence Berkeley Laboratory in California, USA, has long pointed out that micro-environment plays an important role in the development of cancer. Cancer cells, just like any other cells in the body, exist in their own 'micro-environment' consisting of the rest of the tissue. Now, by creating what she calls 'designer micro-environments' in which she changes the environment of breast cancer cells and the three-dimensional structure of the tissue in which they are embedded, Bissell shows that breast cancer can be made to stop spreading. This is an important insight into what causes cancer, and carries implications for treatment.

Better medium than big

The 'bigger the better' theory does not always work, especially with turtles. Justin Congdon of the Savannah River Ecology Laboratory in South Carolina, USA, and his colleagues have found that medium-sized baby turtles have the best chances of reaching adulthood. Over two years, the researchers built fake nests which they filled with snapping turtle (*Chelydra serpentina*) eggs. The smallest hatchlings did badly, while both medium and large hatchlings had a similar chances but selection actually favours mid-sized ones. They may be leaving the nests with bigger yolk reserves and have better growth rates, believes Congdon (*New Scientist*, Vol 164, No 2213).

Bad blood

Introducing new animals in areas where they are on the brink of extinction is considered one of the best ways to reinvigorate a population. However, this may not always work, says Kenichiro Shimatani of Michigan State University in East Lansing, USA. Shimatani set up a model of a population of animals living on an island and used the most powerful method of genetic diversity known as the 'nucleotide diversity index'. He showed that adding new animals with different DNA sequences can actually reduce the overall genetic diversity (*New Scientist*, Vol 164, No 2213).

suggests that the elephant's ancestors were aquatic. "Now there is a wealth of information to show that elephants and sea cows or *sirenia* must have once shared a common ancestor," she says. To prove her point, Gaeth says that the moeritherium, which is a primitive class of elephant, has skeletal features highly suggestive of a semi-aquatic lifestyle. There are similarities in dentition (arrangement of the teeth) between the herbivorous elephant and the sea cow. Further, Gaeth found that a bone in the middle ear of the sea cow was also present in the elephant foetus. Most recently, molecular studies using the gene tree have reinforced the affinity between the elephant and the sea cow.

Regarding testicular evidence, Gaeth says since time immemorial elephant foetuses followed the normal mammalian pattern except that the testes remained intra-abdominal, never descending into the scrotum. At no stage of foetal development were there any characteristics that belonged to scrotal mammals.

In scrotal mammals, the spermatic artery is surrounded by complex blood vessels draining the testis but, in the adult elephant, the structure is notably absent. Instead, the testicular artery ran its direct course from the renal artery to the testes. If they were 'secondary testiconda', whose foetuses had once been scrotal, the complex blood vessels would have been retained as in the case of seals and whales.

Seals and whales are classified as 'secondary testiconda' because when they entered the water, they presumably had scrotal testes, which were subsequently withdrawn in the abdominal cavity to prevent them from getting too cold. Even a brief period of extreme testicular cooling can render an animal permanently sterile, says Gaeth.

The researchers agree that the elephant like the dugong (sea cow) is a testicond mammal — one that has intra-abdominal testes.

The researchers also found evidence of the trunk developing in the foetuses at an early stage. It coincides with the first appearance of the nephrostomes. The trunk might have evolved as an adaptation to an aquatic environment. "It would have been used as a snorkel and it is to this day when elephants swim in deep water," says Gaeth. ■

Cooperation

How bacteria acquires the genes to cause cholera

BACTERIA contains genes that give instructions to make proteins, which cause infections. In other words, in the absence of these genes, the bacteria does not harm its host. Called virulence genes, they may code for a protein that helps the bacterium stick firmly to the host. Or it may encode a protein that acts as a toxin to the host or one that helps to inject bacterial products into the host.

Many of these virulence genes are found in clusters known as pathogenicity islands. The answer to how the bacteria acquired these islands during the process of evolution is provided D K R Karaolis, Sita Somara and their colleagues at the University of Maryland, USA (*Nature* Vol 399, pp 375-379).

The scientists worked with *Vibrio cholerae*, a bacterium responsible for causing cholera for over a century. Diarrhoea, one of the symptoms of cholera, is said to be caused by a toxic protein that the bacterium

releases. However, not long ago, it was discovered that the gene for making the toxin was, in a sense, foreign. The toxin gene was encoded not by *V cholerae* itself but by a virus (or phage), which is called the cholera toxin phage or CTXΦ.

CTXΦ carries one strand of DNA. It manages to get into the bacterium by first sticking to hair-like attachments called pili that extend outward from the bacterium and is used to stick to (colonise) the intestine of its host. The pilus termed toxin co-regulated pilus (TCP) is a fibre of polymerised protein known as TCPA. It promotes colonisation by enhancing interactions between bacterial cells and, perhaps, directly with the host.

TCPA occurs on a pathogenicity island called *vpi* (for *V cholerae* pathogenicity island). All strains of *V cholerae* that cause the disease contain *vpi*. The astonishing findings that Karaolis and his colleagues have now made is that *vpi* too is foreign.

It is part of the genetic makeup of a phage, called *vpi*Φ. Like CTXΦ, it too contains a single DNA strand surrounded by a coat of protein. The scientists say that, for *V cholerae* to be capable of causing cholera, it needs to carry two hitchhikers with it.

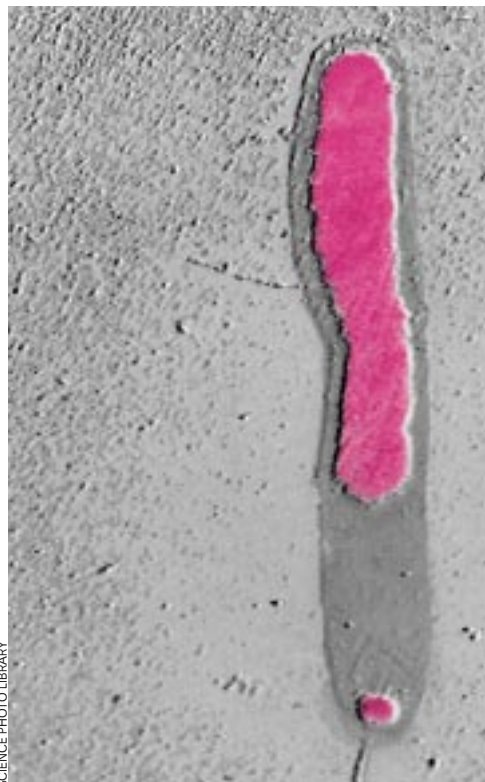
The first, CTXΦ that endows the bacterium with pili and, the second, *vpi*Φ that provides the toxin.

