

The Ecologist

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"The Bank is taking steps... to assure that the projects financed by it do not have serious adverse ecological consequences..."

Ernesto Franco,
World Bank Representative,
March 1970.

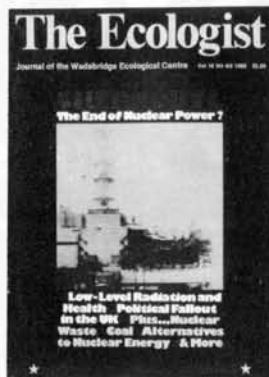
"As a matter of routine, environmental issues are not considered... The Bank does not have the capacity to conduct sector work on environmental issues on a routine basis..."

World Bank Internal Memorandum,
March 1984.

"...We will strengthen the Bank's long standing policy of scrutinising development projects for their environmental impact and withholding support for those where safeguards are inadequate."

Barber P. Conable,
President, World Bank, May 1987.

Can we trust the World Bank?



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Open letter to Mr Conable, President of the World Bank: You Can Only Be Judged On Your Record

Dear Mr Conable

Critics of World Bank policies welcome its new concern for the environment, as expressed in its Development Committee's Report entitled "Environment Growth and Development" (10th April 1987) and in your speech to the World Resources Institute (5th May 1987). Before we celebrate, however, we must be assured that your concern is genuine, and that it will be translated into the appropriate action. Unfortunately, I cannot help feeling that it may well be a vain hope.

To begin with it is difficult to see how you could have done otherwise than express such concern. Senator Kasten, when Chairman of the Senate's Appropriations Sub Committee, said that if people knew what multi-lateral development banks were up to they would "be out in the streets" demanding why their money was "being spent on this kind of destruction." Hugh Foster, the alternate US Executive Director of the World Bank voted against hydroelectric projects in Brazil which he referred to as "pure folly" and "environmental disasters". Indeed indignation against World Bank irresponsibility is growing so fast in official circles, that if you had not promised to reform your ways you would soon be faced with dwindling financial support that might threaten the very survival of your institution.

Of course your new concern for the environment may be genuine, but then it is difficult to avoid asking why it has not occurred to you before that there must be some connection between the escalation of human misery, poverty and malnutrition in the Third World and the progressive degradation of its environment. If Third World people are poor today, Mr Conable, it is not that they suffer from a shortage of transistor radios, plastic buckets, tinned petfoods and the rest of the rubbish that development is making available, at least to the richest among them, nor is it even that their villages remain to be electrified or that they have no access to piped water. If they are poor it is above all because their environment has deteriorated, because the rivers from which they derive their fish and their drinking water are now contaminated with agricultural and industrial chemical, because loggers have cut down their forests causing their rivers to become torrents, their streams and springs to dry up and their weather to change, because their land has been eroded and desertified by large export oriented agricultural undertakings.

As Mrs Rahab W Mwatha said in her testimony at the World Commission on Environment and Development (WCED) Public Hearing (September 1986) "We are awakening to the fact that if Africa is dying, it is because her environment has been plundered, overexploited and neglected." You must know this, Mr Conable. Your Bank's role in plundering, overexploiting and neglecting the environment of the Third World has been pointed out to you in innumerable well-written and highly documented studies by such writers as Susan George, Joe Collins and Frances Moore Lappe, Teresa Hayter, Catharine Watson and Cheryl Payer, to name but a few, and also by environmental organisations such as the Environmental Defense Fund (EDF) The Sierra Club, Survival International, Friends of the Earth (FOE), not to mention ourselves here.

It has even been pointed out to you on many occasions by members of your own staff. Indeed yours is the only multilateral

development bank to have its own environmental department. What is more it employs several highly competent ecologists. But you have invariably chosen to ignore their warnings and to regard environmental considerations as little more than impediments to the achievement of your real priorities.

As Catherine Watson, who worked in the department writes: "Project staff treated us like scourges. As far as they were concerned, we were trouble. We could hold up projects and we could impose new costs on projects, insisting, for example, on reforestation—although we did both extremely rarely." She eventually left because she saw the Department of Environmental Affairs as but "a token office within the Bank" which could never have any real effect on its policies. "When our proposals were accepted" she writes, "it was because they enhanced the progressive image of the Bank and cost the Bank little. When our proposals threatened the future of a project, or had major implications for Bank practice, they and we were dismissed as unrealistic and impractical. Reform was possible, but only in so far as it left the Bank's basis unchanged."

But this has never prevented your Bank from stating your commitment to environmental conservation. Indeed seventeen years ago, Ernesto Franco, a Bank representative, assured government delegates at a planning session for the United Nations Conference on the Environment at Stockholm in 1972, that "before financing future economic aid projects, it would investigate thoroughly any damaging effects on the environment." (*New York Times*, 11 March 1970). Franco further announced that the Bank was taking steps "to assure that the projects financed by it did not have serious adverse ecological consequences" or that if they were likely to, that measures would be taken "to avoid or mitigate them." Needless to say such assurances were never respected. In a leaked World Bank memorandum, (Proceedings of Operational Policy Subcommittee Meeting of March 9th 1984) which we published in *The Ecologist* (Vol.16. No.2/3 1986), it was admitted that "as a matter of routine, environmental issues are not considered, but that they are taken into account in specific instances when environmental consequences are pointed out by the Bank's environment advisor, the press, or special interest groups in host countries." It is also admitted that in any case "the Bank does not have the capacity to conduct sector work on environmental issues on a routine basis"—which World Bank critics know to be the case. But this again has not prevented World Bank representatives from assuring the world at large of its deep environmental concern. It has not prevented Mr Jose Botafogo, for instance, then your Vice President for External Relations, to write in a letter to *The Times* (January 20th 1986) that "more than 1500 (World Bank) projects, many of them including tropical forests, have included environment protection and environment enhancing measures." Nor has it prevented you yourself from talking of "the Bank's long standing policy of scrutinising development projects for their environment impact and withholding support for those where safeguards are inadequate."

My scepticism seems further justified by the emptiness of past World Bank promises to reform other destructive aspects of its policies.

Poverty

Thus, in the early seventies, Mr McNamara, at the time President of the Bank, began to realise that your programmes did little for the poor of the Third World and that some programmes were actually making them worse off. This led him, in the autumn of 1976, to announce "a global compact" whose object was to achieve "the meeting of the basic human needs of the absolute poor in both the poor and middle income countries within a reasonable period of time, say by the end of the century."

Few have questioned McNamara's sincerity. The trouble was, he did not allow his concern for the alleviation of poverty to interfere with normal banking priorities. Thus for Mr McNamara, there was no question of abandoning the Green Revolution, even though, from his speeches at the time, as Susan George notes, he clearly realised how adversely it was affecting poor Third World farmers. The reason for this was clear, the Green Revolution, as he himself stated in July 1974, had notably expanded "the scope of profitable agricultural investment" and had thereby enabled the Bank "to increase its lending for agriculture substantially."

The question was thus "how to bring the improved technology and other inputs to over a hundred million small farmers." But this was an impossible goal. The inputs (hybrid seeds, fertiliser, pesticides and irrigation water) are prohibitively expensive. Even the American farming community—the richest in the world—cannot afford them, and has been bankrupted in its attempt to adopt modern technological agriculture. It owes today more than \$300 billion to the banks, a sum it cannot conceivably reimburse. How then can poor Third World farmers cultivating their thin and largely eroded lands, possibly afford them? In any case, once Third World Governments build the necessary dams and associated perennial irrigation schemes, and subsidise, as they have all done, the purchase of fertilisers and pesticides, they will have no option but to export the food thereby produced in order to earn the foreign exchange required for paying the interest on the foreign loans contracted to finance them. Such foreign exchange can never be earned by small farmers who must inevitably be dispossessed and pauperised so as to make way for the export-oriented plantations and livestock rearing schemes that can.

The Green Revolution may well have been a bonanza to the World Bank, Mr Conable, and also to the dam builders and the agrochemical industry, but it has been a disaster both for the environment and for the rural people of the Third World. As your Bank itself admits in its 1982 "Focus on Poverty" report, your so-called "rural development programmes" which involve spreading the Green Revolution technology to areas where traditional agricultural methods still prevailed, "have provided few direct benefits for the landless, for tenants unable to offer collateral for loans, and for the 'near landless' farmers who find it hard to borrow required inputs and take risks." Yet as John Loxley, at one time economic adviser to the Government of Tanzania, notes "these are the very sections of rural society least able to meet the basic needs," whose satisfaction you have committed yourself to assure?

Your report recommended a more explicitly poverty-focussed orientation. However as Loxley notes, such an orientation could not be reconciled with current banking priority as reflected in the notorious Berg Report (Accelerated Development in Sub-Saharan Africa). So they were simply ignored.

Urban Housing Programme

Your record on urbanisation or urban housing projects also reveals the total incompatibility between your avowed goals and the satisfaction of your banking priorities. McNamara fully realised the social destruction caused by slum clearance programmes in different parts of the world and sensibly decided to upgrade the slums instead. The upgraded housing, however,

was made available on a commercial basis. As Teresa Hayter and Catharine Watson note, the principle of "full cost recovery" had to be respected, people had to pay for the upgrading otherwise the projects would not be "replicable". Predictably, the slum dwellers could not pay for the upgrading, and as a result, were pushed out.

The fact is that a large and ever increasing proportion of the poor cannot and never will be able to pay for upgraded housing any more than they cannot and never will be able to pay off the inputs required for technological agriculture. More than half of the inhabitants of the Third World, in fact, live outside the market system. There is no way in which their lot can be improved by bank loans for there is no way in which they will even be able to pay the interests on such loans let alone repay the capital. Such people you cannot and never will be able to help. All you can do is further impoverish them by financing projects that must deprive them of the basic resources such as the natural forests, the fertile land and the uncontaminated water on which their welfare, indeed their survival, depends and for which the fruits of modern development, even if they could really be made available to them, are no substitutes.

Tribal Peoples

Another area in which the emptiness of World Bank assurances is only too apparent is in that of your dealings with tribal peoples.

In 1982, the World Bank was seriously criticised for the devastating effects of its projects on tribal people in the Philippines, (see Charles Drucker, "Dam the Chico", *The Ecologist*, (Vol. 15, No.4) and in Amazonia (see Bruce Rich, "Multi-Lateral Development Banks. Their Role in Destroying the Global Environment", *The Ecologist*, Vol.15 No.1/2.) It had to do something to placate public opinion, hence its much heralded publication "Tribal Peoples and Economic Development."

In this document, the World Bank undertook not to undertake projects in areas inhabited by tribal peoples "unless the tribal society is in agreement with the project." It also guaranteed to assure the self-determination of tribal people, respect for their land rights, and the maintenance of their ethnic identity and cultural autonomy. These pronouncements were very encouraging, however, as Survival International notes (*Survival International News*, No.15, 1987) "the reality, since then, has been sadly different. Many, perhaps the majority of the Bank's projects in tribal areas have been undertaken against the will of the peoples affected (as in the case of the Narmada and the Bodhghat dams described later in this issue). They have led to the rapid takeover of tribal lands and the destruction of identity and autonomy. Some projects have even led to the virtual extinction of whole communities, as among the Surui and Nambiquara in Brazil."

How does the World Bank justify this glaring discrepancy between its rhetoric and its action? The answer is that it has not even bothered to. Instead it "has progressively tried to distance itself from its own publication." Eventually, in September 1986, one of the Bank's leading lawyers explicitly declared to a Committee of the International Labour Organisation in Geneva, "that the published policies are not those it observes."

The Bank's real policy vis-a-vis tribal peoples, he admitted, is described "in a confidential document, which is not publicly available." In this document, which has been leaked to Survival International, the Bank only talks of "mitigating undesired social effects" the usual line which in practice means very little if anything at all.

As is most abundantly clear in this issue (see Claude Alvares, "Daming the Narmada", Sunil Roy, "The Bodhghat Project and the World Bank" and David Treece "Brazil's Carajas Project"), the Bank continues to regard tribal people, indeed all people who live outside the orbit of the formal economy, as totally expendable.

Forests

Another area in which the World Bank's assurances have proved totally empty, is in the field of forest conservation. In your speech you tell us that your bank "is the world's large single source of financing for tropical forest conservation and development" and that "over the past decade World Bank investments and technical assistance grants in forestry have exceeded one billion dollars," and that you are "ready to do more".

Now, most of your forest conservation programmes go under the name of "social forestry", which is defined by the Gujarat Forest Department as "the creation of forests for the benefit of the community through the active involvement and participation of the community." This is seen as leading to an improvement of rural environment, to a fall in rural migration and rural unemployment "... and to an increase in village self-sufficiency and self-reliance especially with regard to its 'forest material needs.'"

This is clearly an admirable idea, but World Bank social forestry programmes do none of these things. To begin with the social forests do not belong to the villagers but almost always to relatively big landowners. Secondly they are not forests, but plantations of fast growing eucalyptus trees, which are of little use to village people as they produce no fodder for their animals, nor green manure for fertilising their fields. Nor do they provide a suitable environment for game animals, nor do their roots bind together the soil to prevent erosion. Nor is their timber of any use for making implements. But even if it were, it would, in any case, never be made available to the villagers, for in order to be funded by the World Bank, these "social forests" must yield a commercial return on the capital invested. This means that they must be sold to pulp mills at a price that villagers cannot conceivably afford. Worse still the trees which are theoretically planted on wasteland are often planted instead on good agricultural land which once produced food for the villagers. So the 'Social Forestry Programmes' also increase malnutrition. Even worse still, whereas food production is labour-intensive, the growing of eucalyptus trees requires very little labour after the initial planting period, so social forestry programmes also increase unemployment. To make matters even worse, the species of eucalyptus planted tend to use up vast quantities of water which reduces water availability to the villagers, and, as if this were not enough, many of the displaced workers have no option for earning their living but to strip trees for firewood that can be sold in the nearest urban centres, as a result of which the social forests actually serve to further increase the pressure on remaining reserves. To call such destructive enterprises, 'social forests', Mr Conable, is thus utterly dishonest.

This being so, your threat to further increase your Bank's finance "for tropical forest conservation and development" is a very alarming one. It is still more alarming when one learns that the World Bank's Tropical Forest Action Plan is based on the World Resource Institute's 1985 "Tropical Forest—A Call for Action". This plan proposes to save the world's tropical forests by planting even more eucalyptus plantations and does not even suggest curtailing, let alone bringing to a halt, the massive development programmes funded by your bank and other such institutions, which are the prime cause of tropical forest destruction.

Indeed it is thus clear that the World Bank's rhetoric regarding its determination to preserve the environment, relieve poverty, protect tribal peoples or preserve remaining tropical forests, has never been translated into the appropriate action. The reason for this does not entirely lie in the perversity of past presidents of the World Bank nor of the present one but in the fundamental conflict between what is often the Bank's genuine desire to satisfy human, social and ecological imperatives and its requirement, by virtue of being a bank, operating commercially

in a competitive economy, to maximise the short-term return on capital.

You tell us, Mr Conable, that "sound ecology is good economics". Indeed it is, but only if you refer to the sort of economics that involves maximising material benefits over an indefinite period of time which must involve carefully preserving the natural world from which the economy derives its resources and to which it consigns its waste products.

Today's economics do not make such a policy conceivable. They are exclusively concerned with the maximisation of financial returns in the very short-term which means cashing in the resources of the natural world, as cheaply as possible and at the fastest possible rate. The achievement of such a goal, Mr Conable, clearly excludes the adoption of the "mitigating measures" that you and your staff constantly refer to.

What further suggests the emptiness of your rhetoric, Mr Conable, is your statement that you will "continue to support major investments in energy and infrastructure, industrialisation and irrigation" even though as you yourself imply, such investments have in the past been responsible for such terrible environmental destruction. To imply as you do that by displaying "greater sensitivity" to "long term environmental effects" and by withholding support for projects "where safeguards are inadequate" until presumably acceptable safeguards are provided, you will render them environmentally benign is just wishful thinking.

Consider the Great Carajas project in which you have invested so much money. It involves converting an area of invaluable tropical forest, the size of England and France combined, into one massive industrial zone. What safeguards can possibly enable you to set up one of the biggest mining and industrial complexes ever conceived of in a tropical forest without destroying it and marginalising its tribal inhabitants?

Consider one of your major infrastructural investments, the Polonoroeste project. You describe it as "an environmentally sound effort which went wrong." But in what way was it environmentally sound? How could it conceivably have gone right? You suggest that it could have benefited small farmers but was used instead by loggers, but peasant farmers do not need highways, they produce for themselves and for their families and for sale to local markets. When they produce for export it is nearly always against their will since it is at the expense of producing food crops that they badly need to feed their families and export crops are usually forcibly sold to some government body at but a fraction of their true value.

Still less can a major highway benefit a wilderness area, which it inevitably opens up to every sort of exploitative activity that happens to be economic.

The Colonial powers were never dishonest enough to suggest that the railways, bridges and highways they built were for the benefit of the natives. It was never denied that their object was "to open up" new areas so that our manufactured goods could be made available to their inhabitants and their food and raw materials exported to the metropolis.

In any case it is unlikely that whatever "safeguards" or "mitigatory measures" you envisage will ever be applied. Assurances given by governments to this effect are rarely worth the paper they are written on. The national parks and forest reserves set up in Amazonia by the Brazilian Government to mitigate the effects of destructive development projects for instance, were for short-term public relation purposes only. Thus a substantial portion of the Xingu National Park was lost to make way for the construction of the B.R. 080 highway in 1971. The Araguaia National Park has also been violated in the same way. To quote Fernside and de Lima Ferreira from the National Institute for Research in the Amazon (INPA) "in both cases Brazilian laws guaranteeing the integrity of parks and reserves were simply ignored when the reserves proved inconvenient for

road building plans." In Rondonia, the Guapore Biological Reserve created in 1982 has shrunk on no less than two occasions to accommodate development schemes.

Presently projected highways will lead to further shrinkages of the reserve and are now almost certain to allow squatters to enter the forest, who will destroy what remains. The Jaru Biological Reserve set up in 1961 has been even more badly damaged, much of it having been incorporated into the Burareiro Directed Settlement Area, where 500-ha estates were sold for development as cocoa plantations. As Fearnside and de Lima Ferreira note "the reserve has never had a forest guard or staff of any kind, and an undetermined number of squatters are now clearing within its boundaries." Fearnside and de Lima Ferreira provide a long list of highways that have been cut through forest reserves. Even when the latter are not crisscrossed with highways they are reserves in name only. Thus one type of "reserve" can be sold off to private individuals so long as 50 per cent of the area is kept under forest, a law that in practice is never enforced, many of such reserves having been totally cleared "with no legal consequences".

Irrigation Schemes

Consider too, your major investments in hydroelectric and irrigation schemes. No safeguards or mitigatory measures, however ingenious and however well-intentioned can do much to reduce the terrible destructiveness of such projects. Nothing for instance will prevent them from flooding vast river valleys where the land tends to be the most fertile and which, in the densely populated Third World, are likely to be inhabited by a large number of people. Whatever you do, such people will have to be displaced and their lives severely disrupted. As Claude Alvares notes in this issue of *The Ecologist*, the million or so tribal people whose lands will be flooded by the dams you propose to finance in the Narmada Valley will be simply sacrificed and so they must be if the Narmada Dams are to be built; for the cost of resettling them properly, given the terrible shortage of suitable land in the area, would be prohibitive.

Nor can "careful planning and an investment in mitigating measures such as drainage" as your Planning Committee suggests, serve to eliminate water-logging and salinisation, which are the inevitable concomitants of perennial irrigation schemes in the tropics. For one thing it is extremely unlikely that such measures will be adopted. The experience so far is that they almost never are. They are too costly and on the basis of current short-term economic criteria, cannot be regarded as justified. Even when they are adopted they can do no more than slow down the inexorable process of salinisation. As Professor Aloys Michel of the University of Rhode Island insists "water-logging or salinisation, or both problems, will inevitably arise in all but the truly exceptional surface water irrigation system . . ."

Professor Victor Kovda of Moscow University, perhaps the leading authority on the subject, feels the same way. "During many centuries and even millenia, he writes, "only areas having a free outflow of groundwater as in Tashkent and Samarkand have not undergone salinisation or waterlogging." In other words, "increasing salinity in irrigated soils on arid lands is practically universal."

FAO admits that 50-80 per cent of the world's irrigated land is already affected; also that some 10 million hectares of irrigated land—that is about 5 per cent of the world's total—are abandoned each year. Indeed it seems but a question of time before all the land put under irrigated agriculture at enormous human, social, ecological and financial cost, will slowly be transformed into salt-encrusted deserts and eventually taken out of agriculture.

The fact is, Mr Conable, that the only way to avoid the terrible destruction caused by the development schemes that your Bank has so irresponsibly financed over the last forty years is to stop

financing them. There is no alternative. It is not as if these schemes were needed to combat poverty or to improve the welfare of Third World people; they are not. As Alvares shows in the case of the Narmada Dam, such projects only satisfy the short term financial and political interests of a small group of bankers, bureaucrats, industrialists, engineers and politicians.

And this, Mr Conable, brings me to the heart of the matter. The short term interests of such a group are totally incompatible with the long term interests and needs of an increasingly impoverished humanity. You told the World Resources Institute in May 1987 of new policies and new concern for the environment. Will you now signify your genuine concern by immediate cancellation of financial aid for indefensible projects such as the Narmada and Bodhghat Dams and the Great Carajas Project and at the same time reappraise all other World Bank projects using a yard stick which measures the needs of humanity, our children and the biosphere, on whose preservation life itself must ultimately depend? Only then will you be able to persuade the world that your new concern for the environment is a genuine one.

Yours sincerely

Edward Goldsmith
Publisher of *The Ecologist*



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MARINE POLLUTION BULLETIN

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Damning the Narmada: The Politics Behind the Destruction

by Claude Alvares and Ramesh Billorey

The Indian Government has recently given its approval to the Narmada Valley Project—a massive water development scheme, to be funded by the World Bank, which will uproot over one million people and cause the most terrible environmental destruction. The project cannot be justified on social, environmental or ecological grounds. It will, however, bring substantial financial rewards to the local elites, whose support Prime Minister Rajiv Gandhi badly needs if he is to stay in power. Therein lies the only reason why the Gandhi Government has cleared the project. By continuing to finance the scheme, the World Bank is giving its support to this subordination of human, social and environmental priorities to the most squalid of short-term interests.

In mid-April 1987, the Indian Government passed what many would consider a death sentence on one of India's most majestic and sacred rivers. The Central Cabinet granted the states of Madhya Pradesh and Gujarat permission to transform the Narmada river and its valley through a series of more than 3,000 major and minor dams in what has been advertised as one of the most ambitiously conceived projects in human history. The final effect of this gigantic enterprise, which will not be completed until the next century, will be to destroy the river as we know it today for all time.

The Narmada Valley Project has remained intensely controversial every since details of it first became public: environmentalists all over the country and abroad firmly opposed the project (see *The Ecologist*, Vol 15, Nos 5/6, 1985) because it would set in motion fundamental changes in the river valley basin which would be irreversible, should the dams prove to be a failure. The principal focus of the opposition was the two giant reservoirs, the Sardar Sarovar in Gujarat and the Narmada Sagar in Madhya Pradesh, which between them would hold more water than any other dam on the Indian sub-continent. The environmental impact

of the scheme has hardly been assessed in a serious manner: even the Indian Government's Department of Environment and Forests has complained about the lack of data and the appalling state of unpreparedness of the governments concerned to deal with the human and environmental problems the dams will cause.

The principal element in the Narmada controversy was whether the project would create more wealth than it would destroy. The debate was important particularly since the dams would, in addition to causing irreversible environmental changes, also uproot over a million people, a large number of tribals, and submerge about 350,000 hectares of forest lands and 200,000 hectares of cultivated land.

The record makes it clear that decisions on such major projects are hardly ever taken on the basis of their impact on human or natural environments. The powerful landed elites of Gujarat and Madhya Pradesh, both Congress ruled states, were already impatient with the Central Government for dithering over whether the project should be allowed or not. Eventually, the decision to go ahead owed more to the resounding defeat the Congress party suffered in a few other states early in 1987 than to any cost benefit ratio the officials in charge could cook up in favour of the dams. The circumstances which forced the decision indicated the increasing power-

lessness and debility of Rajiv Gandhi's Government—and its true lack of concern for the welfare of the rural poor or the natural environment.

For the moment, the Cabinet's clearance implies that the battle against the project has been lost, but not the war. Essential funding for the dams' construction is to come from the World Bank, which recently has begun to show symptoms of a failure of nerve in the face of mounting global opposition to a number of its proposed projects owing to fears over their likely social and ecological impact. As a result, the World Bank is keener than ever to affect a concern for the poor and the environment.

Yet, in the case of the Narmada Project both the environment and the poor are destined for an onslaught of a kind unparalleled in the history of projects of this kind. So whether the dams are built or not will depend to a great extent on whether the Rajiv Gandhi Government itself collapses, and whether environmentalists are successful in forcing the World Bank to withdraw credit for the project.

The Makings of the Project

The Narmada river, a target of development rhetoric since 1946, is considered by Hindus to be more sacred than even the Ganges. The river originates in a holy tank on the Plateau of Amarkantak in the Shahdol district of Madhya Pradesh and then winds its way through forests, fields and gorges, till it empties 1,300 kilometres

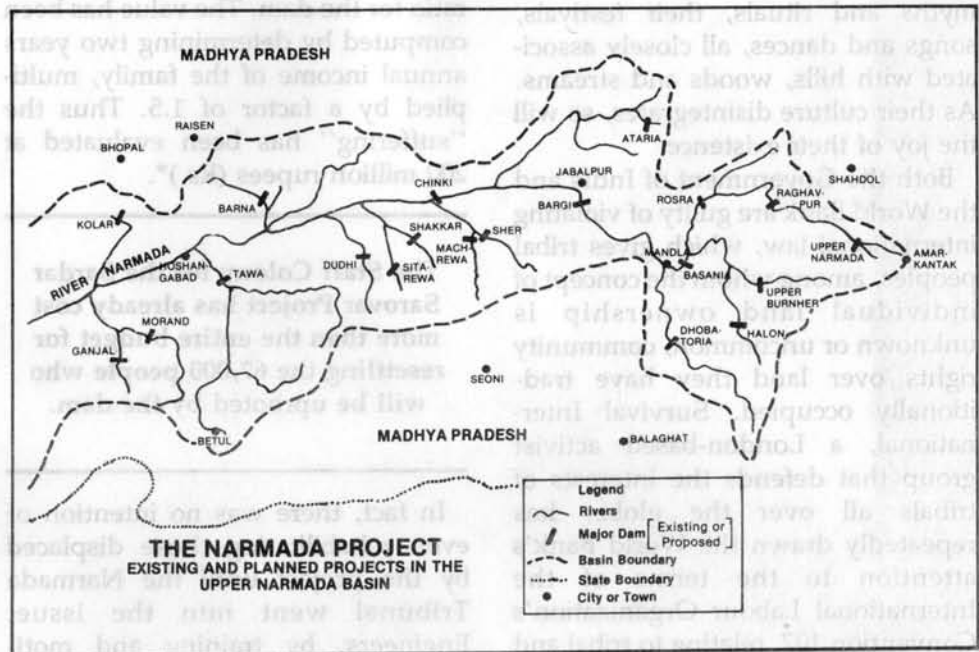
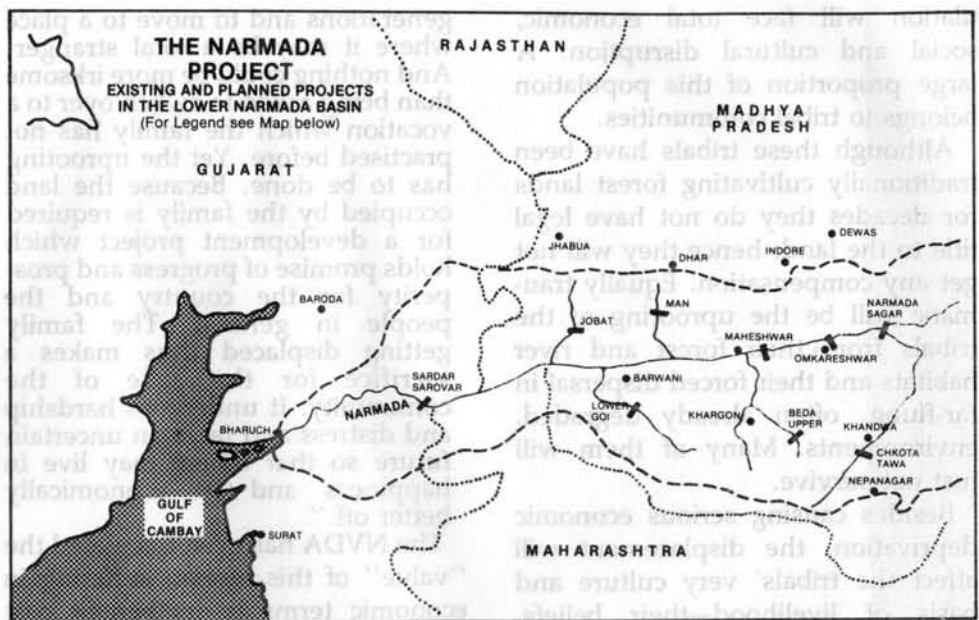
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downstream into the Arabian Sea. All along the route, 41 tributaries add to its waters. Twenty million people inhabit the basin, including tribals like the Bhils, the Gonds and the Baigas. A bewildering variety of agricultural systems and crops are encountered all along the long river's banks.

Since the river passes through three states, it was perhaps inevitable that the Narmada Project should become the subject of an interstate dispute. To resolve the squabbling, the Central Government finally set up the Narmada Water Dispute Tribunal in 1969, which sat for ten years and through numerous delays before announcing its decision. In a fundamental sense, the Tribunal and its deliberations themselves played a major role in the designing of the Narmada Project. Engineers and bureaucrats from the rival states of Gujarat and Madhya Pradesh kept inflating the numbers of the dams and their sizes in order to convince the Tribunal that "their" state had the best, and the most extensive plans for using the river's waters, and therefore should be given a greater share in the river's resources.

Eventually, the number of projects (major, medium and minor) reached the astronomical figure of some 3200 dams, taking more than a hundred years to build. Most of these dams therefore will never be built, being designed only for the Tribunal's consumption. But two of the most important, and for which the World Bank was ready to sanction credit, were the Sardar Sarovar and the Narmada Sagar. It is principally these two dams that the Central Cabinet cleared in mid-April 1987.

Are these projects justified? Are they viable? What are they designed to achieve? Is this merely another senseless round of "temple building"? Do the projects take account of India's disastrous experience with large dams, in particular their acknowledged devastating impact on their immediate environments and on the large vulnerable populations their reservoirs displace? The answers to these questions are clear: both the Sardar Sarovar and the Narmada Sagar are ecological disasters in the making. In addition, their impact on local peoples will be unparalleled in



its inhumanity. Ecologists and environmentalists and world citizens have no option but to continue to oppose and to stall them.

The Narmada Sagar is to be erected near Punasa in the East Nimar district of Madhya Pradesh. It is designed to irrigate 123,000 hectares of land in East and West Nimar districts (in return for which it will submerge over 90,000 hectares). It is also expected to generate 223MW of electricity (which in the later phase will drop to 100MW). The Sardar Sarovar Dam being constructed near Badgam in Bharuch district of Gujarat is expected to irrigate 1,500,000 hectares and to generate 300MW of electricity.

A few secondary "benefits" have been appended almost as an afterthought to improve the image of the dams. The damming of the

Narmada, we are told, will check floods, permit pisciculture, provide water for industrial and domestic use, and of course, tourism. We shall see later how most of these promises are fanciful, ambiguous, doubtful, even ridiculous, and that the economic benefits presumed to arise from all of them put together will not equal even half the economic losses they are expected to give rise to.

The Human Tragedy

According to the Institute of Urban Affairs, New Delhi, the entire Narmada Valley Project will lead to the eventual displacement of over one million people. This, as even the World Bank admits, will be "the largest river basin population resettlement to date." The displaced pop-

ulation will face total economic, social and cultural disruption. A large proportion of this population belongs to tribal communities.

Although these tribals have been traditionally cultivating forest lands for decades they do not have legal title to the land: hence they will not get any compensation. Equally traumatic will be the uprooting of the tribals from their forest and river habitats and their forced dispersal in far-flung, often already degraded, environments. Many of them will just not survive.

Besides causing serious economic deprivation, the displacement will affect the tribals' very culture and basis of livelihood—their beliefs, myths and rituals, their festivals, songs and dances, all closely associated with hills, woods and streams. As their culture disintegrates, so will the joy of their existence.

Both the Government of India and the World Bank are guilty of violating international law, which gives tribal peoples, among whom the concept of individual land ownership is unknown or uncommon, community rights over land they have traditionally occupied. Survival International, a London-based activist group that defends the interests of tribals all over the globe, has repeatedly drawn the World Bank's attention to the terms of the International Labour Organization's Convention 107, relating to tribal and indigenous populations, and ratified by India. Survival International has also focused attention on the Bank's own guidelines for the development of tribal areas, published in 1982, after the Bank was severely criticised for its support for development projects on tribal lands in the Brazilian Amazon and the Philippines. Survival International has pointed out how the Bank is ignoring its own guidelines and recommendations made by its own consultants. (See *The Ecologist* Vol 16, 2/3, 1986)

It is revealing to study how the Chairman of the Narmada Valley Development Agency (NVDA), S.C. Varma, justifies the mammoth suffering the project is bound to cause. He writes:

"No trauma could be more painful for a family than to get uprooted from a place where it has lived for

generations and to move to a place where it may be a total stranger. And nothing could be more irksome than being asked to switch over to a vocation which the family has not practised before. Yet the uprooting has to be done. Because the land occupied by the family is required for a development project which holds promise of progress and prosperity for the country and the people in general. The family getting displaced thus makes a sacrifice for the sake of the community. It undergoes hardship and distress and faces an uncertain future so that others may live in happiness and be economically better off."

The NVDA has even calculated the "value" of this human suffering in economic terms in its benefit cost ratio for the dam. The value has been computed by determining two years annual income of the family, multiplied by a factor of 1.5. Thus the "suffering" has been evaluated at 200 million rupees (Rs.).*

The Staff Colony for the Sardar Sarovar Project has already cost more than the entire budget for resettling the 67,000 people who will be uprooted by the dam.

In fact, there was no intention of even rehabilitating those displaced by the project until the Narmada Tribunal went into the issue. Engineers, by training and motivation, are only concerned with constructing dams. They are ill-equipped to think about the condition of oustees or the environment.

The Governments' priorities are already crystal clear. For instance, according to Kalpavriksh, the buildings at Kevadia Colony in Gujarat, which already house 5,000 staff members working on the Sardar Sarovar dam site, have cost Rs. 230 million, and include air-conditioned rest houses and circuit bungalows. If one adds to this the cost of building roads, supplying electricity and setting up of a communications network, the figure would come to Rs. 330 million, which is more than has been allotted for the permanent settlement of the 67,000 people displaced by the same dam. (See *The Ecologist* Vol 15, No 5/6, 1985)

* As of July 1st 1987, 27.00 rupees were equal to £1.00.

One of the major recommendations of the Narmada Tribunal was that all land-owning families who lose over 25 per cent of their land due to submergence must be allocated as much land as they lost—with a minimum of five acres. But this "land for land" policy has been consistently violated not only in the case of the oustees of the Sardar Sarovar project in Gujarat, but also in the case of those displaced by the dam's reservoir in Madhya Pradesh. Neither the State Government of Gujarat nor that of Madhya Pradesh properly informed the Tribunal that there was just no land available for those who would be ousted by the dams.

The Gujarat Government has not even tried to find adequate land for the oustees of Sardar Sarovar, despite sustained public pressure and even a court case. Some people were given lands of poor quality, others no land at all. In one case, oustees were given lands which in fact were part of a village pasture, and this led to a clash between the oustees and the local population. In the absence of land, Gujarat and Madhya Pradesh have relied on cash compensation. Ousteas are expected to purchase land with the cash received. As a World Bank consultant notes: "Cash compensation usually results in lower living standards and reduced quality of life among the large majority of relocatees."

Both the Centre for Social Studies, Surat, and the National Institute for Urban Affairs, Delhi, in their rehabilitation reports recommended against a policy whereby oustees were expected to look for lands on the open market. For, while the assets held by the oustees were generally undervalued by government officials, the cost of land in adjacent villages where oustees were forced to migrate was generally inflated. As a result, compensation payments were too small to allow oustees to buy land of the same size and quality as that lost to submergence.

The rehabilitation of villages as villages, as suggested by the Tribunal, was also never implemented, the displaced people being scattered over a wide area instead of being resettled together. The Government gained because there was no need to provide various social services and facilities which would have been necessary if

communities, and not individuals, had been made the basis for rehabilitation.

Thus, with regard to the Sardar Sarovar oustees the Status Report of the Madhya Pradesh Government on land acquisition and rehabilitation observes nonchalantly: "It is expected that much of the land will be bought by the oustees themselves with compensation paid to them. It is not expected that many new rehabilitation villages will have to be set up." S.C. Varma, the Chairman of the Narmada Valley Development Agency (NVDA), also admits that "the possibilities of new resettlement villages or colonies are remote." Significantly, the World Bank itself concludes: "The odds are high that the majority of oustees will be worse off following removal".

In addition to the inadequacy of compensation payments, there have been regular scandals in the payment of cash compensation particularly to tribals, and many instances of their exploitation by land owners, money-lenders and lawyers.

A study by the Delhi based Multi-Action Research Group (MARG) not only shows an abysmal lack of information among the oustees from Sardar Sarovar about their coming displacement and relocation, but also provides insights into the attitudes of officials handling the rehabilitation programmes.

Under the Tribunal's award, oustees in Madhya Pradesh from the Sardar Sarovar submergence have an option to shift either to Gujarat or stay within their own state. But officials compelled the people to go to Gujarat or only receive cash compensation. Though each oustee family is entitled to a *minimum* of five acres of irrigated land, villagers were told by officials that if they were ready to go to Gujarat, they would get a *maximum* of five acres. In some villages of Kukshi and Alirajpur districts no land acquisition notices were even issued. Neither were villagers informed about which areas would come under submergence, when they would be required to shift, the rate of compensation, and so on.

Though the oustees of Alirajpur district have refused to migrate to Gujarat, as the land shown to them was sandy and unirrigable, official reports state that the same people



Construction work has already begun to disrupt life in the Narmada Valley. By the time the project is completed over 3000 major and minor dams will have been built and the valley will have been degraded beyond repair.

have liked the land and are ready to migrate. Accordingly to Kawaljeet Singh of the MARG study team, the Madhya Pradesh Consultancy Services (MPCON) states that oustees were visited twice or three times, whereas his own team found that many houses including that of the Sarpanch of Nisarpur, were not visited at all. Various reports brought out by different agencies on rehabilitation, sponsored by the NVDA, do not even tally with each other regarding elementary field data.

As far as the oustees of the Narmada Sagar in Madhya Pradesh are concerned, the situation is far worse in view of the large number of oustees and the absolute scarcity of land for resettlement. As one of the senior engineers of the project told us: "The Madhya Pradesh Government is telling lies. Where is land available in the state for resettlement?" S.C. Varma himself writes: "Almost all cultivable lands available in the villages were brought under the plough, authorisedly or unauthorisedly. This has very greatly reduced the possibility of getting any sizeable blocks of land for being allotted to the oustee families."

He goes on to add: "The grazing lands that remain in the villages have hardly any soil cover and are of very poor quality, totally unfit for crop

production. Even if the percentage of grazing land is reduced further, it would not help in getting any sizeable area for purposes of resettlement."

Another problem is the high percentage of landless families among the oustees. A socio-economic survey of 12 villages within the Narmada Sagar submergence area indicated that landless families constitute 43 per cent of the population. (Likewise a survey of 23 villages in the Sardar Sarovar catchment showed that nearly 30 per cent were landless.) If landholders are not able to get equivalent land areas as compensation, the possibilities of providing lands to the landless oustees is even more remote.

S.C. Varma does not see this as a problem: "Under these circumstances most of these landless will have to be absorbed in activities unrelated to agriculture." Yet he admits that "it is not possible for the agriculturists who have been earning their livelihood from cultivation for centuries to earn the same from any other activity." Thus he leaves the million dollar question—how land could be provided—ambiguously answered. It is clear that he has nothing to offer landless oustees beyond perennial unemployment in a new and strange environment.



Kothari

Traditional boatmen from Madhya Pradesh—one of the million peasants and tribals who will be forced out of house and home by the Narmada project.

