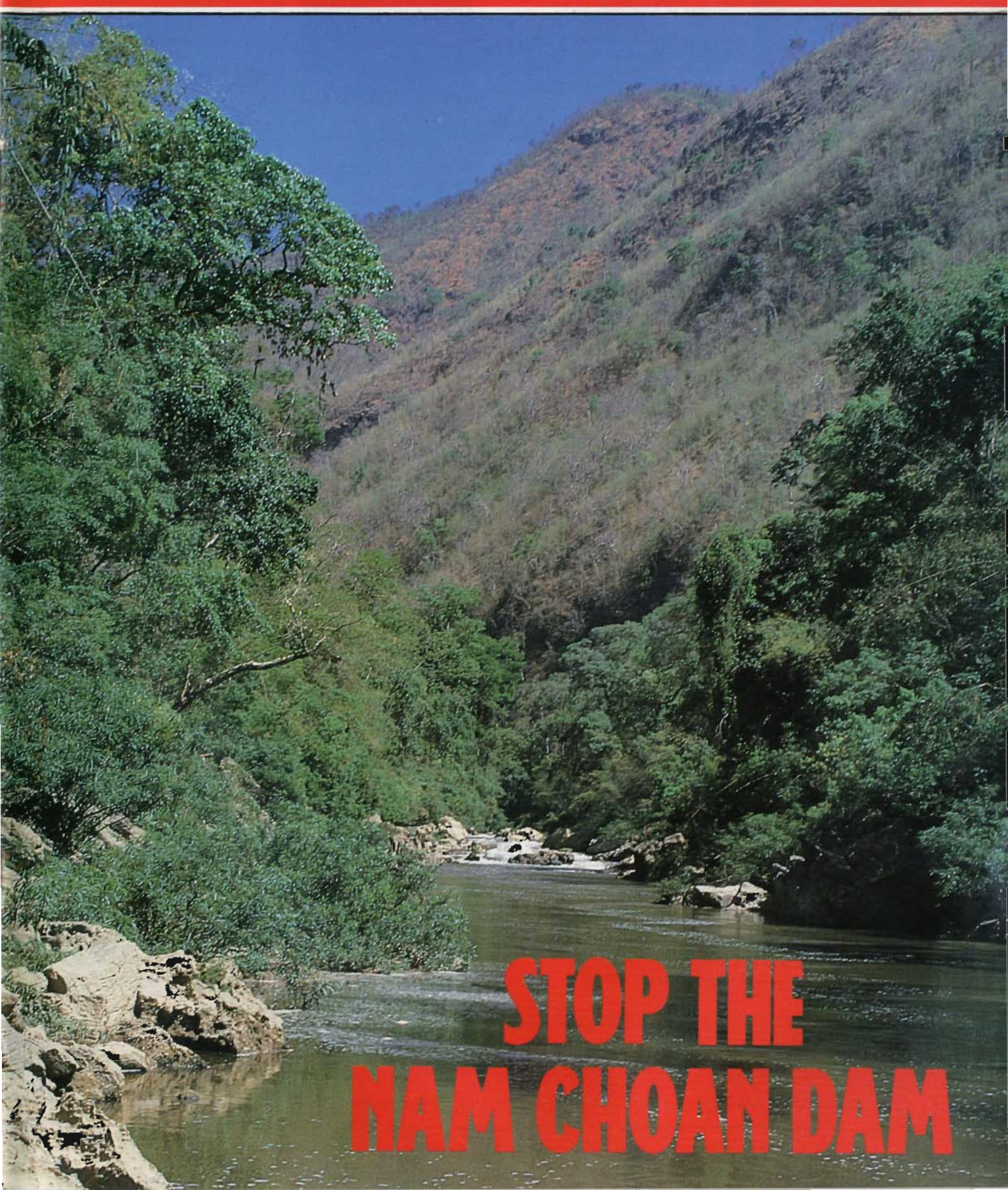


The Ecologist

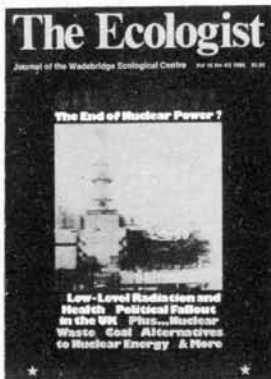
Incorporating Mazingira

Vol 17 No 6 1987

£2.50 (US \$5)