The story does not end there. The coat of protein that surrounds the DNA of *vpi*Φ is nothing else but TCPA, the very same protein that goes into building the pilus. In other words, the same gene, provides the DNA of that phage with a protective protein coat and gives its host bacterium the material to make pili.

While the pilus is necessary for CTXΦ to infect the bacterium, *vpi*Φ provides the means for the other phage to get into *V cholerae*, a truly extraordinary example of cooperation.

However, whether this relationship is found among other infectious bacteria and how it came to be this way during evolution remain unanswered questions. ■

***Vibrio cholerae* bacterium needs 'viral' support**



SCIENCE PHOTO LIBRARY

Storm project

To mitigate the damage caused by frequent cyclones, six Asian countries, including India, will undertake an effective storm warning project. The five-year project is worth \$45 million, and will be coordinated by India. B N Krishnamurthy of the department of ocean development has been nominated as the pre-plan manager to negotiate with international funding agencies and coordinate with member nations. Pakistan, Sri Lanka, Iran, Bangladesh, Myanmar and the Maldives are the other countries involved in the project, which is supported by the World Meteorological Organisation, International Oceanographic Commission and UNESCO. The project involves setting up sea-based observational posts for data collection and development of more accurate computer models (*PTI Science Service*, November 1-15, 1999).

Deep-sea secrets

Oceanographers have discovered significant plumes of chemicals that spew from what appears to be the first signs of deep-sea vents. During a survey of the Atlantic's East Scotia Ridge in the south of the equator, Roy Livermore of the British Antarctic Survey in Cambridge, UK, and his colleagues detected the deep-sea vents. The plumes were traced at two locations, about 2,500 metres under water. This was disclosed by Livermore at a meeting of the British mid-ocean ridge researchers in London recently (*New Scientist*, Vol 164, No 2213).

Lava whirlpool

A swirling vortex of molten rock has been found 3,000 km beneath the North Pole. It is believed that the Earth's magnetic field is generated by circulation in its molten outer core. After studying the historical measurements of the magnetic field, geophysicists Peter Olson and Jonathan Aurnou of the John Hopkins University in Baltimore, Maryland, USA, traced a flow, "which has the structure of a giant hurricane" (*New Scientist*, Vol 164, No 2212).

EARTH SCIENCES

Help on-line

A new cyclone prediction model will indicate the severity of a cyclone at least 12 hours in advance



areas up to 10-15 kilometres inside the coast. A surge or rise in sea level due to cyclones is the leading cause of death and damage because the rising wall of water floods large areas. This is a common phenomenon in India's east coast and Bangladesh (*PTI Science Service*, November 1-15, 1999). For calculation, the model requires satellite data, which can be collected from INSAT satellites, says Dube. The Indian Meteorological Department (IMD) is, at present, testing the operational feasibility of the model for its inclusion in IMD's cyclone

warning programme.

Compared to the current methods used by IMD for weather forecasting, the computer-based model is more efficient as it can identify the exact areas which are likely to get inundated.

Furthermore, keeping in mind the different topography of different regions, the scientists have developed site-specific versions for seven cyclone-prone regions in the country. "We have prepared storm surge prediction models for Andhra Pradesh, Orissa, West Bengal and Gujarat coasts, which are the four major cyclone-prone coasts in India, says Dube.

The IIT team has also developed models for southern Indian peninsula, Sri Lanka, Myanmar and Bangladesh coasts. All models have been calibrated using data recorded in various earlier cyclones, he says.

Meanwhile, the Chennai-based National Institute of Ocean Technology has also developed a surge prediction model, which is claimed to be more efficient than the one developed by the IIT scientists in representing the complex geographical features of the coast. ■

TIME and again, India's east coast has been battered by storm surges and cyclones. The loss of life and property often runs into millions of rupees. And frequently in the eye of the storm is the meteorological authorities, who are blamed for not flashing the warning signals beforehand.

To make the job of weather forecasters easier, scientists have developed a computer-based cyclone forecasting model that will indicate the severity of an impending cyclone at least 12 hours in advance. This will also help the authorities concerned take measures to minimise losses.

The model was developed by S K Dube of the Centre for Atmospheric Sciences at the Indian Institute of Technology, New Delhi, and his colleagues U C Mohanty, P C Sinha and A D Rao. By using parameters like wind speed, speed of the movement of the cyclones and geographical features of coastal regions, the new model can zero in on any area, says Dube.

It can identify the magnitude of the surge, the most likely areas where the surge is expected to hit and inundation

ILLUSTRATIONS: AKHILESH

Charred to extinction

Methane reserves set the air ablaze and roasted alive several species, including the dinosaurs

IF A team of oceanographers are to be believed, methane-fuelled firestorms could have been the last straw for some species, including the dinosaurs. They believe that the impact of a giant asteroid or comet in the Gulf of Mexico released vast quantities of methane that set the air on fire and hastened the extinction of several life forms.

About 65 million years ago, huge amounts of methane generated by rotting vegetation lay trapped in sediments more than 500 metres below the sea level. At these depths, low temperatures and high pressure allow methane to combine with water to form solid methane hydrates.

Several countries, including the US, Germany and Japan are keen on exploiting the potential of methane hydrates as fossil fuels. The methane hydrate reserves have already played a critical role in the Earth's history millions of years ago, believes Burton Hurdle and his colleagues of the Naval Research Laboratory in Washington, USA.

As the asteroid or comet hit the ocean floor, huge shock waves were generated, which travelled round the planet and unleashed enormous amounts of trapped methane. The methane could have been ignited by streaks of lightning in the charged atmosphere. "The atmosphere itself would have been on fire," says Burton. "This could have led to the demise of dinosaurs," he surmises (*New Scientist*, Vol 164, No 2213).

The researchers cite more evidence for their theory. Earlier, a discovery at Black Ridge off the coast of Florida also showed disruption in sediments of the Cretaceous period (65 million years ago), possibly due to methane release. Of late, researchers have also found that trapped methane often escapes from the sea floor even in the absence of asteroid strikes.