The NVDA is sceptical about acquiring land owned by other farmers for the purpose of resettling oustees. Neither has Varma himself any illusion about Madhya Pradesh's ceiling on agricultural holdings, which have been in force since 1960. He writes candidly: "There seems to be an impression that with the introduction of public irrigation, large areas of land would become available under the ceiling law because the uppermost limit of land holding would slide down from 55 acres to 18 acres. The actual experience has shown that much before the public irrigation gets introduced, the owners manage to parcel out their holdings to others in such a way that hardly any land remains to be taken over under the ceiling law. This is borne out by the situation obtaining in the command of the Tawa irrigation project in Hoshangabad district . . . there were a number of holdings having areas more than 18 acres, yet not a single acre has so far come under government possession on that strength."

Varma gives very interesting reasons why some token or even symbolic help should at least be provided to the oustees. He writes: ". . . in the uprooting and resettlement operations, human beings and not material and inanimate objects are involved. And human beings have feelings; they cry and laugh, they can organize and also show their anger. If not handled properly, these human beings could even impede the progress of project building. They could constitute as

Table One: Villages and Population to be affected by submergence due to the principle Narmada Dams

Project	State	District	Villages	Population
Sardar Sarovar	Gujarat	Bharuch Baroda	19	30,000
	Maharashtra	Dhulia	33	
	Madhya Pradesh	Dhar	80	
		Jhabua	26	70,000
		West Nimar	76	
Narmada Sagar	Madhya Pradesh	Khandwa	167	
		Dewas	39	170,000
		Hoshangabad	48	
Omkareshwar			27	13,000
Maheshwar			58	12,000
Total			573	295,000

The number of the oustees will exceed 400,000 by the time the dams are completed. These figures do not include the number of villages and people who will be affected by the backwaters of the Sardar Sarovar Dam. At least 53 such villages exist in Madhya Pradesh.

pockets of protest, unrest and dissatisfaction harbouring grievance in their breast as long as they live. Therefore, the whole gamut of resettlement needs very careful planning and execution."

What does the memorandum by the Department of the Environment and Forests (DOEF) on the Narmada Sagar, submitted to the Prime Minister, say about the rehabilitation of oustees? The memorandum accepts that rehabilitation will take place in five phases, and then goes on to add that the "Rehabilitation Plan even for Phase I is not really ready", and that "the land for rehabilitation has not yet been identified, let alone surveyed for its capacity." In other words, the NVDA is all set to engineer not merely the Narmada Sagar Dam but also the most inhuman dispersal of poor people ever carried out in India, without even elementary plans for relocation.

In its memorandum, the DOEF has further stated that if the height of the dam is reduced from 860ft to 814ft, the number of people affected would come down to 20,000. But officials claim the height of the dam is sacrosanct; that it was laid down by the Tribunal and cannot be changed. Yet the rehabilitation directives are also handed down by the same Tribunal. Alas, that is something else. It concerns the poor and the vulnerable, and modern India in the 21st century has decided not to concern itself with that.

The Destruction of Forest

In a country in which the forest area is already markedly below that required for a healthy environment, the Narmada Sagar will submerge and destroy 40,332 hectares of forest area. These forests will be clear-felled prior to inundation. This figure does not include an extra 1,500 hectares required for staff colonies, canals and related works. The Sardar Sarovar will inundate an additional 13,744 hectares of forest.

The DOEF has issued guidelines for the felling of forests, and for the compensation of forest lands. Originally, according to the guidelines, for every hectare of forest area felled, the agency involved was compelled to afforest an equivalent area of non-forest land. But those guidelines were soon changed. Now agencies engaged in felling are permitted to replant degraded forest lands, if no non-forest land is available, but double the area felled. This change first became applicable with the Thein dam in Punjab. The Narmada is the second major case. To compensate for the more than 40,000 hectares of forests being submerged, the NVDA has promised to afforest 90,000 hectares of degraded forest.

The nation and its environment have suffered a net loss in such a transaction, for it is the duty of the Forest Department to afforest degraded forest lands anyway. Secondly, the forest area which is sub-

merged is lost for ever. Thirdly, the DOEF has not even examined whether afforestation can be carried out in degraded forest lands.

In addition, as is now generally recognised, even the reforestation of degraded forest lands will hardly replace the loss of natural forests. First and foremost, the man-made forests of the Forest Department are better categorised as plantations. Often, they harbour none of the species one would find in natural forests, particularly wild plants valued now for their genes. Equally important, they are unable to support either tribals or wildlife. So there is added loss: the priceless is being replaced by substandard substitutes.

But the destruction of forests is only one problem—albeit a grave one—involved in the construction of the Narmada Project. The other is that much of the area which will be most affected already suffers from chronic sheet erosion, evidenced by exposed tree roots and shrubs growing on mounds. In other words, the ecosystem is fragile and already stretched beyond its carrying capacity for human and livestock population. The forest in many patches is poorly stocked and this stock is declining further. Moreover, overgrazing, poor or non-existent fire protection (and hence poor moisture retention) have all led to continuous degradation of the forests. As an official note points out:

“The vegetative composition of the forests and the silviculture techniques are hardly in tune with the socio-ecological requirements of the present human and livestock population, with the result that the forests have steadily diminished in area and quality. Acute shortage of fodder compels most villagers with small grazing lands to turn their cattle to browse on the forest floor.”

So grave is the fodder problem that a delay in the monsoons spells death for thousands of animals.

A dam or dams in such an area would unleash a chain of further ecological demands and bring about consequences whose nature can only be described as totally unacceptable. Firstly, submergence of such large forest tracts is bound to create pressures on *remaining* forest areas in adjoining areas. According to an official estimate, nearly 200,000 cattle now graze in the forest areas of East

Nimar and Dewas districts which will be submerged. The catchment area of Dewas district alone has a population of 486,248 cattle. Similar demands on the remaining forests will come from the displaced oustees themselves: their fuel and other timber needs will have to be met somehow. The reservoir is going to swamp forever areas supplying some 300,000 quintals of nistar grass (fodder): this at a time when the districts are already groaning under a fodder crisis.

Thus, the indirect ecological consequences of the dams are even more serious than the direct negative consequences, and the former have not even been considered in the cost-benefit ratios used to support the dams.

The Killing of Wildlife

With the forests, will disappear hundreds of species of flora and fauna. While the unplanned resettlement of the human population is brutal enough, the manner in which the project authorities plan to deal with wildlife makes a mockery of whatever legislation for environmental protection post-independence India has placed on the statute books.

As Varma concedes, human beings can organize and protest even the construction of a dam. Animals, of course, cannot. Therefore, they are being abandoned to a watery grave. The animals are supposed to run blindly to “safety” when the waters begin to rise in the area as a result of the dam. Too bad for those that are killed. Others will, the planners “hope”, make it to safety.

According to an official memorandum, the forests to be flooded are rich in wildlife, with a surprisingly large variety of species, some of which are listed in schedule I or in part II of schedule II of the Wildlife Protection Act, 1972, as rare and threatened species. The principal problem is that there are no forest “corridors” that will enable the wildlife to cross over into other forested areas, when their habitats are submerged. This is because the forests occur in large patches, with agricultural fields and bare lands in between. Some of the animals will enter the agricultural areas, and destroy crops; others will be killed. Most will simply drown. The chaotic dispersal will eventually destroy many species.

For instance, south of the river, the entire forest consisting of Baldi and

Table Two: Total area in Hectares to be affected due to submergence by the principal Narmada Dams

Project	Total submergence	Forest	Agricultural Land	No of Villages
Sardar Sarovar	39,134	13,744	11,318	234
Narmada Sagar	91,348	40,332	44,363	254
Omkareshwar	9,393	2,471	-	27
Maheshwar	4,856	-	-	58
Total	144,731	56,547	55,681	573

Table Three: Details of Forest land in Madhya Pradesh to be submerged by Narmada Sagar

Division	Total Forest area (in Hectares)	Teak	Salai	Mixed Forest
Khandwa	32,126	23,452	7,389	1,285
Dewas	4,528	4,075	408	45
Harda	3,678	3,678	-	-
	40,332	31,205	7,797	1,330

Source—EPCO report on Environment Impact Study of Narmada Sagar, Bhopal 1984.



Neeraj Paul/India Foto News Features

Building irrigation canals. Perennial irrigation schemes have invariably led to waterlogging and salinisation. There is no reason to suppose that those in the Narmada Valley will be different.

Singhaji ranges of the North Khandwa division and Handia range of Harda division will be submerged but they are surrounded by cultivated fields. The closest unaffected forests are 50-80 kilometres away. There is no corridor which the animals can use to get to that patch. Much the same could be said to apply to other forest areas coming under submergence. The impact of the Sardar Sarovar reservoir on wildlife will be equally devastating.

The Environment Planning Co-ordination Organization, Madhya Pradesh, (EPCO) report at least admits that "the suitability of the area as a wildlife feeding and breeding habitat may be affected by massive deforestation. Even compensating afforestation till such time as a complete ecosystem including ground flora and different storeys of trees is developed may not be a helpful alternative."

The report further states: "The terrestrial fauna affected by the project will migrate to suitable adjoining habitats—provided the route is not ecologically disturbed." But as we have noted already, it will not be possible for the wildlife to relocate itself. This is admitted in the same report: "Ecological pressures and micro-climate changes caused by deforestation and vegetationally

exposed migration routes will inevitably threaten wildlife."

Indeed, the World Bank report states: "Successful relocation of wildlife is never easy and much death is unavoidable". Amen.

Dams and Earthquakes

The proposed dams are located within a zone of moderate seismicity. In fact, the Narmada basin itself is classified as a zone of moderate seismicity, with infrequent occurrence of earthquakes. It is well known that the basin is disturbed, faulted and fractured and hence, in general, is porous and susceptible to the development of pore-pressure at depths, particularly following impoundment of reservoirs. During the last two centuries nearly thirty earthquakes have occurred in the area—the largest one being the Satpura earthquake of 1938 of magnitude 6.3.

Reservoir Induced Seismicity (RIS) has in recent years been observed in about seventy cases all over the world. The geographical distributions of the reported cases show that reservoirs exhibiting intense seismicity are generally situated in moderately seismic regions like Koyna and Kinnarsani in India, and numerous other places elsewhere.

Apart from the Narmada reservoirs being in a moderately seismic zone, there are other factors which indicate a strong possibility of reservoir-induced earthquakes of high magnitude occurring in the area. These are:

- a) the area is known to have faults and fractures for percolation;
- b) the size of both Narmada Sagar and Sardar Sarovar is large. The height of the former is 91.4 metres and the latter, 155 metres.
- c) the geotectonics and hydrogeology of the basin is similar to that of the West coastal margin, where cases of reservoir-induced earthquakes of high magnitude have occurred, as for instance at Koyna.

Engineers argue that they will take all possible safety measures while designing the dam, so that it is not affected even if earthquakes of magnitude 6 occur. But they have nothing to say about the safety of people living in the vicinity of the dam sites. The Koyna earthquakes of Dec. 10, 1967, levelled the project township, killing over 200 people, injuring

about 1,500, and rendering thousands homeless.

The claim that the dams themselves will be safe from earthquakes can also be questioned. According to Dr Herbert Tiedemann, an engineering consultant of Swiss Reinsurance, a major geological fault like the one at the site of Sardar Sarovar in Gujarat is a permanent threat and cannot be rectified by attempts to plug it with cement concrete. Dr Tiedemann told *The Economic Times* (24.10.85) that if World Bank experts had approved such flimsy measures of plugging a geological fault, "there must be something wrong with the whole affair."

Dr Tiedemann himself is a member of the Seismological Society of America and of the Earthquake Engineering Research Institute. He is also a member of the European Seismological Commission and the Swiss representative on the Experts Committee on Earthquake at the Council of Europe. His fears have recently been echoed by experts at the National Geological Research Institute (NGRI) at Hyderabad.

One NGRI expert, who did not wish to be named, disclosed that an earthquake of at least magnitude 6 could occur in the Narmada Sagar area. According to the Report of the 4th Meeting of the Dam Review Panel on Narmada Sagar, "an earthquake of magnitude 6.5 could occur anywhere in the Narmada-Sone-Damodar lineament." The same report also admits that "filling the reservoir might cause the earthquake to occur sooner."

Siltation

Neglect of soil conservation measures has resulted in rich topsoil being washed away into rivers. Where that silt is deposited within the reservoirs of large dams, it drastically reduces their storage capacity and their useful life. In 1976, the National Commission on Agriculture noted that the rate of siltation of some of India's major reservoirs has been alarmingly high. Nothing has been done since the time of that survey to reduce the siltation rate. On the contrary, one could expect a much higher rate of siltation today than reported by the Commission due to increased and widespread

deforestation in all catchment areas, including the Narmada basin.

In the case of the Narmada Sagar dam, the annual rate of siltation per 100 square kilometres of catchment area was assumed to be 1.55 hectare metres (ha/m) of silt. But later surveys showed that siltation had increased to 5.62 ha/m. Such a phenomenal increase is bound to reduce the lifespan of the dam and cripple its economic viability.

Due to pressure from the DOEF, the NVDA set aside a few tens of millions of rupees for "catchment area treatment". But their casual approach to the problem is reflected in the rhetorical question one engineer asked us: "What is the need for catchment area treatment?" Evidently the authorities do not consider such treatment, which is basically meant to control erosion and thereby reduce silt load in the catchment area, as an integral component of their project plans. In this connection, the following DOEF memorandum is revealing:

"Out of a total catchment area of 98,796 sq.km., up to the confluence of the Narmada river with Arabian Sea, it was first proposed to treat about 17,750 sq.km. of area between Narmada Sagar and Tawa and an area of 29,570 sq.km. between Tawa and Bargi in ten years. This area was subsequently reduced to 11,300 sq.km. and finally the area proposed to be treated is 7,919 sq.km., at a cost of Rs.304 crores* during the next ten years. The extent of area to be treated is on the basis of a thumb rule and not on any field survey."

It then adds:

"Today we have an 'Intention Plan' which can be converted into an Action Plan only on the basis of field survey data which is not available. Considering the accelerated deforestation during the last few years, the total area in the catchment needing treatment is sure to be much larger."

Waterlogging and Salinity

Waterlogging is usually associated with large scale irrigation schemes which lack effective drainage to enable surplus waters to be flushed away. Where such drainage does not obtain, surplus waters accumulate, leading to a rise in the water table,

Table Four: Annual Rate of Silting (Hectare/Metres of Silt) per 100 Sq KM of Catchment Area

Project	Year of Impounding	Assumed while Dam was Built	Observed in Surveys	Surveys Conducted in
1) Maithon	1956	1.62	13.10	1963, 1965, 1971
2) Mayurakshi	1955	3.61	16.43	1965, 1970
3) Ramganga	1974	4.29	18.19	Sediment inflow data
4) Ghod	1966	3.61	15.24	Inflow-outflow data
5) Beas Unit 2	1974	4.29	14.29	Sediment inflow data
6) Ukai	1971	1.47	10.95	Inflow-outflow data
7) Narmada	Under construction	1.55	5.62	Inflow-outflow data
8) Tawa	1974	3.61	11.15	Sediment inflow data
9) Sivajisagar	1961	...	15.24	1966, 1971

Source: National Commission on Agriculture, 1976.

with ground waters eventually making their way to the surface where they evaporate leaving behind salts. Millions of hectares of land have thus been lost to agriculture. In India, 10 million hectares of land have become waterlogged and another 25 million hectares are threatened with salinity. It is being grudgingly admitted today that the rich alluvial plains of Punjab and Haryana suffer seriously from desertification through waterlogging and salinisation, induced by excessive irrigation water—a heavy, but undisclosed price to pay for the Green Revolution.

There is little doubt that a considerable area in the command of the Narmada Sagar Dam will be affected by waterlogging and resultant salinity. A study by the Indian Institute of Science, (IIS) Bangalore, concludes that at least 100,000 hectares in the area to be irrigated by the Narmada Sagar and Omkareshwar projects (roughly 40 per cent of the command of both projects) will be affected by severe waterlogging. The consequent degradation of the soil will gravely affect productivity.

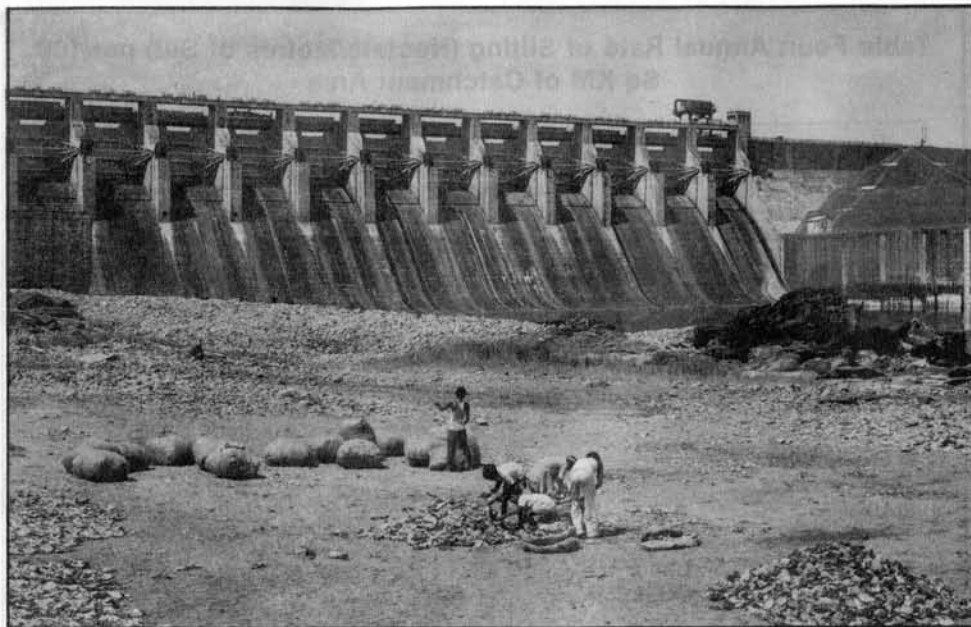
A senior engineer and consultant, R.L. Gupta, has pointed out that the IIS study suffers from serious methodological errors, and that the threat of waterlogging is even more serious than the IIS report makes it out to be. He points out that the

study did not take into consideration the impact of the backwaters of the Sardar Sarovar dam on the ground water system in the command of the Narmada Sagar dam. It should also be pointed out that this region has black cotton soils which are particularly prone to waterlogging under perennial irrigation. Such soils have a high capacity for holding water and retaining moisture and can only be farmed in a sustainable manner under rainfed conditions, when they prove highly productive.

If waterlogging occurs, writes R.L. Gupta, "it surely would take the time clock back to many a millenia; to the geological middle to late pleistocene times, when according to Badam a paleontologist, the Narmada Valley was fit for habitation only by crocodiles, reptiles, hooved animals, hippopotamus, elephants and pigs . . ."

And what is the proposed solution to the prospect of water-logging? Another technological fix. The IIS study recommends that a well be dug every 6.2 hectares, and that water from these wells be pumped out for an hour every day of the year. The energy cost has not been computed. The Report says that on no account should the irrigation system in the area use more than 70 per cent of its water from the dam canals: the remaining 30 per cent must come from the ground waters.

* 1 crore equals 10 million.



The Tawa Dam, part of the Narmada project. The Tawa scheme has caused widespread waterlogging and salinisation and has massively increased the incidence of waterborne disease.

David Dawdy

Health Hazards and Diseases

A related problem is the health hazards associated with large irrigation projects on which there is already enough data within the country, but which the project authorities have mostly ignored in the cost-benefit calculations.

A preliminary memorandum prepared by the Madhya Pradesh Council of Science and Technology, indicates that the incidence of malaria, filaria, cholera, gastroenteritis, viral encephalitis, goitre and some other water borne diseases is likely to increase. For instance, in the command area of the Tawa project, the incidence of malaria has increased. The central Government's Sixth Plan document itself acknowledges:

"Studies have shown that the construction of large reservoirs can result in the elevation of subsoil water in the vicinity with consequent changes in the levels of fluoride, calcium, trace metals etc., in soil sediments. This in turn results in the emergence of diseases, such as fluorosis, in people who are forced to use the contaminated water. For instance, the National Institute of Nutrition in Hyderabad has conclusively revealed the seriousness of fluorosis in areas adjacent to the Nagarjuna Sagar Sam. Skin infection, trachoma, guinea-worm and schistosomiasis are other diseases transmitted by water. The price for the lack of recognition and control of these environment related diseases, is paid not only in terms of human health but also in terms of cost of pest control and medical care."

No such measures for disease prevention are included in the NVDA's plans for the dams.

Other Benefits?

Among the secondary "benefits" which have been claimed by the project authorities are: flood control, large scale pisciculture and tourism.

Regarding flood control, there is an independent body of opinion which argues that flash floods may increase as a result of the project.

As regards pisciculture, the very transformation of the river will effectively destroy the fishing economy which has been established on the river for decades, and whose gross output is valued in tens of millions of rupees. It is doubtful whether organised pisciculture in the new reservoirs will ever replace such resources.

The most important fish commercially exploited from the Narmada estuary is the Hilsa. The river is also a rich source of giant freshwater prawn. According to revenue estimates cited in the 1983 *M.S. University Report on Ecology and Environment of Sardar Sarovar*, the dam will cause the value of the Hilsa catch to drop by 930 million rupees. The loss from prawn will be Rs.700 million. The total loss from these two fish species will amount to Rs. 1,630 million. Other fish like mullet are not included. The Narmada Sagar project cost-benefit calculations include a figure

of Rs. 400 million from pisciculture. The corresponding figures for Sardar Sarovar are not available. In effect, the project authorities are set to sacrifice vast *guaranteed* fish resources now in exchange for "potential" pisciculture in the future.

Finally, tourism. Today the Narmada is the focus of a special religious pilgrimage called the *parikrama*, in which Hindus traverse a great length of the river. Such pilgrimages—which embody a deeply spiritual encounter between man and nature—will be totally disrupted, once the reservoirs are created. Instead, the Narmada Valley is to be given over to the ubiquitous, materialistic tourists of modern times.

Costs and "Benefits"

In return for about 400 MW of firm power from the Sardar Sarovar and the Narmada Sagar (on paper) and about 1,800,000 hectares of irrigated fields (also vastly inflated to impress the Tribunal), we are being asked to permit needless suffering to a population of over 300,000, including tribals, allow a brutal and barbarous onslaught on a vast population of wildlife, and encourage the destruction of more than 100,000 hectares of forest and agricultural lands. In addition, the dams could trigger major earthquakes. They will increase the incidence of waterborne diseases. The reservoirs will have a short life-span due to a high siltation rate, and large tracts of land will be waterlogged and salinised.

Obviously, the costs must far outweigh the benefits.

The Indian Planning Commission has decided that the cost-benefit ratio of projects must always be 1:1.5; that is, for every rupee spent, there must be a return of Rs.1.5. In the case of the Narmada Valley Project, this demand became the excuse for a clumsy effort in data manipulation and fraud. Benefits were invented out of thin air to enable the authorities to pass the project off as economically and socially beneficial.

The cost-benefit ratio has been revised three times in relation to the Narmada Sagar project and the history of these exercises proves how casual is the approach of the Government's various regulatory bodies. In the earliest version, presented in the

1982 Detailed Project Report (DPR), the cost-benefit ratio was shown as 1:1.88. The capital costs of the project were not included, neither were environmental costs. The project authority merely calculated annual "benefits" at Rs.675,329,000 and annual "costs" at Rs.359,436,000.

A second official document, two years later, gives a cost-benefit ratio of 1:1.74. However, calculations, an appendix in the same document give figures which actually yield a cost-benefit ratio of 1:1.52. The appendix was originally written for the Technical Advisory Committee of the Planning Commission. It too did not include environmental costs and excluded capital costs of constructing the dam.

The project authorities were confident that clearance based on such modest figures was near at hand. However, they had not bargained for a major world-wide campaign by environmentalists against the project. Neither did they imagine that the Indian Government's own Department of the Environment would send a memorandum to the Prime Minister evaluating the

"Benefits have been invented out of thin air to enable the authorities to pass the project off as economically and socially beneficial"

environmental losses accruing from the dam at a colossal Rs.300,000 million for Narmada Sagar and another 100,000 million for the Sardar Sarovar.

It quickly became obvious that there would be no clearance for the project. The NVDA took up the challenge of preparing a new cost-benefit ratio. The electricity the dams would produce remained the same, as did the acres irrigated, but the NVDA invented new benefits to match the DOE's figures for Rs. 400,000 million in environmental losses. They were able to get the new figures accepted by the Planning Commission and the Cabinet. Environmental concern did not figure at all.

One example of how costs have been underplayed is the item for catchment treatment, command development and research support, which is shown as Rs.250 million. Now, according to their own documents, the catchment area treatment for just 7,000 square kilometers, would cost Rs.3,000 million, measures for command development another Rs. 2,430 million, and the cost of research studies a few additional tens of million. Altogether not less than Rs. 5,500 million.

Likewise, the costs of human resettlement are shown to be far less than in reality: only about 16,000 families are shown to be in need of resettlement, whereas the DOE memorandum places the displaced population at 129,000, and a more recent estimate puts the figure as 170,000.

Likewise, the cost of plantation is shown as only Rs. 170 million, though according to their own internal documents and norms, it works out to Rs.1,350 million.

The benefits on the other hand are often shown twice over, and significant figures concern irrelevant issues. Thus, the authorities have in-

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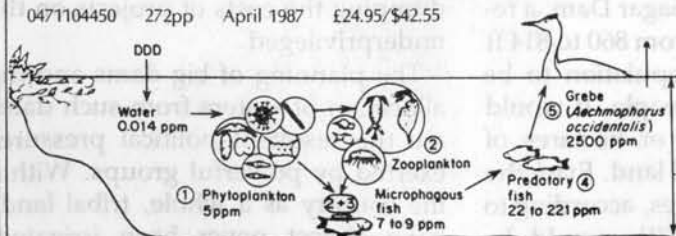
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cluded "savings in various costs because they have a hydel instead of a thermal plant" (Rs.170,000 million). Direct revenue from power is shown as Rs. 136,960 million and repeated again as "increased industrial production" worth now Rs.144,410 million. Thus about Rs. 310,000 million are shown without any justification, to bring the sum total to Rs. 500,000 million and retain the cost benefit ratio of 1:1.51.

When we showed these figures to an eminent economist from the Gokhale Institute of Politics and Economics, Pune, he noted:

"The figures are incredible. I would not have believed it, if I had not seen the documents myself. The concerned engineers seem to be illiterates, and what is more, they do not know that they do not know. Apart from duplication and exaggeration, there is simply no method in the calculation of the cost benefit ratio. I am surprised how the Planning Commission could have accepted the cooking up of such fraudulent figures!"

Thus, the way has been prepared for the planned execution of what may eventually turn out to rank among the world's worst human and environmental tragedies. "River Valleys", pleads R.L. Gupta, "are delicate ecosystems. Once they are damaged, the changes are irreversible." What kind of politics is this which enables a few illiterate engineers to force such a perverse development project on us, and on all future generations?

Alternatives

A memorandum on the environmental aspects of the Sardar Sarovar and Narmada Sagar multi-purpose projects, submitted to the Prime Minister by the Ministry of Water Resources, says that *no effective alternatives to these projects are available*. This is a blatant lie. There are alternative schemes that will produce both power and irrigation potential without destroying the environment and uprooting large masses of vulnerable people.

Such alternatives appear all the more feasible and attractive when we discover that the Narmada Sagar will submerge nearly as much land as it will irrigate, and the Sardar Sarovar will actually irrigate just one third of

the land it is designed to irrigate—all for just 400 MW from both large dams.

The engineers talk of water going to waste in the Narmada river. Yet even today, the available water impounded at Tawa, Barna and Bargi has not even been utilised even after a decade. There is no money to install the irrigation canals.

One alternative would be to build the smaller Jobat and Man projects, which involve little submergence, before embarking on Narmada Sagar and Sardar Sarovar. Indeed, after using the power potential from Tawa, Bargi, Barna, Sukta and Kolar, and giving priority to the construction of the Omkareshwar, Maheswar, Jobat and Man projects, there might not even be enough water in the Narmada to fill the reservoirs which the larger dams would create. Nonetheless, the engineers insist on building the larger projects first. As one critic puts it: "Once they took the wrong step, they want to stick to it for the sake of prestige."

Another alternative would be to reduce the height of both Narmada Sagar and Sardar Sarovar. This may in fact be necessary because the amount of water in the Narmada River appears to have been overestimated. According to recent studies by the Indian Institute of Management, 75 per cent of the dependable run-off in the river amounts to only 23 million acre feet—not 27.2 million acre feet as assumed by the Tribunal in 1979. Over-optimistic projections in the case of the Gandhi Sagar Dam have led to the top 5.4 m its reservoir, representing over 30 per cent of its capacity, remaining dry since construction: 50,000 villagers were evicted to make way for the reservoir.

If the height of the Sardar Sarovar is reduced from 455 to 420ft, 90 per cent of the local population would be saved from displacement and 80 per cent of the cultivable land would be outside the submergence area. In the case of the Narmada Sagar Dam, a reduction in its height from 860 to 814 ft would reduce the population to be displaced to 20,000 people. It would also save thousands of hectares of forest and agricultural land. Even the prospect of earthquakes, according to a source in the NGRI, would be diminished.

Another alternative would be to abandon plans for canal irrigation (which require reservoirs) in favour of "lift" irrigation. Many villages in West Nimar have already invested in such schemes. In some cases, pipelines as long as 5 kilometres take water from the river to fields. The average cost of such schemes per hectare comes to less than Rs.10,000. For canal irrigation, the equivalent cost comes to rs.25,850 per hectare.

The best alternative, however, is the traditional one: small-scale, single-purpose projects. As Nirmal Sengupta of the Centre for Development Studies in Madras has pointed out, small-scale reservoirs are found at present all over the country. In some areas, these are connected with one another, receiving their supplies through diversion channels from rivers and streams, thereby forming a single system over a wide area.

The network of such small reservoirs is so gigantic that, Sengupta notes, not a single drop of water flowing through such big rivers as the Kavery reaches the sea without being used first. Small reservoirs, with modifications, suitable for varied terrains, which is not the case with canal and tubewell technologies.

The reluctance of the authorities to adopt small-scale projects is primarily political. As Sengupta points out, such projects require decentralised management and the active participation of people other than bureaucrats.

Vested Interests

The sociologist, Pradip Bose, has argued that in unequal societies such as India, the type of large-scale irrigation schemes exemplified by the Narmada project not only perpetuate the poverty of the rural masses, particularly tribals, but also enable the top landed elites to prosper at the expense of the poor. Development enables an elite to enjoy the so-called "benefits" of "progress" by casually dumping the costs of projects on the underprivileged.

The planning of big dams and the allocation of waters from such dams are the result of political pressures exerted by powerful groups. Within the country as a whole, tribal lands have almost never been irrigated, while it is the tribals who bear the

real costs of such projects. The elites who benefit from such dams are little concerned about what the dam will do to the environment, since the environment under threat does not belong to the region where the benefits will be distributed: the degradation affects powerless people elsewhere, who can safely be forgotten.

This is certainly true in the case of the Narmada project. Out of the total of 13 zones in the command area of Sardar Sarovar, only Bharuch, Banaskantha and Kutch are really backward. All the rest, including Kaira, Ahmedabad and Mehsana, are areas populated to a large extent by Gujarat's more powerful and successful farmers. They are also centres of major industrial activity and commercial agriculture. These areas have also over the past decade benefited enormously from the largesse made available under Operation Flood, a giant World Bank funded dairying scheme (see *The Ecologist*, Vol. 15, No. 4).

The Narmada project is thus typical

of India's post-independence, elite-oriented development path. The fact that such vast environment losses and human suffering can so easily and thoughtlessly be expended for such paltry benefits—benefits that will accrue to the already privileged—has always been in the nature of most of the development projects implemented to date. But the Narmada scheme only shows that those who perpetrate and benefit from such development have become more shameless, blatant and uncaring in their pursuit of economic power. Just as the advanced countries are willing to compromise, and sacrifice, without a flicker of conscience, the present and future dignity of people in the Third World, so too are the Third World's privileged elites, with the support of bureaucrats and engineers, ready to enhance their own interests at the expense of the underprivileged in their societies.

Finally, it is singularly tragic that a project with such colossal and grave

implications for so many in the Commonwealth should be cleared merely because the present Prime Minister desperately needs to be bolstered in his current shaky political position. This is irresponsibility taken to new heights. If this is the state of our policy, and the basis of the decision to go ahead with the plan to dam the river, then it should be opposed tooth and nail: environmentalists, activists, sociologists, anthropologists, voluntary groups, in India and abroad should renew their fight against the project with increased vigour. Environmental activism has already brought success in the cases of the Silent Valley Project in Kerala, Lalpur in Gujarat and now the Koel Karo in Bihar. It can too with the Narmada, so integral to Indian tradition. Otherwise, we shall be not merely witnesses but active co-conspirators in what may justly be termed the world's largest, planned environmental and human tragedy.

The Bodhghat Project and the World Bank

by S.K. Roy

The Bodhghat Dam Project will destroy much of Bastar's remaining moist deciduous forests and uproot many tribal people. Despite its avowed "concern" for the environment, the World Bank is funding the project.

It is difficult to understand how the World Bank can justify investment in the Bodhghat dam, its second environmentally destructive invasion of the rich, moist, deciduous forests of Bastar. Its first, to clear vast areas in Bastar to plant tropical pine, was rejected at the highest level by the late Prime Minister, Mrs Indira Gandhi. As initially conceived, it envisaged repaying the loan by the export of pulp from the resultant plantations—and this from an India desperately trying to stem the galloping destruction of its remaining natural forests. The Bodhghat dam is more modest, the generation of 107 megawatts of effective power at the cost of \$400 million, hardly justifiable in itself. A 110 MW thermal power station at current prices would cost about \$100 million and could be fuelled with energy from fuel-wood plantations

from the abundant wastelands available in Madhya Pradesh (17.4 million hectares with 12.9 million in non-forest areas). There is even a case for the World Bank to finance an innovative solar power generation project.

Damaging

The Bodhghat dam will be particularly damaging environmentally. Its functional effectiveness is directly linked with downstream projects Kutru I and II and Nugur I and II. Together they impose a very great stress on the environment and will damage the Kutru National Park. This is almost the last satisfactory habitat for the Indian wild buffalo (*bubalus bubalis lin*). The Park, originally 2273 sq kms, was reduced to 1258.37 kms (99,019 hectares) when reconstituted in 1978. It will

now lose 20,000 hectares through this project. In addition, Bodhghat will inevitably lead to the imposition of the Bhopalpattnam and the Inchampalli hydro projects. Indeed the Bodhghat project report refers to the capacity of the Indravati river to contribute 670 MW with the peaking capacity of over 2000 MW. Any assurances to the contrary are meaningless on the basis of past experience.

Key factor

Another key factor is that the Indravati river runs along the Abugh Madh hill area for about 80 kms. Because of the difficulty of the terrain, Abugh Madh is effectively the only still unsurveyed area in the mainland—5000 sq kms of our most ecologically valuable forests. It demands conservation as vehemently as the

Silent Valley, the dam which was also not approved by government. There are reported plans to open up the area and Bodhghat will inescapably involve damaging inroads. The whole area provides the ideal setting for designation as a Biosphere Reserve under the UNESCO "Man and Biosphere programme". It should be included in areas identified and about to be declared Biosphere Reserves, without further delay.

Large areas of the Bastar forests have already been destroyed by the Dandakaranya resettlement for Bengal refugees, generally considered a failure, as well as by the

enormous Baladila iron ore project which has seriously polluted the Sankhini river and has been economically disappointing. The Madhya Pradesh Forest Development Corporation has reportedly cleared forest areas to raise a mono-culture eucalyptus, with only marginal success. Even without Abugh Madh, the whole area is of great ecological importance: sal and teak meet naturally under favourable growing conditions. There is a wide range of valuable plant species with many yet to be identified. These forests should be worked as conservation areas. Assurances of compensatory plantations can by no stretch of ingenuity, recreate the precious natural forests being lost. Current experience is that such afforestation is poorly done, if at all.

All costs are considered except the human costs. The Bastar forests are inhabited predominantly by tribal groups; the Muria, Madia, Halba, Gond and hill Muria are scattered over the whole area. Pressure from non-tribals, Government and contract employees has pushed the tribal populations into the depth of the forests which remain inaccessible and unexploited. Engineers and planners happily sacrifice forests and people, ignoring the injustice of inflicting additional misery on the tribals struggling for survival against destructive projects undertaken in the name of development, virtually all of which is channelled to points far from the project site. About 9000 tribals will be ousted from their homes in the submerged area (13,526 hectares) of which less than half (4,919 hectares) is government-owned.

Compensation

Resettlement, a meaningless term, envisages allocation of a minimum of 5 acres per family even though many own 10 to 20 times this. The land on which they are to be resettled is not cultivable. Village and family groups will be scattered in largely alien communities, often facing discrimination and hostility. Financial compensation is not worth mentioning. It neither enables purchase of cultivable areas or provides anything more than consumption followed by total deprivation.

The World Bank gives little if any weight to the marginalised

people. It is, or should be, well aware of all this. There are no economic yardsticks to evaluate the cost of uprooting hundreds of thousands of already economically deprived peoples from their ancestral homes. An international technical journal—*Water Power and Dam Construction*—has asserted that the social and environmental costs have very often outweighed the benefits of water projects pointing out that "the resettlement of local people has seriously affected their cultural patterns and life-styles. In the last 20 years, more than 500,000 people have been resettled, just for the dams financed by the World Bank."

Havoc

Countries which provide funds for the World Bank need to examine more closely "the unaccountability of the Multi-Development Banks (MDBs) and the environmental damage caused by their projects on the World Environment". The need was highlighted in a statement by Ms Patricia Adams to a Canadian Parliamentary Committee: "The World Bank has spent billions of Canadian tax dollars over the last 30 years in ways that have abused property rights, violated human rights and created environmental havoc in the Third World."

The World Bank is party to an agreement by all international financial and aid giving institutions not to fund projects which are damaging environmentally. Bodhghat is a typical example of priority given to financial policies over both economic and environmental reality. There are no valid reasons to approve such an economically dubious and environmentally destructive project. It should be assessed by our planners in the context of the accusation by *The Ecologist* editor, Edward Goldsmith, in a letter to Mr Clausen, that the World Bank funds "environmentally and socially destructive projects that were seriously contributing to the escalation of poverty, malnutrition and famine throughout the Third World."

Republished from *The Hindustan Times*, March 30th 1987

S.K. Roy, ex Indian ambassador, was chairman of the Working Group for the Assessment of the Environmental Impact of Tehri Dam, India.

Soon available

Major World Bank Projects:

Their impact on People, Society and the Environment
by Graham Searle.

This study was commissioned by the International Institute for Environment and Development (IIED) to serve as a background document for a proposed meeting between the World Bank and its principal critics.

Searle looks carefully at the probable human, social and ecological consequences of three World Bank projects, the **Narmada River Development Project** in India, the **Polonoroeste Project** in Brazil and the **Indonesian Transmigration Programme**, which were to be discussed at the meeting.

The material on which the study is based was largely obtained from the World Bank itself and the study was conducted with the full co-operation of the Bank's project staff.

Unfortunately, the meeting, originally scheduled for June 1986, was postponed to October 1986 and eventually cancelled while the IIED decided against publishing the study.

The Wadebridge Ecological Centre, however, decided that this document must be published because of its value to those concerned about the role played by the World Bank in determining the present course of Third World development. This has been made possible by a generous grant from the Rowntree Social Services Trust, to whom all thanks are due.

Maps, tables and diagrams as well as references to the World Bank documents used to compile the study are included.

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Brazil's Greater Carajas Programme

by Dave Treece, Brazil Consultant, Survival International

Millions of hectares of rainforest are to be destroyed and 13,000 Indians deprived of their tribal lands in order to create an industrial park in Eastern Amazonia. In continuing to support the project, the World Bank and the EEC reveal their lack of concern for the environment and human rights.

The thirteen thousand Indians of the eastern Amazonian region of Brazil have probably not yet heard that the World Bank has announced the creation of "a top-level environmental department to oversee ecological concerns in the development of projects" nor that the EEC is celebrating the European Year of the Environment. Still, this is hardly surprising, since the Indians were never even informed by them nor by the Brazilian authorities when it was agreed to transform their lands into a giant agro-industrial park, otherwise known as the Greater Carajas Programme. They would no doubt be extremely puzzled, however, to learn of these declarations of concern. For the EEC and the World Bank, the two biggest investors in the Carajas Iron Ore Project, are together responsible for many of the problems which the forty Indian communities of the region now face.