**STOP THE
NAM CHOAN DAM**

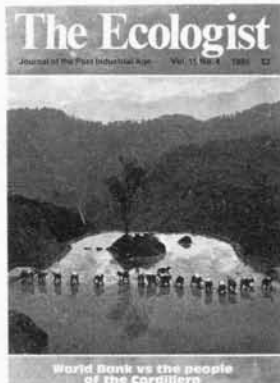


including: Political Statements on Nuclear Power by Rob Edwards, Malcolm Bruce and Tony Benn, Jim Jeffery, The Unique Dangers of Nuclear Power, Richard E. Webb, Chernobyl and what could have happened. Peter Bunyard, The Sellafield Discharges, Jean Emery, Victims of Radiation, Nick Kollerstrom, The Export of Weapons-grade Plutonium, Stewart Boyle, Nuclear Waste—The unsolved problem, Michael Flood, The Potential for Renewables.



including: Patricia Adams, The World Bank: A Law unto Itself. Teresa Hayter and Catherine Watson, The World Bank's Agricultural Policies. George Kent, Food Trade: The Poor feed the Rich. G.P. Hekstra Development Policies ignore Ecological Constraints. Kumar Rupasinghe The Effects of Export-oriented Industrialisation in Sri Lanka. The Narmada Valley Project, including a letter from the World Bank defending its position.

including: Charles Drucker, Dam the Chico, Donald J. Clark, Environmentalism and the Japanese Cultural Tradition, Nart Tuntawiroon, Environmental Impact of Industrialisation in Thailand, Brian Keeble, When Art and Work were One, Bharat Dogra, India's White Revolution, A. H. Walters, Nitrates in Food.



including: Peter Bunyard, Waldsterben and the death of trees, Dorion Sagan, Towards a Global Metabolism—The Sulphur Cycle, Nigel Dudley, Acid Rain and Pollution Control Policy in the UK, Francis Chaboussou, How Pesticides increase Pests, R.P.C. Morgan, Soil Erosion in Britain: The Loss of a Resource.



including: Edward Goldsmith, Open Letter to Mr Conable of the World Bank. C. Alvares and R. Billorey, Damming the Narmada. D. Treece, Brazil's Greater Carajas Programme. T. Outerbridge, The Disappearing Chinampas of Xochimilco. R. Mann, The Case of the Gambia. S. Epstein, Losing the War against Cancer. J.W. Jeffery, The Sizewell Report.



including: Peter Bunyard, Fluoride: Medication or Industrial Poison? Thomas Outerbridge, The Fluoridation Campaign. M. Diesendorf and P. Sutton, Fluoride, New Grounds for Concern. Doris Grant, Fluoride: Poison in our Midst. Brian Morris, Deforestation in India and the Fate of Forest Tribes. Catherine Caufield, Irradiated Food—Who wants it?

The Ecologist Journal of the Wadebridge Ecological Centre

Published by: Ecosystems Ltd., Edward Goldsmith.

Editors: Edward Goldsmith, Nicholas Hildyard, Peter Bunyard Managing Editor: Maria Parsons.

Associate Editors: Robert Prescott-Allen, Jimo Omo-Fadaka, Andrew MacKillop, Jerry Moles, Robert Waller, Lawrence Hills, John Papworth, Nicholas Gould. Raymond Dasmann, Richard Wilson, John Milton (USA), Sigmund Kvaloy (Norway), Wouter Van Dieren (Holland), John Seed, Rain Forest Information Centre (Australia), Henryk Skolimowski, Samuel P. Epstein.

Editorial Department: Corner House, Station Road, Sturminster Newton, Dorset. Tel: (0258) 73476.

Subscription Department: Worthyvale Manor Farm, Camelford, Cornwall PL32 9TT. Tel: (0840) 212711.

Annual Subscriptions:

The Ecologist publishes six numbers a year, generally two double issues and two single issues.

The Rates below are for 6 issues incl.

Postage and annual Index:

Ord. Rate £16.00 (\$28.00)

Inst. Rate £27.00 (\$46.00)

Third World & Student Rate £14.00 (\$22.00)

Air Mail Rate £7.50 (\$12.00) extra

Subscriptions are payable to The Ecologist and sent to The Ecologist, Subscription Department.

The Ecologist Bankers: National Westminster Bank Ltd., 26 Molesworth Street, Wadebridge, Cornwall, UK.

Special Rates available for people who need The Ecologist for their work, but have difficulty in paying the full rate, please don't hesitate to write to us.

Advertisements:

Display Rates:

Full page (261x185mm) £250

Half page (131x185mm) £120

Third page (131x121mm or 261x58mm or 87x185mm) £80

Quarter page (131x93mm) £60

Sixth page (87x58mm) £50

Inserts:

Up to 261x185mm and not more than 10g £35 per thousand.