Dick Norris, a palaeo-biologist at Woods Hole Oceanographic Institution in Massachusetts, USA, who was involved in the discovery of the Black Ridge sediments, agrees with Hurdle

and his colleagues. A lot of methane could have been released from the site if it had been trapped in the form of methane hydrate, he says, adding that increased preponderance of the isotope carbon-12 over carbon-13 immediately after the impact suggests that a lot of methane was burnt. However, this pattern is not repeated all over the globe.

Some experts are cautious of accepting the new theory. Peter Schultz of Brown University in Providence, Rhode Island, USA, who has studied the late Cretaceous impact, says, "I think the idea would be intriguing, but I'm not sure if an impact, even this big, would have liberated that amount of methane."

However, Angela Milner, head of vertebrate paleontology at the Natural History Museum in London, believes that the population of dinosaurs were shrinking even before the collision. And the huge methane fires could have hurried their demise. ■

Warm without carbon dioxide

CO₂ had nothing to do with the Miocene era global warming

THE Earth has already witnessed the warmest era some 14.5-17 million years ago during the Miocene period.

Referred to as the "Miocene Climate Optimum", it is regarded as the warmest era in the last 35 million years. Fossil evidence suggests that the mid-latitude temperatures were as much as 6°C higher than the present. Many researchers believed that high carbon dioxide (CO₂) in combination with oceanographic changes resulted in the greenhouse effect, which was responsible for global warming in the Miocene period.

Now, a new study has revealed that CO₂ levels were surprisingly low throughout the Miocene era. The scientists conclude that the greenhouse gas effect of CO₂ cannot explain the Miocene warmth. Other mechanisms must have had a greater influence (*Nature*, Vol 399, No 6734).

The scientists, M Pagani, M A Arthur and K H Freeman, used a relatively new molecular isotopic approach that is very effective in tracing CO₂ in glacial and inter-glacial cycles of the past several hundred thousand years. The records bear little relation to an expected association between CO₂ and long-term climate change. In fact, low CO₂ values span the warm "Climatic Optimum", which ended about 14.5 million years ago. Meanwhile, rising CO₂ levels seemed to accompany global cooling and expansion of the East Antarctic Ice Sheet about 12.5-14 million years ago.

If Pagani and his colleagues are to be believed other factors, for instance, greenhouse gases like methane and water vapour, and ocean circulation, might have been responsible for Miocene warming. Low CO₂ levels may also have increased the sensitivity of the climate system to heat and vapour transport. Alternatively, changes in atmospheric water vapour and moisture supply to the Antarctic continent may have promoted global cooling and growth of the East Antarctic Ice Sheet.

The new finding has profound implications on our understanding of the Earth's history, including climate change and ocean chemistry. It also raises the prospect that projected CO₂ levels in the next century may be the highest in at least 25 million years. ■



THE DILEMMA OF ANIMAL EXPERIMENTATION

K SATYANARAYANA

THE forcible release of 52 monkeys from the National Institute of Nutrition (NIN), Hyderabad, into a forest by activists led by a Blue Cross functionary, Amala Akkeneni, has once again brought into sharp focus the bad blood between researchers and animal rights activists. The research has suffered a setback by about a year.

The release was ordered by the member-secretary of the Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA) on the grounds that NIN had failed to register itself with the CPCSEA and the institute was not taking proper care of the animals. NIN was doing some safety testing of alpha interferon - an indigenous anti-cancer compound — on monkeys for a Hyderabad-based drug company.

The CPCSEA derives its authority from section 15 of the Prevention of Cruelty to Animals Act (1960). Under this act, the scientific community has progressively developed a system that addresses the welfare of the animals without affecting research. Maneka Gandhi, as chairperson of the CPCSEA, commissioned several NGOs in 1997-98 to inspect about 5,000 laboratories experimenting on over 5 million animals every year.

This report accused scientists of, among other things, conducting insane and redundant research besides performing unnecessary experiments with the express purpose of producing papers to further their careers. The report recommended several steps such as a ban on testing cosmetic substances on animals; reduction in the number of animals being dissected in educational institutions; restrictions on testing variants of drugs that are already available, mandatory provision of anaesthesia and analgesia; advance notification of details of experiments to the CPCSEA for a review of their importance and random checks to avoid repetition of experiments.

New guidelines were issued in September 1998. The Breeding of and Experiments on Animals (Control and Supervision) or BEA Rules notified by the CPCSEA broadly covered all areas of animal experimentation such as their breeding, stocking and experimentation, registration of establishments supplying and using them, permission for conducting experiments, the conditions under which experiments have to be conducted etc. The Gazette notification was issued despite strong objections from the CPCSEA members.

The scientific community reacted strongly saying some of the provisions were considered 'unrealistic' and 'impractical'. This led to the constitution of a high-power committee under P K Dave, director of the All-India Institute of Medical Sciences, New Delhi. But some of the recommendations of the committee were not incorporated in the final notification.

In June this year, the CPCSEA directed NIN to release about 30,000 animals including mice, rats, hamsters, guinea pigs, rabbits and monkeys housed in the National Centre for Laboratory Animal Science, Hyderabad, a department of biotechnology-funded national facility at the NIN. When the NIN refused on the grounds that it has already sought registration and maintained that it did not flout any rules, animal activists



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marched in with the police and took away the monkeys to be released in a forest. This led the scientists to appeal for the prime minister's intervention. The prime minister's office has just constituted another committee under noted neurosurgeon P N Tandon to have a fresh look at the BEA guidelines. The committee has already submitted its report to the PM.

The issue that deserves attention is whether it is possible or even feasible to exclude animal use from laboratory experiments. Complete elimination seems highly unlikely in the near future. But there have been serious efforts globally towards its reduction since the 1970s.

Only a discussion between both the groups in a climate of mutual trust can help find a solution acceptable to both. So far, it appears that there has been no such meeting. There are deficiencies in animal care which that even scientists admit should be addressed. Scientists need to understand that on any ethical issue societal inputs must and should be taken. The Institutional Animal Care and Use Committee (IACUC) mechanism in laboratories should be strengthened. Animal activists, on their part, need to keep an open mind and not insist upon imposing impractical and unworkable set of rules that are detrimental to the progress of science. ■

The author is a scientist with the Indian Council of Medical Research, New Delhi. The opinions expressed are his own and not of the council

Is there an alternative to guinea pigs in laboratory testing? Two members of the scientific community give their views



SAUMITRA BHARADWAJ

THE philosophy of prevention of cruelty to animals has been the central theme of many societies and cultures around the globe. The issue of discontinuing the use of animals for testing by various research institutes and pharmaceutical firms is thus a continuation of the same tradition.