The Carajas Mineral Province, the core of the Project and of the development programme for the whole region, surrounds half of the Catete Reserve, home to 300 Xikrin Indians. Practically the entire reserve is subject to mining claims by subsidiaries of the state company responsible for overseeing the Iron Ore Project. Independent gold panners have already been active in the reserve, polluting the rivers and disrupting the traditional lifestyle of the Indians. The 900 kilometre railway, carrying 12 trains a day to the coast, each with 160 wagons stretching 2 kilometres, cuts through the territory of the Gavioes, in one case just 3 kilometres from a village. The railway also intersects the Rio Pindare Reserve of the Guajajara and runs adjacent to the Caru territory, acting as a flood-gate for thousands of landless settlers to enter the Indians's land and set up claims.

But besides its immediate impact, the Iron Ore Project has provided the basis of a regional infrastructure which will transform an area the size of Britain and France combined, 50 per cent of it consisting of tropical rainforest, into a massive agro-industrial park. Six industrial zones

have been established, where metallurgical, timber, food-processing, cement-producing and other projects are being installed with attractive fiscal incentives. Roads, the railway and electrical transmission lines pass through or close to the lands of twelve of the tribal communities in the region. Many, such as the Apinaye and Krikati, are constantly attacked by local farmers and are forced to compete for land and game with the ever-increasing population of peasant squatters that the transportation network has brought to the region.

The most disturbing of the projects to gain recent approval under the Greater Carajas Programme is a series of nine pig-iron and iron alloy plants along the railway, most of them to be powered by charcoal produced directly from timber cut from the local forests. This will mean the destruction of 1.5 million hectares of forest in a band along the railway. Among the tribes whose survival is jeopardised are the Guaja, Brazil's last purely nomadic hunter-gatherer people, who are already threatened by mining and by a branch of the railway.

Cosmetic Concern for Environment and Human Rights

Has nothing been done to protect the Indian communities and their environment in the Carajas region? The state mining company which runs the project, has spent US\$ 53 million on environmental measures, and US\$ 13.6 million on an Amerindian Sub-Project. Impressive sums, at first sight maybe, but only a tiny fraction of the programme's budget of US\$ 62 billion. They were in fact imposed upon the company as a condition of the US\$ 300 million and US\$600 million loans provided by the World Bank and the EEC, respectively. Yet these projects are little more than public relations exercises. The programme of "Support for the Indian Communities", has served merely to bolster the bureaucracy of the Government's Indian agency, whilst imposing ambitious profit-making farming

schemes on the tribal peoples in order to integrate them into the economic structure of Carajas, in the meantime shattering their social institutions and cultural identities. Virtually no money was set aside for securing the Indians' lands, with the result that 16 out of the 27 tribal territories still lack the necessary legal protection. Despite these deficiencies, the "Support" Programme ended in June 1987, whilst the development itself has centuries to run.

Nevertheless, the World Bank and, in particular, the European Commission refuse to fund an independent environmental programme and a programme of land demarcation for the Indians of Carajas; this despite repeated appeals by the General Assembly of Non-Governmental Organisations for the suspension of the EEC loan until guarantees can be found for safeguarding human rights in the area. Similar motions and questions have been put forward by Euro-MPs who have visited Carajas. A draft report by the European Parliament's Committee on the Environment, Public Health and Consumer Protection concluded that the Carajas Project has had a disastrous impact on the environment and on the tribal peoples of the region, and regrets the decision to finance the Project. Still the European Commission refuses to listen.

In return for the EEC loan, the Community was guaranteed a third of the iron ore—50 per cent of its needs—reportedly at "banana" prices. Cheap at the price, if it were not also an investment in social and environmental disaster, an investment which the Indians and their forests cannot afford.

Survival International* is calling on the World Bank and the EEC to institute an emergency programme of relief for the Indians and forests of Carajas.

A new document analysing the tribal and environmental impact of the Greater Carajas Programme is soon to be available from: Survival International, 310, Edgware Road, London, W2 1DY, or telephone 01-723 5535.

The Disappearing Chinampas of Xochimilco

by Thomas Outerbridge

For centuries, the Indians of Lake Xochimilco in Mexico have practised a highly productive form of agriculture, which is unique in the western world. The system involves building garden plots, known as Chinampas, on the lake itself. Today, Xochimilco and its gardens are threatened by pollution, mechanised agriculture, drainage schemes and the expansion of Mexico City.

The Valley of Mexico is a large basin enclosed by mountain ranges on all sides. The basin measures approximately 120 kilometers (km) north to south and 80km east to west, and lies at about 2,260 meters (m) above sea level.

Until the arrival of the Spaniards some 450 years ago, a large part of the basin floor (1,575km²) was covered by a series of shallow interconnected lakes. The lakes supported an abundant variety of flora and fauna, and a large Indian population that had developed a lacustrine agriculture to a level of sophistication unmatched in the Western hemisphere.

Today, Mexico Distrito Federal (D.F.), with near 20 million inhabitants, covers the same area once occupied by fish, waterfowl and Indian farmers. Within the city limits, there are still two shallow lakes, Lake Texcoco and Lake Xochimilco. Texcoco, a fraction (5 per cent) of its former size, is situated beside Benito Juárez International Airport. The lake is highly contaminated and supports a small population of aquatic birds.

On Lake Xochimilco, also no more than a fraction of its previous size (15 per cent), the Xochimilcans still practise the same unique agricultural system that they have practised for centuries. They farm on rectangular garden plots raised several centimeters (cm) above the lake water level. These plots, known as chinampas, cover Xochimilco in a patchwork interlaced with canals, and form a system renowned for its productivity. The chinampas of Xochimilco are what remain of the lacustrine agricultural system that flourished in the basin at the time of Cortés' arrival in 1519.

Early History of the Valley of Mexico

The formation of the Valley of Mexico began approximately 20 million years ago. "Fractures, sinking, faults, compaction, volcanic eruptions, etc., produced a depression surrounded by hills at the four cardinal points, and without passage to the outside for water coming from these same hills".¹ Thus from its beginnings, the basin has collected water; indeed, there is evidence that during the Pluvial Maxima the basin floor was covered with water.²

Indian settlement began in the Valley before the start of the Christian era. Near present-day Xochimilco, there are remnants of dwellings built on artificial foundations that antedate the birth of Christ by several centuries; these were presumably surrounded by chinampas.³

Although there are large sites on the lakes' shores that date from A.D.1 onward, the development of chinampas and lake dwellings seems to have been minimal until the 12th century. One authority, Pedro Armillas, postulates that a rise in the water level restricted the use of the lakes for habitation and farming.⁴ Subsequent lowering of the water level created favourable conditions for the construction of chinampas, which continued until some time after the arrival of the conquistadores.

There is no consensus on the exact origin of the chinampa technique, or the date of their first construction in the Valley. It is agreed, however, that the chinamperia of Lake Xochimilco, "exists today in a form virtually unchanged from that which Cortés and his followers witnessed when they entered the Valley."⁵ What remains of Xochimilco—of the once enormous lacustrine agriculture system—is in grave danger of disappearing altogether in the face of the persistent expansion of Mexico City.

Xochimilco

Xochimilco as a city and a lacustrine zone is not simply unique among all of the chinamperias that once occupied the Valley of Mexico because it alone exists today. Since before the arrival of the Aztecs, Xochimilco has had qualities, both naturally endowed and related to its human inhabitants, that have made it distinct from the rest of the Valley.

According to some sources, Náhua Indians, known as Xochimilcas, entered an uninhabited Mexico Valley in 1156. It seems likely that the Valley was the home of few well-established societies, since the Xochimilcas were able to settle in the most favourable spot in the basin:

"From its foundation, the city (Xochimilco) was constructed with a clear sense of the landscape, within the region of the prehispanic lakes of the Valley of Mexico; the Xochimilcas...chose the sight that seemed to them best".⁶

By the 12th century there were six interdependent yet distinguishable lakes—Zumpango, Xaltocan and San Cristobal in the north, Texcoco situated in the middle and Xochimilco and Chalco in the south. The differ-

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ences between the lakes were primarily those of water level, water quality and sources of water.

The water level of Zumpango, Xaltocan, San Cristobal and Texcoco tended to fluctuate widely from rainy season to dry season. The water level of the southern lakes on the other hand, was generally consistent.

There were great differences in the quality of the water in the basin lakes. The water of Texcoco and the northern lakes was saline, while Xochimilco and Chalco were sweet water.

Both the water level and water quality differences in the lakes can be largely explained by the lakes' respective water sources. To the north and northeast of the basin stand volcanic mountain ranges from the Oligocene-Pliocene period, composed of almost impermeable stone and incapable of absorbing and filtering the rains.⁷ For this reason, "the greater part of the rivers of the basin are torrential in nature, with flows of short duration. Their beds remain dry during the dry season".⁸ Two rivers that fed Texcoco, the Cuauhtitlán and Las Avenidas Rivers, ran over such impermeable hills, and according to one source, the four disastrous floods of Mexico City can be attributed to the increased flow of these rivers during the rainy season.⁹

The water that arrives in Texcoco and the three northern lakes travels over 'tierra salitral', dissolving and carrying sodium feldspars, which abound in the rocks of the valley mountains. Thus all but Xochimilco and Chalco receive water that is naturally saline. Also, the lake bottoms of all but Xochimilco and Chalco are

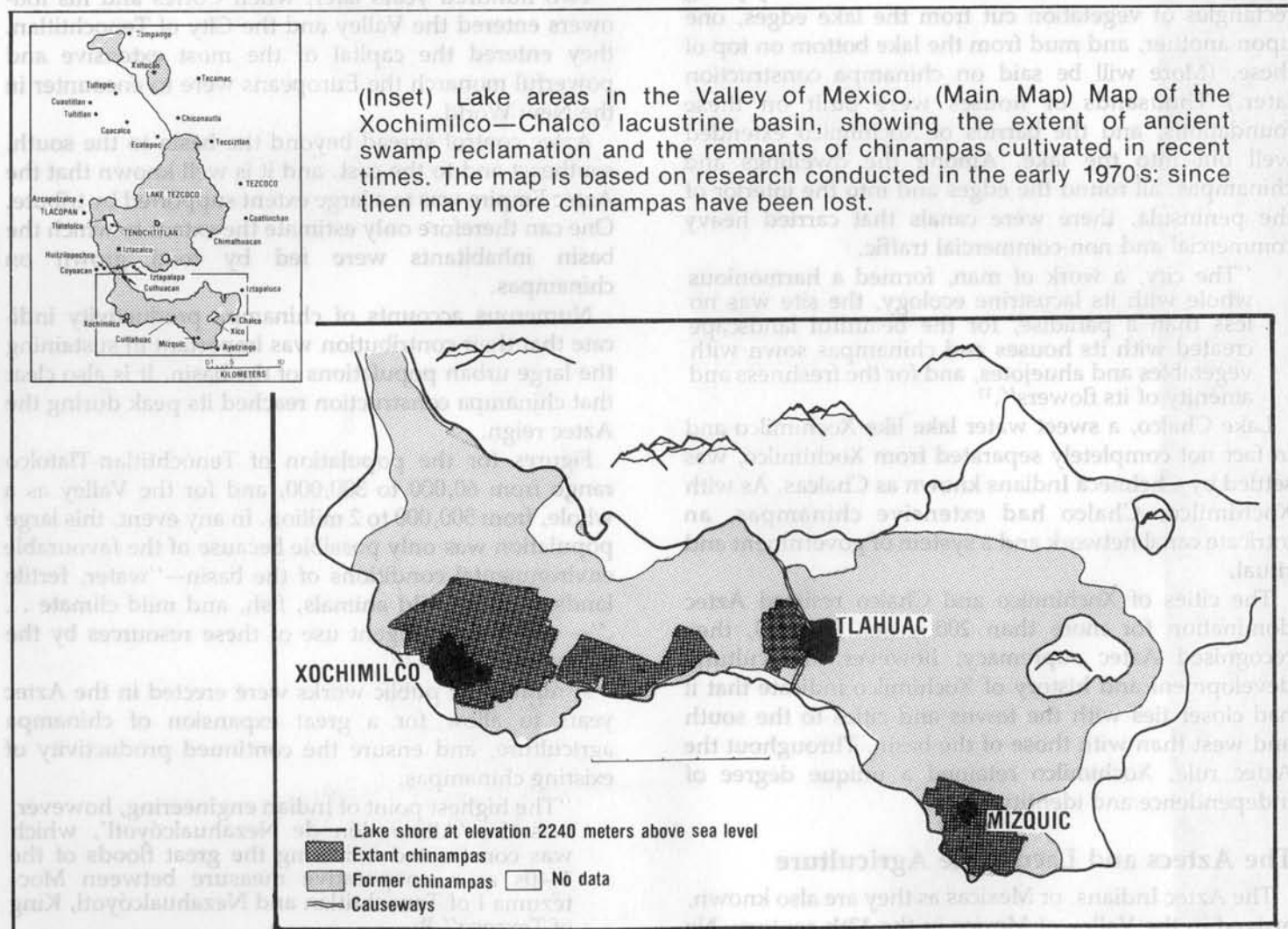
saline, which contributes to the salinity of their waters and their unsuitability for lacustrine agriculture.¹⁰

To the south of the basin lie a range of volcanic mountains, whose lava flow now covers a sizeable area of the valley floor.¹⁰ The importance of the lava flow, which dates back to the late Pleistocene and Holocene, lies in its permeability. Above this base of volcanic soil are forested slopes that capture and filter rainfall. This saved Xochimilco and Chalco from the torrential flows of saline water suffered by the other lakes.

The volcanic nature of the southern mountains also meant that water filtered by the permeable soil later appeared at the foot of the hills along the southern edge of the lakes in the form of fresh water springs that flowed year-round. According to a document of the National General Archives, there were eight important springs that entered Xochimilco in 1782.¹¹ As well as these springs, Xochimilco was fed by three rivers that carried water throughout the year—La Magdalena, San Angel and San Agustín de las Cuevas.¹²

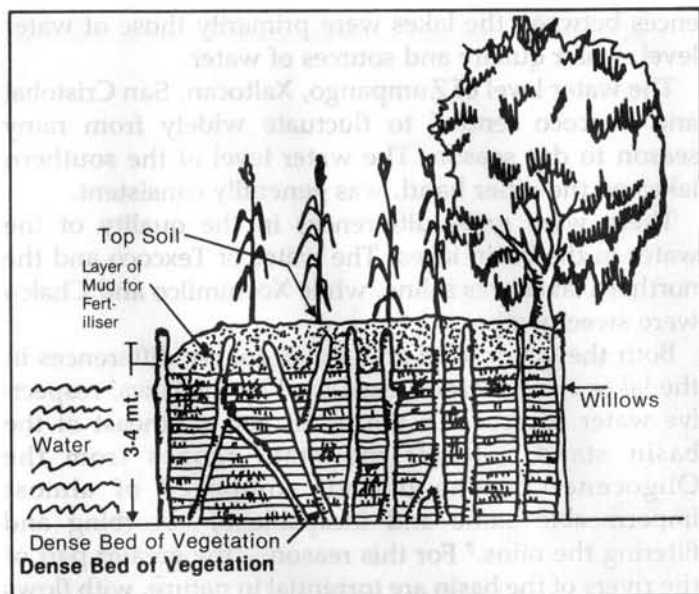
The Xochimilcas built their city (today the barrios of Xochimilco) at the foot of the Cuauhtzin Hills of Mt. Ajusco, on a peninsula that juts into present-day Lake Xochimilco. The southern and western edges of the peninsula were swamp-like, while the water of the lake surrounded its northern and eastern sides, making it well suited for defence.

The city had a ceremonial centre with a temple and surrounding buildings of stone and lime. Around these were placed the houses of the town, made of materials





Science



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(Left) Chinampa plots at Tiahua, Federal District, Mexico. (Above) cross section of a chinampa. The Chinampas have been noted for "their beauty, their productivity, their ecological soundness and for the way in which traditional farming practices have been maintained amongst the chinamperos."

from the lake—tule (a swamp plant with a straight stalk), reeds and tree branches.

The Xochimilcas created land for themselves by piling rectangles of vegetation cut from the lake edges, one upon another, and mud from the lake bottom on top of these. (More will be said on chinampa construction later.) Thousands of houses were built on these foundations, and the barrios of Xochimilco extended well out into the lake. Among the dwellings and chinampas, all round the edges and into the interior of the peninsula, there were canals that carried heavy commercial and non-commercial traffic.

"The city, a work of man, formed a harmonious whole with its lacustrine ecology, the site was no less than a paradise, for the beautiful landscape created with its houses and chinampas sown with vegetables and ahuejotes, and for the freshness and amenity of its flowers".¹³

Lake Chalco, a sweet water lake like Xochimilco and in fact not completely separated from Xochimilco, was settled by Chelmecha Indians known as Chalcas. As with Xochimilco, Chalco had extensive chinampas, an intricate canal network and a system of government and ritual.

The cities of Xochimilco and Chalco resisted Aztec domination for more than 200 years. In 1450, they recognised Aztec supremacy; however, the cultural development and history of Xochimilco indicate that it had closer ties with the towns and cities to the south and west than with those of the basin. Throughout the Aztec rule, Xochimilco retained a unique degree of independence and identity.

The Aztecs and Lacustrine Agriculture

The Aztec Indians, or Mexicas as they are also known, arrived in the Valley of Mexico in the 13th century. No

one is exactly sure of where they came from. They were at first overpowered by the various Indian groups already settled in the basin, including the Xochimilcas, and were forced to hide on islands in Lake Texcoco. There they founded the City of Tenochtitlan in about 1325, and gradually came to dominate the Valley.

Two hundred years later, when Cortés and his followers entered the Valley and the City of Tenochtitlan, they entered the capital of the most extensive and powerful monarch the Europeans were to encounter in the New World.

Aztec control spread beyond the basin to the south, southeast and to the east, and it is well known that the Aztec Empire was to a large extent supported by tribute. One can therefore only estimate the extent to which the basin inhabitants were fed by food grown on chinampas.

Numerous accounts of chinampa productivity indicate that their contribution was important in sustaining the large urban populations of the basin. It is also clear that chinampa construction reached its peak during the Aztec reign.

Figures for the population of Tenochtitlan-Tlatolco range from 60,000 to 300,000, and for the Valley as a whole, from 500,000 to 2 million. In any event, this large population was only possible because of the favourable environmental conditions of the basin—"water, fertile lands, woods, wild animals, fish, and mild climate . . ."—and the intelligent use of these resources by the valley inhabitants.¹⁴

A number of public works were erected in the Aztec years to allow for a great expansion of chinampa agriculture, and ensure the continued productivity of existing chinampas.

"The highest point of Indian engineering, however, was the 'Albarradón de Nezahualcōyotl', which was constructed following the great floods of the 1440s as a cooperative measure between Motecuzuma I of Tenochtitlan and Nezahualcōyotl, King of Texcoco".¹⁵

Tenochtitlan, or Mexico as it was also known (the heart of present-day Mexico City), is at the lowest point in the basin. This, and the torrential nature of the rivers feeding Lake Texcoco, made the city extremely susceptible to flooding. The 'Albarradón (dike) de Nezahualcóyotl' was a massive work approximately 16km in length, which ran from north to south, dividing Lake Texcoco in two.

Tenochtitlan, located in the western section, named Lake Mexico, was protected to some degree from the torrential rivers entering Texcoco. The lake and City of Mexico escaped the great inflows of saline water and instead were fed by the rain and by overflow of sweet water from Xochimilco to the south. Thus Lake Mexico gradually became suitable for lacustrine agriculture.

Following the creation of the freshwater Lake Mexico: "chinampas covered its surface, separated by limpid spaces which were furrowed by swift canoes, and all the suburbs of this enchanting capital became flowery orchards".¹⁶

The streets of Mexico were of both water and earth.

"On the streets of water came and went innumerable canoes or hollowed logs, with the necessary provisions and services for the city . . . and not only in the city were these canoes used, but all around the lake by everyone in the region, canoes without number served the city".¹⁷

Estimates of the number of water craft in use in the basin range from 50 to 200,000.

In addition to 'Nezahualcóyotl', there were six or seven other dikes built, which, as well as controlling water levels, served as roads for land travel. By the size of the hydraulic works erected and the resources then available for construction, one may deduce a high degree of socio-political organisation under the Aztecs.

Anthropologist Gerardo Frenk observes:

"the economic development of the Mexicas came at the expense of the dominated peoples, but not of the Valley's natural resources; the Indians never had the intention of destroying the people's means of survival, but rather of conserving it, enriching it, and beautifying it".¹⁸

The Chinampa Agricultural System

"There is little doubt that the chinampas just south of Mexico City represent the most sophisticated version of Mesoamerican swamp agriculture. The complexes are extensive and most are strictly rectilinear, oriented roughly in accord with the sacred direction of Teotihuacan. The hydrology of the system has always had to be closely managed in order to prevent flooding, as well as to introduce sufficient fresh water to maintain levels and a slight flow in the canals. Production is year-round and finely tuned. All in all, this is an engaging garden landscape or, rather, it was until mechanised commercial cultivation and suburbanisation led to the obliteration of many chinampas".¹⁸

The chinampas of the Valley of Mexico have been noted for their beauty, their productivity, their ecological soundness and for the way in which traditional farming practices have been maintained amongst the chinamperos.

Since before the rise of the Aztecs, the chinampas have been producing corn, calabaza, tomatos, beans, chillies and other vegetables. Later, after the arrival of the Spaniards, the chinampas produced such European

vegetables as cauliflower, spinach, alfalfa, onions, lettuce, carrots and beets. Throughout the centuries, all of these products have been produced by the lake gardens in abundance. According to one source, chinampa agriculture is "one of the most intensive systems of agriculture past or present, in the Western Hemisphere, in terms of total annual production per unit of land".¹⁹

The depth of the lake is critical to the construction of chinampas. The lakes in the basin were all relatively shallow in the 1500s—from one to three metres.

The first step in chinampa construction was to locate a 'cimientto' (foundation) in the lake. This was done from a canoe by sounding the depth of the lake until a shallow area was found. A rectangle was then marked out above the 'cimientto' with reed stakes.

With the 'cimientto' thus prepared, 'cesped' was cut and brought to the site. 'Cesped' is a dense bed of vegetation or mat of aquatic plants essentially lirio (water lily) and tule, which grew in the large swampy areas of the lakes in masses "so thick that a man walking over them would not sink".²⁰ Rectangular pieces of 'cesped' (about 10m², although Armillas put the figure at 500m²) were cut with large knives and pushed and pulled by canoes to the 'cimientto' where they were piled one on top of another until they formed a solid bed.

On top of this vegetation was piled mud from the lake bottom and earth taken from old chinampas that had grown too high, until the surface of the new chinampa was approximately 30cm above the water.

This stage finished, the chinamperos would plant seedlings of ahuejotes (water willows) all round the edge of the chinampa, at intervals of four or five metres. Ahuejotes grow rapidly and straight upwards without branching out a great deal, which would shade the chinampa surface. The ahuejotes served to prevent the sides from eroding, as well as to fix the chinampa firmly to the lake bottom.

The chinampa thus constructed did float above the lake bottom a little, but after five or six years the ahuejotes were firmly rooted and the chinampa solidly seated on the 'cimientto'.

Perennial Fertility

The porousness of the chinampa vegetal foundation, the narrowness of the chinampa (rarely more than 10m wide) and the proximity of its surface to the water, all combine to maintain year-round, an ideal moisture content in the surface soil. The plant roots will receive water as long as the lake level is not more than one half metre from the chinampa surface.

The chinampa generally provides a continuous succession of crops—the soil does not rest. The ability to maintain soil fertility under such conditions is one of the chinampa system's most outstanding characteristics.

The chinampero has several sources of organic material with which to enrich his soil. The lake canals have always supported a plentiful supply of aquatic plants. Previously, these consisted of various species of tule and lirio. Today the canals of Xochimilco abound with a plant called 'huachinango', which was

introduced from Asia, and does so well that it blocks the canals and became a problem. Almost always 'chilacastle', a confetti-like plant, grows amidst the 'huachinago'.

Aquatic plants in the past were, and presently are, collected in canoes and brought to the chinampa where they are left in a corner to dry or chopped up with machete and turned into the soil green.

Mud from the lake bottom is also used as fertiliser. Previously, the organically rich mud was spread over the entire chinampa prior to each sowing, encouraging the chinampas to increase in height until the distance from lake level to chinampa surface prevented water from reaching the plant roots. Soil was then taken from the old chinampa for use in the construction of new ones. Today the chinamperos use the canal mud only in seed beds, known as 'almacigo', and in the cans and plastic bags also used for growing seedlings.

In pre-modern times there were Indians who collected bat manure in the caves of Guerrero and Morelos, and twice a year, in caravans of 50 or 60 mules, travelled to the basin to sell their load to the chinamperos. The bat manure, used primarily in sowing chillies and tomatoes, has been replaced with chicken manure. In the days of Aztec rule, human waste was also collected and used to fertilise the chinampas, a practice that is not common today.

In addition to the various organic materials employed to maintain soil fertility, the chinamperos practised crop rotation to some extent.

Growing Seeds

All plants, with the exception of the root crops, are sown in 'almacigo', and transplanted as seedlings to the chinampa field. 'Almacigo' measure about 10m x 1.5m, with a depth of 15cm to 30cm, and are usually constructed on the edge of the chinampa near a canal.

According to one source:

"These seedbeds with their concomitant protective and growth promoting mechanisms are the real core of chinampa agriculture. Without them this type of cultivation could function no more efficiently than any other kind".²¹

'Almacigo' offer several advantages. One, while waiting for the harvest, a chinampero can be working on the beginnings of his next crop. "The seeding is timed so that the shoots are ready for transplanting immediately after the previous crop has been harvested".²²

Second, it is easy to give the plants close attention and care as they pass through the delicate stage of seed to seedling. Protective measures include the use of straw or dried plants to cover the seedbed, or 'abrigos'—mats of reeds and today, plastic and cloth—erected over the young plants. A third advantage is that sowing in 'almacigo' "improves crop yield, since only the healthy sprigs are transplanted".²³

To build an 'almacigo' a shallow trench is dug, and the bottom covered with a layer of vegetation, manure or sand to prevent seedlings in the individual seed beds from sticking when the time comes to transplant the seedlings.

The chinampero next collects a canoe of mud. The

mud is not of the same quality throughout the canals, and the chinampero will often go far to where he knows mud of the best quality is to be had. The mud is cleaned of any garbage, plants or roots, brought to the chinampa and transferred to the trench, filling it completely.

The filled 'almacigo' sits for two or three days, until the mud has dried to the consistency of gelatin. Then, using a string like a carpenter's chalk line, the mud is carefully marked into squares—the square size depending on the seed to be sown. With a large knife, the 'almacigo' is cut along the lines, creating cubes known as 'chapines'. A hole is poked in each 'chapine' and seed(s) dropped into each hole, followed by a layer of fine soil or manure. The narrowness of the 'almacigo' allows all the work to be done without treading on the seedbed.

Depending on the plant, the time spent in 'almacigo' will vary from 20 days (coriander) to 100 days (chillies). When plants are ready to leave 'almacigo', transplanting is easily accomplished since each plant is well contained in its 'chapine'. Some plants, such as the ornamental ones and the flowers, travel directly from 'almacigo' to market. Others, such as chillies, leave the chinamperia to be grown in the hills.

Chinampa agriculture is outstanding in many respects. The remnant chinamperia that exists today in Xochimilco is a living example of this. There, the chinampas still yield impressive harvests, and the chinamperos farm in ways not fundamentally different from their great ancestors.

The Colonial Era: Draining the Valley

Hernán Cortés and his men entered the Valley of Mexico in 1519 and not only came upon a city larger and more organised than they had ever seen, but also encountered a lacustrine agricultural system of astounding sophistication and beauty.

Six months after his arrival, Cortés imprisoned Moctezuma, King of the Aztecs. The Spaniards then left the Valley, but returned in 1521 and laid siege to Tenochtitlan. By the time the city was in Spanish hands, it was in ruins. It was rebuilt as the capital of New Spain.

"The new rulers of Mexico were not familiar with the dangers and devastating capability of the floods, and completely neglected the ancient dikes. The hydraulic works had suffered a good deal of damage during the siege and war, and now fell into complete disrepair".²⁴

Not only did the Spaniards fail to maintain the works that protected Tenochtitlan, they also found in the dikes a good source of stone for the construction of their new city.

In 1555, there were heavy rains and the streets of Mexico City were flooded for days. The Viceroy, Don Luis de Velasco, ordered the reconstruction of some of the dikes, but at the same time was looking for 'a more permanent solution'.

For the next fifty years, Mexico City suffered a series of floods. The Spaniards tried a number of preventative measures, such as diverting the Cuauhtitlán River from its course to Texcoco, and gradually came to see floods as their 'principal enemy'.

"One reason for the continued flooding seems to have been the introduction of sheep and the subsequent overgrazing on the uplands surrounding the valley. This caused heavy siltation and a raising of the lake bottom, and probably greatly increased runoff".²⁵

In 1604 and 1607 there was serious flooding and the Spaniards decided to act on the idea of draining the lakes. The first such project was one proposed by the Spanish engineer Enrico Martinez. This was a canal, known as Río Desagüe (literally the River Drainage), which began at the northwestern edge of Lake Zumpango and stretched 25km to a low divide at the north end of the Valley. In order to connect the canal with the Tula River, and so drain the lake, a 6.6km underground passage (called the Tunnel of Nochistongo) was constructed.

By tapping Zumpango with Río Desagüe, the Spaniards could begin drainage of the entire basin because the lake waters run with a slow current from south to north.

This ambitious project was completed in less than a year by 60,000 Indians. An estimated 10,000 to 12,000 Indians died during the construction from sickness, and another 10,000 from work accidents.²⁶

A project proposed by Luis de Illescas was also carried out in the 1600s, which consisted of the diversion of three rivers, known as the rivers of Amecameca, which emptied into Chalco. This project brought strong protest from the chinamperos, but the interests of the City overrode the needs of the farmers. It was, nevertheless, only partially successful.

Even these measures did not suffice to halt the periodic inundation of Mexico City. Other works were constructed so as to complete the drainage of the northern lakes by the end of the 19th century. The emptying of Zumpango and San Cristobal was realised with the construction of the Mier and Tres Palacios Canals. Texcoco was dry by 1895, after the Tequisquiatic Canal was put into operation.²⁷

Although the principal motive for draining the lakes was to stop the floods that were so damaging to the capital of New Spain, it was also anticipated that the lake beds would provide fertile farmland.

"The results (were) not altogether fortunate, for the lake bed soils were found to contain such a high percentage of salts that not even pasture grasses would grow on them without expensive chemical treatment. Instead, therefore, of acquiring a huge area of exceptionally rich farmland, as was anticipated, the City of Mexico found itself bordered by a vast expanse of empty flats, only the edges of which can be utilized. During the dry winters, the bare ground gives off great clouds of dust which contributes to the unhealthful conditions of the capital".²⁸

Urban Mexico gradually spread out to fill the lake beds, which may help to explain why drainage efforts did not even cease after the northern lakes had been drained. Even today, Mexico City suffers from flooding after heavy rains.

By the middle of the 19th century, the lacustrine agricultural system in the basin was restricted to Lakes Xochimilco and Chalco. These survived all drainage efforts for several important reasons.



Mexico City, showing the site of the ancient Great Temple (bottom left) near the modern cathedral (top right). The city's expansion has led to massive drainage schemes and to increased pollution, both a threat to the chinampas.

As mentioned, a large number of springs fed the lakes, as well as rivers that flowed year-round. These sources combined to provide a water supply sufficient to maintain the lake levels.

Another factor that helped to preserve the chinampas in the southern lakes was the nature of the people who lived there:

"The people of the south of the Valley of Mexico are unique, particularly for the level of cultural, traditional cohesion that prevails amongst them. The strongest, most persistent force that has prevented the disappearance of the chinampas since the Spanish conquest until the present day, are their inhabitants".²⁹

Efforts to drain the south of the Valley did not cease, and by the turn of the century, Chalco was dry. This was accomplished by the diversion of two of the largest rivers that fed it, Tenango and Tlalmanalco. These rivers, as well as several smaller ones that emptied into Xochimilco, were diverted to the Mexicaltzingo Canal (today known as the Viga Canal). This, along with the Tequisquiatic Canal (finished in 1894) completed the desiccation of Chalco.³⁰

The Viga Canal is a natural waterway that has existed since pre-colonial times. It connected Lakes Xochimilco and Chalco with Lake Mexico, and served as one of the principal means of transporting produce from the southern chinampas to the Aztec capital. It was also the passage through which Xochimilco's sweet water passed into Mexico, making that lake suitable for chinampas. The rivers diverted in the 19th century to the Viga Canal then travel on to Río Desagüe.

The Chinampas in the Twentieth Century

Lake Xochimilco alone has survived until the present day, although it is much reduced in size; and of the 20,000 chinampa hectares that existed in Xochimilco 500 years ago, 200 remain.³¹

The 20th century has brought a whole new series of pressures on the chinamperia, all related to the continued expansion of Mexico City. At the start of the century the Porfista Government planned to resolve the problem of a potable water supply for the City by pumping water from the springs of Xochimilco to the City's centre. Government scientists calculated that by pumping two cubic meters/second from the Nativitas Spring, the City's water problem would be solved. Work began on the aqueduct in 1905; it was completed and operating by 1913.

The aqueduct did not solve the potable water problem as anticipated, and by 1930 a series of pumps had been added to enlarge the system. All of Xochimilco's large springs were tapped—La Noria, Nativitas, Acalpixca and Tlaxiatemalco.³² These actions caused the gradual drying up of the lake, and were met with violent protest from the Xochimilcans.

The pumping had its worst effects on those chinampas near the periphery of the chinamperia. There, the reduction of available water dramatically reduced the productivity of the soil, and chinamperos were forced to sell their land for residential development projects.

In 1950, a year of weak rains, the canals of Xochimilco

were dry. The government responded to the Xochimilcan outcry by reducing the rate of pumping for a time; meanwhile they arranged to send the City's semi-treated black water (sewage) to the chinampa canals.³³

The black water, which leaves the plant full of salts, began to arrive in Xochimilco in the 1960s via Canal Nacional. This open canal is a dumping ground for the industrial wastes and household garbage of those living near to it. In 1973, the Universidad Nacional Autónoma de México conducted an analysis of the canal water and found it unsuitable for irrigation on public health grounds.

Until the 1950s, one could drink the canal water. According to a 1957 register, at that time the canals supported "carp, trout, ajolote, acocile, mussels, turtles, frogs and juile. A similar record for 1973 found none of these in the canals".³⁴

In addition to destroying the fauna of the canals, Xochimilco's new water supply has been gradually reducing the chinampas' fertility. Only a fraction of the once abundant selection of vegetables and flowers are salt-resistant enough to grow in the increasingly saline soil, and even these species are growing at a slower rate.

Aside from the poor quality, the City water that arrives in Xochimilco has not sufficiently augmented the lakes diminished supply. The mountains to the south have been progressively deforested, the capture and filtration of water has declined, the springs have less water, and soil from the mountains is being washed into the canals by surface runoff.

Toward the end of the 1960s, the City began to draw on the chinamperia groundwater. At first three pumps were installed to feed the Cuemanco Canal. The Cuemanco Canal is used for sport rowing. The chinampas nearest to the pumps sank dozens of centimetres.

In the 1970s, a series of deeper wells were sunk all around the lacustrine zone in order to pump water from the subsoil to the City's potable water system. More of the chinamperia began to sink.

The subterranean water mantel is apparently unable to recharge itself under the present conditions, and so, "like a dry sponge, the subsoil is compacting and the chinampas are sinking".³⁵

In the northern section of Lake Xochimilco, towards the Cuemanco Canal, the chinampas were almost completely inundated during the 1984 rainy season. In the southern section on the other hand, the chinampas have not sunk and they are too dry.

In the south there is a significant tourist industry that operates by taking tourists and City dwellers through the canals in colourful canopied canoes. The canoeemen were complaining that their boats were scraping bottom in the same year that the northern chinampas were suffering from floods.

A "solution" has been sought by creating two lacustrine subsystems within lake Xochimilco. Between the northern and southern sections of the lake are the barrios of Xochimilco. Through the barrios there are two main passage ways that connect the two sections and allow for canoe travel throughout the chinamperia. By blocking the passage ways with sandbags, the water level in the south could be raised without further inundating the north.

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Under pressure from the owners of the tourist canoe fleets, the Agriculture and Water Resource Ministry (SARH) blocked the passages; they remain blocked today. This action has brought serious problems for the chinampa farmers and their families (about 5,000), who survive by the produce of their plots. The reason lies in the chinampa farming method, which requires the use of good quality mud in 'almacigo' for the first stage of plant production. The bottom of the southern canals is salinated and full of garbage left by tourists—it is unsuitable for plant production. Now, the chinamperos of the southern and middle portions of the chinamperia—where most of the farmers are concentrated—are unable to take their canoes north to collect mud and seedlings as they have done for years.

By preventing canoe travel amongst the different lake portions, the SARH is harming nearly all the chinampa producers in order to protect the tourist industry of Xochimilco, which itself is suffering because of the fading beauty of the chinamperia. Transporting the mud by land is not economically feasible.

Owners of the tourist canoes want the blockades maintained, as do certain producers in the north. Producers from the south and middle chinamperia have requested that a simple system of locks be installed so as to allow for different water levels in the north and south, but also permit canoe travel—perhaps only at certain hours of the day. They point out that in the past there have been similar locks, such as those where the chinamperia and the large canals that go to the City's centre meet.

The SARH delegation would like to close the passages permanently, with cement rather than sandbags. This was done to the passage ways that linked the present chinamperia with Tepalcatlalpan, a former chinamperia now covered with housing developments.³⁶ How this conflict will be resolved remains to be seen.

Conclusion

The importance and value of preserving the chinampas is clear. The chinampas of Xochimilco are a living, functioning monument to the great lacustrine agricultural system that once flourished in the Valley; they should be preserved as an example of traditional, indigenous technology and life-style.

The chinamperia of Xochimilco is not a system that has past its time. In 1950, it was producing the greater part of Mexico City's fresh vegetables.³⁷ In 1986, it was estimated that Xochimilco is still capable of producing 25 per cent of the vegetable demand of Mexico City.

Chinampa farming is a valuable technique for tropical lowlands. Chinampas are now being constructed in Veracruz and Tabasco, with help from Xochimilcan chinamperos.

In addition to providing vegetables, flowers and decorative plants, the greenery of Xochimilco serves as a badly needed lung for Mexico City. And finally, Xochimilco is still a popular tourist zone. The canals provide a healthy afternoon escape for many city dwellers.

With protection from the pressures now destroying the chinamperia, it could become again the precious

area it once was, as described by Jose Montes de Oca in 1926:

"... countless Mexicans and foreigners ... go to join themselves, like the symbolic poets, with nature, to drink in the images, and to receive in Xochimilco the gentle caresses of the colours and perfumes of the roses, the verdure of the phantasmal willows, the emerald of silent waters, the blue of the far hills, the words of the wind in the grass full of flowers ..."

The first steps towards chinampa rehabilitation would be a system of locks at the barrio passages, reduced pumping from the springs and groundwater and better treatment of the black water. Unfortunately, the government lacks determination to maintain a place for Xochimilco, its residents and their way of life, amidst the expanding urban complex; rather, the chinamperia is seen as potential land for residential and commercial development.

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Robert Mann

Gully erosion on Cotton and Groundnut fields, Basse, The Gambia.

Development and the Sahel Disaster: The Case of The Gambia

by Robert Mann

The imposition of modern agriculture and the introduction of the cash-crop economy have wrought havoc with the fragile environment of the Sahel. Widespread soil erosion and the loss of vegetation have caused a seemingly permanent change in the local climate, reducing rainfall and bringing the nineteenth consecutive year of overall increasing aridity.