Enquiries to:

The Ecologist, Advertisement Department, Worthyvale Manor Farm, Camelford, Cornwall PL32 9TT. UK Tel: (0840) 212711.

Contributions:

The editor welcomes contributions, which should be typed, double spaced, on one side of the paper only, and with generous margins. Contributions should be accompanied by black and white photographs, line drawings, and tables where appropriate.

While every care is taken with manuscripts submitted for publication, the editors cannot guarantee to return those not accepted. Articles published in The Ecologist do not necessarily express the views of the editors.

The Ecologist's International Serial Number is ISSN 0261-3131.

Printed by: Penwell Ltd., Parkwood, Dupath, Callington, Cornwall, UK.

The Ecologist is available on Microfilm from University Microfilms Int., Ann Arbor, MI, USA.

Editorial

Nicholas Hildyard

Stop the Nam Choan Dam 210

Feature Articles

Belinda Stewart Cox

Thailand's Nam Choan Dam: A Disaster in the Making 212

If it is built, the Nam Choan Dam in Thailand's western province of Kanchanaburi would cause irreparable damage to the Thung Yai and Huai Kha Kheng Wildlife Sanctuaries, which would be cut in three by the dam's reservoir. The largest single wildlife reserve in mainland South-east Asia would thus be effectively destroyed. The loss would be an area of biological importance without peer in the region.

Philip Hirsch

Nam Choan: Benefits for Whom? 220

The benefits which the Electricity Generating Authority of Thailand claims Nam Choan will bring are unlikely to materialise and have been greatly exaggerated. Moreover the social and economic costs of the dam have been deliberately underplayed.

Prinya Nutalai

Earthquakes and the Nam Choan Dam 223

Six active earthquake faults lie near the proposed site of the Nam Choan Dam. The likelihood of the dam being seriously damaged, with terrible consequences for those living downstream, is high. Earthquakes have already damaged many other dams throughout the world.

Bill Weinberg

Laguna Verde: The Nuclear Debate in Mexico 226

Plans are afoot to start up Mexico's first nuclear power station. Opposition to the plant is widespread and has spawned a growing Green Movement.

Joanne Bower

The Scientist, the Stockman and the Animal 230

Although science has enabled farmers to increase yields, it has done so at the expense of good husbandry and the welfare of animals. Conditions in modern intensive units are morally unacceptable and should no longer be tolerated.

Alwyn Jones

From Fragmentation to Wholeness: A Green Approach to Science and Society (Part 1) 236

Modern science sees the natural world as something "out there", from which man is entirely separate. But our "apartness" from nature, upon which science's claim to be value-free is based, is apparent not real. A new holistic worldview is required, one which postulates the oneness of all reality. Only then shall we see that any abuse of nature is at the same time an abuse of ourselves.

Marjorie Sykes

Bracken: Friend or Foe? 241

Bracken is an unpopular plant with farmers who seem hell-bent on destroying it. In the past it was often harvested as a crop of value. Why not again?

Feature Book Review

Sandy Irvine

Green Britain or Industrial Wasteland? 243

Books

..... 247

Letters

..... 248

Cover Picture (Belinda Stewart Cox): The proposed site of the Nam Choan Dam.
Lay-out and Design: John McIntyre

Stop the Nam Choan!

In March 1988, after almost ten years of bitter controversy, a committee appointed by the Government of Thailand is due to recommend whether or not to approve construction of the proposed Nam Choan Dam, which the Electricity Generating Authority of Thailand (EGAT) wishes to build on the Upper Kwai Yai River in the west of the country.

If the government give the go-ahead, the dam will effectively destroy the largest single tract of protected primary tropical forest in the whole of mainland South-east Asia—some 6000 square kilometres in all, consisting of the Thung Yai Wildlife Sanctuary and the adjacent Huai Kha Kheng Wildlife Sanctuary. Naturalists are agreed that in terms of their size and the diversity of their flora and fauna, the two sanctuaries are unrivaled in the region; indeed, Huai Kha Kheng was the only site in Thailand to be included by the International Union for the Conservation of Nature (IUCN) in its "Indicative Inventory" of natural areas of "World Quality Status". The dam's reservoir will itself flood outright some 223 square kilometres of rare riverine forest. More serious, it will cut the sanctuaries into three, blocking vital migration routes and thus threatening the survival of those animals which depend on access to new feeding grounds throughout the seasons (see pp.212-219). The final blow to the area would be the inevitable influx of settlers, loggers and hunters—many of them displaced from their own lands to make way for other "development" schemes or seeking a release from the grinding squalor of city life—who would use the dam's access roads to enter the forest, which they then clear for agricultural land. Such settlers have already destroyed much of the forest around the recently constructed Sri Nakharin Dam, immediately below the Nam Choan site, and that around the Chiew Larn Dam. Over 1000 square kilometres of forest immediately outside the Thung Yai reserve have already been lost to encroachments by settlers using a road illegally cut by EGAT to the Nam Choan site in anticipation of gaining approval for the dam. Apart from increasing the rate of soil erosion and water run-off, the loss of forest cover could have a major impact on local weather patterns, threatening forest growth over a far greater area than that originally deforested. At a global level, *any* loss of tropical forests must inevitably increase carbon dioxide levels, and thus exacerbate the threat of the "Greenhouse Effect".