Recently, it was reported that an animal rights organisation freed a number of animals which were earmarked for research. It is high time to address this problem in its totality. Does our responsibility end with an occasional act of emotional hysteria? We also have a responsibility to prevent cruelty to animals which are housed in slaughterhouses and those owned by companies that are involved in animal husbandry and selling of animal products.

Another community which has taken a lot of flak on the issue is the scientific community. But we must look at the role of the scientific community in a different light. It is unreasonable to regard all the scientist all cold-blooded, insensitive people. We should not forget the great contribution that scientists have made for the betterment of life on this planet. The information gained from the various scientific experiments not only go a long way in serving the needs of humans but also animals. For example, the antibiotics produced in the labs are also used for the treatment of various diseases in animals.

A question we are faced with is how to discover, invent and

promote products for the betterment of all without the use of animals. It is not possible to develop a software which simulates various *in-vivo* conditions as we have in some other branches of science.

In order to protect people's lives, the rules regulating the introduction of various medical products are very stringent and in some cases even harsh. During trials a drug has to pass numerous stages of scrutiny before it is finally approved for use. After getting the initial permission, the drug is developed and tried on lab animals and the results studied. Then the therapeutic dose required, LD 50 (lethal dose which kills 50 per cent of the test animals), the carcinogenic profile and adverse fetal effects are closely monitored. It is only after this that the drugs are approved and tried on human volunteers. In rare cases only drugs not approved may be used for treating patients not responding to existing treatments. The effects of the drug are then statistically analysed. Even after the drugs are introduced in the market they are monitored by the postmarketing surveillance department. All this takes many years.

The benefits of animal use in research are enormous and we will have to continue doing so till we find an alternative. Progress in science has let scientists discover the causes of diseases whose origins were earlier unknown. As life expectancy increases, new long-term manifestations of diseases like diabetes are appearing. How are we going to find cures for AIDS, cancer, Alzheimer's disease? How are we going to develop vaccines for diseases like leprosy?

Today, it is of utmost importance to monitor the use of animals for research. The agencies - governmental and non-governmental - should scrutinise the justification of these requirements and their ecological impacts. They should make sure that no arm-twisting is done by governments just to get their orders passed. They should ask for submission of periodic reports from the labs on the progress of the various research projects and then evaluate their validity. They should also inspect the labs to ensure standards are met. The scientist have to be trained in the understanding of animal behaviour and husbandry. It is of utmost importance that high levels of ethical and moral values be maintained.

The medical fraternity should also play a constructive role. The discovery of alternative methods for research should be high on the agenda. A case in point is the production of vaccines in Human Cell Series which not only produce better vaccines but do not involve the use of animals, all the while minimising the chances of adverse effects. Animal rights should be constitutional rights as animals too have a right to this planet. These rights are supposed to be respected by not only the people working in the laboratory but also by the common person and other professionals involved with animals in various ways.

People could contribute to the cause by joining the various animal rights organisations so that the message can be propagated properly. They should also empower these organisations sufficiently to influence governmental policy. ■

The author is a medical practitioner based in Delhi

IN A SPOT

Are the new industrial siting rules a boon or a bane?

SAGAR DHARA

THE Union ministry of environment and forests (MEF) has recently circulated draft rules on industry siting, a decade-and-a-half after the guidelines were first formulated. Choice of industrial sites has caused more conflict, between project proponents and the local people who will be potentially affected, than any other environmental issue. If the draft becomes a law, the rules will heighten this conflict.

Industry contributes to economic growth — not necessarily equitably — but, among other things, it also degrades the environment, poses health risks and alters landuse. Mumbai and Kanpur are bustling centres for industry and trade today. But they are also congested and polluted. The Bhopal gas disaster's high toll was because the Union Carbide Corporation decided to locate its plant at the edge of the city, rather than away from it. Until three decades ago, Dalli was a little known town in Durg district's tribal area. Iron ore mining turned it into a boom town, but also caused rapid depletion of the surrounding dense teak forests.

Site choices have an economic logic. Minimising transport costs is the single-most important factor to influence industry siting. Kalyani Steels, for example, wanted to locate their new coke oven plant near Mangalore as the port there can handle the 2.5 million tonnes of coal the plant will import, which other Karnataka ports cannot. Their next choice was Ramnagar, one km from Karnataka's rich Western Ghat forests and close to the Goa border.

Why Ramnagar? Because the Vasco port in Goa is close by and so are the coke-consuming steel plants in northern Karnataka and southern Maharashtra. The nearby Supa reservoir will provide water and the rail and roadheads at Ramnagar are convenient for coal and coke movement. Finally, a Karnataka site provides Kalyani Steels better tax breaks. It makes good sense for Kalyani Steels to want to locate at Ramnagar. But for the people and the forests, it doesn't.

For decades now, infrastructure development and industry departments have helped industry select sites. Industrial estates have come up close to sources of raw material and markets and where there is power, water, a transport head, cheap labour and upstream or downstream industries. But, as in Kalyani's case, the cost of the impact on the environment, people's health and livelihood — even if they can be computed — are left out of the economic equation used for site selection.

Regulations and conflict

Nine months after the Bhopal tragedy, MEF published the first industry siting guidelines. Essentially, the guidelines prescribe that industries should be located at least 25 km away from ecologically sensitive areas and towns with populations over 300,000, and half-a-kilometre from coastal areas, flood plains, riverine systems, highways and railway lines. The guidelines were not mandatory, they were never implemented seriously.

In the last decade, there has been a substantial increase in

the number of instances where site choices have led to conflicts. Birla Periclase's calcite mines and approach road through thick Eastern Ghat forests and Dupont's N6,6 plant in the agricultural areas of Goa are some of the cases that come to mind readily. Industrialists saw these sites as economically beneficial, but the local people saw them as 'unwanted neighbours' who would dirty their surroundings and affect their livelihood.