In April 1972, Northern Ghana was suffering from extreme desiccation, dams and water holes had dried up, the people were in a desperate situation and there was no sign of rain. Flying north from Accra, the wind-borne dust was so thick that Upper Volta, Mali and half of Algeria were completely blotted out; this was yet another vivid indication of the seriousness of land degradation across the African continent.¹

The area of Ghana is 238,538 square kilometres (km²) of which 47,900 km² was forest and 111,100 km² was open woodland in 1937/38. By 1980/81, the area of closed forest had been reduced by 64 per cent to 17,200 km² and woodland had declined by 37 per cent to 69,800 km².²

In May 1973, a photographic record

was made in the Soddo to Lake Abaya area of Ethiopia, where extensive clearing of trees with heavy machinery on a 'resettlement' scheme funded by foreign aid had greatly added to the previous incredible erosion throughout that region. The photographs showed gulleys up to 18 metres wide, top soil and crops washed away, and urgent attempts by farmers to replough and sow seed for food crops again in the remnants of soil erosion debris. The recent famines in Ethiopia should have been no surprise, they were brought about by years of incorrect land use.³

In this same year, in the Southern Province of Zambia, some 2,300 kilometres south of the Sahel Region, evidence of change in land-use was also being examined.⁴ Air photographs of identical sites taken in 1955 and 1970 were placed side by side, and the most astonishing differences were clearly visible; tree cover had gone, grazing land was under annual crops, the Magoye river had dried up, and the Chivuna area had

changed almost beyond recognition over the 15-year period. But it should not have been a surprise; looking at farmers' fields at Tundaile village in the Kataba area in June 1971, the soil had already become sand, no humus was left, and plant nutrients had leached down. The farmers had been pushed onto marginal land many years before to allow 'settlers' access to large acreages for cash crops and cattle ranches.⁵

Deforestation in The Gambia

At the end of 1974, work commenced in The Gambia on the raising of drought-resistant indigenous trees at Yundum Experimental Station, joint project of the Methodist Mission Agricultural Programme (MMAP) and Ministry of Agriculture and Natural Resources (MANR). But convincing evidence was needed to show the urgency of the situation, so the 1946 and 1968 air photos were located in the Surveys Department and changes in land-use were documented over that 21-year period for

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20 sites throughout the country, each of 25km² in size. The analysis by percentage of land area showed that two-storey forest had dropped from 28 per cent in 1946 to 3.4 per cent in 1968, woodland savanna had been reduced from 31 per cent to 4.6 per cent over that same period, much previously cropped land had gone out of production due to decreasing fertility, and the practice of adequate fallow periods to rejuvenate soil had been abandoned by many farmers. It was evident that the fragile ecology of this region had been thrown out of balance by improvident land-use practices, and as a matter of urgency attention was drawn to the need for soil and water conservation through comprehensive land planning for the whole agricultural production complex, with particular emphasis on reconstitution of pasturelands and reafforestation.⁶

Dust and the Lack of Rain

Where vegetation cover is progressively reduced over large areas, increasing desiccation and rising dust levels ultimately bring about lower and unreliable rainfall, which together cause soil moisture and water tables to drop below the tree-root zone with dramatic results. This occurred in Northern Senegal, just 250 kilometres from the Gambian border where, between 1970 and 1974, the loss of *Acacia Senegal* (gum tree) forests ranged from 20 per cent to 80 per cent, and up to 90 per cent of all *Combretum* species died.⁷

Dust fall-out across the Atlantic from the African continent measured at Barbados in the West Indies increased from 8 micrograms per cubic metre in 1967/68 to 15 micrograms in 1972 and 24 micrograms in the summer of 1973. Here is the Sahel catastrophe: a 3-fold increase in measured fall-out at a distance of 4,700 kilometres west of the Sahel, and this dust is not sand but top soil.⁸

In 1977, dust-laden winds continued blowing across The Gambia long after the usual February to April period. Ground level dust was particularly heavy in mid-June, and high level dust was still observed pouring out across the Atlantic as late as mid-July. The July 1977 rainfall for Yundum was only 138mm compared with the 1949-66 average of 317mm

for that month. In August, there was no rain at all; village roadside cashew planting did not survive, and many farmers in Western Division had total crop failure.⁹

With the rains in The Gambia now frequently insufficient for basic food production needs, farmers turned to dry-season vegetable gardening wherever suitable land could be found. But unlined wells in sandy-clay soils collapsed repeatedly. Concrete-lined wells were essential to support dry season vegetable growing and the establishment of fruit tree nurseries at village level, and local fabrication of the steel shutters, winch tripods and accessories to construct lined wells was initiated using indigenous blacksmithing skills and workshop expertise.¹⁰

The Wells Dry Up

The joint MMAP/MANR programme moved to Brikama in Western Division in 1979 where a central fruit tree nursery was set up. In the first 6 months of 1980, however, the two nursery wells had to be deepened 3 times, due to a sudden fall in the water table. Of the 46 wells constructed by MMAP/MANR teams in 1978/79, 43 had to be deepened as, one after the other, they went dry from January 1980 onwards.

The need to go back and deepen wells on already completed village schemes was not just a temporary hindrance to assisting other villages; it also raised much more serious questions as to the technical feasibility of re-establishing village level tree cover when the rains were inadequate for planting and when well water supplies were insufficient to support trees during the 9 months dry season.¹¹

With rainfall levels at only half of the 70 years average for Banjul up to

1967, even upland rice in Western Division (the South-Western region of The Gambia) failed to produce a crop in 1980. Local hardy orange trees dried up in the villages, and in the following year the rainfall was lower still. In 1981/82, the teams had to deepen 106 wells (see Table 1).

Western Division is classed as The Gambia's "Humid Zone" and rated as having the highest levels of rainfall in the whole country. Accurate data on water table levels in MMAP/MANR wells in Western Division had been kept since 1978; out of 97 wells measured in June 1982, only 9 had more than 122cm depth of water in the aquifer, 26 had between 61cm and 122cm, and 62 had less than 61cm. In effect, the majority of wells would have to be deepened yet again if there was to be any chance of garden crop production in the next dry season.¹²

During the original construction of the wells, porous rock and granular lateritic layers of varying depths were observed above and sometimes extending down and into the upper level of the main rain-recharged aquifer. As the drought progressed, with the water table dropping by up to two metres per year, the deepening of many wells involved excavating below the lateritic zones into silt and clay sub-soil formations which were highly unstable structurally under horizontal aquifer pressure. They also gave significantly lower water yield even with the extraction strictly limited to withdrawing water by hand using a bucket and rope.¹³ The position of the laterite and silt-clay zones indicated that the water-tables in question have not been this low in recent times, certainly not within the last century; the effects of the previous much shorter drought period of 1910-13 on the water-table would in any case have been considerably cushioned by

Table 1: Wells dug and Deepened, 1978-82

Year	No. of wells constructed	No. of wells that had to be deepened
1978	14	2
1979	32	4
1980	37	43
1981/82	28	106

the much greater vegetative cover of the land area, and therefore aquifer stability, at that time.

On the issue of drought as a major constraint to food production, an external evaluation team to The Gambia in 1981 recognised that the country would become increasingly marginal for dry land rain-fed crops if the new rainfall trend line fitted to records by the Department of Hydromet were to become reality, but then stated, ".....in the absence of any agreement as to an identifiable trend in rainfall we shall assume there is none....."¹⁴

Banjul is situated near the 1100mm isohyet, but in 1983, sixteen years after the drought commenced in 1968, it received less than 450mm of rain, the lowest amount since records commenced in 1886.

Man-Made Climate Change

Ecologists and climatologists have continued to debate whether in fact man can affect world climate.¹⁵ The views of scientists are not taken lightly, their stated opinions do have a profound effect on the priority decisions made by Aid Organisations and hence the actions of recipient administrations. But while the debate goes on, the would-be initiatives of many local field workers are thwarted and much valuable opportunity for soil and water conservation through replacement of vegetative cover is being irretrievably

"While it may be logical to consider the current fluctuations as a short-term period, it is prudent to take into account the possibility that it may not be."

lost. How often have the village farmers themselves been consulted on these issues? They have a wealth of ecological knowledge which is largely ignored, and if this discussion is not promptly turned into action then increasingly large areas of Africa will become arid wastes.¹⁶

Meteorologists estimate that deforestation must affect an area of some 250,000 km² before climatic changes occur.¹⁷ But, in the century prior to 1981, an estimated 880,000 to 1,228,000km² of forest-woodland had been removed in West Africa alone, within the path of the intertropical convergence zone.²

In 1975, a UNESCO document on ecological approaches to land use in the Sahel gave the following caution; "....While it may be logical to consider the current fluctuations as a short-term trend it is prudent to take into account the possibility that it may not be".¹⁸

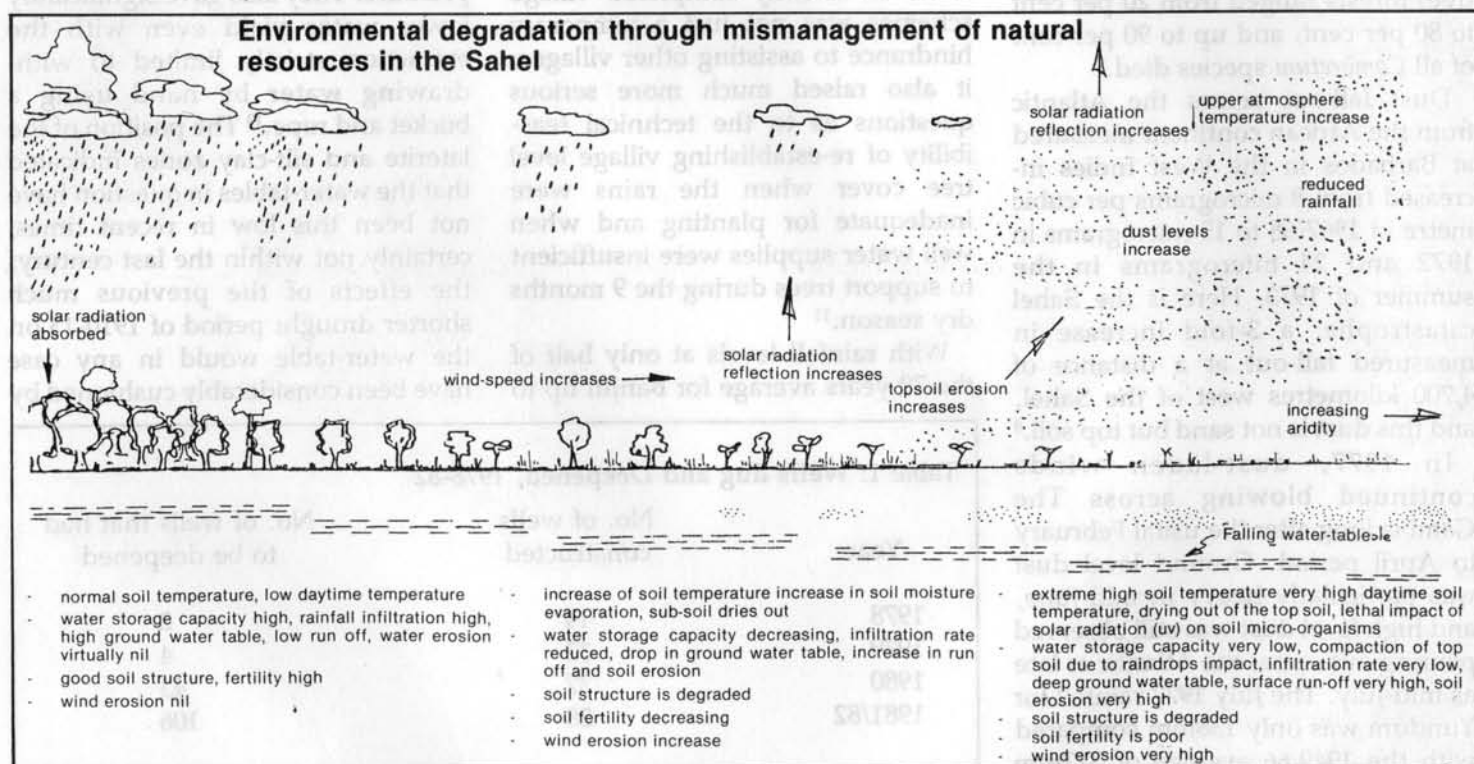
Biogeophysical feedback, the concept that drought is reinforced either through changes it evokes in the Sahelian land surface or through similar changes produced by human impact on the ecosystem, was init-

ially proposed by Jule Charney in 1975.¹⁹ The hypothesis suggests that removal of vegetation increases surface reflection of solar radiation, which affects the atmospheric energy budget in such a way as to intensify the sinking motion leading to further compression and warming of the air masses which promotes aridity in the Sahel and Sahara.

In 1984, Sharon Nicholson pointed out that, while the scientific community had been slow to accept this concept, most of the proposed mechanisms were physically sound. Furthermore, mathematical models testing several hypotheses had, despite different assumptions and varied surveyed mechanisms, universally concluded that changes in the Sahelian surface can act to diminish rainfall; also, the known sensitivity of the tropical atmosphere to surface parameters increased the plausibility of the idea.²⁰

The Importance of Tree Cover

The MMAP/MANR programme assisting village farmers with tree planting had been meeting a need as expressed by the people themselves. This joint extension facility by a non-government organisation working with the Departments of Agriculture and Forestry had grown over the years through the credibility of the village farmers' efforts under appalling climatic conditions. The farmers chose fruit trees, mainly local



varieties of polyembryonic mango, some particularly drought-resistant local sweet grapefruit varieties, jackfruit, sweetsop, soursop, guava, and cashew used as compound fencing, field boundaries and also in orchards. These trees, all seedlings, were planted for their usefulness as food and cash income, and it is a credit to the persistent efforts of the village people that actual progress was made in the face of desiccating winds, repeated drying up of wells, and low/unreliable rainfall from one year to the next.²¹

In order to show the importance of maintaining and increasing tree cover, day-time temperatures were taken simultaneously in shade, under mulch, under trees, and on bare ground, during the dry season of 1983/84 and again in 1986. The mid-day in-shade air temperature taken under *Cola cordilifolia*, a common Gambian village shade tree, was found to peak at around 34°C at 2pm, while the temperature taken at the same time on the ground underneath a 30cm depth of mulch (placed around young fruit trees to conserve moisture) was about nine degrees higher at 43°C. The bare ground temperature was found to peak at 2pm at readings of up to 67°C, while the temperature on the ground under the shade of 5-metre high cashew trees of less than 4 years of age was found to be as low as 36°C at that time of the day.²²

These are not isolated recordings peculiar to The Gambia. Peak day-time temperatures of 37°C under the shade of *Acacia albida*, and 67.5°C on bare ground, were taken at Zalingei in the Sudan in 1965.²³

Such data provide a vivid example of why it is essential to maintain sufficient vegetative cover in the tropics. Bare ground will heat up to more than 60°C; by contrast, crop residue left on fields can reduce mid-day soil temperature by an estimated 15°C to 20°C or more, while trees can bring down the peak ground temperature by as much as 30°C. Furthermore, it has been observed that the dry season top soil condition on sandy clay soil in The Gambia can be transformed from a dense hardpan to one of a high humus crumb structure in less than 4 years under cashew and 5 years under mango trees due simply to the annual leaf-

fall litter and the use of a grass mulch.

Latosols and Deforestation

In 1958, Ignatieff and Page of the UN Food and Agriculture Organisation (FAO) gave a clear warning in respect of the vast areas of Latosols in Africa which stretch across from The Gambia to the Sudan and down to Zambia;

- clean clearing and monoculture would result in disastrous soil depletion and erosion
- an almost continuous ground cover is essential to prevent leaching of nutrients;
- mineral fertilizer use can upset the balance, and can never substitute for the beneficial effects of mulch and growing vegetation in the maintenance of soil fertility.²⁴

Removal of vegetation and the erosion of soil from laterites and associated soils can result in the formation of concretions in the surface horizon and below ground in the position of the intermittent water table. In parts of West Africa, removal of the thin forest for the cultivation of cotton and groundnuts increases the drying of the soft laterite enough to harden it under the very feet of the farmer.²⁵ In Ghana, a farm established by clearing and tractor ploughing at Prang in 1962 was abandoned 4 years later in 1966 because of low yields resulting from hardening of the laterite soil. On farms near Sapu in The Gambia in 1967/69, boulder formation was seen to have occurred in those fields where the bush fallow of 1 year after 2 years monocropping with groundnuts followed by millet proved an insufficient resting period to prevent the soil from hardening.²⁶

These are just two examples where land suited to permanent tree crops and grazing was brought under cultivation in a 'Westernised' monocropping pattern only to become rapidly degraded and infertile within a short period of time. In many cases irreversible hardening of laterite soils does occur, but reclamation is possible if action is taken in time. Vegetation is the only agent known to prevent or reverse the hardening process, trees and other woody perennial plants being reported as the most effective.²⁵

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Traditional vs. Modern Agriculture

The traditional agricultural system as practised by shifting cultivators was characterised by diversity and complexity, several different crops being planted at once. Such mixed cropping spread harvest effort, provided security in case of crop failure, and, by creating a varied environment, avoided serious losses to pests and diseases. It also meant that the soil was almost continuously protected from the destructive influences of sun and rain. It was an ecologically sound system wherever the ratio of land to people was high enough, and was well matched to forest conditions at that time. Few of the men and women who practised it had ever been formally educated, even at primary school, yet they carried in their heads an extraordinary fund of scientifically sound knowledge about plant species and soil qualities.²⁷ Indeed, the demise of traditional agriculture has brought ecological ruin to large parts of Africa.

In the Sahel, the connection between the expansion of the area devoted to the cultivation of annual export crops and the desertification process is obvious. The Sahelian farmers used to take the precaution of planting several varieties of sorghum and millet which had different moisture requirements in order to run fewer risks in case of variable rainfall. But ever since they have been obliged to plant cotton and groundnuts for export, they have taken greater risks with their own food. They now plant those varieties which produce the most and which require good rainfall, thus running the risk of producing nothing at all. It is not the African husbandman who lacks foresight; rather, the political-commercial world cares little for the producer and is quite ignorant of the consequences for the future.²⁸

Inappropriate Technology

Many new tools, or forms of crop husbandry, have been designed and tried in farming systems in Africa just because it was 'generally thought' or 'assumed' that a particular task was limiting or onerous, or that traditional crop production methods were giving below-desirable yields,

only to find that the new methods were not adopted.²⁹ The local farmers' knowledge of the environment in which they work is highly complex and organised; research will only be useful if it is consistent with, rather than at odds with, well tried traditional methods.³⁰

Basic tools for producing crops have been developed over centuries by the very ingenuity of the African farmer to match specific tillage and resource-conserving requirements.

In the 1940s in Northern Senegal, farmers were alarmed at the introduction of the western mouldboard plough because they saw that it inverted the soil. It was subsequently reported that a considerable amount of their best land was lost due to wind and water erosion through the use of that tool.³¹ In areas with a high average soil temperature and frequent drywinds, the need is to break the soil without inverting it in order to collect and store as much moisture as possible and to delay the natural decay of vegetation.³² Yet in Senegal the agricultural policy behind the intensive extension drive from 1963-67 to increase groundnut production was still pushing the concept of deep cultivation.³³ The inevitable consequence was to further top-soil losses by wind erosion during the following drought years.

The Ethiopian locally-made ard plough cannot be improved upon for the conditions under which it has been designed to work; it produces a ridged tilth, does not invert the soil, leaves dead vegetation on the surface, and the unique pivot action between furrow-openers and beam enables the plough point to be lifted up and over obstacles. Yet there have been many attempts to introduce ploughs of foreign origin into Ethiopia contrary to that accumulated local wisdom.²⁶

Similarly, the indigenous African hoe, produced by local blacksmiths in many shapes and sizes has been devised within each situation for the precise task to be done, and it was these balanced hand-cultivation systems which had been planned by farming communities with conservation of the soil resource and its micro-climate very much in mind.³⁴

But what of the situation now for

smallholder farmers in Africa? Their whole environment is changing under the disruptive forces of combined deforestation, soil erosion, monocropping, and the influence of rising human and livestock populations.³⁵

Environmental Destruction and Rainfall Patterns

A paper presented at a conference held in 1985 on Agricultural Development in Drought-prone Africa contained the following important statement;

"...the plausibility of feedback and atmospheric change theories makes it imperative that any plans for the semi-arid regions should take account of the real possibility that present conditions may persist into the future".³⁶

In the same year a report focusing on Africa for the Independent Commission on International Humanitarian Issues under the title, *Famine; A mad-made disaster?*, clearly stated that environmental degradation once set in motion can certainly become self-reinforcing, and that loss of vegetation cover does adversely affect the amount of rainfall.³⁰ Why has it taken so long to come to this critical conclusion, an understanding of which is vital to the forward planning of sustainable food-production systems in Africa?

For those who have actually lived and worked at village level in Africa there is no doubt in our minds that micro and macro climate are linked. This has been pointed out over many years, but visiting 'consultants' and 'advisers' have chosen to ignore the reports and supporting data. Remove ground cover, trees in particular, and you will observe the climate change; it is not difficult to take measurements of humidity, soil moisture, and temperature, the results are there for all to see.

It would indeed be wise to face the possibility that the Sahelian drought is not a cycle, that it is part of a long-term trend of increasing aridity which became worse in 1968 and has continued ever since.

Meteorologist Derek Winstanley worked out that by 1984 the Sahelian drought had lasted 17 consecutive years, and the odds against that happening had been calculated as 1:125,000.³⁷ But the 1985 and 1986

rainfall figures for Banjul in The Gambia were again low at around 900mm and 700mm respectively, so by the same reckoning there have now been 19 consecutive years of overall below-average rainfall. In 1967, the odds against that happening would have been 1:750,000.

Logging and Deforestation

In addition to the negative influence of many of the crops grown for export on the balance of tropical ecosystems, the present frantic exploitation of the forests in the Ivory Coast, Ghana, and Guinea-Bissao—a practice 'imported' from the industrialised countries—has greatly contributed to the degradation of the environment, and is a matter which requires immediate attention and control. Nonetheless, the United Nations Conference on Desertification at Nairobi in 1977 chose not to discuss or take action on this issue.²⁸

In 1817 when the commercial extraction of *Khaya senegalensis*, Gambian mahogany, was just starting in The Gambia, it was recorded that the local people were not willing at first to cut and prepare it for shipping. It was further stated: "... since that time thousands of loads were shipped to England and by 1910 this trade ceased as all exploitable trees had been cut."³⁸ What must be noted is that this particular tree was not used for firewood or construction in the villages, but the rural people were aware of its value as an essential part of their habitat.

The Impact of Reduced Rainfall

The reduced rainfall in The Gambia has had profound consequences; in most years it is no longer possible to obtain sufficient food from rain-fed crops. On the MMAP/MANR programme assisting village farmers to establish their own nurseries, orchards, and windbreaks, with drought-resistant fruit trees, the field staff are constantly aware of how the water-table is sinking progressively lower each season. It is they who are supervising the well construction and deepening and monitoring the water levels. They are equally aware, that soil-surface temperatures recorded at mid-day on open ground can reach 65°C or more compared to say

35°C under the shade of trees, because they are responsible for taking these measurements. Since 1976 the River Allahein, on the southern border with Casamance, has disappeared, and where it once entered the Atlantic there are now sand dunes; over that same period, the rain-fed rice swamps in Western Division have dried up and are now abandoned.

But to many visiting 'consultants' and 'advisers', the implications of these facts are unacceptable; they prefer to believe that man-made technical and chemical inputs can solve the problems and that the present drought is a cycle which will go away.

Increased Salinity

A further indication of the seriousness of declining rainfall in The Gambia has been the incidence of increasing salinity in village domestic and garden wells, particularly since 1983, to the point where the water

has become unusable for drinking or the watering of garden vegetables. Measurements of salinity, calculated from electrical conductivity readings of water samples taken in April and May 1986 by scientific staff of the Water Resources Division, reveal the sub-surface movement of salt water on both north and south banks of the River Gambia. The salt is getting into certain village wells, causing them to become abandoned as far up river as Nyanga Bantang, 190 kms from the coast.³⁹

In checking these readings against the data contained in the FAO, UNEP, and UNESCO mapping of land degradation in Africa north of the equator, carried out in 1979-80, it was apparent that the area throughout Lower River Division which had been classed as "a high-risk area" for future salinization at the time the maps were compiled, had in fact already become widely affected by salt water intrusion from the River Gambia into the main rain-fed aquifer as at the dry season of 1986.⁴⁰



Declining rainfall has led to village wells becoming increasingly saline. In addition, the wells must be dug deeper and deeper before reaching groundwaters.

Conservation in The Gambia

The commitment of the Gambian Government to conservation and rehabilitation of its natural resources is deep-rooted. In 1968 it became signatory to the OAU African Convention for the Environment, and that commitment was integrated into its 1975-80 Five Year Plan. In 1977, the President, Sir Dawda Jawara, issued the Banjul Declaration on conservation, and in the following year, 1978, he again took considerable initiative in launching the National Tree Planting Programme. The Gambian Government has upgraded the protection and productive aspects of its forest resources, and has established a Soil and Water Conservation Unit and an Environment Documentation Centre. The Government has an excellent integrated relationship with non-government organisations in the

country. Such initiatives deserve every possible form of encouragement in view of the climatic difficulties currently being faced.⁴¹

The commitment of the African husbandman to conservation goes back further still, for agro-forestry is not new to Africa; the symbiotic relationships between trees, crops and animals has long been recognised and applied in indigenous farming systems as the key to survival.⁴²

Tapping Traditional Wisdom

But time for Africa is running out fast; as soil is eroded and the microclimate disintegrates, field-crop and livestock production is decreasing yet further. However, this does not have to be; there is much hope for recovery if action can be taken quickly.

There is a great need for proper understanding of the links between removal of ground cover and increasing aridity. There is an equal need for field workers to be able to perceive—through the eyes and minds of rural communities in Africa—practical ways of stemming the tide of decreasing productivity by enabling the very wisdom of village people to be used in their own forward planning. There is indeed an urgent need to tap all possible sources of information on indigenous soils and water conservation methods aimed at stabilising the food production base, and to go for advice to Africa's smallholder farmers who for years have deserved that their depth of knowledge be understood.

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Losing the War Against Cancer

Who's to Blame and What to do about it

by Samuel S. Epstein

In 1971, the US Congress launched a War on Cancer. Sixteen years and billions of dollars later, the US is still in the grips of a cancer epidemic—and the number of victims grows every year. Much of the money has been squandered on a fruitless search for cancer "cures". Little or nothing has been done to prevent exposure to carcinogenic chemicals in the environment—this despite ample evidence that chemical pollution of our air, water, and food is the major cause of cancer. On the contrary, government, industry and a small coterie of scientists have combined to stymie efforts to introduce preventive measures, such as strict pollution control standards. But cancer remains a preventable disease. It is up to citizens to push for action.

Cancer is now a major killing disease in the industrialised world and its rates are sharply rising.¹ In contrast, there have been major reductions in deaths from cardiovascular disease, still the number one killer in the US, probably because of a recent decline in smoking and attention to diet and exercise.

With over 900,000 new cases and 450,000 US deaths last year, cancer has now reached epidemic proportions with an incidence of one in three and a mortality of one in four. Analysis of overall cancer rates, standardised for age, sex and ethnicity, has demonstrated a steady increase in cancer rates since the 1930s. In recent years, the incidence rate has risen sharply, by some 2 per cent a year, with mortality rates rising by 1 per cent a year.

Striking confirmation of these recent increases comes from estimates of the lifetime probability of getting cancer for people born at different times. For white males born in 1975 to 1985 for instance, the probability of developing cancer has risen from 30 to 36 per cent, whilst the probability of dying from cancer has risen from 19 to 23 per cent. Such increases in overall cancer rates are also reflected in the increasing incidence of cancers of the lung, breast, colon, prostate, testis, urinary bladder, kidney, and skin, and of malignant melanoma and lymphatic/hematopoietic malignancies, including non-Hodgkin's lymphoma.² Lung cancer is responsible for about one-third of the overall recent increase in incidence rates. It should be stressed that some 75 per cent of all cancer deaths occur in people over 55 years, and that recent increases are largely restricted to these ages.

Static Cure Rates

The overall cancer "cure rate", as measured by survival for over five years following diagnosis, is currently 50 per cent for whites but only 38 per cent for

blacks. There is no evidence of substantial improvements in treatment over the last few decades, during which the five-year survival and age-adjusted mortality rates for the major cancer killers (lung, breast and colon) and for most other organs, have remained essentially unchanged. The only improvements have been for cancer of the cervix, and for relatively rare cancers, such as testicular seminomas, Hodgkin's disease and childhood leukemias treated with radiation and/or chemotherapy. Apart from immediate toxicity, such treatment, while effective, can increase the subsequent risk of developing a second cancer by up to 100 times.

Increasing Carcinogenic Exposures

Cancer is an age-old and ubiquitous group of diseases. Its recognised causes and influences are multifactorial and include natural environmental carcinogens (such as aflatoxins and sunlight), lifestyle factors, genetic susceptibility, and more recently industrial chemicals. Apart from modern lifestyle factors, particularly smoking, increasing cancer rates reflect exposure to industrial chemicals and run-away modern technologies whose explosive growth has clearly outpaced the ability of society to control them. In addition to pervasive changes in patterns of living and diet, these poorly controlled technologies have induced profound and poorly reversible environmental degradation, and have resulted in progressive contamination of air, water, food and workplaces with toxic and carcinogenic chemicals, with resulting involuntary exposures.

With the dawn of the petrochemical era in the early 1940s, by when technologies including fractional distillation of petroleum, catalytic and thermal cracking and molecular splicing became commercially established, the annual US production of synthetic organic chemicals was about one billion pounds. By the 1950s, this had reached 30 billion pounds, and by the 1980s over 400 billion pounds annually. The overwhelming majority of these industrial chemicals has never been adequately tested—if tested at all—for chronic toxic, carcinogenic, mutagenic and teratogenic effects, let

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alone for ecological effects, and much of the limited available industrial data is at best suspect.

Occupational exposure to industrial carcinogens has clearly emerged as a major risk factor for cancer.³ The National Institute for Occupational Safety and Health (NIOSH) estimates that some 10 million workers are now exposed to 11 high volume carcinogens. Five to 10-fold increases in cancer rates have been demonstrated in some occupations. Also persuasive are British data on cancer mortality by socio-economic class, largely defined by occupation, which show that the lowest class, particularly among males, has approximately twice the cancer mortality rate of the highest class.

Living near petrochemical and certain other industries in highly urbanised communities increases cancer risks, as demonstrated by the clustering of excess cancer rates. High levels of toxic and carcinogenic chemicals are deliberately discharged by a wide range of industries into the air of surrounding communities. Fall-out from such toxic air pollutants is also an important source of contamination of surface waters, particularly the Great Lakes. While there still are no regulatory requirements in the US for reporting and monitoring these emissions, unpublished government estimates indicate that they are in excess of 3 billion pounds annually.⁴

Another example of the effects of run-away technology is the hazardous waste crisis. The volume of hazardous wastes disposed of every year in the USA has risen from under 1 million tons in 1940 to well over 300 million tons in the 1980s—more than 1 ton per US citizen per year. The industries involved—fossil fuel, metal mining and processing, nuclear, and petrochemical—have littered the entire land mass of the US with some 50,000 toxic waste landfills—20,000 of which are recognised as potentially hazardous—170,000 industrial impoundments (ponds, pits and lagoons), 7,000 underground injection wells, not to mention some 2.5 million underground gasoline tanks, many of which are leaking. Not surprisingly, an increasing number of rural and urban communities have found themselves located on or near hazardous waste sites, or downstream, down-gradient or down-wind from such sites. Particularly alarming is growing evidence of contamination of ground water from hazardous waste sites, contamination which poses grave hazards for centuries to come. Once contaminated, ground waters are difficult, and sometimes impossible, to clean up.

Environmental contamination with highly potent carcinogenic pesticides has reached alarming and pervasive proportions. Apart from high level exposure of workers in manufacturing, formulating and applying industries, the contamination of ground and surface waters has become commonplace. Residues of ethylene dibromide in excess of 1,000 ppb in raw grains, cereals and citrus fruits have been well known to industry and the Environmental Protection Agency (EPA) for as long as ten years after its very high carcinogenicity was first demonstrated; not until 1984 however, did EPA develop a 30 ppb tolerance, which was rejected by the Commonwealth of Massachusetts and the States of New York and Florida, and replaced by much lower and less hazardous levels. While the exact numbers are uncertain, it is probable that tens of millions of homes



Household chemicals being packed into drums for disposal as hazardous wastes. Little is done to limit everyday exposure to such chemicals, few of which have been tested for their carcinogenic properties.

nationwide are contaminated with varying levels of chlordane/heptachlor, pesticides still registered by EPA or termite treatment. It should be noted that, on the basis of extensive hearings some 14 years earlier, the Agency concluded that exposure to chlordane/heptachlor posed an "imminent hazard" due to cancer (besides other chronic toxic effects) leading to a subsequent ban on their agricultural uses.

Much cancer today reflects events and exposures in the 1950s and 60s. The production, use and disposal of synthetic organic and other industrial carcinogens was then miniscule in terms of volume when compared to current levels, which will determine future cancer rates for younger populations now exposed. There is every reason to anticipate that even today's high cancer rates will be exceeded in coming decades.

Concern has understandably focused on increasing cancer rates but these substantially underestimate the extent and scope of the public health effects of environmental pollutants. Only a small proportion of the tens of thousands of petrochemicals in commerce, well under 500, are carcinogenic. However, many of these, together with other non-carcinogenic petrochemicals, can induce other chronic toxic effects, including neurological, respiratory, reproductive, hepatic and probably immunological diseases, whose true causation is generally not suspected let alone investigated.

"Industry has used various strategies to con the public...and divert attention from their own responsibility for the cancer epidemic."

How Industry Fights Regulation

Twentieth century industry has aggressively pursued short-term economic goals, uncaring or unmindful of harm to workers, local communities and the environment. So far, industry has shifted responsibility for the damage it has caused onto society-at-large. Belated government efforts to control polluting industries have generally been neutralised by well-organised and well-financed opposition. With the exception of special purpose legislation for drugs, food additives and pesticides, there were no regulatory requirements for pre-testing industrial chemicals until the 1976 Toxic Substance Control Act, legislation which the industry had stalled for years, and which is now honoured more in the breach than in the observance.

Apart from the failure to pre-test most chemicals, a key characteristic of industry's anti-regulatory strategy has been the generation of self-serving and misleading data on toxicology and epidemiology, and on regulatory costs and cost-benefit analyses. The record of such unreliable and often fraudulent data is so extensive and well-documented as to justify the presumption that much industry data must be treated as suspect until proven otherwise.

Attempts by the Carter Administration to develop comprehensive, 'generic' regulation of occupational carcinogens, later reversed by the Reagan Administration, were attacked by the Manufacturing Chemists Association, which created the American Industrial Health Council to organise opposition. Such reactions generally reflect a short-sighted preoccupation with perceived self-interest rather than with efficiency and economy. The virtual uniformity of industry opposition to regulation is in marked contrast to the heterogeneity of the industries involved, both in terms of size and the diversity of their interests. Regulation has, in fact, generally resulted in substantial improvements in industrial efficiency and economy, particularly in large industries, by forcing development of technologies for recovery and recycling of valuable resources. A deplorable result of regulation, however, has been, and continues to be, the export of the restricted product or process to the so-called lesser developed countries.⁵

Apart from well-documented evidence on control and manipulation of health and environmental information, industry has used various strategies to con the public into complacency and divert attention from their own recklessness and responsibility for the cancer epidemic. Key among these is the 'blame-the-victim' theory of cancer causation, developed by industry scientists and consultants and a group of pro-industry academics, and tacitly supported by the 'cancer establishment'. This theory emphasises faulty lifestyle, smoking, and fatty diet, sun bathing or genetic susceptibility, as the major

causes of preventable cancer, while trivialising the role of involuntary exposures to occupational and environmental carcinogens. Another misleading diversion is the claim that there is no evidence of recently increasing cancer rates other than lung cancer, for which smoking is given the exclusive credit. While the role of lifestyle is obviously important and cannot be ignored, the scientific basis of this theory is as unsound as it is self-serving. Certainly, smoking is a major, but not the only, cause of lung cancer. But a wealth of evidence clearly incriminates the additional role of exposure to occupational carcinogens and carcinogenic community air pollutants. Hence, some 20 per cent of lung cancers occur in non-smokers; there have been major recent increases in lung cancer rates in non-smokers; an increasing percentage of lung cancer is of a histological type (adenocarcinoma) not usually associated with smoking; high lung cancer rates are found with certain occupational exposures independent of smoking; and excess lung cancer rates are found in communities where certain major industries are located. The chemical industry thus clearly uses tobacco as a smoke screen to divert attention from the role of carcinogenic chemicals in inducing lung cancer, besides other cancers.

When it comes to diet, the much touted role of high fat consumption, while clearly linked to heart disease, is based on tenuous and contradictory evidence with regard to breast and colon cancers. The evidence certainly does not justify the wild claims by lifestyle theorists that some 30 to 40 per cent of all cancers are due to faulty diet. For instance, a 1982 National Academy of Sciences report concluded that "... in the only human studies in which the total fibre consumption was quantified, no association was found between total fibre consumption and colon cancer." Similarly, a large scale 1987 study, based on the eating habits of nearly 90,000 nurses, concluded that "—there is no association between dietary fat and breast cancer."

Another illustration of grossly misleading strategies relates to the identification of chemical carcinogens. When a particular chemical or product is threatened with regulation on the basis of animal carcinogenicity tests, the industry invariably challenges the significance of these tests, while routinely using negative test results as proof of safety. At the same time industry insists on the need for long-term epidemiological investigations to obtain definitive human evidence of carcinogenicity. To test this apparent reliance on direct human evidence, researchers at Mt Sinai Hospital in New York compiled a list of some 100 chemicals accepted as carcinogenic on the basis of animal tests, but for which no epidemiological information is available, and sent this list to some 80 major chemical industries. Respondents were asked whether any of the listed carcinogens were in use and, if so, whether epidemiological studies had been conducted, whether they were being conducted, or whether it was intended to conduct them in the future, and if not, why not. The responses were revealing. The great majority of those industries using particular carcinogens replied that they had done no epidemiological studies, were not doing any, and didn't intend to do any for various reasons, including alleged difficulty, impracticality, expense, or because of their belief that these



Asbestos being stripped from schools. For years the industry refused to acknowledge the carcinogenicity of asbestos, even going so far as to suppress incriminating data. Even today, "white" asbestos is in widespread use, despite being a potent carcinogen.

chemicals could not possibly be carcinogenic to humans. A perfect catch-22: knock the animal tests and insist on human studies, but make sure that the human studies are never done.

Industry positions are vigorously advocated by trade associations, such as the Chemical Manufacturers Association, public relations firms, such as Hill and Knowlton, front organisations, such as the American Council on Science and Health (the contributions of whose director, Whelan, have been aptly characterised as "voodoo science"), and lay writers such as Efron (who charges that the American scientific community has been terrorised into submission by environmental "apocalyptic"). Disturbingly, another major source of support for anti-regulatory strategies is a stable of academic consultants who advance the industry position in arenas including the scientific literature, federal advisory committees, and regulatory and congressional hearings.⁶

Government and the Cancer Epidemic

Presidents play a powerful role in setting national public health priorities, not unnaturally reflecting their own political agendas. Reagan, however, is unique in having run for office on an ideological anti-regulatory platform, and in having then systematically used his office to implement this ideology, often in contravention to the spirit and letter of the law. Reagan has thus neutralised legislative mandates on controls of toxic and carcinogenic exposure by direct frontal assaults on regulatory agencies.⁷ Strategies employed include: staffing senior positions with unqualified, ideologically selected

staff hostile to their agency mandates; budget cutting; insisting on formal cost-benefit analyses which focus on industry costs with little (or biased) consideration of the costs of failing to regulate and which effectively stall the regulatory process; illegal, behind closed doors meetings with industry; and making regulation dependent on the Office of Management and Budget with its subservience to the White House.

An example is the White House decision to block the \$1.3 million 1984 request by the National Institute for Occupational Safety and Health (NIOSH) to notify some 200,000 workers of risks from previously undisclosed exposure to workplace carcinogens, as identified in some 60 government studies, in order to enable medical follow-up and early diagnosis of cancer. The reason for this refusal of modest funding seems to have been a desire to shield corporations from possible legal claims.⁸ Such a track record justifies the conclusions of a 1984 Congressional Study Group report that "efforts to protect public health and the environment from the dangers of toxic pollution have ground to a standstill under the Reagan Administration . . . (which was charged with being) a public health hazard."

The US Congress has become sensitive to public health and environmental concerns, as exemplified in a plethora of legislation in recent decades.⁹ Such legislation has evolved fragmentarily, reflecting particular interests and priorities. New laws have focused on individual environmental media—air, water, food or the workplace—or on individual classes of products or contaminants, such as pesticides or air pollutants, with little or no consideration of needs for more comprehensive

and integrated approaches. Furthermore, the legislative language has traditionally been ambiguous, thus allowing maximal regulatory discretion to bureaucracies which in some instances, have subsequently become closely associated with or even "captured" by the regulated industries. A noteworthy exception is the 1958 Delaney Amendment to the Federal Food Drug and Cosmetic Act, with its absolute prohibition against the deliberate introduction of any level of carcinogen into the food supply. Even so, the Reagan FDA is redefining the Delaney Amendment to allow carcinogenic food additives at levels alleged to be devoid of significant risk.

Congress has also tended to abdicate decision-making to scientific authority (or perceived authority), rather than questioning its basis in the open political arena. Of particular importance was passage of the 1971 Cancer Act in response to orchestrated pressures from the "cancer establishment", the National Cancer Institute (NCI), American Cancer Society (ACS), and clinicians aggressively pushing chemotherapy as a primary cancer treatment. The cancer establishment misled Congress into the unfounded and simplistic view that the cure for cancer was just around the corner, *provided* that Congress made available massive funding for cancer treatment research. The Act did just this, while failing to emphasise needs for cancer prevention, and also gave the NCI virtual autonomy from the parent National Institutes of Health, while establishing a direct chain of command between the NCI and the White House. Some 16 years and billions of dollars later, Congress still has not yet appreciated that the poorly-informed special interests of the cancer establishment have minimised the importance of critically needed cancer prevention efforts, and have singularly failed to support such efforts. Nor has Congress appreciated the long overdue need for an investigation into the conduct and priorities of the NCI. Given the heterogeneity of congressional interests, the complexity of the problem involved, the heavy lobbying by industry, the indifference of the general scientific community and the well orchestrated pressures of the cancer establishment, it is not surprising that Congress has still to recognise that we are losing the war against cancer.

Until recently, state governments have largely deferred to federal authority, exercising relatively minor roles in cancer prevention. Reagan's federal deregulatory efforts have begun to reverse this relationship. Regulatory actions against carcinogens are now emerging at the state level, such as the banning of chlordane/heptachlor and aldrin/dieldrin for termite treatment by Massachusetts and New York, the banning of daminozide (Alar) for apple ripening and tough restrictions on ethylene dibromide food tolerances by Massachusetts, and the introduction of informative occupational labeling laws by various states, such as the "right-to-know" workplace legislation of New Jersey.

In some cases, such state initiatives have evoked federal preemption by restricted regulations—such as the 1983 Hazard Communication Standard of the Occupational Safety and Health Administration—despite Reagan's avowed commitment to getting big government off the backs of the people. In February

1987, a coalition of labour and citizen organisations asked the US Court of Appeals to enforce its 18 month-old order directing OSHA to expand coverage of its communication standard from manufacturing to all workers. In an apparent about face turn, the Chemical Manufacturers Association is supporting the expansion in conformity with regulations developed for various states.

The Cancer Establishment: Standing in the Way of Prevention

The cancer establishment still continues to mislead the public and Congress into believing that "we are winning the war against cancer", with "victory" possible only given more time and money. The NCI and ACS also insist that there have been major advances in treatment and cure of cancer, and that there has been no increase in cancer rates (with the exception of lung cancer which is exclusively attributed to smoking). Yet, the facts show just the contrary.

The cancer establishment periodically beats the drum to announce the latest "cancer cure" and dramatic "breakthrough". These announcements reflect optimism and wishful thinking, rather than reality. The extravagant and counterproductive claims for Interferon as the magic cancer bullet of the late 1970s have been followed by the unpublicised recognition of its limited role in cancer treatment.¹⁰ The latest NCI "breakthrough" claims for interleukin-2 as a cancer cure are grossly inflated and rest on questionable data. These claims fail to reflect the devastating toxicity and lethality of this drug, and gloss over the high treatment costs, which can run into six figures.

Equally questionable are claims by the NCI and ACS that overall cancer survival rates have improved dramatically over recent years. These claims, based on "rubber numbers" according to one prominent critic, ignore factors such as "lead-time bias", earlier diagnosis of cancer resulting in apparently prolonged survival even in the absence of any treatment, and the "over-diagnosis" of essentially benign tumours, particularly those of the prostate, breast and thyroid, as malignant. Recently the director of the NCI, DeVita, resorted to blaming community doctors for using inadequate doses of chemotherapy drugs as the "real" reason why cancer cure rates are no better than they are.

The NCI misrepresentations are well reflected in budgetary priorities which are largely and disproportionately directed to cancer treatment research—to the neglect of cancer prevention. Even the very modest funding on cancer prevention is largely directed to endorsing industry's "blame-the-victim" concept of cancer causation. Thus, the NCI exaggerates the role of tobacco for a wide range of other cancers besides lung cancer, and treats as fact the slim and contradictory evidence relating diet to colon, breast, and other cancers.

Apparently still oblivious to mounting criticisms, the NCI continues vigorously to propagate these misrepresentations. A 1986 NCI document on cancer control objectives, the executive summary of which fails to even mention environmental and occupational exposures to carcinogens and focuses on diet and tobacco as the

major causes of cancer, rashly promises that annual cancer mortality rates could be reduced by 50 per cent by the year 2000.

More disturbing than indifference to cancer prevention is evidence uncovered in September 1982 by Congressman Dave Obey that the NCI has pressured the International Agency for Research on Cancer (IARC) funded in part by the NCI, to downplay the carcinogenicity of benzene and formaldehyde in IARC monographs which review and rank the carcinogenicity data on industrial and other chemicals. Such evidence is noteworthy since, contrary to the scientific literature and its own explicit guidelines, IARC has also downgraded the carcinogenicity of other carcinogenic industrial chemicals, such as the pesticides aldrin/dieldrin and chlordane/heptachlor, and the solvents trichloroethylene and perchloroethylene.¹¹

Over the last decade, consistent with its low priorities for cancer prevention, the NCI has played little or no role in providing the data base in support of critical federal or state legislation and regulation on cancer prevention. Examples where NCI scientific input could have been reasonably expected include attempts to prevent the exposure of much of the US population to carcinogenic pesticides, such as ethylene dibromide residues in food or chlordane/heptachlor in the air of a high percentage of the many million homes treated for termites, and also exposure to industrial discharges of carcinogenic air pollutants or drinking water contaminants.

Following nearly a decade of fruitless discussions with the ACS, at a February 7, 1984 press conference, a national coalition of major public interest and labour groups, headed by the Centre for Science in the Public Interest (and myself), and supported by some 24 independent scientists, charged that the ACS

"is doing virtually nothing to help reduce the public exposure to cancer causing chemicals . . . Despite its promises to the public to do everything to 'wipe out cancer in your lifetime', the ACS failed to make its voice heard in Congress and the regulatory arena, where it could be a powerful influence to help reduce public exposure to carcinogens."

More specific criticisms included the following:

- ACS fails to support, and at times has been hostile to, critical legislation that seeks to reduce or eliminate exposure to environmental and occupational carcinogens. For example, ACS refuses to join a coalition of major organisations, including the March of Dimes, the American Heart Association, and the American Lung Association, to support the Clean Air Act. ACS has rejected requests from Congressional subcommittees, unions, and environmental organisations to support their efforts to ban or regulate a wide range of occupational and environmental carcinogens. Giant corporations, which profit handsomely while they pollute the air, water and food with cancer causing chemicals, must be greatly comforted by the ACS's silence.
- ACS's record on supporting efforts to ban carcinogens is dismal. Often ACS's statements are expressly or implicitly hostile to regulation.
- ACS's approach to cancer prevention largely reflects a "blame the victim" philosophy, which emphasises faulty lifestyles, rather than workplace or environmental carcinogens. For instance, ACS blames the higher incidence of cancer among

blacks primarily on their diet and smoking habits, which diverts attention from the fact that blacks work in the dirtiest, most hazardous jobs, and live in the most polluted communities.

A few days after the press conference, ACS announced a "new set of policies", passing resolutions for the improved regulation of such chemicals as asbestos and benzene, and the cleaning up of toxic waste sites. However, there has been no evidence of any real change of heart in the ACS, since then.

The Lifestyle Academics

The lifestyle academics are a group of conservative scientists including Sir Richard Doll, the Warden and Director of the industry-financed Green College, Oxford,¹² his protégé R. Peto, a statistician also from Oxford, and more recently Bruce Ames, a California geneticist. The purist pretensions of "the lifestylers" for critical objectivity are only exceeded by their apparent indifference to or rejection of a steadily accumulating body of information on the permeation of the environment and workplace with industrial carcinogens, and the impact of such involuntary exposures on human cancer.

Consciously or subconsciously, these academics have become the mouthpiece for industry interests, urging regulatory inaction and public complacency. Among the more noteworthy contributions of these academics is a series of publications claiming that smoking and fatty diet are each responsible for 30-40 per cent of all cancers; that sunlight, drugs and personal susceptibility account for another 10 per cent, leaving only a few per cent unaccounted for which, just for want of any other better reason, was then ascribed to occupation. According to the lifestylers, this then proves that occupation is an unimportant cause of cancer, which really does not warrant much regulatory concern.

Apart from circulatory referencing each other as authority for these wild guesses, the lifestylers have never attempted to develop any estimates of how many workers are exposed to defined levels of specific carcinogens. Without such estimates there is no way of attempting to determine just how much cancer is due to occupational exposure.

The lifestyle theory was further advocated in a 1981 report dealing with causes of cancer in the USA by Doll and Peto where they denied evidence of increasing cancer rates other than for lung cancer, which was largely ascribed to tobacco without adequate consideration of the importance of community and occupational exposure to carcinogens.¹³ To reach their misleading conclusions on static cancer rates, Doll and Peto excluded from analysis people over the age of 65 and blacks, those groups with the highest and increasing cancer mortality rates. Not content with such manipulation, they claimed that occupation was only responsible for some 4 per cent of all cancers, without apparent consideration of a wide range of recent studies dealing with the carcinogenic effects of such exposures.¹⁴ This wild 4 per cent guess was matched by "guestimates" that diet was determinant in some 35 per cent of all cancers. To trivialise the significance of animal carcinogenicity data on industrial chemicals, Doll and

Peto minimized the predictive value of these tests, while emphasising epidemiological data as the basis of regulation.

Doll is prompt to side with industry in downplaying evidence on carcinogenicity of industrial chemicals. For example, he recently lent enthusiastic support to the Australian Royal Commission on Agent Orange in its dismissal of the experimental and epidemiological carcinogenicity data on the herbicides 2,4-D and 2,4,5-T.¹⁵

Bruce Ames is a geneticist who, in the 1970s, developed bacterial assays for mutagenicity which he advocated as short-term tests for carcinogens. He then published a series of articles warning of increasing cancer rates and of the essential need for tough regulation of industrial carcinogens, such as the fire retardant Tris and the fumigant ethylene dibromide. By the 1980s, however, Ames did an unexplained 180 degree turn, now claiming just the opposite, that overall cancer rates are not increasing, that industrial carcinogens are unimportant causes of cancer which do not need regulating, and that the real causes of cancer are natural dietary carcinogens, largely because mutagens can be found in a variety of foods.¹⁶

What to do about Cancer

The cancer epidemic poses the nation with a grave and growing crisis of enormous cost to health, life and the economy. In my 1979 book, *The Politics of Cancer* I concluded with the following specific recommendations designed to reduce the toll of preventable cancer:

- Cancer must be regarded as an essentially preventable disease;
- The hidden political and economic factors which have blocked and continue to block attempts to prevent cancer must be recognised;
- The ineffective past track record of government in cancer prevention must be recognised;
- The critical roles in cancer prevention that public interest groups and informed labour leadership have exercised must be recognised and their further efforts fully encouraged and supported;
- Congress must resolve the major inconsistencies in a wide range of laws on environmental and occupational carcinogens;
- Substantially higher federal priorities for the prevention of cancer must be developed;
- Policies of the various federal agencies with responsibilities in cancer prevention must be effectively integrated and coordinated;
- Top business management must recognise the essential similarities between their long-term interest and goals and those of society. Prevention of occupational cancer and cancer in the community-at-large is of primary importance to both;
- The American Cancer Society must be influenced to balance its preoccupation with treatment with activist programmes designed to prevent cancer;
- The medical and scientific community must accept a higher degree of responsibility and involvement in the prevention of cancer by actions on both the professional and political levels;
- Medical schools and schools of public health must be persuaded to reorient their educational and training programmes from the diagnosis and treatment of disease and cancer to prevention;
- Chemicals in consumer products and in the workplace must be clearly and simply identified and labeled;

- New approaches must be developed for obtaining and for retaining honest and scientifically reliable data on the carcinogenicity and toxicity of new chemicals, in addition to those untested or poorly tested chemicals already in commerce; such data must be made accessible to public scrutiny. Maximum legal penalties should be directed against all those responsible, directly and indirectly, for distortion or manipulation of toxicological and epidemiological data on the basis of which decisions on human safety and risk are based;
- Apart from actions on a political level, we all have limited personal options. To some extent, it may be possible to reduce our own chances of developing cancer by making informed changes in lifestyle, in our use of consumer products, and in our work;
- The major determinants of preventable cancer are political and economic, rather than scientific, and as such must be addressed in the open political arena. Cancer prevention must become a major election issue, on a par with inflation.

A decade later, these goals still stand as valid, but none have been achieved while cancer rates have steadily risen. To prevent similar conclusions a decade from now, the cancer prevention rhetoric must be translated into reality.

To compete with the well-financed propaganda of industry, tacitly supported by the cancer establishment and lifestyle academics, an educational offensive must be mounted to inform the public and develop grass roots pressures for a cancer prevention campaign. The cutting edge for such a campaign can be provided by the major public interest organisations, including the Natural Resources Defence Council, Sierra Club, Environmental Defense Fund, Health Research Group of Public Citizens, Environmental Action, Consumer Fed-



Fertilisers and other agricultural chemicals have contaminated groundwaters throughout the world. Many are carcinogenic

eration of America, National Campaign Against Misuse of Pesticides, the National Campaign Against Toxic Hazards, Greenpeace, the Rachel Carson Council, and the Centre for Science in the Public Interest. Equally critical will be involvement of the Industrial Union Department of the AFL/CIO, and key unions such as the United Steel Workers of America, the United Rubber Workers, the Linoleum and Plastic Workers of America, the International Association of Machinists, Oil Chemical and Atomic Workers, the Amalgamated Clothing and Textile Workers, and the United Auto Workers.¹⁷ Many of these organisations have well informed professional staff, and some have played major roles in whatever limited legislative and regulatory successes have been achieved over the last two decades.

Active support at the local level is being provided by local groups and labour organisations that have formed in response to community or regional concerns over such threats as hazardous waste dumps, contaminated drinking water or lawn care chemicals; the motto of some such groups is "Think globally, act locally". Further support can be provided by a small network of independent and government scientists, whose thinning ranks have been recently boosted by the welcome involvement of professional organisations such as the American Public Health Association and the American Lung Association.

A potential source of cancer prevention funding is the multi-million dollar budget of the American Cancer Society (ACS) raised by voluntary public contributions.

An economic boycott of the ACS is now well overdue. Funding inappropriately used by the Society should be diverted to public interest organisations and labour groups, which are more likely to achieve the goal of winning the war against cancer. Other potential funding sources include certification to participate by designation in the United Way and Combined Federal Campaign.

Public interest and labour organisations should develop coalitions with initially limited objectives, focused around specific areas of cancer prevention of local concern. These could be subsequently expanded into wider "rainbow" coalitions with more comprehensive goals. The 100th Congress, revitalised by the defeat of the Reagan revolution and by a democratic renaissance, is now more likely to be receptive to such initiatives. This receptivity should be directed into increasing priorities for government concerns on cancer prevention, besides restoring the fragmented regulatory apparatus of government. It is also likely that key Congressmen could be galvanised into making cancer prevention one of their major political priorities, and that presidential candidates could be interested in the potential grass roots appeal of a cancer prevention ticket.

Equally important are initiatives at the state level, the recent track record of state legislations offering encouraging precedents. These include the banning of chlordane and heptachlor for termite treatment by Massachusetts in 1985 and New York in 1986, largely at the impetus of a citizen group, People Against Chlordane (PAC); passage of a \$1.5 billion hazardous waste clean-

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up bond by New York, the Environmental Quality Bond Act of 1986; and passage of Proposition 65, the Safe Drinking Water and Toxic Enforcement Act of 1986, by California.

Proposition 65, masterminded by the Sierra Club and the Environmental Defense Fund and supported by a coalition of Californian public interest citizen and labour groups, is a sophisticated referendum which imposes tough financial penalties on industries knowingly discharging carcinogens into the drinking water supplies, and which makes mandatory the full public disclosure of such discharges by industry and state officials. A vocal opponent of Proposition 65 was Bruce Ames, who nonetheless failed to impress the California public with his lifestyle advocacy and his trivialising the significance of carcinogens in drinking water. Potential opposition by the petrochemical industry was anticipated and muted by the earmarking of some 50 per cent of revenues from fines for the state superfund budget. However, Governor Deukmejian, responsive to special interest lobbying, has recently neutralised the scope of the new legislation by restricting its scope only to epidemiologically confirmed carcinogens. This restriction is now under legal challenge. Irrespective of the outcome of this challenge, Proposition 65 has excited national interest and is being used as a model for similar regional initiatives, such as the 1987 Safe Drinking Water Act of New York which is currently being drafted.

Among early Congressional priorities should be enactment of comprehensive white collar crime legislation. This would impose tough sanctions on individual executives, managers and professionals of industries found guilty of wilful "non-disclosure" of information on hazards to workers, local communities and the nation. White collar crime legislation should also be extended to US and multinational corporations which export carcinogenic products or processes which have been banned or regulated in the US to "lesser developed countries", especially in the absence of full disclosure of hazards directed to ultimate users and consumers. Attention should also be directed to developing comprehensive new "cradle-to-the-grave" legislation as the basis for regulating toxic and carcinogenic chemicals. Such legislation can be designed to complement regulation by the judicious application of marketplace pressures, in the form of financial incentives and disincentives designed to wean industry away from unsafe practices, and to ensure that responsible industry is not penalised or subjected to unfair competition. At present, other than the prospect of toxic tort litigation, there are virtually no incentives for industry to develop safer new products and processes. Legislation is needed to develop federal funding for research and development into such benign technologies and to ensure that they are closely coordinated with environmental, energy and resource policies.

A critical legislative priority is the amendment of the National Cancer Act to give the highest possible priority to cancer prevention; to redress the historical imbalance existing in the NCI between cancer prevention and research on diagnosis and treatment; and also to insulate the NCI from direct Presidential influence. In addition

to replacing the NCI's director, De Vita, who, in spite of his contrary protestations, has been indifferent if not hostile to cancer prevention efforts and who has played a major role in perpetrating the myth that we are winning the war against cancer, senior NCI staff should be restructured and boosted by professionals competent in environmental and occupational cancer and committed to cancer prevention. The National Cancer Advisory Board should be reconstituted with a balanced mix of independent cancer prevention professionals, representatives of public interest and labour organisations and concerned citizens, and should be subject to close Congressional scrutiny. Such scrutiny should ensure that the institutional resources are largely directed to cancer prevention, that grants and contracts reflect this priority and that NCI staff play a key role in providing the supporting scientific basis for legislative and regulatory cancer prevention efforts at the national and state levels.

Cancer is essentially a preventable disease. Given high national priority, this goal will be achieved.

Based on keynote presentations at the National Safety and Health Conference of the International Association of Machinists, Washington, DC, March 9, 1987, the Fifth National Pesticide Forum of the National Coalition Against the Misuse of Pesticides, Washington, DC, March 21, 1987, and the Conference on Global Development and Environment Crisis, Friends of the Earth (Sahabat Alam), Penang, Malaysia, April 8, 1987.

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Notes

1. Just by way of quantitative contrast, mortality from AIDS (another eminently preventable disease) although highly alarming, if not catastrophic, is relatively low. About 33,000 cases, more than half already fatal, have been reported since 1981 when the disease was first detected; additionally, it is estimated that 2-3 times as many Americans suffer from advanced symptoms of the AIDS-related complex which often progresses to full-blown AIDS. Rapidly increasing numbers of cases, totalling some 270,000, are projected by 1991.
2. It should, however, be noted that there have been substantial decreases in rates for stomach and cervix, and less so, for rectal cancer.
3. In 1978, a blue ribbon government commission (under the auspices of the then Health, Education and Welfare (HEW) Secretary Califano) estimated, on the basis of the only available exposure data, that up to 38 per cent of all cancers in coming decades would reflect past and continuing exposures to just six high volume occupational carcinogens. In spite of the recognised limitations of these estimates, both in the direction of overestimating exposure to certain of the named carcinogens, particularly asbestos, and a failure to reflect a wide range of other possibly more significant exposures, their magnitude was surprisingly confirmed by industry consultants, Stallones and Downs of the University of Texas School of Public Health, in a confidential report commissioned by the American Industrial Health Council.
4. The Environmental Protection Agency has diverted attention away from its failure to regulate such toxic emissions, although so authorised under Sec. 112 of the 1970 Clean Air Act, by attempting to shift responsibility to local and state agencies, and by a barrage of poorly supportable claims that indoor air pollution, from pollutants such as cigarette smoking, radon and pesticides, is a more important regulatory target than toxic air emissions. In spite of this near exclusive emphasis on indoor air pollution, EPA still refuses to ban the continued use of such carcinogenic pesticides as Chlordane and Aldrin, both used extensively for domestic termite treatment.
5. Information on such exports is being systematised by Consumer Interpol, a programme of the International Organisation of Con-

- sumers Union (IOCU) based in Penang, Malaysia, which promotes protection for the consumer from dangerous products. The participants in this network are consumer, environmental, health and other citizen groups concerned about unrestricted trade in hazardous substances. Besides the global dissemination of such hazards, the multinational corporations involved are also responsible for the loss of US jobs and their replacement by cheap "expendable" foreign labour.
6. These consultants include: MacMahon, a Harvard epidemiologist who has cleared his contracted studies with industry before submitting them for publication; Demoupoulos, a pathologist at the New York University Medical Centre who claims that asbestos and vinyl chloride are weak carcinogens and that the high cancer mortality rates in New Jersey are due to poor treatment by foreign trained doctors in that state; Olson, a clinician at the Pittsburgh University School of Medicine who has testified that benzene cannot be carcinogenic in humans because it does not induce tumours in animals; Hayes, ex-Centre for Disease Control (CDC) and Vanderbilt University School of Medicine, a toxicologist repeatedly on record as rejecting the human significance of animal carcinogenicity data on organochlorine pesticides; and Harbison, a toxicologist from University of Arkansas Medical School, who in 1980 testified as a government witness that rodents are "good predictors of human cancer risk", and who, as an industry expert, testified just the opposite in 1985.
 7. Such successes of the Reagan Administration at the regulatory level are, however, in striking contrast to its failure to make any impression on the scientific underpinning of public health and environmental regulations. For instance, a 1985 report by the Office of Science and Technology Policy of the White House clearly affirmed such critical tenets as the value of animal carcinogenicity data in extrapolating to human risk, and the inability to set "safe levels or thresholds" for exposure to carcinogens.
 8. On February 26, 1987, hearings were held before the Labour and Human Resources Committee on a bill sponsored by Senator Metzenbaum to require the Department of Health and Human Services to notify past or present workers known to be at risk of cancer and other occupational diseases. To the annoyance of Republican Committee members, NIOSH officials supported the bill, which was opposed by Administration spokesmen who claimed that it would duplicate existing efforts and generate "too much litigation". The senior dissenting officials received a subsequent "dressing down" from the Administration. However, unexpected support for the bill on March 27, 1987 came from the 3000-member American Electronics Association, a trade group, from IBM, the Digital Equipment Corporation, and from the General Electric Company.
 9. Congress, however, has yet to recognise the need to consider certain industry practices from the perspective of white collar crime. White collar crime legislation has heretofore been exclusively directed to economically motivated crimes with economic consequences, such as anti-trust violations. Efforts, such as the 1979 and 1984 bills by Cong. John Conyers (H.R. 4973 & 6350), to extend such legislation to economically motivated crimes with public health or environmental consequences, resulting from wilful suppression or "non-disclosure" of risks from hazardous products and processes, have not yet been successful. This is the case in spite of the fact that the consequences of such crimes may be measured in countless cancer deaths.
 10. Interferon is particularly effective, if not often curative, for two rare neoplasms—hair cell leukaemia and juvenile laryngeal papillomatosis.
 11. Apart from the noted exceptions, the IARC monographs are unique and well systematised compendia of data on the chronic toxicity, carcinogenicity and uses of a wide range of industrial and other chemicals.
 12. According to a founding fellow, Hermann, Green College was established in 1978 as a "special point of entry for industrial interests wishing to collaborate with university departments in research—".
 13. This study was sponsored by the Office of Technology Assessment, whose contract officer Gough was apparently unable to find any US experts with knowledge of cancer in the US, and so selected British lifestyle advocates for the project. (Gough is also subsequently on record in a book on Agent Orange as dismissing evidence on the hazards of dioxin, including rejecting evidence of its carcinogenicity based on extensive animal data. Gough recently left OTA for a position in a chemical industry consulting firm.) Apparently responsive to criticisms of a draft report, The Office of Technology Assessment decided against its publication, which instead was independently published.
 14. Even if only 4 per cent of cancers in the general population are occupational in origin, this implies that occupation is responsible for some 20 per cent of all cancers in exposed workers.

15. The 2,4,5-T component of Agent Orange was contaminated with high concentrations of 2,3,7,8-tetrachlorodibenzodioxin which, according to the Carcinogen Assessment Group of EPA, is the most potent carcinogen it has ever evaluated, being some 7-fold orders of magnitude more carcinogenic than the potent carcinogen vinyl chloride.
16. Ames fails to extend his logic by claiming that faeces are carcinogenic, although they are a rich source of bacterial mutagens! Moreover, assuming that Ames' exclusionary emphasis on dietary carcinogens has scientific validity, the critical issue is not what carcinogens are "natural" and what are industrial (asbestos is an example of a carcinogen belonging to both categories), but what exposures are preventable or at least reducible.
17. Liberal organisations and progressive labour groups, through effective research, writing, direct mail and public advertising, are now challenging the ability of business to formulate the national agenda and shape the debate on basic social issues, such as worker rights, taxation and environmental concerns, and on foreign policy. Such organisations include the Centre for National Policy, Citizens for Tax Justice, The Democracy Project headed by Mark Green, The Economic Policy Institute headed by Jeff Faux, and the Council for Economic Priorities.

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The Sizewell Report: A Foregone Decision

by J.W. Jeffery

A review of Frank Layfield's Sizewell Report and Peter Walker's 'Quasi—Judicial' Decision

The British Government has given the go-ahead for a Pressurised Water Reactor to be built at Sizewell on the Suffolk coast. The decision follows the publication of the official report of Sir Frank Layfield, the Inspector at the Sizewell Public Inquiry. The report, which recommended in favour of the project, took no account of the Chernobyl accident, which makes nonsense of its risk assessment calculations, and no account of falling oil prices, which makes equal nonsense of its economic case for building the reactor. The report should be seen for what it is: a rubber stamp to a foregone conclusion.

The Sizewell Report is the responsibility of Sir Frank Layfield, the Inspector, but he was helped at the Inquiry and in preparing the Report by four assessors, Professor J.M. Alexander, Sir Christopher Foster, Professor W.D. Hall and Dr J. Vennart. All the assessors agree with the content of the Report as regards matters with which they were concerned.

The Report, in 109 chapters divided into 8 volumes, covers the subjects of danger (euphemised to "safety"), economics, environmental consequences, and other matters. The latter deals primarily with questions of the production and disposal of plutonium. I shall leave the last two subjects to be dealt with by others more directly concerned; but CND must be congratulated on the persistence with which they pushed their case on plutonium. Although the Inspector came to the predictable conclusion that nothing of any consequence could or should be done about the problem of plutonium, CND's case, with all its documentation, is almost all there in chapter 105, including the contradictory statements of the US and UK governments, and even Lord Hinton is posthumously recorded as having called CEBG 'bloody liars' for denying that CEBG plutonium had been used in bombs.

In general, the letter from Peter Walker, the Secretary of State for

Energy, giving his decision on Sizewell, follows the Inspector's recommendations, and comment on it is covered in the discussion of the Report below. The one part of the letter which might have been significant is Section III, "Developments since the Inquiry closed". The reasons, where they are given, for deciding that Chernobyl, lower coal and oil prices and increased capital costs, have not materially affected the conclusions, will be dealt with under the various sections of the Report.

Danger

In his summary of the CEBG's case on "safety" and the arguments of the objectors against it, the Inspector gave as the first of the major objections that: "nuclear power was by nature highly dangerous, and could not be safely used at all (2.7)".¹ This was repeated in slightly different words later in the Report (33.80), but otherwise no further mention was made of this objection, although the case was supported by evidence submitted to the Inquiry on "The Unique Dangers of Nuclear Power";² which the Inspector did not try to refute. (A condensed and updated version of this evidence was given in a recent issue of *The Ecologist*.³) How then did the Inspector justify his support for Sizewell B?

One of the points which the Inspector bore in mind in reaching his conclusions was:

"(d) nuclear power involves the possibility of accidents which could kill hundreds or even thousands of people. But nuclear power is not

unique among industrial activities in this respect" (2.124d).

This leads on to the conclusion that, "An accident at Sizewell B, if built, would almost certainly have tolerable consequences, at worst requiring measures such as the banning of milk near the station. Theoretically possible accidents which could cause hundreds or thousands of deaths would almost certainly not occur" (2.126d).

This, in turn, is based on the following method of assessing social risk:

"Again ignoring effects other than death, social risk can be expressed as the average number of deaths expected to occur each year if the activity in question were carried on indefinitely. In general such a social risk would not be a whole number of deaths. If the risk arises from a single type of event expected to occur on average every hundred years, and the average number of deaths per event is ten, the social risk is ten divided by a hundred, that is, an annual probability of 0.1 deaths. Alternatively, the social risk can be expressed as an average of one death every ten years" (10.9).

In determining a figure of accident probability to calculate the risk from Sizewell B, the Inspector notes that "because of the difficulties of modelling human errors, their full effects were not included"; that "some accident sequences may have been omitted inadvertently"; and that "This is one of the most difficult subjects on which to form a judgment" (2.66). Nevertheless, he estimates that such unknowns would not increase the probability of a degraded core accident by more than "a factor of up to ten" (2.6). Even allowing for this:

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"the total probability of an uncontrolled release (of radioactivity) is likely to be sufficiently close to the CEGB's criterion of once in a million years to be tolerable" (2.69).

Applying the risk assessment of once in a million years to a hypothetical major nuclear accident killing 10,000 people, gives a risk of 1 death in 100 years, or one third of a death over the 35 year lifetime of a nuclear station. The Inspector's best estimate is that one or two workers at the station would die of radiation-induced cancer during the lifetime of the station (assuming it functions normally) and that there is a "significant probability" that one member of the public might be similarly killed (47.66e).

The consequences of a major accident, if spread over a million years, have thus been made to appear negligible. But to the community and generation suffering such an accident, where the deaths would almost all occur over 20–30 years, the risk would appear as $10,000/30 = 300$ deaths per year or 30,000 deaths in 100 years. This is the level of risk which has materialised at Chernobyl and which is instinctively perceived by ordinary people who contemplate the consequences of a nuclear accident.

Nonetheless, the Sizewell Report sticks to the figure of one death in a hundred years. This calculation, which could only be seriously put forward, even before Chernobyl, by people who perceive others as abstract statistics and who are mesmerised by numbers, is presented despite a US Nuclear Regulatory Commission (NRC) document which states:

"one can anticipate a continued occurrence of abnormal events (at nuclear power stations). Some of these may cause . . . deaths among the plant labour force or even among the neighbouring populations . . . NRC credibility will suffer badly unless positive steps have been taken to inform the public that such events can occur."⁴

Clearly, such "abnormal events" continually contain the danger of a major accident developing. In 1982, the NRC *Accident Sequence Precursor Study* investigated 20,000 incidents at nuclear stations between 1969 and 1979. It identified 169 of these as possible 'precursors' of a major acci-

DOE HELPED PREPARE SIZEWELL REPORT

According to a recent report in *The Observer*, parts of the Layfield report were prepared by officials from the Department of Energy (DOE). The DOE, which admits the charge, was one of the major parties supporting the Sizewell B application.

About 6 civil servants were seconded to the inquiry secretariat but remained employees of the DOE. The DOE officials helped draft the sections of the report on safety and economics. They also offered their views to the Inspectorate.

Commenting on the revelations, Mr Robin Grove-White of the Council for the Protection of Rural England (CPRE) told *The Observer* "The DOE was an important witness, and gave highly controversial evidence on economics. The idea that DOE officials should have been evaluating that evidence is shocking."

The revelations surely undermine any confidence one might still have in the objectivity of the Sizewell Inquiry.

In June, the Health and Safety Executive granted permission for construction work to begin on the first stage of the Sizewell B reactor. The Central Electricity Generating Board (CEGB) also received a site licence from the Nuclear Installations Inspectorate (NII)—this despite earlier NII fears about the station's ability to cope with a sudden loss of power from the grid. In such an event, the reactor's coolant system would have to rely on the station's own generators being brought into service. The CEGB argues that such a "power disturbance" is an extremely unlikely occurrence and would probably happen only once in 8000 years. But an accident of this type nearly occurred at the Sizewell A station in 1980 when freak weather conditions interrupted the station's power supply.

Friends of the Earth have launched a legal challenge to the new Sizewell B reactor on the grounds that the Government and the CEGB "have clearly ignored the stringent legal requirements for nuclear safety laid down by Parliament in the Nuclear Installations Act (1965 and 1969)." Although their case was rejected in the High Court, on the grounds that there had been "undue delay" in submitting their application, FOE is to appeal the decision. The appeal will be heard on July 20th.

Nicholas Hildyard

dent. Fifty-two of the 169 were considered to hold a significant risk of leading to severe core damage under the right conditions.⁵ Even before Chernobyl, the 'one in a million years' supposition was incredible to anyone not committed to the development of nuclear power at all costs.

Has this judgement been altered by Chernobyl? The Chief Inspector of Nuclear Installations advises the Minister that "the Chernobyl accident does not call for any reconsideration of the conclusions or recommendations in the Sizewell Inspector's Report." The Minister accepted this advice [4.61],⁶ and concluded "that the Chernobyl accident is not material to my decision." [4.81].

Statistical studies, undertaken since Chernobyl, come to a very different conclusion. The most optimistic of three independent calculations⁷ states: "The probability of an accident in the next ten years is unlikely to be less than a quarter". An insurance expert, who is very sceptical of calculations from small numbers of accidents, nevertheless

says, on the basis of abundant data in a similar, if simpler field, "The observed failure frequency of civil engineering structures, for example, is several orders of magnitude greater* than the safety to be expected from calculations. How large is the error margin if far more exotic products are designed according to logical, albeit theoretical scenarios?"⁸

After the Shuttle disaster in the US, an independent member of the inquiry committee said that NASA "exaggerates the reliability of its product to the point of fantasy".⁹

It is also worth remembering that although the aircraft industry designs its aircraft so that the calculated danger of a major disaster is of the same order as for a nuclear power station, major disasters continue to happen nevertheless.

It would seem to be wise to work on the assumption that there is an unacceptable risk of Sizewell B being the next Chernobyl.

On the dangers posed by low level radiation under normal operating conditions, the Inspector concludes

*That is, 100 to 1000 times greater.

that no member of the public would get a dose of radiation greater than one per cent of the dose from natural background (2.84), and in relation to local cases of leukaemia he concludes:

"No causative link has been established between the operation of Sizewell A and cases of leukaemia in the general population of Leiston, the nearest town to Sizewell, or among workers at Sizewell A itself. Nevertheless, it is important to be as sure as possible that no such link exists." (2.86).

The wording of the last phrase would be more impartial if it had said "whether or not such a link exists". But of course, if such a link were admitted to be even probable, this would be the end of nuclear power.

On these grounds the Inspector's final conclusion on danger is that:

"There should be good confidence that Sizewell B, if built, would be sufficiently safe to be tolerable, providing that there is expected to be economic benefit sufficient to justify the risks incurred." (2.126).

ALARP Misused

According to the Inspector, "The ALARP (As Low As Reasonably Practicable) principle underlies the approach to nuclear safety in the UK." (35.2). He comments:

"The question of what is 'reasonably practicable' is not straightforward. According to the NII (Nuclear Installations Inspectorate), 'reasonably practicable' implies that the responsible person should go out of his way to reduce risk until there is 'gross disproportion' between the expenditure involved and the corresponding reduction in risk. The NII said that gross disproportion was a formal expression of its policy of 'erring on the side of safety'." (35.5).

For those who believe, as the Inspector does, that there is no appreciable danger of a major accident, the question of eliminating an effectively non-existing danger does not arise. But if the danger of a major accident is thought to be worth eliminating (and most people appear to believe this to be desirable), there is a very simple application of ALARP which can achieve this. The immediate alternatives to Sizewell B given in the Report are an AGR or a coal-fired station. While the AGR is slightly less dangerous than a PWR, it has the same combination of massive new radioactive poisons and an unstoppable furnace, which make nuclear technology in general so 'unforgiving' and dangerous. But a coal-fired station has no such dangers, as was shown to the Inspector from first-hand experience¹⁰ of a loss of

coolant accident far more complete than that of Three Mile Island, in a large coal-fired station, which had no casualties (or any likelihood of casualties), and which was repaired with the station back on line within four days. The substitution of a coal-fired station for Sizewell B on the ALARP principle was not seriously considered in the Report, because the Inspector accepted (again, on the basis of a major nuclear accident occurring only once in a million years) that:

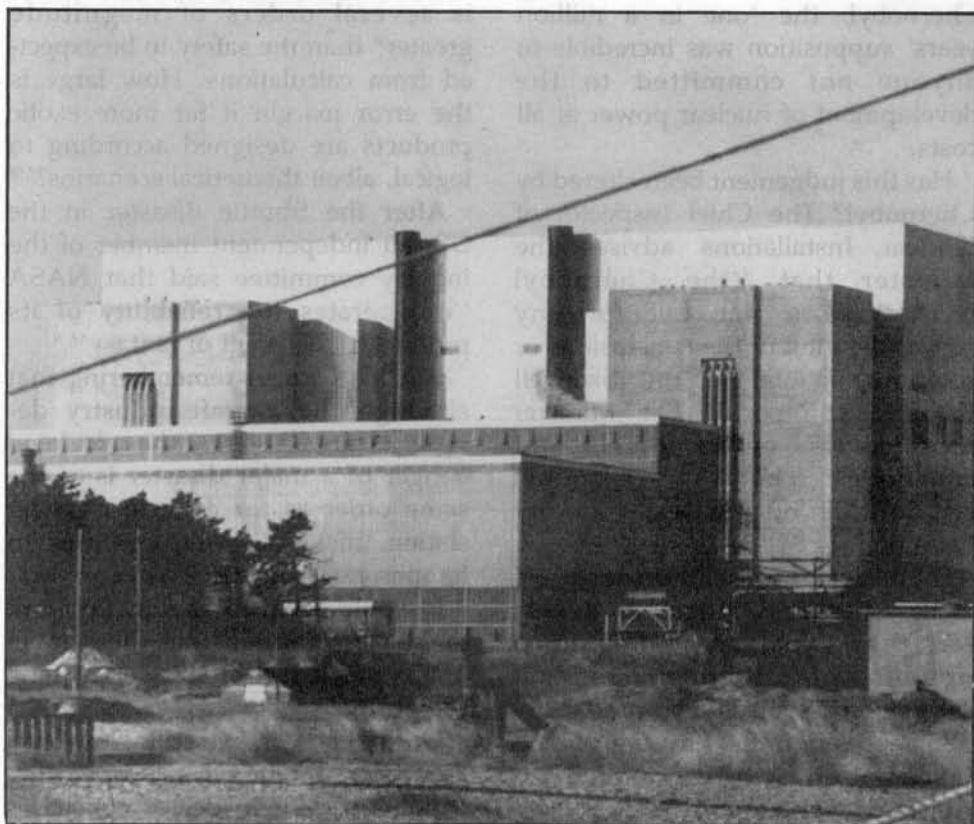
"The evidence suggested that the risks arising from generating a unit of electricity from coal and nuclear power were not greatly dissimilar; the uncertainties in the numbers and reservations about the comparability of the fuel cycles prevented any definite conclusions being reached." (12.29).

However, building a coal-fired station in place of Sizewell B would completely eliminate the danger of a major nuclear accident at that station.