The Cogentrix power plant in Dakshin Kannada (DK) district in coastal Karnataka is the best example in recent times of bad siting leading to conflict. Popular groundswell against the proposed site has stalled plant construction for years. The Karnataka government argues that DK district is industrially underdeveloped and hence needs power plants and other industries. The people counter this by saying: "The bulk of the power is for Bangalore, Karnataka's load centre, so why put power plants in this ecologically-rich district? Besides, DK district is ahead of the rest of Karnataka in every respect of human development. Polluting industries will only deteriorate the quality of life here." The reason for siting Cogentrix in DK district is its proximity to Mangalore port, which significantly cuts costs of hauling coal.

Sensing the gathering storm over industry siting, MEF has



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recently circulated draft rules, the main provisions of which are:

- 15 industries, for instance, refineries and petrochemical plants cannot be located in urban areas and within 25 km of sanctuaries, national parks, biospheres and metro cities, and 7 km from notified wetlands and half a kilometre from highways and rail lines;
- 10 industries cannot be sited within 7 km of notified archaeological monuments.

Draft rules: part of the problem

The draft rules, though well intentioned, are fraught with many problems. First, is the exclusion of many highly polluting and hazardous facilities — for instance, power plants, nuclear reactors, chemical storages — from the list of industries for which distance criteria apply.

Second, the draft rules do not provide for a 'no-development zone' around drinking water reservoirs for cities to prevent their contamination. The Hussain Sagar Lake in Hyderabad, once a drinking water source, has been contaminated by effluents from industry located 15 km away.

Third, the draft rules are based on the underlying assumption that the impact of pollutants wanes with distance from the source. This is not always valid. Tanker trucks carrying hazardous chemicals, for instance, have been involved in serious accidents many miles away from cargo filling points.

Fourth, the draft rules beg the question: "What is the scientific basis for specifying 25 and 7 km?" With 15 years of experience of doing environmental impact assessment (EIA)

studies (the first guidelines appeared in 1985), there should be adequate data to say, for example, that a cement plant has a credible impact range of 10 km. On the other hand, it may be a few hundred kilometres for nuclear reactors, as was the case in the Chernobyl accident.

Lastly, and most importantly, the 25-km-from-metro-cities rule discriminates against people living in non-metros. It implies that people in smaller habitats can be subjected to greater pollution loads from industry as they have a lower incidence of pollution-related health effects. Where is the epidemiological evidence for this?

The 1999 draft siting rules are a watered down version of the 1985 guidelines, though they will become mandatory only when notified. They were fatally flawed, *ab initio*, as they distribute risks unevenly across society, a sure recipe for strife.

Good siting rules: a solution

Siting is only one of several factors that contributes to environmental management of industries. In India, though, it has the potential to be the most important one. Proper industry siting is a cheap and quick way to improve many aspects of environmental management as all it requires is putting on a thinking cap. The other factors that contribute to environmental management — technology, government policy and regulation, enterprise-level management policies, profitability and people's involvement in environmental management — require large outlays and considerable time.

Good siting regulations act as a 'no go' gate for bad sites and the results show. The many cement plants in Telangana and northern Karnataka, located mostly in rocky and scrub areas, have had little adverse impact on their surroundings.

There is yet another good reason for choosing good sites at the outset. Once a facility comes up on a bad site, it is difficult to do anything about it. A Madhya Pradesh minister's statement, months before the Bhopal gas disaster, illustrates the mindset of policymakers. To a suggestion that the Carbide plant posed a threat to Bhopal, the minister said that the plant was not a pebble which can be picked up easily and placed elsewhere.

Distance between pollution sources and receptors, the pre-eminent criteria used by the draft rules, is not very satisfactory for protecting either the environment or people's health. Four additional measures for improving siting regulations are required.

- Siting rules should be based on risk standards. These standards require that risk be below the specified limits for all persons. Further, all hazardous facilities, regardless of mention in the rules, will be covered by the risk standards. If cumulative risk in an area is close to the limit, additional facilities which increase risk would be barred.
- It is necessary to define criteria for ecologically-sensitive areas (ESAs). Areas that meet the criteria must then be notified as ESAs. One such area would be the Western Ghats and a buffer area around them. Human activity in ESAs should be suitably regulated, including exclusion of polluting and hazardous industries. Apart from protecting India's rich but threatened biodiversity, the demarcations of ESAs will also minimise the chances of selecting sites such as Ramnagar and the consequent conflict.
- Environmentally-suitable industrial sites, with low potential impacts, should be identified on a war-footing in



every state so that they can be offered to project proponents as and when they wish to set up industries. Hitech industry zoning maps for about 30 of India's 549 districts have been under preparation for several years. However, progress has been slow, and maps for only seven districts are now available. Simpler maps can be prepared quickly to help industry siting.

- Site clearance can be made more effective and faster if environmental clearances are done in two stages rather than in a single stage, as is done now. Current procedures require EIA and risk analysis studies to be submitted for 29 categories of industries before a site is considered for environmental clearance. These studies do not come cheap and Indian industry is generally loathe to spend on such 'unproductive' items. Invariably, project proponents submit only one site for consideration and this puts environmental clearance committees under pressure to clear that site.

In a two-stage environmental clearance, the first stage would consider granting a provisional clearance for a site, after examining two or more candidate sites. The second stage, meant for successful stage 1 sites, would consider granting a project clearance based on detailed EIA and risk analysis studies.

Democratising environmental management will also help siting. Environmental issues are far too complex for a single stakeholder to tackle. There is, then, a strong case for government to become more transparent and for environmental decisions to become more decentralised and participatory. Accordingly, two steps should be taken immediately regarding industry siting.

All environmental documents, other than those which affect the nation's security and patent laws, should be brought into the public domain. Public watchdog efforts will do the rest.

The case of the proposed barge-mounted power plant in the Tadri estuary illustrates this well. In the public hearing for the site, the EIA study for the project was asked for and obtained by the local people. The study failed to mention or assess the impact of oil spills on the salt pans, prawn farms, shell fish and the rich mangroves in the estuary. Instead, the EIA study referred to "coral reefs and snow (*sic*)", neither of which occur at Tadri.

An independent appraisal estimated that the plant would affect 2,000 families dependent on the Tadri estuary for their livelihood and cause an annual revenue loss of Rs 40 crore (excluding environmental costs) to the local economy, but only add a tenth of that as revenue gain. A few months after the Tadri EIA study was made public, the project proponents withdrew from the site.