In the original calculations, the cost of a coal-fired station was much greater than that for Sizewell B, but the Report's recognition of the early stages of the reduction in coal prices meant that the Inspector gave a coal-fired station a 1 in 40 chance of actually being more economic than Sizewell B; since then the fall in fossil fuel prices has led the Department of Energy (DEN) to recalculate this down to 1 in 7. (4.4). New calculations* have shown that the costs are roughly the same. It is therefore possible to eliminate the danger of a major nuclear accident completely at very little or no cost. The vast majority of people would see this as a worthwhile application of the ALARP principle.

In the meantime all the smaller coal-fired stations which were to have been retired prematurely to make way for Sizewell B on the grounds that they were less economic, can, with present and projected coal prices, produce electricity far more cheaply than by building and operating Sizewell B. ALARP demands that as many of these as possible¹¹ should continue to operate, because they give a double benefit of putting off the danger of a new nuclear station and producing cheaper electricity.

* See below under Economics.



The Sizewell A reactor on the Suffolk coast. Construction work has already begun on its new neighbour, the Sizewell B Pressurized Water Reactor.

Economics*

The Inspector concluded that:

"The national advantage in achieving cost-saving generation of electricity by Sizewell B followed by its contribution to meeting capacity needed in the mid 1990s seems to me to be of great value. Some further national benefit is to be gained from a step to reduce the CEBG's reliance on one principle fuel. In my judgement, the expected national economic benefits are sufficient to justify the risks that would be incurred." (108.37).

So the 'economic benefits' of Sizewell B which, in the Inspector's view, outweigh the dangers analysed above are: (a) cost-saving generation of electricity; (b) contribution to meeting capacity need; (c) reducing CEBG's reliance on coal for fuel, and especially the consequent reliance on coal miners for its extraction.¹³

These are considered in turn below:

a) Cost-saving Generation

This was the one important area in which the Inspector did not accept the CEBG's analysis and conclusions. The CEBG's economic case depended on the assumption of high future coal prices. These assumptions were rejected in the Report, and the Inspector produced his own much lower values for future prices of coal, based on the evidence up to March 1985. Since then, coal prices, current and projected, have fallen even lower, and the most recent calculations show that to build Sizewell B ahead of need would be grossly uneconomic.¹⁴ But this has further implications which could not be considered in the Report.

Since 1976/77, the CEBG has closed prematurely, or plans to close by 1990, stations totalling 12.8 gigawatts (GW)¹⁵—equivalent to more than ten Sizewell Bs. Most of this premature retirement occurred in the four years to 1984/5. The Inspector recorded that "Because it had excess capacity, the CEBG advanced retirement of 10.7 GW of plant in 1981/82—1984/5." (53.15). This is justified on the grounds that the smaller and older coal-fired stations involved, cost more to keep running than building and running a nuclear

station.¹⁶ The lower coal prices have reversed this, and the small older stations can now produce electricity more cheaply than building and running a new station. The CEBG's duty to supply electricity economically means that as many as possible of these stations, closed or to be closed prematurely, should be kept in being for use in meeting future demand,¹⁷ thereby putting off the date of capacity need into the next century even on the CEBG's own demand projections.

Thus the first "economic benefit" of building Sizewell B is to produce electricity at a higher cost than can be achieved by existing stations which have been or are being destroyed. This unjustified destruction is then said to make Sizewell B necessary to satisfy increasing demand. This is the second "benefit" to be investigated.

b) Contribution to Meeting Capacity Need

It should be possible to save enough of the stations being prematurely retired to generate an output equivalent to at least three Sizewell Bs.¹⁸ This will, by itself, put off the date of capacity need to the next century. But the estimate of future demand, on which capacity need is based, is the most flawed part of the Report. In particular, the acceptance of the CEBG's Scenario C demand projections is unjustified.

It is necessary to distinguish between electricity demand in units (kWh) per annum and peak demand during winter, in gigawatts (GW). The number of power stations required depends only on the peak demand. It is possible for electricity demand to go up considerably without increasing peak demand. By definition all increases in "off-peak" consumption do not affect the peak demand. Last year, in the South West Electricity Board area, electricity sales went up while peak demand went down. Increase in electricity units produced does not necessarily mean a corresponding increase in peak demand, although recent increases in electricity demand have been used as a spurious argument for more stations to meet capacity need, and there is a general tendency to blur the vital distinction between these two forms of demand.

Although future peak demand is

the factor which determines whether new stations will be required, the CEBG does not estimate it directly. Instead, it estimates the future trend in electricity sales, split into five different categories. It then estimates the future variation in the system load factor, which is even more difficult to forecast, and combines the two to produce the future peak demand.

Since none of these future estimates are much more than informed guesses, it is not surprising that this procedure produces errors in the forecasts of peak demand. What is, perhaps, surprising is the direction and extent of the errors. Under cross-examination at the Sizewell Inquiry, the CEBG admitted that the error in the estimate of peak demand seven years ahead for the ten forecast years from 1972/3 to 1981/2 had been a minimum of 23 per cent, a maximum of 29 per cent and an average of 26 per cent. All of the estimates were too high.

Despite this and other evidence of the continual overestimation of future peak demand, using this extraordinary indirect method, the Inspector chose to ignore the only direct evidence on future peak demand,¹⁹ and instead concluded that "the CEBG's Scenario C projection of restricted winter maximum demand provided a reasonable general basis for assessing the capacity need for Sizewell B." (86.3).

If the Inspector had used the evidence presented to him he would have found:²⁰

- (i) The curve of Average Cold Spell (ACS) maximum demand²¹ from 1950 onwards shows that the increasing demand of the 1950s and 1960s has flattened off in the 1970s and 1980s.
- (ii) The best straight line drawn through all the points of restricted ACS maximum demand for the 14 years from 1971/72 to 1984/85 is almost level at 42.0 GW, and none of the points are more than 2.1 GW above or below this value.
- (iii) The points fluctuate about the level 42.0 GW line. When they go up the CEBG's forecasts continue the upward line, but when they go down, the forecasts go up even faster.
- (iv) The present upward fluctuation is less steep than the previous one, and even including 1985/86 and 1986/87 has only just reached the level of 1979/80.

If, instead of accepting the latest

* This section relies for its justification on two documents¹² produced since the Report was published, and they should be consulted for detailed references not given here.

CEGB overestimates of future peak demand, the Inspector had taken for his central forecast the extrapolated value of 42.0 GW in 2000²² he would have found that:

(i) No new stations will be required before 2003 at the earliest:

(ii) There would be no major demand for oil-fired capacity in 1993 or later, and there would be no oil to be saved by a new nuclear station. This would make any new station even more uneconomic, and further improve the economics of existing small stations.²³

(iii) There is no need for Sizewell B on capacity grounds, and therefore no "economic benefit" from meeting capacity need to be set against the dangers of a new nuclear station:

(iv) If and when a new large station is required on capacity grounds, a pollution-free coal-fired station, equipped with scrubbers, would have at least a fifty-fifty chance of being more economic at present coal prices, on the narrowest grounds, and has many advantages on other grounds.²⁴ The next

generation of stations should be mainly combined Heat and Power stations. Coal-fired stations are obviously the only choice for phasing out nuclear power.

c) Reducing CEGB's Reliance on Coal (or Fuel Diversity)

Even the Inspector seems to have felt that there was something peculiar about the "benefits" to be had from fuel diversity. The CEGB "paid less attention to fuel diversity" and "could not assist in quantifying the costs and benefits of fuel diversity." (90.13). The only concrete evidence given by the CEGB was in relation to the interruption of supplies of coal by strikes (87.31). The Department of Energy merely stated that "the Government expects the electricity supply industry to pay due regard in its planning to the need for diversity and security in supply, including an appropriate nuclear component . . .

The mix between the two sources could be improved in favour of nuclear power" (87.32).

But although the Inspector did not give much weight to this aspect of CEGB's case, he failed to realise the social and national economic consequences arising from it.²⁵

Conclusion

The failure of the Report to consider vital evidence presented to the Inquiry and its acceptance of the incredible "once in a million years" danger of a major accident, have led to irresponsible conclusions. These conclusions may be understandable in the light of the March 1985 deadline for the consideration of evidence, and the enormous pressures from the establishment, operating through Department of Energy officials and other sources, but they represent one more failure of the Public Inquiry System to stand up to official pressure. The fact that the Department of Energy allowed £200 million to be committed on Sizewell B, before the Report had been produced and without objection from the Inspector, is a measure of the objectivity of the proceedings.

However, the failings of the Report fade into insignificance compared with those of the Minister and his Department in taking no account of Chernobyl or the changes in the economic assessment since March 1985.

The Minister's decision can only be categorized as irresponsibility of the highest order, and proof of the contention, made during the Inquiry, that the result was a foregone conclusion.

The truth is there are no economic benefits, but considerable costs, in developing nuclear power, so that there are no arguments for proceeding with Sizewell B, and all the considerations of danger against doing so.

Notes and References

1. The numbers in round brackets refer to the Sizewell Report. The figures before the point give the chapter, those after, the paragraph.
2. Given on behalf of the Stop Sizewell B Association (SSBA) by J.W. Jeffery. Inquiry reference: SSBA/P/4.
3. Jim Jeffery, 'The Unique Dangers of Nuclear Power: An Overview', *The Ecologist*, Vol. 16, No. 4/5, 1986, p.147-163.



Our ultimate weapon in the fight against Sizewell B.

The proposed Pressurised Water Reactor at Sizewell in Suffolk isn't built yet. And it can still be halted if the Friends of the Earth's legal challenge against it is upheld by the courts. To fight this case we need your support now.

The Government and the CEGB have clearly ignored the stringent legal requirements for nuclear safety laid down by Parliament in the Nuclear Installations Act (1965 and 1969).

This law places an absolute duty on the operators of nuclear power stations to prevent injury or death to the public.

Friends of the Earth has therefore challenged, in the High Court, the legality of the decision to build Sizewell B, and we'll take it to Appeal if we have to.

We believe no Government or public body is above the law, and certainly not when public safety from nuclear accidents is concerned.

Our case will be expensive. Only with your help do we have a real chance of halting Sizewell B in its tracks. Please join us in our fight.

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4. Advisory Committee on Reactor Safeguards (ACRS), in *ACRS suggestions for an NRC long range plan*, 15/10/86, NUREG/BR-0032, Vol. 6, No 142, 29/10/86.
5. *Science*, Vol. 217, 23/7/82, p.338.
6. The numbers in square brackets are the section and paragraph references in the Minister's decision letter of 12/3/87.
7. *Nature*, Vol. 322, 21/8/86, p.691; *Nature*, Vol. 324, 4/12/86, p.417; *Nature*, Vol. 324, 18/12/86, p.622.
8. *Nature*, Vol. 324, 4/12/86, p.404.
9. *Science*, Vol. 232, 27/6/86, p.1596.
10. Given in Proof of Evidence, op. cit. supra note 2., p.1.
11. A particular example is the 300 MW station at Shoreham, near Brighton. The CEBG proposes to close it down prematurely in 1987 and have it completely demolished by mid-1988. The 300 staff are opposing the closure and they should challenge the CEBG to show why a station with a Net Avoidable Cost (NAC) of about £16/kWpa is being closed in order to make way for a nuclear station with a Net Effective Cost (NEC) of about £60/kWpa on present projected coal prices (see the Section on Economics). There is a *prima facie* case that CEBG is breaking its statutory obligations.
12. (a) *An Update of the Economics of Sizewell B*, Earth Resources Research, Ltd., 258, Pentonville Road, London N1 9JY, for the Council for the Protection of Rural England, 4 Hobart Place, London SW1, March 1987. (b) J.W. Jeffery, 'The Fatal Flaws in the Sizewell Report; a review of the economics of Sizewell B', *Energy Policy*, Vol. 15, No. 5, Oct. 1987 (in press).
13. See Report (87.31) and the last section of this article on 'Fuel diversity'.
14. Cumulative losses over 35 years of £2,000 to £3,000 million.
15. 1 GW = 1,000 MW = 1,000,000 kW. Modern large power stations have an output of 1-2 GW. Sizewell B would be 1.15 GW. It is useful to think of 1 GW as the output of a large power station. In connection with Net Effective Costs (NEC) + £30/kWpa is equivalent to + £30 million/GWpa and a large 1GW station with an NEC of +£30/kWpa would lose £30 million a year.
The CEBG's stations and other supplies total about 60 GW.
16. The CEBG gave the Net Avoidable Cost (NAC) of an old station as about £16/kWpa. In other words, if they closed down 1.15 GW of old stations they would gain $1.15 \times 16 = £18.4$ million per annum. Provided that building Sizewell B (1.15 GW) gave either an actual gain or a loss less than £18 million per annum, it would pay to build Sizewell B and scrap the old stations. Since the smallest gain CEBG expected from building Sizewell B was £31 million per annum, the question of retaining older stations did not arise. With the new existing and projected coal prices, building Sizewell B would give losses of £60 to £90 million per annum and retaining old stations, even with considerable refurbishment, is an economic proposition.
17. Since the CEBG, even with all the premature closures, still has a gross overcapacity of stations, it may be necessary to keep stations going on a maintenance basis (combined with refurbishment if necessary) or in some cases to mothball the station until it is required in the 1990s.
18. See Ref.11. The additional premature closure by 1990 of 5 GW of older stations

was announced during the course of the Inquiry (CEGB/p/4 (ADD 6), p.9).

19. See Ref. 12 (b) under "The Failure of the Report to Assess Vital Evidence". The Inquiry reference is SSBA/P/1 (ADD 1) and this is given in extended form in J.W. Jeffery, "A critique of the CEBG's economic case for a PWR at Sizewell", *Energy Policy*, Vol. 14, No.1, February 1986, pp 65-78.
 20. Not all these deductions were presented in the evidence, but the data were given from which they could be produced. The deductions were all made in the Feb. 1986 paper cited in Ref. 19.
 21. The Maximum Demand actually registered is adjusted to ACS conditions for comparison. For planning purposes the future projection of ACS Maximum Demand is reduced by the load management total which can be arranged. This gives the Restricted ACS Maximum Demand which the planners have to cover.
 22. The Inspector did investigate the effect on capacity demand of reducing the CEBG's projection for 2000 by 10 per cent. This gave a figure only slightly greater than 42.0 GW and did put capacity demand beyond 2000, but the Inspector decided that the possibility was too unlikely to be considered or followed up.
 23. The possibility of no oil remaining to be saved was not considered in the Report, although the CEBG was forced to concede during the Inquiry, that its original figure of 12 million tonnes coal equivalent (mtce) should be reduced to 5.5 mtce, and even this was strongly challenged.
 24. A coal-fired station has no possibility of becoming another Chernobyl, produces no radioactive waste or decommissioning problems, can be built more quickly, is far less difficult to repair in the event of accident and provides more peak capacity. It lends itself more readily to the smaller scale required for Combined Heat and Power schemes and for reducing the cover required for breakdown. The only one of these advantages which got serious consideration in the Inquiry was Winter Peak Availability (WPA) and nuclear inferiority in this respect actually operated to its advantage in the CEBG's comparison with a coal-fired station.
 25. This claim for "diversity" made by the CEBG and the Department of Energy only makes sense in the light of the leaked Cabinet minutes of 22/10/79 containing the sentence, "But a nuclear programme would have the advantage of removing a substantial portion of electricity production from the dangers of disruption by industrial action by coal miners or transport workers." (See: John Valentine, *Atomic Crossroads*, Merlin Press, London, 1985, p222).
- It is perhaps understandable that CEBG did not want to 'quantify' the 'benefits' of diversity, and no one can quantify the misery of broken communities and unemployed miners, but we are paying for this in social disruption and crime. The attempt to achieve 'diversity', far from being a benefit, has been one of the most disastrous aspects of the nuclear juggernaut. The cost has been far greater than any social subsidy to the coal industry that might have been needed, if existing coal-fired stations and any necessary replacements (equipped to prevent acid rain pollution) had been used, instead of building uneconomic and unnecessary nuclear stations.

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**EUROPEAN YEAR
OF THE ENVIRONMENT**

Lewis Mumford—Philosopher of the Earth

by Grover Foley

For Lewis Mumford, the roots of our present ecological crisis lie in our quasi-religious quest for mechanical power. We have surrendered our freedom to the machine. If we are to have a future, we must reject "Megatechnics" in favour of "Polytechnics"—technology that enhances life rather than destroys it. Above all, we must reintroduce "balance" into our lives.

In her book, *Philosophers of the Earth*, published in 1972, Anne Chisholm dedicated her first chapter to Lewis Mumford, as the West's "pre-eminent" ecological thinker.¹ Yet in the following years, scholars forgot about Mumford. Not even leaders of protest movements seem to know his work. Why then, in the eyes of an ecologist like Frank Fraser Darling, should he rank as our foremost philosopher of ecology?

From his first book—*The Story of Utopias*—, published in 1922, Mumford has sought to pattern thought on life as much as Descartes patterned it on the machine. He has written no books on "scientific" ecology. His concern is man's *total* environment, and that requires holistic thinking. He calls ecology the chief science of the future—if we have a future. But to preserve the whole, we need a science of the whole: the humanities as much as the natural sciences, subjectivity as much as objectivity, quality as much as quantity, ends as much as means.

Shunning academic specialisms, Mumford calls himself a "generalist." Due to illness, Mumford never finished his bachelor's degree at City College of New York. (He told his first class at MIT, after he had won fame, "I must confess to you that I have never earned a university degree." The class was taken aback. One student raised his hand: "But, Mr Mumford, you could still get one".)

Mumford does in fact believe it important to master some special fields: he himself became a leading authority in urban studies, architecture, utopias, American culture, and technology. But humane studies must break through the boundaries of academic empire builders, who end by knowing everything about nothing.

Mumford's speciality was life in all its variety. In his early years he took as his chief guide the Scottish town planner and biologist Patrick Geddes, a leading generalist. The more Mumford studied our society—its desiccated pragmatism, Nietzschean nihilism, and irrational rationality—the more he traced its crises back to technology. We have surrendered our freedom to the machine. The quest for mechanical power robs us of personal power.

Faith in the machine goes back to Bacon, Hobbes, and Descartes (who loved automata and autocrats). The very

richness of life had hindered man's comprehension and control. Francis Bacon called on scientists to dissect life in order to control it. Galileo separated primary from secondary qualities, the mathematically describable from life, and objectivity from subjectivity in the scientist himself. But in the very process of gaining control, man began to lose it. The organic world knows limits; the machine does not. Mechanist science does not know when to stop, even if its outcome is the Hydrogen Bomb or a man-made plague.

The Myth of the Machine

Life and the machine are twin poles of Mumford's thinking. Before turning to his philosophy of balance and "biotechnics,"* let's look at the new insights in his philosophy of technology: first, the *subjectivity* of the machine; second, the mechanist side of *romantic reactions* to the machine; and third, the *invisible machine* behind megatechnics (a thesis so novel that scholars to this day have ignored it).

Mumford entitles his major work *The Myth of the Machine*. By "myth" he does not mean merely a "false story". He means also, like the philosophy of religions, a "story of the gods." Mumford believes the machine has become as god to us. From Bacon to Carlyle, thinkers defined man as a tool-maker, *Homo faber*. But man's *brain* was fully developed when his tools were still primitive. Why did man first create tools? For symbolic, not utilitarian purposes. *Minding comes before making*. "Man is pre-eminently a mind-making, self-mastering, and self-designing animal."² Before man shaped tools, he shaped himself: his language, ritual, and society.³

As early as 1934 Mumford found the key invention of the industrial revolution not in the steam engine or automatic loom but in the mechanical clock. The clock, ticking off the minutes punctually, standardized time, space, and motion. Measuring units of time precisely, it laid the foundation for our "scientific" world view, based on astronomy and mechanics. Mumford's analysis of the clock is often cited by scholars. But despite corroborating work from such scholars as Georges Friedmann, Bertrand Gille, and André Leroi-Gourhan, its implications have not been fully seen.

What creates our megatechnic disasters? Not animal unreason but man's "superior irrationality." Why have

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* In Mumford's vocabulary, "biotechnics" means "life-enhancing" technology. It has nothing to do with "biotechnology" or genetic engineering.

the most rational—the scientists—created the most irrational: Bomb, rocket, genetic chimaera? Because man seeks in his tools divinity. His first major social tool, the city, embodied such a *mysterium*—both tremendous and fascinating. Man gave up the stability and innate humility of other species. He did not simply progress from barbarism to civilization, civilization becomes barbarism, worse than any known to the “primitives”.⁴

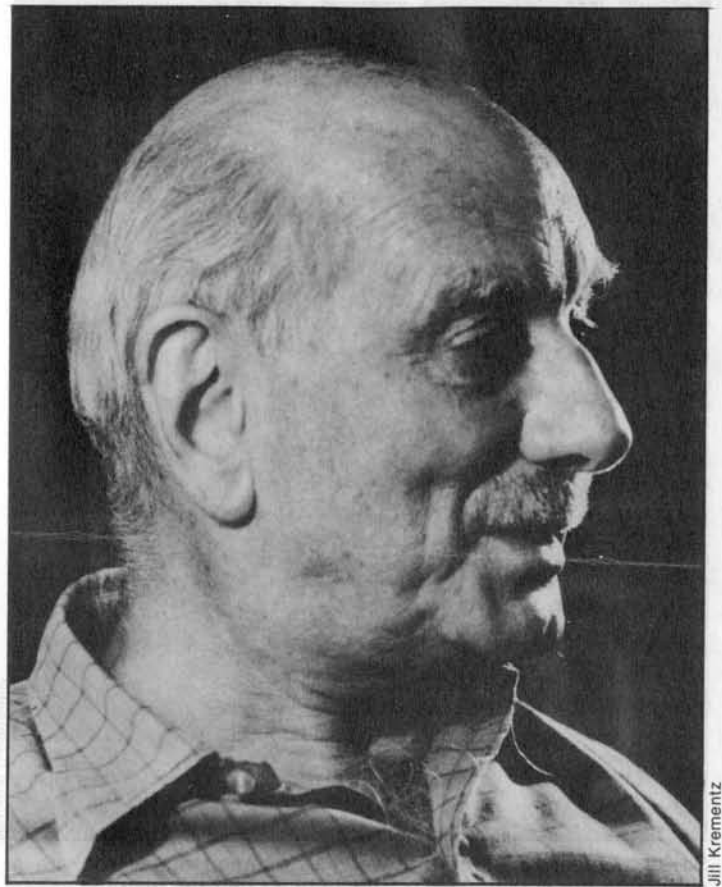
A Mechanised Nirvana

Only such deep longings can explain the mechanized paradise our modern experts promise us. Consider the quest for the Absolute Weapon: the Bomb's absolute power, the rocket's mythical speeds, the computer's superhuman control and accuracy. In “peace” too, the technocrats offer us an absolute: a mechanized heaven, says Mumford, if we put their dreams together. “Beginning with artificial insemination and extra-uterine pregnancy (Muller), the automatic conditioning of the infant will start in his isolated and enclosed crib (Skinner); thenceforward learning machines (Skinner and others) operating in isolated cells without direct human contact will teach the growing child.” Scientists will analyze the child's dreams, adjust his personality, and feed in pre-programmed information. Computers will automate farming (Rand); robots will perform all household work (Glenn Seaborg). Technicians will set up automated, workerless factories (Norbert Wiener), centralized remote control for motor cars (M.I.T. and Ford), underground cities and colonies on asteroids (Dandridge Cole). Through electronic media, “constant bombardment of meaningless messages will massage the tribalized mind (McLuhan).” Computers will replace decision-makers, while among the masses, “hallucinogens will give every vestigial human being the ecstatic sense of being alive (Leary).” Organ transplants (Barnard) will add a century or two to this pseudo-life. “Finally the beneficiaries of the system will die without for a moment having realized that they have never been alive.”

No rational dream, this quest for mechanical Nirvana. “It is,” says Mumford, “an essentially religious phenomenon.” The techno-utopians believe the very universe calls for constant change, centralized control, and limitless power. Such a vision precedes actual change. More than ideology, it is a faith. Like Prince Gautama, it promises release from pain. With one difference: the Buddhists' senses grew keener and flowered in poems, philosophy and new hope for life on earth. Our paradise holds no such hope. In fact, “long before reaching this terminal stage, a planetary interchange of hydrogen bombs or scientifically contrived plagues will, far more probably, bring on an equally vacuous conclusion by an even speedier method.”⁵

The Irrationality of Rockets

To take a specific example, consider the paradox of speed. The pace of technological change creates situations we cannot adapt to. We become addicted to change and incapable of a slow, stable life. By “change”



Lewis Mumford. “Shunning academic specialisms, Mumford calls himself a ‘generalist’, believing that humane studies must break through the boundaries of academic empire builders, who end up knowing everything about nothing.”

Mumford means something far broader than Alvin Toffler's “future shock.” Toffler eulogized the jetsetters for adapting smartly to technological change. Mumford does not believe we *can* adapt to it. It goes beyond making us uncomfortable: it makes us unbalanced. At best we react with pseudo-adaptations, approaching the lobotomised stupor of “post-historic” man.

Mumford criticizes speed in many forms. I will discuss only the rocket, since it is still being offered as a panacea both in war and in peace. President Reagan looks to Star Wars as the solution to nuclear war—the ultimate quick techno-fix. But the famed peace leader Carl Sagan also looks to space travel as the cure for our ills: men on Mars as an alternative to rockets on the Kremlin. Sagan too exemplifies the age-old dream of conquering the heavens.

What first drove men to build space rockets? The capitalists' search for profit? The generals' search for victory? The Chauvinists' search for an ultimate phallic symbol? Perhaps all of these, but more: a religion of power that, like the Tower of Babel, exalts man to the heavens and belittles the earth.

Note the goal of our rockets: either to obliterate the enemy or to ferry men to a barren satellite unfit for life. The rockets, said Mumford, cost as much as atomic bombs and are just as futile. They squander earth's resources and enlist an army from industry, science, and labour unions. All in the name of power: to destroy or spy on other nations, or just to be able to say, “We were the first”? In 1969, at the peak of “Moon Mania”, Mumford found in the rockets not just hardware but homicidal fantasies.⁶



National Geographic

Soviet cosmonaut. Mumford sees in manned space rockets a parallel to the pyramids: "I would suggest that the manned space capsule corresponds exactly to the innermost chamber of the great pyramids, where the mummified body of the Pharaoh, surrounded by the miniaturized equipment necessary for magical travel to Heaven, was placed." The Egyptian pyramid was a static rocket; the modern rocket is a mobile tomb.

But do the rockets really vilify earth? Mumford points to Arthur C. Clarke, arch apostle of high technology who was knighted for his services to science fiction. Clarke said rockets would bring a flowering of intelligence, albeit non-human: "The dullards may remain on placid Earth, and real genius will flourish only in space—the realm of the machine, not of flesh and blood."⁷ But robot minds, says Mumford, make insatiable demands on earth's resources. Space exploration has no organic limits. To meet its demands, nations must mobilize for war. The dream of freedom in space leads to greater repression on earth.

Mumford sees in the rockets a parallel to the pyramids: "I would suggest that the manned space capsule, as now conceived, corresponds exactly to the innermost chamber of the great pyramids, where the mummified body of the Pharaoh, surrounded by the miniaturized equipment necessary for magical travel to Heaven, was placed."⁸ The Egyptian pyramid was a static rocket; the modern rocket is a mobile tomb. Mumford notes how three Russians volunteered to spend a whole year in a simulated spaceship. Why this voluntary entombment? Because of a deep commitment. They lived like Christian hermits who sometimes sealed themselves lifelong within dark huts and received their food only through a vent.

But such a religion denies earth's own riches. Its ultimate goal—shown in Buckminster Fuller's eulogy to jet travel—is to reduce earth to the dimensions of a billiard ball. "Space travail" reduces man to a mummy, like Pharaoh. "Behold the astronaut," says Mumford in

a photo caption: "a scaly creature, more like an oversized ant than a primate—certainly not a naked god."⁹ Hurtling through space, he is a mere function of mass and motion. For shipment, he must be either drugged, trained for sensory deprivation, or rendered comatose by speed itself.

High speeds show a paradox. The old slogan was "improvement by movement." But the faster we move, after a point, the less we experience life or even movement. "On a transcontinental flight by a jet plane approaching supersonic speed, the actual trip is so cramped, so dull, so vacuous, that the only attractions the air lines dare to offer are those vulgar experiences one can have by walking to the nearest cabaret, restaurant, or cinema: liquor, food, motion pictures, luscious stewardesses. Only a lurking sense of fear and the possibility of a grisly death help restore the sense of reality."¹⁰

Clarke's robot utopia denies the rich variety of life. Earth still holds as many mysteries as the Milky Way; we shall never unravel all the mysteries of life's species. Nor can space offer even a fraction of life's plenitude. The three imprisoned Russians suffered so much tension they could not risk even a game of chess. In space travel they would have to endure far more: anxiety, weightlessness, and loss of immunity to disease. They would have to live without trees and brooks, spring and summer, night and day. Compared to earth, space is infinitely dull. "Humanly speaking, space technics offers a new style of non-existence: that of the fastest possible locomotion in a uniform environment, under uniform conditions, to an equally undistinguishable uniform destination. A world franchised exclusively for Howard Johnson Restaurants and Hilton Hotels."¹¹

To sum up, space rockets embody the genius of anti-life: "Satan's power bribe," Mumford at one point terms them.¹² "With space exploration, the traditional enemy of God and man has already re-appeared, in post-Faustian form."¹³ He offers absolute control over life itself—at the price of one's soul.

The Robot and the Rebel

Writers on technology, if they do not ignore Mumford altogether, tend to equate him with Theodore Roszak, chief theorist of the counter-culture. Yet Mumford objects to much in the counter-culture: not just drugs ("the counterfeit infinity," Roszak himself calls them) but also its faith in change, speed, and freedom.¹⁴ Living life in the slow lane, he found little to admire in Ken Kesey's psychedelic bus tripping or Timothy Leary's gone-to-pot religion. But his critique of the youth culture had deeper roots. At bottom, he does not share its romantic faith in feelings as the answer to the "objectivity" of the machine. Feelings lie at the heart of our machines—so how can more feelings be the answer to their threat?

Mumford rejects what his friend Victor Branford long ago called "addled subjectivity." To see what sets him apart from the counter-culture, we must keep in mind a basic thesis: that id and automaton are Siamese twins, two interdependent extremes. In our age of irrational rationality, Caliban and the computer work hand in hand.

Technology does more than mechanize man. Because man's selfhood cannot be totally quenched, the robot rebels. In a balanced culture, subject and object are in harmony. But in our mechanized world, the assembly-line robot becomes a Saturday night rebel. In *The Transformations of Man*—still an excellent introduction to Mumford's thought—Mumford traces the rise of the twin aspects of New World Man, the mechanist and the romantic. The mechanist exalted power, nationalism, and usefulness; the romantic, exploration, freedom, and vitality. The mechanist dreamed of abstract symbols, universal laws, predictable events; the romantic, of uncharted oceans, the wealth of the Indies, the fountain of youth. The pioneer aimed at natural resources, the technician at machine-created wealth. One explored the Americas, the other the atom. "In both modes of exploration there was from the beginning a touch of defiant pride and demonic frenzy."¹⁵

For a moment the two became one: in Daniel Defoe's famous castaway, Robinson Crusoe. Both Adam Smith and Rousseau loved this middle-class hero. In the saga of Crusoe, battling storm and ocean, at one with earth and stars, the new man saw himself: "The black sheep of art and the lone wolf of capitalism could both treat it as a useful guidebook: it might lead a Gauguin to Tahiti and an Andrew Carnegie to the steel mill."¹⁶

Mumford finds these two sides throughout modern life: in work and play, in warring and thinking. War above all links the mechanical and the irrational, regimentation and plunder. Work in turn echoes war. From the cauldron of war arose the arts of mining and metallurgy. The miner's world is as bleak and regimented as the soldier's: colourless, tasteless, perfumeless.¹⁷ So the miner too turns for relief to riotous pleasures, drunkenness and gambling.

Modern work likewise cannot satisfy the passions. The paper-pusher and card-puncher are as bored as the sentry keeper. So the worker rebels, with strikes, sit-ins, slow-downs, and—too often—sadistic fantasies of power.

Nor does leisure balance the imbalance. Play becomes a mere safety valve for the over-regimented.¹⁸ The Roman emperor gave them bread and circuses; the Baroque princes entertained them with the newly introduced carnival; the nuclear state gives them the illusions of freedom through sex, drugs, and TV.

Fascism above all unveiled the two faces: ice-cold efficiency and Darwinist science on the one hand, blood and soil on the other. Nazism combined method and madness, as in such infamous experimenters as Dr Mengele: detached, objective, indifferent to social results—yet wholly depraved.¹⁹

Automaton and id, the over-rational and the irrational, cannot make peace: they can only oscillate in growing imbalance, ending in breakdown. We cannot restore organic balance by adding more of either extreme (following for example the counter-culture's motto, "Make love not war.") Both extremes lead to disaster, for both think themselves absolute. Both reject the past, or fabricate a mythic past. The 18th Century rationalists, embracing "Voltaire's grinning formula for progress—to strangle the last king with the entrails of the last priest," in effect rejected history.²⁰ The 20th

Century irrationalists likewise reject it, turning to the New World and unrepeatable happenings.

Mumford and the Counter Culture

Though siding with youth, for they are our future. Mumford greeted neither the lifestyle nor the heroes of the counter culture—Marcuse, N.O. Brown, Blavatsky. Where Roszak found the hippies "disheartening," Mumford labelled them "fundamentally dissolute."²¹ While Roszak called the Age of Aquarius "as epoch-making as the appearance of speech", Mumford warned of its cult of freedom, that embraced drugs, Black Power, witchcraft, and McLuhan.²² For him it offered only the reverse image of the power complex.

Consider first its call to liberate the id: sexual exhibitionism, Mumford terms it. More libido will not end aggression, nor will Marcuse's "polymorphous perversity." Normless freedom is not freedom. Turned on and tuned in, rolling stoned in psychedelic buses, as rootless and regimented as their elders, the youth clung together at Woodstock, "a hundred thousand bodies floating in the haze and daze of pot."²³ They were even under commercial control, for Woodstock was "a strictly money-making enterprise, shrewdly calculated to exploit their rebellions, their adulations, and their illusions." Here too, the id reinforces the automaton.

The id also has its idols. The counter-culture sees "idolatry" as a biblical invention that took the magic out of life and barred the way to gnosis and feeling. Mumford, in contrast, sees idolatry as a constant temptation. Woodstock was no exception. "The success of the festival was based on the tropismic attraction of 'Big Name' singers and groups (the counter-culture's Personality Cult!), idols who command colossal financial rewards from personal appearances and the sales of their discs and films."

Like their stars, the youth can suffer megalomania that alternates with paranoia. "We want utopia, and we want it now." "Don't trust anyone over thirty." World-conquering easy riders, fearing they will be shot down on the highway, turn to attacking all authority. For they, like their elders, suffer boredom. Their anarchic festivals, dreams of an effortless life, and ceaseless search for a place to "crash": "What is this but the Negative Power Complex, attached by invisible electrodes to the same pecuniary pleasure centre?"

Mumford sympathizes with their plight. Many feel they are in a free-fire zone. Like Hawthorne's Young Goodman Brown, they have spied their elders at a Witches' Sabbath ending in human sacrifice. In the sixties many gave up careers and have lived in ruins. But those who seek total freedom become part of the pathology. "By reducing their world to a series of addled happenings," wrote Mumford in 1970, "they invite the ultimate Happening against which they supposedly protest."²⁴

The Super Machine

What technological source begets and sustains the myth of the machine? Mumford calls this source the "megamachine." Scholars have ignored this concept, for good reason. It requires a vision of society as a

whole, where past is present, machines are ideas, and scientists may even be priests.

Mumford soon gave up his hopes of the thirties for a "neotechnic" revolution. In the late fifties, at an MIT seminar, he warned of the almost demonic unreason of some technologies. Thanks to the airplace, napalm, and atomic science, war has become genocide. For the first time, Mumford confronted the question head-on: must technical reason become unreason? "I cannot pretend that I eagerly searched about for an answer."²⁵ But the more he studied the city, the more he learned of ancient civilization. "Digging mentally around those urban ruins, I discovered an extraordinary complex machine which turned out, on analysis, to be the first real machine, and the archetype of all later machines."²⁶

Why have others not seen this machine? It is invisible, says Mumford, because it is made of human parts. It arose in the Fourth Millennium B.C., that brought a cultural implosion. In Egypt and Mesopotamia, the new cities combined political and technological power. This city-civilization had certain basic components, like parts in a machine: the Divine King, the scientist-priest, the scribe-bureaucrat, the standing army, and the work army.

We fail to see this machine for still another reason: because it drew its power chiefly from a new idea. A new religion of the sky gods—called the Sun-God, Atum-Re, in Egypt—brought a revolution in thought. The primitive tools of that age cannot explain its grand monuments and technical achievements. The Egyptians built their pyramids without pulleys, derricks, or wheeled wagons. What then was their technological secret? Chiefly an awesome expansion of thought, comparable to the invention of language over many millennia. Their chief tools were inventions of the mind: mathematical symbols, astronomers' calculations, and the priests' concept of a heavenly order that changed the king from a hunting chief to an avatar of the Sun God. The new absolute order of the heavens called for absolute order on earth. Now huge work armies could be organized for vast building projects tribal man had scarcely dreamed of. The king's subjects marvelled at his pyramids and ziggurats, as we marvel today at our leaders' rockets, lasers, and Mach-2 fighter planes.

The Megamachine in the Modern Age

So far Mumford was only flying over the archeologists' trenches. But his next thesis was still more unpalatable: the ancient megamachine has come to life in our own day. Our civilization has the same components—the Divine King is our *Führer*, President, or Omnicomputer; the magicians and soothsayers are our scientists and technicians; the work army is our transnational corporation staffed by obedient Organization Men. The bureaucracy and military play as central a role today as then. Whether destructive or productive, whether geared to war or to peace, this complex lives by a common faith in power. To question it is to disobey the gods. To attempt to break out is heresy.²⁷

So huge is this machine that we find it as hard to grasp as to resist. It alone deserves the name, megamachine. But its very size meant it could perform

only large tasks. For smaller tasks, it gradually developed machines of wood, brass, and iron. But throughout the rise and fall of civilizations, the original pattern held fast in the army: in its discipline, standardized parts, and remote control via the chain of command.

Of course, civilization brought immense gains. But it also brought immense threats. It founded cities, only to destroy them. It produced wealth, freedom, and splendour, but also poverty, slavery, and squalor. It built canals, dikes, and granaries, but also chariots, vast army barracks, and the Sumerian phalanx, a "pedestrian tank, grinding over the bodies of its enemies."²⁸ The trauma of civilization lay in the boomerang of its power—a concept certainly more factual than Freud's idea of primordial sons murdering their father.

Parallel Courses to Disaster

Note the parallels between ancient and modern machines, in values, components, and products. The chief value for both is power. To tribesmen, the army must have seemed an Absolute Weapon. But, as with nuclear proliferation, the enemy soon got their own army. Then as now, the machine sought absolute speed and control: the winged lions at the palace gates equalled our rocket-borne H-bombs, while the seers, messengers, and all-seeing Eye of Re equalled our technocrats' dream of an Omnicomputer. Each machine also showed immense dynamism. The Pyramid Age rivalled our own at combining change and power. Each Pharaoh built himself a new capital. Such public works projects absorbed surplus energy, balanced the economy, and proved the power of the new faith. Our modern machine, in turn validates its faith by building space rockets, superhighways, and collective tombs called fallout shelters. No other faith, says Mumford, has shown such dynamism and suppressed so many alternate ways of life.²⁹

The machines also have similar components. First, semi-divine kings. Both machines have divinized the few and regimented the many. So divine are our rulers that some have not only had their giant photographs paraded as ikons but have even been embalmed, like Lenin and Stalin, for public veneration: a parallel to the Pharaohs so striking that, were it not for the fact, Mumford feels he would be accused of inventing it.³⁰ But what of the scientists as priests? Egypt's priests, like our own, brought a new mathematical view of life. They too unleashed the sun's energy on earth, though as yet only in thought. Our own "new priesthood" (as the physicist Ralph Lapp calls his colleagues)³¹ flock to research centres labelled "think tanks". They avoid the old centres of urban life, says Mumford, that would bring "disturbing reminders" of a different faith and lifestyle. Their ideal site, like Los Alamos, is the desert.

Finally, the two machines have the same products. The ancient world had its wonders—we have ours. As ancient men marvelled at the Sphinx or the Colossus of Rhodes, we marvel at the Concorde or the Manhattan skyline. By word and deed, the system's devotees witness to the kingdom, power, and glory of their nuclear

and electronic gods. The miracles of this faith are genuine. Only its claims are spurious. Its chief products of old were colossal tombs for the rulers and ruined cities for the masses. But we continue to glory in its destructive force. "Symbolically, at the entrance to the new pyramid complexes stands the nuclear reactor, which first manifested its powers to the multitude by a typical trick of Bronze Age deities: the instant extermination of all the inhabitants of a populous city."³²

Of course the age of science has brought gains. It has expanded our outlook, says Mumford, and may even close the gap between matter and life. But unless controlled by wisdom, mechanist knowledge will only replace man, either by the computer's pure "intelligence" or by radioactive dust. "Over the entire Pentagon of Power . . . hovers a nuclear Ragnarok, or Twilight of the Gods, long ago predicted in Norse mythology: a world consumed in flames, when all things human and divine would be overcome by the cunning dwarfs and the brutal giants."³³ The Pyramid Age collapsed in violent uprisings. Our Nuclear Age may be fissioned before that can happen. Too much know-how has cost us wisdom. Using scientific means for insane ends, we founder in irrational rationality. Our nuclear priests can say, like Captain Ahab: "All my means and methods are sane: my purpose is mad."

Polytechnics Against Megatechnics

Against giant technics Mumford sets "polytechnics." Such technics are diverse, their variety creating stability. As we must protect the genetic pool against monoculture, we must also protect the "technological pool" against monotecnics. Polytechnics are democratic, dispersed into many hands.³⁴ They have the same advantage over centralized megatechnics as windmills have over nuclear reactors. For this very reason the state favours megatechnics, which in turn adds to its power. We owe the nuclear reactor to the atomic bomb; the jumbo jet to the Pentagon's C-5A cargo plane; the US interstate highway system—the greatest public works since China's Great Wall—to military requirements approved by Congress.

But megatechnics become too complex even to repair. A century ago William Morris predicted that, to repair a rake, we would some day need a whole crew of men. "That day," says Mumford, "is already here."³⁵ Polytechnics also have more scope than megatechnics for invention and improvement. Until capitalism drove them out, crafts were growing—from 90 to 250 during the seventeenth and eighteenth centuries.³⁶ Refined technologies show great potential for crafts and cottage industries. The small electric motor and generator give new powers to the handyman. With fuelling mills or precision machines like lathes, craftsmen began to use power-driven tools on a small scale—a process we can continue today. Mumford notes how transistor radios kept Czechs informed of the revolt in 1968, and bicycles helped Vietnamese guerillas triumph over B-52s.

Polytechnics, further, make full use of minds and hands. Real work, says Mumford, should approach art. "The purpose of art has never been labour-saving but labour-loving."³⁷ The nineteenth-century traveller Raphael Pumpelly once met a Japanese metal-worker

who had never seen a screw. Shown an iron screw, the next day he brought back a dozen brass ones, gleaming works of art. He even duplicated Pumpelly's colt revolver with one that not only worked well but was more highly finished.

Art itself depends on meaningful work. In the past, folk work and song helped produce classic music. In his Nocturne in E-flat Major, Schubert used the work song of pile drivers.³⁸ Why did symphony and opera peak in the late eighteenth and the nineteenth centuries? Perhaps because they could still draw on folk music. Today euphony has given way to cacophony, and human rhythms to mechanised chaos.

To sum up, polytechnics rank balance above growth, life above power, and renewal above revolution. Their awareness of limits, balance, and diversity preserves us from the mad attempt to build an artificial world. In his treatise, "What is Art?" Tolstoy tells of a man who carefully seals his apartment, pumps the air out, and then with still more costly gear pumps it back in again—instead of simply opening the window.³⁹ With our pale or lethal imitations of life, we do the same.

The Organic vs the Technical

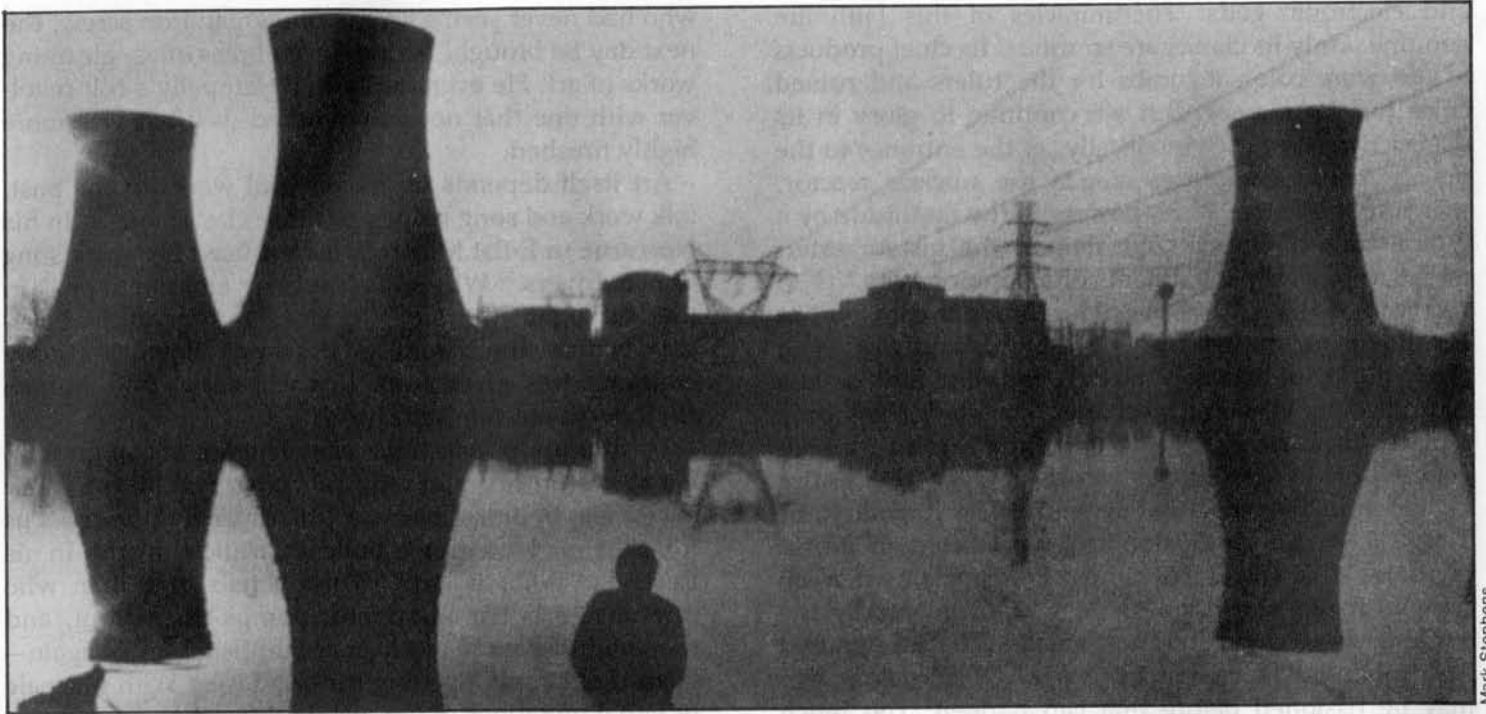
I can only touch lightly on Mumford's lengthy discussion of polytechnics. What, to conclude, are its strengths and weaknesses? Mumford neither accepts nor rejects all technology. Though he lacks the forceful brevity of Ivan Illich, he has more scope and depth. Instead of the bureaucratic drive to disempower the individual, he stresses the mythic roots of authoritarian technics and the need for a mix (not just bicycle *against* cars, nor self-education *against* the university).

Unlike E. F. Schumacher, he does not greatly stress a *new* technics, intermediate between ancient and modern. Nor does he make as clear our desperate need for simple, cheap, repairable tools. He stresses, instead, the over-all clash between organic and technical world views. Beyond a balance of technics, he calls for a balance of the spirit, that alone can bring timely and lasting change. His strength lies in his breadth and balance. Only Mumford's life-long study of technics could reveal the madness behind our giant technics. Megatechnics owes its strength not just to profitability (Marcuse), efficiency (Ellul), or concentration of power (Illich). The lunacies of, say, lunar rockets spring from a faith that approaches a religion.

To choose life, Mumford says, we need a counter faith: that life is better than utopia. When reason fails, he warned his liberal friends during Hitler's rise, drastic remedies are needed: force and grace. A faith for living may call, *in extremis*, for readiness to sacrifice—a sacrifice made by Mumford's son Geddes, lead scout of his regiment, who fell on the Gothic Line in Italy in 1944.⁴⁰

This faith for living merges into Mumford's broader view—a philosophy of organic balance. He does not expect to prove this balance to mechanist science. Today, "scientific" ecologists, like "scientific" Marxists, reject even the modest concept of the balance of nature.⁴¹

Life proves its balance not by statistics but by stability,



Three Mile Island, site of America's worst nuclear accident. Nuclear power plants are a prime example of "megatechnics" and stand in sharp contrast to such "polytechnic" devices as windmills. "Polytechnics" are democratic, being dispersed in many hands. But the state favours centralised systems, which add further to its power.

in total contrast to the insensate dynamism of technological man.

Organic Balance

Mumford differs from both techno-culture and counter-culture in having a comprehensive philosophy of balance. His thought takes life, not the machine, as the pattern for human culture. In past ages, both religions and philosophies preached the idea of balance: "The Golden Mean," "Nothing in excess," "A sound mind in a sound body." Modern man believes instead in growth, progress, and power. Yet Aristotle's principle of the mean holds true for all life. Life knows when to stop growing and (for individuals) when to stop living.

As Walter Cannon showed in his concept of homeostasis, activity must be balanced by stability. The body maintains an automatic balance that is more than quantitative. "It involves," says Mumford, "not merely the right measure but the right mixture of qualities and the right pattern of organization."⁴² Stasis and action mutually support one another: homeostasis of the physiological functions promotes freedom, allowing the mind and voluntary muscles all sorts of "superfluous" activity, such as art and play.

The future must also be balanced by the past, and evolutionary change by ecological continuity. the "Now Generation," that thinks itself the wave of the future, loses the future because it loses the past. Like the technocrats—the "men who are ten years old," as an ancient Pali text puts it—it discards the wisdom of tradition.⁴³ But evolution retains the past faithfully, in the memory of man and the genes of each cell. If we bury "the dead past," we bury life. No longer able to digest and transcend the past, we must repress it—and that condemns us unwittingly to repeat it, as we are now repeating, with our arms man a rape of nature, and

exploitation of the poor, the trauma of ancient civilization.⁴⁴

Mumford goes beyond the implicit scientism of many environmental experts. Take Barry Commoner's three laws of ecology. The first two relate to Commoner's main concern, pollution: all things are interconnected; everything must go somewhere. The third comes closest to Mumford's chief point: "Nature knows best." But Mumford takes a further step: Nature knows *balance*. That means, for one thing, limits on population as well as pollution. But it also means balance between science and the humanities, knowledge and values, logic and beliefs. Neither technical reason nor socialist revolution suffice to rescue life. Life knows qualities, inner drives, and creative aims. Beyond means, it knows ends: values and beliefs are as central to human life as facts and logic.

Mumford set out above all to replace mechanist thinking by ecological thinking—by bio-technics and bio-science. Instead of quantitative, he calls for qualitative growth—"plenitude" in place of power. To affluence, he opposes not poverty but organic abundance. Life needs limits as much as growth, stability as much as evolution. Organic growth is regulated and balanced. "Balance, wholeness, completeness, continuous interplay between the inner and the outer, the subjective and the objective aspects of existence are identifying characteristics of the organic model." Evolution and continuity are twin aspects of "plenitude."⁴⁵

Mumford sees this concept in the traditional idea of "the great chain of being." Religious thinkers first formulated it, as they marvelled at the abundance of nature and God's unceasing creativity. They were astonished not just at the number of species but at life's immense diversity, that told of the organic freedom that culminates in man.

Mumford finds the same idea in Darwin's theory of evolution. But Victorians believed in power. Like T. H.

Huxley, they reduced the selectivity of nature to extermination and its self-development to mere survival. They denied the autonomy of life, its ability to transform itself and evolve purposefully. Where life shows a dynamic equilibrium, they saw change alone—change for the sake of change. Unlike life, their mechanical power knew no boundaries or qualifications. Because power was their new myth, they thought the idea of balance a myth. They could not see that to survive, man must temper growth with self-maintenance, external proposals with internal responses, activity with recuperation.

Mumford seeks balance also in daily living. He prefers Fourier's "butterfly principle" to routine eight-hour jobs: spending some hours on one task, then moving to another.⁴⁶ He has also balanced city and country living. Born and raised in New York City, he did not move permanently to the country until almost forty. Even there, a railway line linked him easily to New York City, until the monotronics of the automobile replaced the train. He balanced farmhouse life with stints of university teaching. In major works he has defended the historic city against the anti-city, Megalopolis. Though he treasured Thoreau in his youth and affirms the need for wildernesses, he chose to live in the farming country of Dutchess County, an area of woods, meadows, and parks one hundred miles north of Manhattan. He helped friends like Benton MacKaye launch the Appalachian Trail but has himself walked only a few miles of it. Yet each day he enjoyed the solitude of his study in his hundred-year-old farmhouse, along with a ramble along the back roads that lead, only a few miles away, to a national park and the Appalachian Trail.

The idea of balance ruled Mumford's earliest writing. He sought "wholeness," placing the Whole Man against one-sided Pragmatic Man, that ruled in the philosophy of John Dewey. He criticized the muckrakers for looking only at specific evils, not at the whole (a criticism that applies just as well to current protest movements). He could not leave out any part of life. In 1964, he became the first public figure to denounce Lyndon Johnson's escalation of the war in an "Open Letter to the President." In 1965, he brought politics into sheltered academe: giving his retiring speech as president of the American Academy of Arts and Sciences, he launched a withering attack on American aggression in Vietnam.⁴⁷

Mumford does not reject science, technology, or progress, any more than he rejects the city or the automobile (given the right size, speed, and ends). For him ecology involves change as well as stability. His concept of plenitude embraces both growth and self regulation. The answer to mechanical abundance is not scarcity but organic abundance. The mechanist model never knows enough. The organic model knows: "Enough is plenty." Evolution and ecology go together: profusion and harmony, riotous abundance and balanced stability. Such "plenitude" is the opposite of quantitative mechanical productivity.

Like the Benedictines, Mumford says, we need to balance *ora et labora*: thought and work, quality and quantity, stability and change. In unleashing the atom,

we have revived the Sun-God, Atum-Re. What we need is not the sun but its earthly offshoot: not nuclear fusion but life. We need a revival of human values, balanced with nature's. Nature sets limits to growth, boundaries to freedom, and constraints on change. Organic living includes "the luxury of turning one's back on specious luxuries."⁴⁸

To learn much, Mumford gave up much: wealth, luxuries, adulation. I believe he saw too clearly, too deeply, too soon, to be heard. Perhaps he is wrong. But he is worth *proving* wrong. In an age of megatechnic disaster, we could do worse than give heed to our foremost analyst of megatechnics.

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Victims of Radiation

Ann Heidenreich reports from a recent conference on the health effects of radiation.

For many, the victims of radiation are no more than statistics—a few excess cancer deaths hardly perceivable amongst the many who die of cancer every year anyway. The health effects of the Chernobyl accident will not even be noticed, we are told, and as long as the health effects of radiation remain invisible, they can be ignored. A conference on radiation and health, held May 21-24 in Amsterdam, the Netherlands, helped to make the invisible visible. For four days, radiation victims, scientists, physicians and campaigners met to exchange experiences and discuss further activities. The conference was organized by the International Institute of Concern for Public Health of Toronto, Canada, the World Information Service on Energy (WISE) in Amsterdam, and Friends of the Earth—Holland.

Radiation Victims

Lively discussions arose as radiation victims told their stories. Ken McGinley and Mike Reid took part in British nuclear weapons tests on Christmas Island. Ole Markussen was involved in the cleanup of plutonium following a B-52 bomber crash in Greenland, and his wife Sally initiated a health survey of the Danish workers involved when she noticed increased health problems amongst her husband's colleagues. Paul Doj, Stig Dunfjell and Sigrid Toven are Samis from Sweden and Norway, where a whole traditional culture based on reindeer herding is threatened by radiation. Joan King is the widow of a Windscale worker who suffered near-blindness before he died of a brain tumour as a result of radiation exposure. Pauline Esteves is a Shoshone Indian from Nevada in the US where native lands are still used for the "underground" testing of nuclear weapons—tests

which regularly vent into the atmosphere (see Photo). Bien van der Schoot is a nurse who worked on a cancer ward in a Dutch hospital, and Evert van Amerongen an engineer who worked with small open-point radioactive sources in a research laboratory.

While the physicians and scientists assembled at the conference did not agree on exactly what health effects could or could not be attributed to radiation exposure, the victims recounted several common symptoms of exposure including eye problems, general malaise and ill health, muscular problems similar to arthritis, and birth defects. An informal survey of 400 Danish workers involved in the plutonium cleanup at Thule Airforce Base in Greenland showed only 7 children born afterwards, none of them healthy. Children and grandchildren of the British Nuclear Test Veterans also showed health defects. Another common experience shared by the radiation victims was the disbelief and denial they faced from authorities when seeking recognition or compensation for their health problems.

Doctors and Scientists

Among those doctors and scientists who participated in the conference were: Dr Rosalie Bertell, (Canada), Dr Alice Stewart (UK), Dr Carl Johnson, Dr Ernest Sternglass, and Dr Léon Gottlieb (USA), Dr Patricia Sheerhan (Ireland), Drs Denis and Antoinette Fauconnier (Corsica), Roger & Bella Belbeoch (France), Prof André Vorobjov and Dr Valeri Savtchenko (USSR), Dr Karl Adzersen and Prof. Inge Schmitz-Feuerhake (FRG), and Prof. Sadao Ichikawa (Japan). Polish, Swedish and Swiss doctors were also represented. Many of the attending doctors are well-known for their work on

the health effects of radiation. Others became concerned when they observed health problems following the Chernobyl accident.

Unlike most conferences, the scientists and physicians were not invited to present papers, but to listen to the radiation victims, comment on what they heard, and participate in strategy and campaign discussions. However, many brought papers with them which present new and significant research findings. Alice Stewart's study on background radiation and childhood cancers, for example, found that approximately 70 per cent of childhood cancers are caused by background radiation.¹ Stewart's findings are based on a comparison of data from the ongoing case/control Oxford Survey of Childhood Cancers with a recent survey of background radiation by the National Radiological Protection Board in England, Scotland and Wales. Clearly, as Stewart pointed out at the conference, if background radiation is the main cause of childhood cancers, then any additional radiation will cause even more cancers, and should not be tolerated.

The International Commission on Radiological Protection (ICRP), which is mainly responsible for setting international radiation standards, still maintains that the best method of estimating cancer risk from small doses of ionizing radiation is by linear extrapolation of high dose effects. A main source of ICRP recommendations is a study of the atomic bomb survivors from Hiroshima and Nagasaki. Stewart's earlier work on the Hanford nuclear workers showed that a linear extrapolation of high dose effects grossly underestimates the cancer risks of low-level radiation. Her more recent study on background radiation supports these earlier findings.²

In his paper, Dr Carl Johnson reported on a study published in February 1987 by the Los Alamos National Laboratory which shows striking increases in cancer deaths in workers receiving far less than the permissible dose limit of 5 rems. "Briefly, the Los Alamos National Laboratory studied cancer deaths among 5,413 white males who had

been employed at least two years at the Rocky Flats nuclear weapons plant. Employees who had more than two nanocuries (two billionths of a curie) of plutonium deposits in body organs were compared to those with less than two nanocuries (5 per cent of the official maximum permissible limit). After an induction period (latency period) of two years there was a 7.7-fold excess of lymphoplastic neoplasms (lymphatic cancers); a two-fold excess of lymphosarcoma and reticulum cell sarcoma; 3.3 times more esophageal cancer than expected; 80 per cent more gastric cancer and 3.7 times more prostatic cancer. Employees with a longer latency period (5 years) had 9.9 times more lymphatic cancers than expected; about a 5-fold excess of cancer of prostate; a 3.7-fold excess of esophageal cancer; 2.5 times more lymphosarcoma and reticulum cell sarcoma; 2.2 times more stomach cancer; 1.7 times more digestive cancers combined; and 62 per cent more cancer of colon. After an induction period of ten years, there were 5.2 times more lymphatic cancers than expected; 61 per cent more cancers of all types than expected; 10.6 times more prostate cancer; 5.7 times more cancer of colon; 4.8 times more stomach cancer and a 43 per cent excess of lung cancer."³ Since the Los Alamos National Laboratory is solidly within the nuclear establishment, it will be hard for them to ignore these findings.

Another paper which stimulated much debate at the conference described an analysis of US government mortality statistics by Dr Ernest Sternglass and Dr Jay Gould. Sternglass and Gould have observed a 1.5 per cent increase in the age-adjusted mortality rate from 1979 to 1980 with the greatest increases in states within 500 miles of the Three Mile Island nuclear reactor, where a partial core meltdown occurred in March 1979. This represents as many as 50,000 excess deaths. While Dr Gould said it was premature to attribute these deaths to any single cause, ongoing research "suggests that a link may exist between these deaths and the millions of curies of radioactive emissions from Three Mile Island."⁴ If Sternglass and Gould are right, it means that low-level radiation has an immediate impact

on the immune system, particularly among the elderly, lowering their resistance to all infectious diseases and to stress. If this is so, then Europe should already be experiencing elevated mortality rates among the elderly as a result of the Chernobyl accident.

Dr Rosalie Bertell prepared a paper in which she calculated the total number of casualties caused by the civil and military nuclear industries since 1946, based on United Nations data about how much radiation has been released into the environment and UN data on global population counts. Her casualty figures include cancers and damage to offspring. Deaths from infectious diseases due to the effect of radiation pollution are not counted since there is at present no way to estimate their number. Estimates of contamination include radiation from above-ground weapons tests, civil and military nuclear reactors and nuclear support activities (uranium mining, reprocessing, etc.). The estimates exclude nuclear reactor accidents (TMI/Chernobyl) and releases from "underground" weapons testing. Still, Bertell concludes that "a fair, conservative central estimate would be 16 million casualties . . . The true number may be greater than 30 million."⁵

What We Can Do: Health Surveys

A number of young European doctors at the conference reported an increase in birth problems among humans and livestock since Chernobyl. In the course of the conference, it was decided to develop a common questionnaire on birth problems which could be used by doctors from all countries for gathering data. A questionnaire formulated by the German section of International Physicians for the Prevention of Nuclear War will be used as a basis for an international document.

Radiation victims and doctors alike expressed the need for a common basic questionnaire to be used in general health surveys. Both the Shoshone and the Samis were encouraged to undertake such "barefoot epidemiological surveys" after hearing the experience of Sally Markussen, who began her own in-



On December 18, 1970, an underground nuclear test at the Nevada Test Site (NTS) code named Baneberry resulted in a release of radioactivity to the atmosphere. Baneberry had a yield of ten kilotons and was buried about 900 feet beneath the surface of Yucca Flat, near the northern boundary of the test site. The radiation release, or venting, resulted in a cloud of radioactive dust about 10,000 feet above the surface, some of which drifted off the test site.

formal survey when her husband and many of his colleagues became ill some years after cleaning up a plutonium spill in Greenland. Alarmed by Mrs Markussen's findings, the Danish Government has finally agreed to undertake a more extensive (and expensive) survey of the workers involved in the plutonium cleanup.

A general health survey carried out among the Samis in northern Norway and Sweden could be expected to turn up significant results. Reindeer herders in the far North have been living with raised levels of contamination since weapons testing began in the 1950s.⁶

Such informal surveys, while they do not carry the same weight of formal epidemiological studies, can gather enough evidence of health damage to alert people and put pressure on the authorities to halt damaging practices and commission formal health studies.

A third health survey, developed by Cumbrians Opposed to a Radioactive Environment (CORE) to help workers assemble health data for compensation cases, will also be

made available to conference participants and other interested parties.

In the course of a discussion about the health effects of the Chernobyl accident in the Soviet Union, Professor Andrei Vorobjov invited Western specialists to visit the centre in Kiev where Chernobyl data is being collected. The offer was immediately accepted by several of the doctors and scientists present.

What We Can Do:

Radiation Standards

Since 1950, the recommendations of the International Commission on Radiological Protection (ICRP) have been accepted as the basis of both national and international radiological protection standards. Now the ICRP is increasingly coming under fire. The group is self-appointed, accountable to no one, all-male, and made up of people who were educated and are paid to work with radiation.

The Commission itself makes clear that the levels it sets are "acceptable" rather than "safe", designed to protect the nuclear industry as much as the health of the public. Thus, ICRP Publication 26 states:

"Radiation protection is concerned with the protection of individuals, their progeny and mankind as a whole, while still allowing necessary activities from which radiation exposure might result."

In 1966, ICRP Publication 9 stated that the 5 rem per year dose limit for radiation workers was retained because the "Commission believes that this level provides reasonable latitude for the expansion of atomic energy in the foreseeable future." If dose limits are set to provide for nuclear expansion, one would expect further increases in permissible exposure levels as the nuclear industry expands. Indeed, this is precisely what has happened. Recommendations from ICRP Publication 26, published in 1977, permit increases in exposure to individual body organs of between 2 and 10 times. The largest increase occurred in the case of red bone marrow, which went from a maximum permissible dose of 50 millisieverts (mSv) per year (5 rems) under ICRP 9 to 420 mSv under ICRP 26. Meanwhile, evidence coming in from all sides indicates that radiation is at least 2 to 10 times more dangerous than ICRP claims.

Another critical area concerns radiation-induced genetic effects. ICRP Publication 27 states, "the harm attributable to genetic effects of radiation in the descendants of the exposed person depends critically upon a number of decisions which are essentially matters of opinion," (our emphasis). Genetic abnormalities induced by radiation which cause failure of development or implantation of the fertilized ovum, or which cause abortion of a non-viable foetus, can, in the opinion of the ICRP, be excluded from risk estimates, despite the recognition that these do occur. The infertility of Danish workers involved in the plutonium cleanup in Greenland, many of whom were around age 20 at the time of the cleanup, is evidence of the seriousness of this omission.⁷

ICRP 26 is now 10 years old, yet it has not been fully implemented across Europe. In September this year, in Como, Italy, the ICRP will be meeting to produce a new set of recommendations to replace those of ICRP 26. The Como meeting will be vitally important, for it will determine the course of radiological protection standards around the world for the next ten years.

In Britain, Friends of the Earth (FOE) has launched a campaign to put pressure on the ICRP for an immediate reduction in dose limits to workers and the public by at least a factor of 10. FOE is also coordinating an international campaign, launched at the radiation conference, to inform the press, and to encourage scientists to endorse a statement calling for a reduction of exposure levels and submit technical papers to the ICRP.*

The Amsterdam conference also resolved to oppose new standards for radioactive contamination of food proposed by the European Commission. The proposed new legal limits on radionuclide levels in food sold in, and exported from, Europe, were issued by the Commission in late May. Current levels, set after the Chernobyl accident, are 370 Becquerels (Bq) per litre for milk and 600 Bq/kilogram for all other foods. The new proposed limits are 1000

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*Briefing packets containing necessary campaign materials are available from Patrick Green, Friends of the Earth, 377 City Road, EV1 1NA, UK. Tel: 01-837 5152.

Bq/1 for milk and 1250 Bq/kg for all other foods.⁸

Environmentalists say the new levels imply acceptance of yet another nuclear accident, since lower levels would mean that much of the food grown in Europe could not be marketed when new contamination occurs. The new standards will also have a detrimental health effect, since 50 per cent of the exposure Europeans receive from Chernobyl is still to come: half of this will be from external sources and half from internal exposure through food intake⁹. Some of the latter could be prevented by setting stricter limits on radionuclide levels in food. With governments setting unacceptably high contamination levels, a network of groups called "Parents Against Nuclear Power" in West Germany have taken independent action and successfully lobbied baby food firms to provide baby food which contains less than 1 Bq/litre.

The radiation and health conference in Amsterdam was part of a global movement to bring together radiation victims, professionals and campaigners to exchange information, discuss strategies and campaigns and work for a nuclear-free world. Two more conferences will be held this year: the world conference for the 42nd anniversary of the atomic bombings, *Conference for a Nuclear-Free World*, will be held in Hiroshima & Nagasaki, August 2-9, 1987¹⁰ and the *First Global Radiation Victims Conference* will be held in New York City, September 26-October 3, 1987.¹¹

Ann Heidenreich.

Note: All of the papers and documents mentioned in this article, and the full report of the Amsterdam radiation and health conference, are available from WISE-Amsterdam, P.O. Box 5627, 1007 AP Amsterdam, The Netherlands. Tel: 020-853857.

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8. A becquerel represents one nuclear disintegration or transformation per second. In a litre of milk containing one becquerel there will be one disintegration per second, 60 per minute and 3600 per hour. Caesium-137, the most prevalent contaminant from Chernobyl, stays in the adult body 70-100 days and in children's bodies 30-50 days, before it is eliminated through natural processes. Any one of these disintegrations can cause cell mutation which eventually leads to cancer or genetic damage.
9. From a talk by Dr Klaus Baetjer at the International Anti-Nuclear Meeting organized by GRAEL (Green Alternative Link or Rainbow Coalition) in the European Parliament in Brussels, May 7-8, 1987. Dr Baetjer compiles measurements of radioactive contamination in food from many independent measuring stations in West Germany, at the Arbeitsgemeinschaft "Ökologische Forschungsinstitut", Hornerstr. 1, 2800 Bremen, FRG., Tel: 0421-76053.
10. Contact Ichiro Moritaki, Coordination Committee for the World Conference, c/o Gensuikin, Akimoto Bldg., 4F, Tsukasa-cho, Kanda, Chiyoda-ku, Tokyo, Japan 101.
11. Contact Kitty Tucker, Health & Energy Institute, 236 Massachusetts Avenue, N.E. Suite 506, Washington DC, 20002 USA.

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Books

The Prophet of Green Fundamentalism

BUILDING THE GREEN MOVEMENT, by Rudolf Bahro, Heretic/GMP, 219 pp, \$19.95

If Rudyard Kipling were alive today, he would find in *Building the Green Movement* a radical perversion of the Imperialist creed he espoused nearly a century ago in his now infamous poem "The White Man's Burden".¹ In the hands of Rudolf Bahro, that "burden" has, in many respects, been turned on its head and recast into a "decivilising" mission. According to Bahro, the West now bears the urgent responsibility of undoing the damage it has wreaked upon the peoples of the undeveloped and developing countries of the world, and upon the global environment, by dismantling its economic Empire and scaling down its industry and the arrogant, "exterministic" logic by which it has been driven for the last 200 years. And unlike Kipling's intended mission, Bahro's is one that must begin in the West's own backyard. Accordingly, his potential converts are not the "heathens" or poor folk of the Third World—Kipling's "sullen, silent" natives—but rather the passive consumers and producers of the rich, industrial nations of the First World.

Such is the urgent message of Rudolf Bahro, one of the more prominent and provocative figures associated with the West German Green Party and the prophet of Green fundamentalism. Having enthusiastically embraced the Green Movement immediately upon his release from prison in East Germany in October 1979, Rudolf Bahro has played a key role in forging a theoretical and practical bridge between environmental and socialist groups in West Germany. This was to contribute in no small measure to the welding together of the various local and State Green groups into a federal party—Die Grünen—in January 1980.

However, his theoretical contribution has come to represent much more than a simple revamping of Marxism to accommodate the environmental crisis. Although schooled in the Marxist tradition, Bahro soon confounded the expectations of its orthodox practitioners by abandoning many of its central tenets. For Bahro, the environmental crisis (of which the nuclear arms race is but one manifestation) is the quintessential crisis of capitalism. Contrary to orthodox Marxist theory, capitalist society will not come to an end via the intensification of the class struggle but rather by meeting *external*, natural limits. The institutionalised wage struggle has become part of the problem, part of the expansionary spiral of monopoly capitalism such that "the world-historical-mission of the proletariat" must now be declared obsolete. Indeed, Bahro has gone so far as to describe both Marxism and Socialism as mere quarries from which we may salvage some useful insights and theoretical tools but which must ultimately be abandoned in the interests of human survival and emancipation.

In particular, Marxists must rid themselves of the notion that the development of capitalism—and its handmaidens, science and technology—is the pre-condition for the free development of all members of society by creating more wealth for social distribution. Such a notion, Bahro argues, merely perpetuates the vicious circle of relative inequality, compulsive consumerism and the undermining of our biological support system.

No Compromises

Bahro's intellectual trajectory—which may be loosely summarised as a movement from critical Marxism to eco-socialism to Green fundamentalism—may be traced through his three previous English publications, beginning with *The Alternative in Eastern Europe*² (which led to his arrest and imprisonment in East Germany), and followed by *Socialism and Survival*³ and *From Red to Green*.⁴ *Building the Green Movement*, which is presented as a collection of essays, interviews and lecture notes written or recorded between November 1982 and June 1985, continues this development whilst at the same time marking a significant turning point in Bahro's career. Disillusioned with the parliamentary group's compromise approach on the question of animal experiments (which opted for a policy of strict regulation rather than an outright ban), Bahro publicly quit the party at its Hagen conference in June 1985, declaring that he would henceforth dedicate himself to extra-

parliamentary resistance. The party's policy was seen by Bahro as indirectly legitimising experiments on animals by introducing measures to prevent "superfluous" cruelty, thereby underscoring a mentality "by which the place of a living being on the evolutionary ladder determines which is selected first for torture". The party's draft proposal was thus a "cop-out" that not only failed to confront the power of the scientific establishment and the might of the wealthy German pharmaceutical industry, but also reaffirmed the pervasive European attitude of mind that sees humans as "the measure of all things and lords of all creatures". For Bahro, the animal experiments policy demonstrated that the party had become a counter-productive tool, "a trap into which life energy disappears". In his formal statement of resignation (which appears, appropriately, at the end of the collection of articles which comprise *Building the Green Movement*), Bahro makes it clear that for him the only proper space for a truly radical social transformation lies *outside* party structures and the traditional institutions of the State. Defending and extending this space in the form of "Liberated Zones", that is, a network of interlinked grass-roots communities, has become Bahro's major occupation.

Fundamental Change or Realpolitik?

Bahro's resignation from the party is perhaps the inevitable by-product of his own particular brand of Green fundamentalism, the animal experiment issue providing the proverbial last straw. Bahro's fundamentalist faction occupies one end of a number of spectrums within Die Grünen. From a tactical standpoint, the fundamentalists oppose any form of alliance with the SPD (Social Democratic Party)—now in opposition—on the ground that the SPD is no different from the more conservative CDU (Christian Democrat) government in its involvement in and dependence on a growth oriented economy. In short, Bahro's argument is that co-operation with the SPD is tantamount to co-optation by the industrial order. The bane of the fundamentalists are the Realpolitikers or pragmatists (many of whom are ex-SPD members), who argue that an alliance with the SPD is a necessary means of countering the mood of neo-conservatism which ushered in the present Kohl government, and of opening up the prospect of sharing the balance of power. Bahro, however, is uncompromising in his rejection of the Realpolitikers' coalition tactics and reformist arguments:

"... Realpolitik—and our groups concern themselves with little else—means that we try to make the dragon's armour-plating a little lighter, to clean his teeth and deodorise his bad breath and sort his excrement".⁵

Notwithstanding Bahro's criticisms, the Realpolitikers exert a considerable influence in a number of West German states, notably Hesse, North-Rhine-Westphalia and Lower Saxony, and in the parliamentary group. Moreover, the chief advocate of Realpolitik and main target of Bahro's invective, Joschka Fischer, has recently become the first member of Die Grünen to take on a ministerial portfolio. In the state of Hesse, where the Greens hold the balance of power, the SPD government (led by Holger Boerner) entered into an uneasy coalition with the Greens in 1985 and reluctantly appointed Fischer as the new minister for Environment and Energy.⁶ Fischer's handling of the portfolio may well determine the future direction of the Greens, who are presently divided over whether to go into coalition with the SPD and compromise the party's platform, remain a strongly principled minority party, or turn their backs on parliamentary politics altogether. Whether the Greens will resolve this dilemma before the 1987 federal elections remains an open question. Bahro, for his part, will no doubt take up where he left off in *Building the Green Movement* and continue his criticisms of the Realpolitikers from outside parliament in an effort to woo party members to follow his lead and build a Green resistance movement from "the bottom up".

Ending Industrialism

The conflict over parliamentary tactics embodied in the Bahro versus Fischer debate is a manifestation of a more fundamental division within Die Grünen on the question of the nature and direction of social change to be pursued. Here, Bahro's main foe is the eco-socialist faction, who favour a strategic alliance with labour and trade unions. For Bahro, however, the ecology crisis is the broader, overriding challenge. The project of the Green fundamentalists is to facilitate the demise of most of the environmentally destructive industries on which the unions depend:

"... it would simply be a further victory for the existing order if we let ourselves be pushed into giving priority to the fight against unemployment and social decline in the wake of the old trade union and left socialist defence strategies. We are not

here to defend or create jobs in the industrial system."

Bahro would prefer to see priority given to supporting workforce demands for the power to dispose of existing large-scale productive plants with a view to joining with the unemployed to work for a new social formation. According to Bahro, the initiative for real social change can only come from people and groups (such as the peace and environmental movements) who do not see themselves as buttressing any particular class interest or securing a sectional advantage over other groups or classes in society. Only a broad-based, popular coalition of individuals and grassroots groups who have experienced the contradictions of industrial expansionism can rescue humanity from the juggernaut.

Bahro paints with a very broad brush. His target is not just capitalism, but rather Western civilisation as it has developed in the last 200 years. And his call for a social transformation is accordingly total, reaching into the economic, political, social and, above all, spiritual domain:

"What is coming goes deeper than all the political and social revolutions Europe has seen since the transition from Antiquity to the Middle Ages. Radical ecology is only the external side of preparedness for this radical change."⁸

Forging New Communities

As a means of demonstrating the plausibility of his apocalyptic prophecy, Bahro has frequent recourse to the historical example of the collapse of the Roman Empire, which he sees as the only event that is comparable in dimension to what he foresees as emerging out of the present day crisis. According to Bahro, here was a pre-eminent example where *all* social classes turned their backs on the Empire and its wars, corrupt cities and destruction of nature in search of a new way of life in harmony with each other and with nature. No single class (least of all the proletariat) can accomplish such a total transformation. And just as the spiritually inspired monastic communes of the Benedictines were an answer to the total crisis that went before with the collapse of the Roman Empire, so too the establishment of spiritually inspired communes or Liberated Zones is the necessary alternative to the destructive expansionism, or "Extremism" as Bahro frequently calls it, of industrial society today. Establishing and extending a network of interlinked decentralised communities based on an "ecological cyclical economy"—employ-

ing a self-sustaining and environmentally benign as distinct from expansionary and environmentally destructive mode of production—is seen by Bahro as the only sure path that will solve the manifold crises facing the world today, which Bahro lines up along three major axes: Human vs Nature, East vs West and North vs South.

Such a path necessarily requires that the rich, industrially developed nations of the "North" disarm themselves, both militarily and industrially, in order to break down the lopsided relationship between their exploitative conurbations and the dependent peripheries of the "South". The path of reconciliation with the Third World and with Nature consists in our becoming "Third World" ourselves by scaling down our industry and consumption patterns. Industrial band-aids such as pollution filters and catalytic converters will simply not do.

The Need for Spiritual Awareness

Bahro's alternative scenario is one that gives top priority to introducing a personal/spiritual dimension into political activity:

"The entry into a different society which is on the agenda in the metropolitan countries can only be achieved via 'a journey into the interior'. A policy of conversion must begin there."⁹

The majority of West Germans are seen as having the material resources but not the personal motivation or the spiritual insight to disentangle themselves from the industrial system. Bahro suggests that a special initiatory role will therefore fall to the spiritual community to provide the "psychological preparedness for the departure into new contexts of life."

The "spiritualisation" of politics and the politicisation of spirituality is a central theme in Bahro's writings. Political activity which seeks to ward off crises such as the nuclear arms race, mass starvation in the Third World or environmental destruction will not bring about a lasting solution unless we can also gain insight into the "impotence/omnipotence dynamic in the human psyche" (an interesting concept that Bahro does not satisfactorily enlarge upon). Nor will withdrawal from the world on "some selfish neo-religious trip" serve to dismantle the concrete problems facing the world today. What is needed is a synthesis between "the street-fighter and the hermit in the white empty room", which presupposes a co-operative and supportive community context. Enter again Bahro's Liberated Zones.