While there is no legal bar on having project-affected persons attend environmental clearance meetings of regulating agencies, this is not currently the general practice. Environmental clearance regulations should be amended to specifically allow for all stakeholders to participate as equals at every stage of environmental clearance. This will throw more light on the specifics of sites under consideration and develop consensus amongst stakeholders regarding good and bad sites and also how to conduct post-project environmental management at the sites. The beginnings of this process can be seen in satisfactorily held public hearings for proposed projects. ■

NATIONAL FOUNDATION FOR INDIA

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The North East Media Exchange Programme invites applications for 10 Fellowships: six for journalists from the North East and four from other parts of India.

ELIGIBILITY

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★ All applications must be typed double spaced. Handwritten applications will not be considered.

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“The rich are enjoying themselves at the expense of poor people’s health”

KAREN E SMOYER of the University of Alberta, Canada, has been working on the impact of poor environment on the weaker sections of society. During her recent visit to Delhi she spoke to **LIAN CHAWII** on the susceptibility of the poor to heat waves in the urban areas of the US

How does pollution affect the poor?

In the developed countries, it is not the poor who are responsible for environmental problems. It is the richer class which owns more than one car per family, who dump their waste in the neighbourhood. Therefore, the rich are enjoying themselves at the expense of poor people’s health. Similarly, people in developing countries are using second-hand and outdated technology that has been dumped by the developed countries. The poor are affected in two ways: both by the foreign as well as the mother countries.

Can you cite some examples of how residents living near hazardous waste sites have the highest incidence of cancer?

In the 1950s and 1960s, toxic by-products were found in Love Canal in the US, because chemicals were dumped in it. Similar incidents have taken place in many parts of the world. But it is only after a period of time does the effect of the chemicals show up. As a result, mothers are giving birth to deformed babies. However, it is hard to attribute it to any chemical because of a lack of proper studies.

Are people aware of the link between degraded environment and its effect on health?

The level of awareness differs from country to country. The developed countries can afford to conduct research on their environment. But in most developing countries, this is neglected. This is because they don’t have the financial strength as people are worried more about their livelihood than the environment. It has been proved that when the economy improves, environment becomes a serious issue.

You have worked among the people of the lower income group in St Louis, Missouri, USA. Why are these people



more susceptible to heat waves?

The poor do not have access to air conditioners, and even if they have, they do not use them because they cannot afford to pay the bills. Many of them live in high-rise buildings, where air circulation is poor because buildings block the flow of air currents.

There are other reasons too. Flats in high-rise buildings are dingy and very close to each other. Warm air entering a flat is trapped because there is not enough space for circulation. Moreover, these buildings are crime-prone and the occupants are forced to keep all doors and windows shut. This aggravates the problem and also leads to a number of respiratory illnesses. These are some of the major reasons why the poor are more susceptible to heat waves.

As a result of unchecked and unplanned development programmes, the people living in cities like Mexico have to endure poor environmental conditions. Do you see the same

happening in India?

This problem exists in almost all cities in developing countries. People from the rural areas come to cities in search of employment and for a better life. But the cities are not planned to handle the pressure of an increasing population. These people are then forced to live on the streets making the city unhealthy for everyone. They also suffer from many other ailments in the process.

In such a scenario the governments must anticipate the situation and provide better housing for these people.

What should be the focus of our research on health in the future?

There is a need to initiate research programmes aimed at reducing environment health impacts. The poor should be given access to better sanitation. Since it is difficult to relocate

The poor should be given access to better sanitation. Since it is difficult to relocate them, efforts must be made to ensure that they do not live in shanty dwellings

them, efforts must be made to ensure that they do not live in shanty dwellings.

An in-depth study needs to be conducted on the environmental health burden on the poor.

How can countries like India take advantage of their enormous human resource ?

The health sector needs to given prime importance. Education also needs to be taken into consideration. Only then, will there be a healthier and educated population over a period of time. What strikes me most when I look at countries like India and China is that the gap between the rich and poor is increasing day by day. ■

All about agreements



THE IMPLEMENTATION AND EFFECTIVENESS OF INTERNATIONAL ENVIRONMENTAL COMMITMENTS, THEORY AND PRACTICE Edited by *DG Victor, K Raustiala and EB Skolnikoff* Cambridge: Mass: The MIT Press • Pages 755 pp • Price \$30

INDIRA KHURANA

'THINK global and act local' may sound clichéd, but it most aptly describes the efforts that are required to stop, reverse and prevent environment degradation. No longer can the environment be thought of, or tackled at purely the local level, even the country level. Emissions and omissions of a country can, and do effect others, best exemplified by the 1997 forest fires in Indonesia, which resulted in

a blanket of smoke hanging over neighbouring countries.

Numerous such examples abound in contemporary history. Rapid industrialisation by the northern countries has led to the formation of a hole in the ozone layer and the phenomenon of global warming. Subsequently, Australia has to cope with the increase in skin cancers, while coastal areas and small islands are threatened with submergence.

Many environmental problems thus cross international political boundaries and their solution requires co-operation between countries on an unprecedented scale. In most cases, the approach to tackle problems of transboundary environment issues has been through international agreements. Through the United Nations Environment Programme, more than 170 multilateral agreements pertaining to the environment have been signed.

The success of any agreement depends on how it is formulated and what it contains. The most difficult part is its implementation — the translation of intent into action, without which the agreement is not worth the

paper it is written on. The Achilles heel of most of these agreements is the steps that need to be taken if member signatory countries fail to take necessary action.

Compliance, by signatory states, sadly, does not automatically imply that there will be a discernible positive change in the environment and thus the effectiveness of an agreement also needs assessing.

This book aims to do just that. Based on 14 case studies, it is the culmination of a three-year research project titled 'Implementation and effectiveness of international environmental commitments' conducted by the International Institute of Applied Systems Analysis in Laxenberg, Austria. These case studies look at the implementation of eight major areas of international environment regulation. The book is divided into two parts. The first part looks at systems of implementation — institutions that allow the contracting parties to share information, compare activities, review performance, handle non-compliance and adjust commitments at the international level, and the other describes the implementation at the national level.