Bahro draws his own spiritual inspiration from a wide range of tra-

ditions and religious figures, including the personal example and teachings of Christ, Buddha, Lao Tzu, Thomas Munzer, St Francis of Assisi and the Hopi Indians. He is also considerably intrigued by the success of the Rajneeshpuram experiment in Oregon, USA, and the "inward journey" that the guru Bhagwan Shree Rajneesh has appeared to provide so many West Germans. Bahro has declared, however, that the "Indo-American cultural form" existing in Rajneeshpuram (as it then was) is not a solution for West Germany. He would prefer to see a remobilisation of the Christ tradition (as distinct from the Church and Christianity) of responsibility towards the world which would bring about a synthesis of the personal journey of the *sannyasins* (of which there are 50,000 in West Germany, according to Bahro) and the political activities of the West German Greens (of which there are only 30,000). In Bahro's world, there would be no more navel gazing and no more activist burnout.

Fire and Brimstone?

In assessing Bahro's fourth book, it is well to recall E. P. Thompson's observations, in his preface to *Socialism and Survival*, that Bahro came from East Germany "with a prophetic sense of urgency, and by deliberate choice he allowed himself no time for 'rehabilitation' or reflection". He chose to think in public and on his feet.¹⁰ *Building the Green Movement*, which continues the loose, programmatic style of *Socialism and Survival*, must also be appraised in this light. The reader may therefore experience a degree of impatience with the repetitive and occasional rambling nature of this recent collection of writings. But then again, it does not purport to be a dispassionate, tightly woven academic treatise. It is a living record of the campaigns—some would say sermons—of a committed Green prophet whose primary and urgent goal must be seen as the building of a Green Movement with hegemonic aspirations via a kind of neo-religious conversion or personal awakening.

Doubtless there are many who will find the Gospel according to Bahro too hard to swallow. This may, in part, be due to his style and mode of address, which, to press the missionary metaphor a little further, occasionally assumes the form of a fire-and-brimstone sermon. And there are many who, for whatever reason, will not share his pessimism and sense of urgency and will therefore find themselves either unmoved or uncomfortably blackmailed by his major technique of persuasion,

"What is coming goes deeper than all the political and social revolutions Europe has seen since the transition from Antiquity to the Middle Ages"

which is to remind us that the nuclear sword of Damocles is hanging above our heads, that it is "five-minutes-to-midnight".

But one ought not to be turned away by the form and style of *Building the Green Movement* and so overlook the substance of Bahro's message and the consistency with which it is maintained. Both Bahro's critique and vision are extraordinarily broad. He has thrown down a significant challenge to contemporary social and labour movements by introducing a number of new coordinates to the political map in an attempt to revolutionise our political priorities. By shifting the emphasis away from the national distribution struggle to the global stage—to the East/West and North/South conflict and, above all, to the environmental crisis—Bahro has made the priorities and national campaigns of the union movement and many work-a-day environmentalists in the so-called First World seem short sighted and parochial. It is because Bahro's critical orientation is not rooted in any particular class or sectional group that he is able to mount such a full-scale critique of modern industrial society and conceptualise, by way of an alternative, an innovative new hegemony. Bahro's Liberated Zones are not simply refuges of support for alienated minorities but rather his solution for the whole of society.

Bahro draws upon many of the ideas of the Italian political thinker Antonio Gramsci. The term "hegemony" is employed here in the Gramscian sense to mean that body of ideas that enjoys political and ideological ascendancy at a given period in history.

Far Reaching Critique

Bahro's far-reaching critique may, however, also be his downfall. His bold and uncompromising call for nothing less than a massive rupture in the continuity of the European way of life and a re-examination of our entire Western heritage is likely to be dismissed as faintly comical, as throwing the baby out with the bathwater. This is not to say that Bahro does not make some telling points in his analysis, but rather to wager that he will engender more psychological resistance than spiritual awakening as audiences begin to grasp the magnitude of the changes

he is asking them to make. Bahro's impatient exhortations have made no attempt to deal with the human need for certainty, security and continuity—needs which are likely to remain significant obstacles to the wider acceptance of "Green ideas".

Bahro also refuses to present us with an easily identifiable class against whom we can pin the blame for our global predicament, for he insists that we are all implicated in the Industrial Goliath and are therefore all accomplices to the "crimes" it has committed in the name of technological innovation and economic growth. On this point, I would agree with Bahro, although he does tend to overlook the fact that there are degrees of blame, which ought not to be uncritically apportioned according to one's degree of dependence on the Industrial Order. Bahro's apparent lack of concern for the immediate fate of the employees in the many large-scale industries he would like to see dismantled will only serve to entrench their efforts to protect their jobs in the absence of an *employment* alternative, at least as a transitional measure. And Bahro's insistence that there is only *one* path—his path—out of the industrial maze via the route of extra-parliamentary resistance, is more than a little dogmatic.

Whatever Bahro's shortcomings, he has presented the Green Movement with an important sense of long term direction through his own powerful, mobilising vision of decentralised communities. And from his extra-parliamentary pulpit, he will, no doubt, remain an important thorn in the side of both the Realpolitikers and eco-socialists and a continual reminder to other party members not to lose touch with the needs and ideals of the party's grassroots base.

Robin Eckersley

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Twisted Roots

THE ROOTS OF MODERN ENVIRONMENTALISM, by David Pepper, Croom Helm, London, 1984, (pb 1986), £9.95.

Notoriously, human nature is such that people tend less to base their beliefs and attitudes on established facts, than to establish facts in accordance with their beliefs and attitudes. Therefore, argues David Pepper, desirable attitudinal changes towards the environment will not be achieved by merely appealing to facts; we should rather develop a historical and philosophical perspective on how we and others have arrived at our present set of attitudes and beliefs, and through the insights gained by such an understanding, we will be in a better position to work towards bringing about the attitudinal changes we think desirable. By exposing, examining and challenging the unconscious or semi-conscious assumptions of different ages, including our own, we lay the foundations for affecting radical change in our present and future relationships to nature. In the words of Bertrand Russell, whom Pepper quotes, we need "to exercise our historical and psychological imagination in order to enlarge the scope of our present thinking."

Dividing modern environmentalists into "technocentrics" and "ecocentrics", Pepper analyses the historical roots of both attitudes. One of the characteristics of technocentrism is its faith in the discoverability of wholly objective, universally valid scientific truths—a faith which springs from the revolutionary approach to nature forged by the mechanistic scientists of the 16th and 17th centuries: Kepler, Galileo, Descartes and Newton. Connected with this is the optimistic belief in progress, made possible by an elite of scientific experts which, through the accumulation and utilization of scientific knowledge, guides the fortunes of both man and nature towards the maximization of the human good. Implicit in the belief in progress-through-science, the genealogy of which stretches back to Francis Bacon, is a homo-centric, managerial attitude to nature. By placing the ideas of modern technocentrics (like Kahn, for instance) in this historical perspective, a certain insight can be gained into their cultural and psychological "mind-set". In contrast to technocentrism, ecocentrism lays emphasis on the intrinsic value of nature; and, in place

of the exploitative relationship implicit in the technocentric view, espouses the virtues of living in harmony with our natural environment. The roots of ecocentrism Pepper traces to the Romantic movement of the 18th and 19th centuries; to Byron and Shelley, Keats and Wordsworth in England; Thoreau and Emerson in the USA.

Neither technocentrism nor romantic ecocentrism find favour with Pepper. If technocentrism is ecologically disastrous, then romantic ecocentrism is too superficial and politically naive to affect real change. Modern ecocentrism requires a solid scientific base, but one which is liberated from the constrictive assumptions of technocentrism. Such an ecocentric science Pepper sees in the "systems" approach of von Bertalanffy, and more recently advocated by Fritjof Capra. Despite the dangers of reductionism in some mechanistic systems theory, a real alternative to technocentric science is to be had in the von Bertalanffy-Capra organic systems model, which is holistic, non-determinative and able to integrate the self-organising, self-transcending human organism.

But the redirecting of science towards organic systems theory is not by itself enough to ensure ecological stability. After a disappointing discussion of scientific epistemology, in which Pepper gives an almost totally inaccurate description of phenomenology, we come to the crux of his argument. This is that scientific knowledge in any form (whether technocentric or ecocentric) is pervaded by ideology; ideology is influenced or determined by economic and social factors; and so ultimately our consciousness of nature (including attitudes, values, etc) can only be changed by changing the economic and material conditions of our existence.

The premise of this argument is, I believe, essentially wrong, although it represents a partial truth. Of course science is a social activity, and it is possible to find many examples of supposedly neutral, value-free, and objective scientific analyses employed to support the vested interests of minority power-groups. But it is absurd to characterize all scientific knowledge as ideologically biased. It is also unfortunate that, through his misunderstanding of Husserl's phenomenological method, Pepper is unable to appreciate one viable method of accomplishing the needed change in our consciousness of nature that does not require us to wait for a prior overturning of the social order, but which may nevertheless have consequences which spread into the economic and social spheres.

From the Marxist standpoint

which Pepper adopts, the central problem of epistemological dualism, which we experience in our sense of being onlookers upon nature, is redefined in economic and political terms. Since human beings are definable as economic producers, and since nature is simply definable as the realm in which human beings are productively active, it follows that given the right mode of production, our consciousness (and hence our science) of nature will be "right"—that is, liberated from the clutches of the mechanistic-dualistic-exploitative paradigm (associated with capitalist modes of production) to become organic, holistic and environmentally harmonious (under socialist modes of production).

In a word, the answer to our ecological problems is *not* to de-industrialize, for industry is the middle term between nature and man, by which each has its existence. Indeed, the full development of productive forces is required for the realization of the potential of both human beings and, by implication, the natural world. The environmental crisis, and its accompanying crisis of consciousness, is due not to industrialism but to the *capitalist* form of industrialism. Once we change this form of economic organisation to a socialist industrialism, our relationship to nature will be healed and ecological harmony restored.

Pepper castigates romantic ecocentrics for failing to appreciate the dialectical movement of history enunciated in historical materialism, and for trying to "put the clock back" to some form of idealized primitive social organisation. Ecocentrics in general are accused of political naivety, since not only do they campaign for change within the

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existing political framework (instead of realizing that the problem is the existing political framework), but they have failed to grasp the essential truth that consciousness is determined by the economic and social forms of organisation and not vice versa: in other words little or nothing will be achieved by merely "spreading ideas". Finally, and most seriously, the political naivety of ecocentrics extends beyond their ignorance of the central importance of class conflict in bringing about changes in our relationship to the environment; Pepper suspects that "apolitical" environmentalism is itself a reactionary, middle-class/capitalist movement in which these classes are simply seeking to defend their own interests.

There is much that is thought-provoking in Pepper's Marxist critique of ecocentric environmentalism, and it is a useful contribution to the dialogue between Marxists and environmentalists. But the strictures which Pepper directs at the Green movement should not distract us from the internal tensions in contemporary Marxism which they conceal. Marxism is essentially posi-

tivistic and technocentric: Marx sought to unveil scientific laws operating in the economic and social spheres and his overall outlook was that of a severe scientific materialist. Likewise, he believed unquestioningly in industrialism and industrial expansion. How to hold on to these tenets of the Marxist credo while adequately addressing the environmental problems—and problems of consciousness—which we now face, is a formidable task.

If, to his own satisfaction anyway, Pepper accomplishes this task, he does so only by revealing the metaphysical chasm that separates Marxism from the Green movement. Despite the relative value of the Marxist diagnosis and prognosis, to the romantic ecocentric it seems philosophically reactionary, psychologically shallow and politically outmoded. It is also hard to see how it is not also inherently anti-ecological. Philosophically it is reactionary because of its uncompromising materialism; what is "real" for the Marxist is only what is material, or an epi-phenomenon of the material. Hence Pepper can say: "In reality, modern science has removed any validity from the childlike perception of nature inherent in romanticism". The "adult" Marxist must crush that tentatively emerging faculty of imaginative vision by which the romantics achieved their glimpse of realities transcending those of the merely economic and material order. For the human being is defined in terms of his material existence as "Homo economicus"; our cognitive capacities curtailed, the epistemological relationship to nature is crudely reduced to a function of the economic relationship. Nature is deprived of any identity outside the secular framework of economic activity.

It is precisely this degradation of both human beings and nature to the economic level, as partners in "production" (the only thing which seems to have ontological status in Marxist metaphysics) that is so patently anti-ecological. For it leads to the view that the realization of human potential—and, bizarrely, nature's potential also—is accomplished by continued and indefinite industrial expansion. No matter if the forms of production are socialist, Pepper fails to convince the reader that socialist industrial expansion is necessarily less exploitative of nature than capitalist industrial expansion. Furthermore, the Marxist model of human nature, which assumes that our psychological well-being is directly correlated to our economic activity, lacks real depth. While it is true that our consciousness, attitudes and assumptions may to some extent be

tied into the mode of production we engage in, there are vast areas of human psychology which lie beyond the range of the Marxist model of the human soul, which is viewed as a kind of bi-product of our material existence.

Finally, despite many valuable insights in the Marxist political analysis, the monolithic division of society into mutually antagonistic classes, into which the individual vanishes, is fundamentally at variance with the ecological perspective which, for example, Roszak (beloved of the Greens, and, oddly, ignored by Pepper) has argued is personal and anarchist, taking its stance beyond the 19th century class divide.

The roots of modern environmentalism are not simply economic and social; militant class conflict and the establishment of socialist forms of production will accomplish nothing if inwardly people remain imprisoned within the confines of the secular, materialistic world view which Marxism assumes.

Jeremy Naydler

Politics and Climate

CLIMATIC CHANGE AND WORLD AFFAIRS, Sir Crispin Tickell, University Press of America, 1986, £7.95.

Sir Crispin Tickell's short treatise on the relationship between climatic change and human activities divides the subject into three parts: an account of theories of climatic change; a look at the human responses to it; and a proposal as to how it might be monitored, controlled and even mitigated. The book provides us with an informed, well argued and realistic assessment of the impact of climatic change, along with some constructive suggestions as to how its consequences might be tackled.

The first part of the book presents a clear and wide-ranging account of the various causes of climatic change. There are, firstly, changes which are the result of solar and galactic activity but whose effects are remote and measured in geological time. Secondly, there are climatic changes resulting from terrestrial activity such as volcanoes, continental drift or any change in the particular configuration of land, sea or ice. Thirdly, there are the man-made causes: the build-up of the greenhouse gases, deforestation, large irrigation schemes, nuclear tests and so on. What this comprehensive review accomplishes is to make us realise that we live today, as Tickell puts it, in a "tiny, damp,

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curved space at a pleasantly warm moment," and that an apparently trifling fluctuation of 0.5°C in average world air temperature over 200 years, for example, could spell disaster in terms of weather conditions.

Throughout the book, Tickell laments the gap between the political timescale in which most decisions are made and the climatic timescale in which events threaten nonetheless to impinge very directly on our lives. As he explains, "No responsible and, still less, elected government could lightly sacrifice a short-term and direct advantage in terms of wealth and employment for its people to avoid a long-term indirect and uncertain advantage for the human race or life as a whole."

Parallel to this frank no-nonsense approach, he discreetly questions the ethics "of fouling the future for the sake of the present". He quotes A.V. Hill: "If ethical principles deny our right to do evil in order that good may come, are we justified in doing good when the foreseeable consequence is evil?"

It is with this realistic outlook that he turns to consider (and endorse) the necessity for an international agreement on climate. Climate is almost by definition international. The Soviet scheme to divert the Siberian rivers, for example, threatened to affect the climate well beyond its national boundaries. But Tickell is well aware that agreements when they occur are often cosmetic in nature. He also realizes that the agencies appointed to enforce such agreements are either incapacitated by inadequate funding or adept at avoiding firm conclusions, or both.

He therefore suggests a modest approach based on consensus rather than constraint. This agreement would fall into three parts: the first part would cover all major experiments undertaken to test the behaviour of climate or that might inadvertently do so. Such an agreement would generally monitor rather than restrict experiments. A second part would cover all actions intended to change global, regional or local climate or that might inadvertently do so. Because, inevitably, there are activities which certain governments would not want to see included, the third part of the agreement would represent a kind of "voluntary code" of good climatic behaviour. Tickell rightly insists that it is in the interests of all to attempt to reach such an agreement and he commendably appeals to the better natures of the world's governments to make a move in that direction.

Alexander Goldsmith



Letters

The Hastings Fluoridation Experiment: Postscript

Dear Sir

The following are minor corrections to our article in Vol. 16 No. 6 1986. They do not affect the validity of its findings. On page 246:

1. *First paragraph, last two lines:* Replace "13 per cent" by "16 per cent" and "2 per cent" by "less than 3 per cent".
2. *Caption under Figure 2, 5th line:* The words "consumed fluoridated water throughout life" should read "consumed the city's water throughout life". *Next line:* Change "259 (5-year)" to "259 (6-year)".
3. *Second sentence of paragraph headed "Napier Reduction":* Delete words "Only the 1957 results of those surveys seem to have been published" and add to reference: *Australian Dental Journal* Vol. 8 p109.
4. *Page 247, 17th line:* "the entire 5-year-old population" should read "the entire pre-school population".

Various criticisms of our article have been made. None have offered an explanation for the inexcusable omission, from all published versions of the Hastings study, of any reference to the pressure applied to staff of the School Dental Service, in Hastings only, to lower their diagnostic standards from those practised at the commencement of the study and in the rest of New Zealand. As was pointed out in our article, the resulting "spectacular" reductions in fillings in Hastings were claimed to be caused wholly by fluoridation. We answer some of the criticisms:

- 1) *The New Zealand Department of Health claims that the diagnostic control problems experienced related only to occlusal (biting) surfaces of molars (back teeth), and that diagnostic criteria for smooth tooth-surfaces ("approximal" or between teeth and "gingival" or near-the-gums), which were the surfaces most affected by fluoridation, were not changed.*

Answer: The claims of "spectacular reductions" caused by fluoridation, in Health Department press releases between 1958 and 1965, were for the 6- and 7-year-olds' occlusal surfaces of molars. Only later was it claimed that smooth tooth-surfaces showed the greatest reductions. The Health Department in effect admits that its earlier claims were untrue and exaggerated. Although Tables 1 and 2 in our article applied to occlusal surfaces of molars, the reports

in the released files from which we quoted, as well as other reports, make clear that the diagnostic change applied to all fillings. In a letter to one of us Brigadier Fuller, chairman of the committee directing the experiment, wrote: "We had set out to replicate the North American studies and on their advice had adopted their diagnostic criteria and protocol, especially the diagnosis of caries which necessitated, ipso facto, the cessation of fillings in teeth that were not carious." The stage at which a tooth became "carious" was, of course, debatable at that time, as it still is.

- 2) *An Australian academic claims that the "lag period" for decay reductions in children older than 8 years shows that the school dental operators could not have obeyed instructions to stop filling doubtful cavities. If they had, he claims, the reductions would have occurred from the start in the 9- and 10-year-olds also.*

Answer: It appears to us that the lag period which occurred for the older children strengthens rather than weakens our finding that the big reductions were due mainly to the change in diagnostic standards. The lines in our Figure 1 do not connect the same groups of children, as in Figure 2. The first age groups to show big reductions were the 5- to 8-year-olds of 1957. These children were 2½- to 5½-year-olds in 1954, with no permanent teeth, so unlike the older children most of their fillings had been placed under the new diagnostic standards. These reductions continued as the pressure to lower diagnostic standards intensified after 1957. By 1959, the 9- and 10-year olds had also received most of their fillings under the new criteria, so also showed big reductions. Most cases of very big reductions, beyond the "limit of credibility", are explained by the change in diagnostic procedure. Exceptions are the big reductions after 1961, for 6- and 7-year-olds, who by then had all received fillings after the change in diagnostic standards. But these reductions could not have been caused by fluoride, because the groups being compared had all received maximum (life-long) exposure to fluoridated water.

- 3) *The above critic also criticized our Figure 3, for Napier reductions, on the grounds that the samples were too small to be meaningful.*

Answer: They were small because only a few records are still available for Napier. The Figure suggests the decline started in Napier much earlier than the brief period between 1955 (when Napier decay was already lower than in Hastings after two years of fluoridation) and 1961. The same finding from early clinic records was reported to the 1957 Commission of Inquiry by Ludwig, author of the Hastings study, who believed that a soil factor was responsible. In the later brief period less pressure appears to have been applied to school dental operators in the control town of Napier. Ludwig's letter, reporting on which Hastings operators were and were not "co-operating", contains no mention of Napier although the letter was written after the 1957 examinations but well before Napier was abandoned as a control.

- 4) *Both the above critics disputed the relevance and validity of our 5-year-old national dental statistics.*

Answer: We presented the figures for that age group because it is the only one for which such continuous national sta-

istics have been kept in New Zealand. The statistics were mostly from very large samples, from the population of 5-year-old new dental clinic patients. Much smaller samples have been used in most fluoridation studies. Statistics from eight countries show that reductions in tooth decay of older children also occurred without fluoridation (*Nature* Vol. 332 p125).

5) *One critic ridiculed our statement "It was alleged by opponents that fluoride must have damaged Hastings childrens' teeth".*

Answer: Analysts' reports and correspondence in the files reveal that, contrary to the Commission of Inquiry's report, water fluoride levels in the early period of fluoridation, before the commencement of the study, were occasionally very high, from 4 to 8 parts per million, and that intermittent overdosing continued well beyond that early period. Yet the Commission had discounted complaints of fluoride-induced ill health by 38 Hastings citizens, stating that "their disorders were not due to the fluoridated water at Hastings but to their acceptance of inaccurate and misleading information on the subject" (page 114) and "in some cases they have been affected by the nature of certain propaganda to which they have been subjected" (page 116).

6) *All critics defended the Hastings study on the grounds that its findings were consistent with fluoridation studies in other countries.*

Answer: We agree about the consistency. Our article showed one way that such consistency was achieved. Fluoridation studies in other countries have recently been criticized (*Nature* Vol. 332 p125 and Vol. 324 p298, *Search* Vol. 17 p256, *Fluoride* Vol. 14 p123) and are now also suspect.

Yours faithfully,
John Colquhoun and Robert Mann,
Auckland, New Zealand

Fluoride: The Official Case

Dear Sirs,

The anti-fluoridationist articles in *The Ecologist* (Vol 16 No 6) are a *pot pourri* of what they have been saying for years. I suspect that their recently increased tempo and frenzy is born out of sheer frustration at not getting over their message in the UK.

In recent years they lost the Strathclyde legal case (1978-1983) on the safety and efficacy angle. They failed to stop the Water (Fluoridation) Bill 1985 and failed to introduce any of their wrecking amendments in spite of their strenuous efforts. Further they have failed to sway national public opinion in the UK: in the latest 1987 national opinion poll by Gallup only 15 per cent disapprove as against 76 per cent who approve, a degree of approval reflected in every stratum of society and in every region. If the proponents of water fluoridation had repeatedly failed in this way we would be similarly despondent.

One reason for their lack of success is their failure to understand that not all research reports are of equal standing. We do not have to rely on researchers of yesteryear. One of your correspondents has been beating the drum about errors and omissions in fluoridation studies for

decades. He had every opportunity to present his case to the judge in the Strathclyde case and this he did. The judge summed up his accusations as follows: "... in a perfect world each study might have been carried out in a more perfect manner in one or two details ... nevertheless ... the message is loud and clear from all parts of the world. Water fluoridation reduces the incidence of caries."

Another reason for failure is their inability to distinguish between the extremes of fluoride ingestion and water fluoridation at a level of 1 ppm F. There is no argument about health hazards induced by ingesting high levels of F, but this is not the topic under discussion. The question which needs to be addressed concerns the efficacy and safety of water fluoridation.

On the question of efficacy we do not need to rely on the inadequate studies of the past. There has been a host of studies since the early days of investigation, carried out by people independent of each other in varying circumstances in different parts of the world. The one consistent finding is the inverse relationship between fluorides in drinking water and the prevalence of dental caries. To deny this is to deny the truth.

On the question of safety the most telling single fact is that there has been no evidence of ill health due to fluoridation after over 40 years' experience in Grand Rapids, USA. If there had been, the health authorities would have vetoed fluoridation years ago.

Dental fluorosis and skeletal fluorosis loom large in their list of dangers. Dental fluorosis is an extreme condition of dental mottling which in turn has a large number of causes. In the UK the prevalence of dental mottling in a non-fluoridated community varies between 20-50%. In a fluoridated community the prevalence and distribution of mottling is effectively the same as in a neighbouring non-fluoridated community. This is not dental fluorosis. I state quite categorically that fluoridating a water supply at 1 ppm F in a temperate climate does not increase the level of mottling over and above that normally expected. Under these conditions skeletal fluorosis does not exist. Your correspondents are quite wrong in raising these two spectres.

And now to the question of big business which is implied to control fluoridation advocacy like a puppet on a string. The British Fluoridation Society has no commercial connections of any kind and has never been approached by big business. All council members give their services voluntarily.

To suggest that endorsing bodies like the AMA, the BMA, the RCP and the USPHS to mention a few, cannot make judgements on water fluoridation because they have not carried out "... any comprehensive research into the safety of the free fluoride ion in a living organism" displays ignorance of how peer judgements are made. These bodies consist of many people who have actually carried out fundamental research but apart from all this, good scientists are quite capable of making peer judgements on research not directly in their own discipline. It is clear that after due consideration the scientists within these bodies reject the kind of evidence to which your correspondents refer. Because of this they are dubbed as ineligible to make a judgement: this

illuminates the way their corporate minds work.

Yours faithfully,
Professor D. Jackson
Chairman
British Fluoridation Society
London, UK

Eucalypts—another view

Dear Sirs,

In a recent issue of this journal (Vol 16, 4/5), Nicholas Hildyard reviewed a book by Shiva and Bandyopadhyay which critically examined the cultivation of eucalypts in India. I have not yet obtained a copy of the book to study in detail but I would like to comment generally on several matters raised by this review.

Firstly, the genus *eucalyptus* contains in excess of five hundred species which, with a few exceptions, are indigenous to the continent and coastal islands of Australia. Species of eucalypts grow in forests, woodlands and savannas throughout the continent in environments ranging from semi-arid to subtropical, and coastal to sub alpine.¹ Not surprisingly there is great variation in morphological and silvicultural characteristics both between and sometimes within species. For this reason it is necessary that a species is correctly identified before its performance can be compared with that of another in either the same or a different genus. I am concerned that the article presents broad generalizations about *eucalyptus* without reference to the particular species involved, possibly drawing the reader into misleading comparisons.

Readers of the article who are unfamiliar with Australia could also gain the impression that eucalypts are confined to the moister and more fertile regions on the margin of the continent. This is in fact not the case and eucalypts occur in semi arid areas throughout the continent, not necessarily being confined to watercourses. For example, woodlands dominated by eucalypts were widespread throughout the southern corner of Western Australia in areas with an annual rainfall of only 250-300mm (10-12" approx).² Sadly much of this fine woodland has been lost to agricultural clearing. Extensive areas were also cut over to provide timber and fuel wood for goldmining settlements. Despite the low rainfall and the regular extremes of temperature in these areas most cutover stands have regenerated naturally and now carry fine regrowth—a credit to the resilience of eucalypts in their natural environment.

The question of water use by eucalypts provides an interesting contrast between the environmental problems in rural India and those in the agricultural areas of south western Australia. While the high water use characteristics of eucalypts are seen as a serious environmental problem in India these same characteristics have helped to maintain the quality of water in Australia. Where deep rooted native vegetation dominated by eucalypts has been replaced by shallow rooted agricultural crops the level of saline groundwater has progressively risen causing salt scalding of low lying land and release of saline water into streams. Probably the only long term solution to this problem is to replant at least a portion of the land with deep rooted tree crops.

In conclusion I would certainly support the principle that native species should be favoured when they provide the most appropriate solution to environmental problems. I hope my comments may prevent readers from developing inaccurate, and perhaps unfair impressions about the versatile and fascinating eucalypts.

Yours faithfully,
Lachlan McCaw
Manjimup, Western Australia

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1. Boland *et al* *Forest trees of Australia* Nelson, CSIRO, Melbourne, 1984.
2. G.M. Chippendale, *Eucalypts of the Western Australian Goldfields (and the adjacent wheatbelt)*, Australian Government Publishing Service, Canberra, 1973.

Transmigration and The New Tribes Mission

Dear Sir,

I was pleased to receive recently a copy of *The Ecologist* (Vol 16 No 2/3 1986) dealing with Indonesia's transmigration programme. However, I would point out some inaccuracies which detract from the balance, accuracy, and fairness one should see in your journal.

The vigorous promotion offered by central Indonesian government to missionary organisations might have been true in the past but for this decade at least new missionaries are not welcomed and are refused visas. (p.96)

The New Tribes Mission to the best of my knowledge does not work in West Papua—although it does work elsewhere in Indonesia.

The Summer Institute of Linguistics, by the nature of its contract with the government, cannot undertake proselytising activities and I have not read of any report, as yet, emanating from Indonesia that they are undertaking "forced conversions". (p.96)

How easy is it to visit transmigration projects in Indonesia—does one need special permission etc? Has the recent drop in oil profits caused any reduction in the size of the transmigration programme? Have your efforts to make such organisations as the World Bank aware of what they are doing in providing funds for such programmes brought any change in subsistence or attitude?

Yours faithfully,
M. J. Webb,
Aberdeen
Scotland

The Amish and Taoism: A Meaningless Comparison?

Dear Sirs,

I have seldom read anything quite so ridiculous as Thomas Foster's comparison of Taoism and the Amish (*The Ecologist* Vol 17 No 1). Any person can compare any two systems of thought from anywhere in the world and still manage to find similarities, as well as elements of environmental awareness.

Merely acquire a superficial knowledge of the systems, scrape and glean

selected quotations from each, studiously avoid or gloss over any which contradict your argument, twist and stretch the interpretations mightily to fit, and voila! Your name in print!

One could write a convincing comparison, for example, of the similarities between the Amish and Communism, but I don't think it would go down too well with either party. Furthermore, what would be the point of it?

I read Mr Foster's article because it was in *The Ecologist*; therefore, I assumed it must be meaningful and/or relevant to ecological issues. It is neither. He makes only 3 brief references to the environment: first, that the Amish foreswear technologies deemed a threat to the environment (p.1), which he supports by his third reference (p.11) in which he attempts to portray them as organic farmers (they are not). His second reference (p.10), that the Amish have "a reverential attitude toward nature", he supports by the statement that half of them are farmers (a most feeble and dubious connection!).

Considering the other excellent contributions on such vitally important issues as Transmigration, dams in Chile, and environmental movements in India and Mexico, I must ask: should *The Ecologist* really be devoting valuable publication space to this load of old waffle?

Yours faithfully,
Barbara A. Nest
London, UK

Thomas Foster Replies

Dear Sirs,

Barbara West, in criticising my comparison of the Taoists and the Amish, asserts that anyone "can compare any two systems of thought from anywhere in the world and still manage to find similarities, as well as elements of environmental awareness."

She further questions the point of making what she considers to be such far-fetched comparisons and implies that the article is irrelevant to ecological issues.

In reply, I will first assume that Ms West has no quarrel with the ecological *ethos* and environmental concerns expressed in the writings of the early Taoists. As for the Amish, my article suggested that the culture and organisation of their small, sacred communities also closely approximate the ecological ideals set forth by E. F. Schumacher in *Small is Beautiful*.

In other words, the contemporary Amish provide a working model of an extreme, conservator-oriented society that embodies values and practices which many people in the modern world regard as being utopian and practically impossible. If only for this reason—that they provide a valid demonstration model of a conservation-oriented society—the study of the Amish becomes ecologically relevant.

More specifically, Amish society, like Schumacher's ideal society, utilises appropriate technologies, avoids consumer-oriented education, has escaped from fossil fuel dependency—and structural unemployment—and is democratically self-governing. In fact, Kiman Valaskakis, a Canadian scholar, in reviewing several models of conservator-oriented societies, concluded that the purest examples of such would corres-

pond to Schumacher's notion of the "frugal community".

Valaskakis then went on to describe how the Hutterian Brethren, a "plain" Anabaptist sect that is theologically and culturally related to the Amish largely fulfills the requirements of Schumacher's model in the real world. In a similar vein, John Hostetler, a leading authority on the Amish, has commented, "The Amish practise the ideals so ably presented by E. F. Schumacher in *Small is Beautiful* though neither seems to have found the other."

Three years ago hundreds of Ohio Amish from the Geauga county settlement attended public rallies to protest the proposed construction of a series of 345,000 volt electrical transmission towers across some of their prime farming lands and maple sugaring areas. The proposed towers would have transmitted electricity from the Perry nuclear power plant, located on Lake Erie, to a substation situated some fifty miles due south. In defending the Amish position in court, Professor John Hostetler successfully argued that, if built, the transmission towers would have entailed more than an economic injury to the Amish, they would, as well, have constituted a "symbolic intrusion" into a culture that places a high spiritual value upon the land and nature and which rejects most of the values and technologies of modernity.

Finally, of Amish farming practices, one may cite the works of the late pioneer organic farmer Louis Bromfield, who greatly admired Amish soil-building techniques and the commitment of the Amish to soil replenishment and conservation. There are also the writings of Wendell Berry, a leading author on ecological topics, and a well-known practicing organic farmer, who singled out the Amish as being the only modern people who are "true masters of technology". Wrote Berry, "They alone, as a community have carefully restricted their use of machine-developed energy... they have mastered one of the fundamental paradoxes of our condition: we can make ourselves whole only by ac-

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Yours faithfully,
Thomas W. Foster
Assistant Professor of Sociology,
The Ohio State University.

References

- Wendell Berry, *The Unsettling of America: Culture and Agriculture*, New York, Avon Books, 1978.
John A. Hostettler, *Amish Society*, Baltimore, Johns Hopkins University Press, 1980.
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Saving the Bumblebee

Dear Sirs,

In recent weeks (and over past years) whilst walking from Beeleigh's countryside to the little town of Maldon, in Essex, I frequently have to stop and render assistance to Queen Bumblebees, also their worker-bees, who have been stunned by passing cars and other road vehicles. Along just a two-mile stretch of road, I recorded 33 bumblebees either dead or needing assistance.

To help these industrious creatures of Nature's wonderland (some bumblebees have been known to carry in their pollen baskets 60 per cent of their own weight) I gently lever the insect onto my fingers, then taking the bumblebee well into the grass verge, or perhaps to a nearby wild flower. Incidentally, I have never been stung, even when for observation purposes, in close proximity to a colony or nest of them.

Alas, latter years have found the bumblebee yet another endangered species of our living countryside, but as I have indicated, we as individuals can help. Practical conservation measures may include; (i) the creation of miniature garden nature reserves, (ii) caring for certain stretches of roadside-verge, and (iii) persuading farmers to leave hedgerows, and wild flower areas on the perimeter of fields.

There are eighteen species of bumblebee, beautifully coloured black with yellow, red or white. They live in small colonies underground, in nests of grass and leaves. However, the continued loss of habitat, together with the use of spray chemicals for almost anything that moves, is gradually leading to the demise of one of Britain's most important pollinating insects of the wild.

In conclusion, I hope that many people will join with me in my campaign to save the bumblebee.

Yours faithfully,
John Lodge,
Director & Projects Leader,
The British Wildlife Society,
Wildexplor (junior explorer) Projects,
Maldon, Essex.

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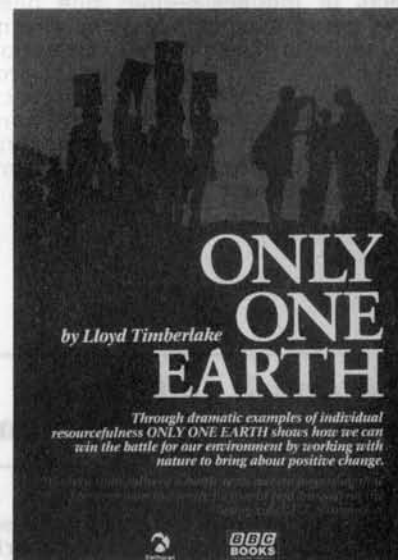


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LANCASTER EARTHCARES FESTIVAL, 24–31 August 1987—European Year of the Environment. A dozen or so local people from all walks of life have initiated the programme which has already attracted participants from industry, education, the arts, the media, countryside organisations and many charitable groups.

The events include a series of films at the Dukes Playhouse, practical activities, games and workshops, a Health and Environment conference, a nature conservation organisations' marquee, exhibitions, a multi-media installation involving local children, guest speakers, demonstrations of local Earth-caring industries and an open-air interfaith service. For further details contact: Chris Whitehead, Earthcares Publicity, 25 Gerrard Street, Lancaster LA1 5LZ.

HUMAN SCALE—Education Conference 4, 5, 6 September 1987 at Oxford Polytechnic. A new movement has been launched to promote the principles of human scale in education. Speakers include Tim Brighouse, Dr Fred Koury, Dr Clare Burstall, Dr Mart Petri, Stephen Rowland, Andy Wiggans, Satish Kumar and Philip Toogood. There will be lectures, workshops, presentations and forums. Details from: Philip Toogood, Harton Manor Cottage, Hartland, Bideford, Devon EX39 6BL. (Tel 02374—640).

INTERNATIONAL CONGRESS ON BIOLOGICAL NATURAL FOOD TECHNOLOGY to be held in Madrid on 9, 10 and 11 October 1987. Organised by the Vida Sana Association, a non-profit organisation dedicated to the promotion of the practice of biological agriculture and of the use of biological foodstuffs. For further details and enrolment: Asociación Vida Sana, BioCultura, Gran Via de les Corts Catalanes, No 618, Pral 2a, 080077 Barcelona, Spain. Tel. (93) 3025426.

International Symposium on NEW CROPS FOR FOOD AND INDUSTRY, held 22–25 Sept 1987 at Southampton University, UK. Details from: N. Haq, Symposium Secretary, Dept Biology, Building 44, The University, Southampton SO9 6NH, UK (Tel: 0703 585559, Telex 47661 SOTONUG, Fax 0703—559308).

The 4th WORLD WILDERNESS CONGRESS will take place in Colorado, USA from September 17th to 18th 1987. For further details contact Roger Pope, 6 St John Street, London WC1N 2ES (Tel 01-242 9921) UK.

ENVIRONMENTAL POLICIES AND ACHIEVEMENTS in Germany, Austria and Switzerland. A two day conference is being organised by the UK Centre for Economic and Environmental Development from 21-22 September 1987 at the Goethe Institute, 50 Exhibition Road, London. Further details from Steve Newman, UK CEED, 10 Belgrave Sq., London SW1X 9PH.

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GREENPEACE (London) are offering an information pack plus McDonalds and Unilever leaflets. Send £3 for 100 leaflets of each of the above or just a large SEA 20p stamped envelope for the information pack. Greenpeace (London) 5 Caledonian Road, London N.1. Tel. 837-7557

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CALL FOR PAPERS

INTERNATIONAL CONFERENCE ON ERGONOMICS, OCCUPATIONAL SAFETY AND HEALTH AND THE ENVIRONMENT. 24-28 October 1988, Beijing, China. Joint organisers: The Chinese Society of Metals and The Darling Downs Institute of Advanced Education, Australia. Abstracts in English, approximately 500 words, are to be sent by 31st August on the above topics to: Conference Administrator ICE-O-SHE, Darling Downs Institute of Advanced Education, PO Box 44, Darling Heights, Toowoomba Qld. 4350, Australia or telephone Mrs D. Baker on (076) 312210, Telex AA440010 or Fax (076) 301 182, Australia ISD 61.

FOURTH INTERNATIONAL SYMPOSIUM ON REGULATED STREAMS, is devoted to scientific research on rivers modified by large dams, channelisation and flow diversion schemes. Under the auspices of the Permanent Organising Committee, the symposium will be held at the University of Technology, Loughborough, England, August 15-19, 1988. Papers are invited on the following topics:

- * Effects of dams, weirs, channelisation or inter-basin transfers on plankton, macro-invertebrates, periphyton, macro-phytes and fish;
- * Effects of river regulation on estuarine, wetland and floodplain ecology;
- * Water-quality of river-reservoir systems;
- * Instream flow methodologies;
- * Fisheries management;
- * River restoration;
- * Conservation of river systems;
- * Water management and river regulation in the Third World;
- * River regulation and integrated basin management.

Authors should submit an abstract (500 words) by 30th November 1987. All papers will be in English. Selected papers will be published as special issues of *Regulated Rivers* within six months of the Symposium.

Dr G.E. Petts (FISORSII) Dept. Geography, University of Technology, Loughborough, Leicester, LE11 3TU, UK. (Tel. 0509-263171).

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