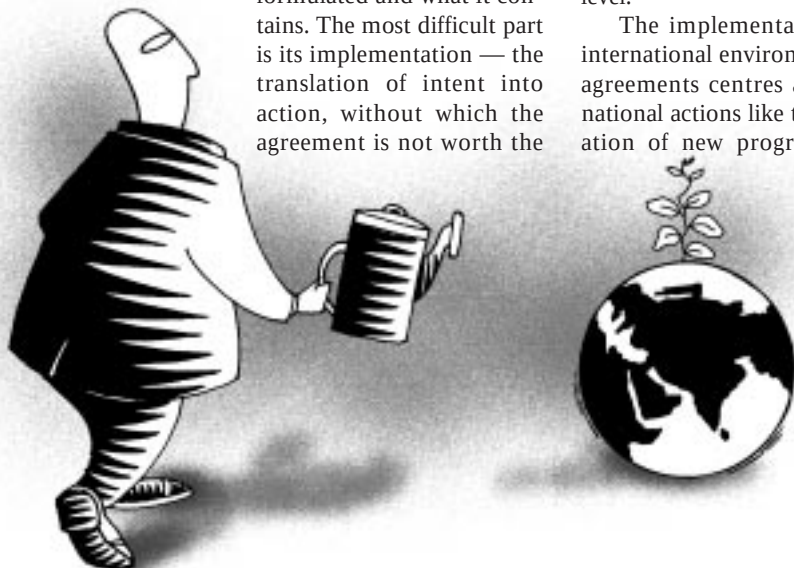
The implementation of international environmental agreements centres around national actions like the creation of new programmes

and the enforcement of laws and standards. Thus actual implementation experiences will naturally differ between nations, based as implementation is, on political dynamics, various interest groups, institutional arrangements and national priorities. National level implementation is tricky, which, given the number of actors that are involved, comes as no surprise. The government agencies, the industry, non-governmental organisations (NGOs), the people, all play a role. The tricky part is that national level implementation requires a change in habits and practices not always easy to change.

The author attempts to examine and analyse a wide range of international environmental and implementation regimes and come to the conclusion that there really is no standard model that can be adopted for implementation. The effectiveness of implementation cannot be predicted and the fate of these agreements can often be uncertain, more so when the national level implementation requires striking changes. Often, even otherwise highly performing governments find themselves unable to meet international requirements.

The book is comprehensive and exhaustive, perhaps repetitive at times. One major drawback is all the case studies are from the north and Russia. There are no examples from Asia or Africa. While the book does get into the intrigue and the various behind-the-scene actors, strong-arm tactics by countries that can flex their muscles is not given due attention.

The book should will easily and justifiably find itself on the shelves of students of international relations and diplomacy. ■



BOOK

Beware of policymakers



PEOPLE, PLANTS AND PATENTS: THE IMPACT OF INTELLECTUAL PROPERTY ON BIODIVERSITY, CONSERVATION, TRADE AND RURAL SOCIETY • *Crucible group* • International Development Research Centre, Ottawa, ON, Canada • 1994 • 141 pp

RIZWANA ULLAH

EXTINCTION is a nasty word one normally associates with lumbering gigantic lizards, huge prehistoric insects, dragon flies the size of a fighter plane or the Dodo. While humans had no say in the death of the dinosaur, they definitely played a major role in the death of the Dodo.

Today a policymaker, if given the chance to save the Dodo, would have the benefit of hindsight. All that would be required is to out-

law both dogs and guns in areas inhabited by the Dodo. The next step would be to introduce patrolling. Despite these efforts the Dodo might still have died out. Perhaps there is something wrong about the policy-makers' decision, which speed up the loss of biodiversity rather than reverse it.

Government laws can force farmers to adopt a particular plant variety or even a totally different crop from the one which sustains and is sustained by the area's ecosystem. This leads to genetic erosion of certain plant species and even livestock.

Decisions about intellectual property, particularly for plant life, have implications for food security and rural development in every country, specially in the developing world. From the early 1970s to the 1980s, governments pushed their farmers to use new high-yielding varieties, especially in the South, where populations are large and grain was the primary source of food. The 1970s were also the period when there was growing concern that an irreplaceable

resource of genetic material was being lost at the cost of meeting food security objectives. In the mid-1970s there were only 10 countries with germplasm conservation programmes; 15 years later, more than 100 countries had outlined their strategies.

On December 29, 1993, the Convention on Biodiversity came into force. It attempts to provide a legally-binding framework to set up a system that will ensure that plant germplasm will be effectively conserved. They have brought with them a wide range of perspectives — some essentially from an eco-conservation perspective, while others put genetic diversity conservation in the context of the need for empowerment of rural communities. All concur on the need to develop mutually-supporting systems.

The book provides essential information that will enable all of us to make up our minds on what should be done. It offers policymakers the options available and represents a wide cross-section of agricultural experience and national perspective. It includes grassroots organisers working with small-scale and subsistence farmers, research scientists and managers. ■

ON THE SHELF



THE WORLD'S WATER: THE BIENNIAL REPORT ON FRESHWATER RESOURCES 1998-1999-12-07 • *Peter H Gleick* • Washington DC: Island Press, 1998; 318 pp • £24.95

This book is a pathbreaking effort to illustrate the issues surrounding one of the world's most important resources. It is the first of a biennial publication tracking the state of the world's water. Gleick details a range of water issues and outlines the effort of international institutions to review and address water resource issues.



GLOBAL VEHICLE EMISSIONS: COMMERCIAL OPPORTUNITIES FROM EMISSIONS REGULATION FOR VEHICLE MANUFACTURERS AND COMPONENT SUPPLIERS • *Michael Nevin and Mark Barrett* • London: FT Automotive, Financial Times Business Limited, 1999 • 199 pp • \$825

A thoroughly comprehensive report which will assist manufacturers and component suppliers to exploit the demand for clean technologies to increase their market share, and enhance their profitability in the medium term future. This book fills the gap by providing accurate, up-to-date information.

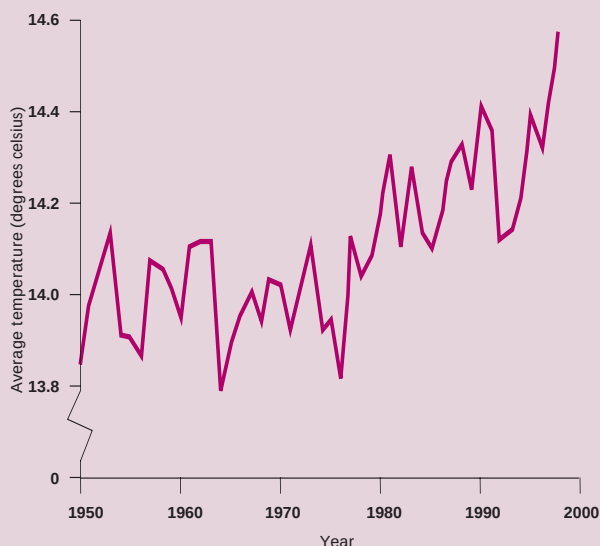


Dirty business

Has economic growth become dirtier? While the world economy has grown steadily since 1950, global temperature increased from 13.84°C to 14.57°C (in 1998). But even after a slowing down of trade in 1998, the temperature continued to rise. Down the years, the volume of international air freight has also increased rapidly from just six million tonnes in 1970 to 24 million tonnes in 1997. However, this mode of transport is far more energy-intensive than shipping, another favoured form of transportation.

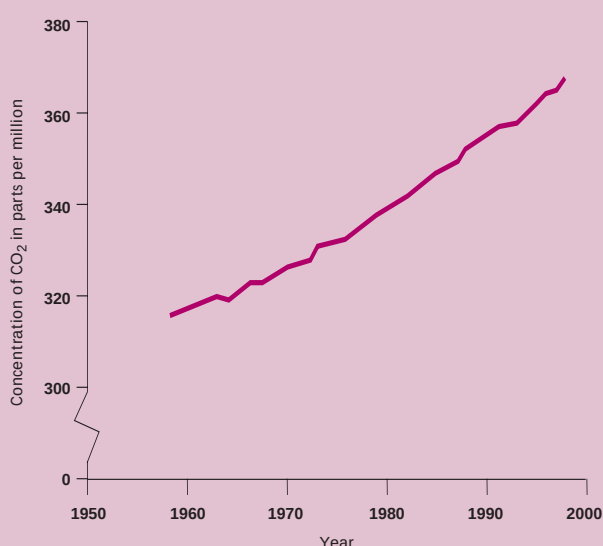
Upward move

Accelerated buildup of greenhouse gases in the atmosphere is the best explanation for global warming



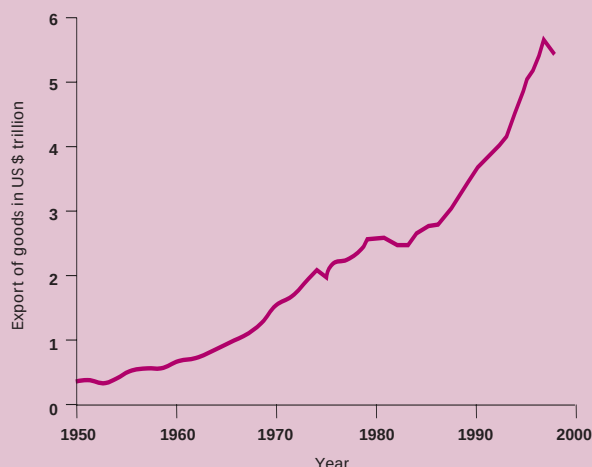
Direct causes

The global carbon dioxide concentration has risen steadily from 1960 to 1998



Rising and falling

At the same time world export of goods rose from US \$0.4 trillion in 1950 to US \$5.6 trillion in 1997 but fell in 1998



Share decreasing

In the 1990s, exports as share of gross world product rose to 15 per cent of the economy but fell by one per cent in 1998

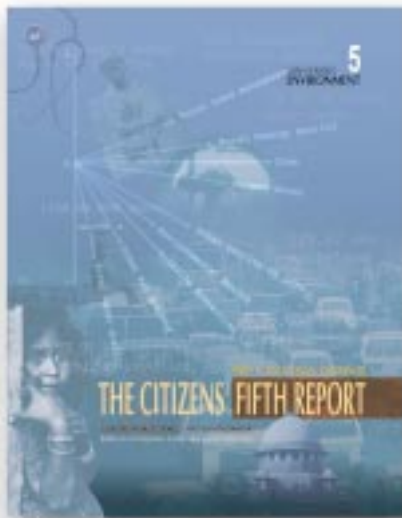
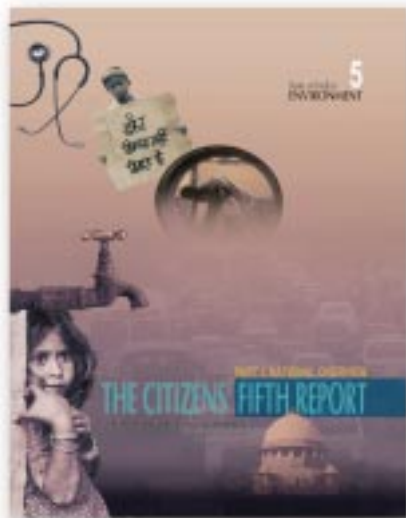


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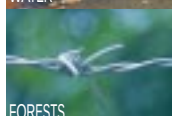
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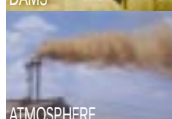
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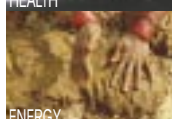
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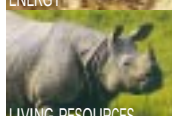
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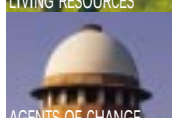
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A stylized illustration of a tree where the trunk is a blue and silver fountain pen. The pen has a textured blue upper section and a silver lower section with a visible nib. The canopy of the tree is composed of green leaves and a soft, yellowish-brown cloud-like background.

FELLOWSHIP FOR JOURNALISTS

The Centre for Science and Environment is offering **one month fellowships** for journalists to study and report the following two pioneering projects of the of Madhya Pradesh government:

- ☐ The community-based Watershed Management Programme
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Those interested should send in their **applications latest by October 25, 1998**. All applicants will be screened by a special committee.

Selected applicants will be given **Rs 7,500 for travel** for 15-20 days in Madhya Pradesh to visit villages and districts. The articles should be completed within a month of the grant of the fellowship.

Applicants must send a **letter from their editor** saying that he/she will use the articles submitted. Freelance journalists can get a similar letter from an editor of a leading paper. Applications must also include a salary certificate, a letter from the editor saying that leave will be granted immediately on receipt of the fellowship, and full details of the places to be visited.

The fellowship amount will be 50 per cent over the existing salary. Freelance journalists will get a sum of Rs 10,000.

Please send your applications to:

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