In addition, the dam will require the resettlement of some 2000 Karen villagers, in all likelihood forcibly, since many have stated their intention to die rather than move from their lands. The record of similar resettlement schemes, both in Thailand and elsewhere, makes it plain that those who survive the

experience (and the old often do not) will have little to live for: their culture will be shattered and their whole way of life destroyed.

For those living downstream, the dam will exacerbate the severe social and ecological problems which have been caused by the three large hydro-electric dams which EGAT has already constructed on the River Kwai. As Philip Hirsch points out (pp. 220-223), the reduced flow of the river, particularly during the period when the Nam Choan's reservoir is filling up (a process that is expected to take two years), will greatly increase the intrusion of salt water into the Meklong Delta, causing the further salinisation of farmland in the area. It will also severely worsen the local water shortages which have already led to the rationing of irrigation water for downstream farmers. The problem of drought is likely to be compounded still further by the loss of forest in the watershed upstream, both as a result of local climatic change and because the denuded hills will lose their capacity to retain the monsoon rains and release them slowly throughout the year: instead the rains will simply cascade down the barren slopes, precipitating a drought-flood cycle. Significantly, deforestation has already been held responsible for the severe drought in 1987 which affected farmers in Uthaitani. The dam is also expected to reduce further the supply of nutrients to the Gulf of Thailand, threatening fish stocks in an area which is already grossly depleted of fish.

Finally, the presence of six active earthquake faults in the vicinity of the dam makes the probability of the dam suffering structural damage at some time in its life extremely high. The consequences for those living below the dam would be disastrous, particularly if the collapse of the Nam Choan was to trigger a domino effect with its breach causing the breach of the other dams downstream. According to Dr. Prinya Nutalai of the Asian Institute of Technology, there have already been both earthquakes and rock movements along the fault which runs under the dam site: one earthquake in 1983 measured 5.8 on the Richter scale (see pp.223-225).

And all this for a dam that will generate just one per cent of Thailand's energy requirements—energy that could well be supplied through a programme of energy conservation and improved energy efficiency. Significantly EGAT has itself admitted that cancellation of Nam Choan would *not* cause power shortages. Meanwhile, an EGAT engineer has shown that the country's energy supplies could be boosted by at least one per cent through installing more modern generators at existing hydro-electric dams—and at a fraction of the cost of building Nam Choan.

A Biased Committee

The Nam Choan was first proposed in 1980, causing widespread protests, both in Kanchanaburi province and within Bangkok. Pressure from a wide coalition of dam opponents finally forced the government to shelve the project in 1982. However, in 1986, the project was revived once again, having been introduced into parliament under a different name. Protests from environmentalists and farmers quickly poured in not only from within Thailand but from throughout the world. As a result, the government eventually bowed to public pressure and set up a 40-member committee to review the pros and cons of Nam Choan and to report back to the cabinet with its recommendations. The committee is scheduled to present its final report on March 25th.

Those who had hoped for an objective review of EGAT's proposals, however, have been sadly disappointed. Sources within Thailand report that the committee has been heavily stacked with pro-dam supporters, with critics of the dam outnumbered by eight to one.

The various sub-committees which have been set up to consider different aspects of the dam are all chaired by people who are openly pro-dam. Entire teams of EGAT officials and consultants have been given open access to the committee meetings, whilst those few committee members who are critical of the dam are denied permission to call upon outside expertise.

Much of the information presented to the sub-committees is not only misleading but frequently downright false: for example, two committee members testified that most of Thung Yai was already badly degraded, whereas aerial photographs taken by the Forestry Department show that more than 99 per cent of the sanctuary remains untouched. Similarly, EGAT witnesses told the sub-committee on geology that there were *no* faults—active or inactive—near the proposed dam site—a statement that blatantly contradicts the findings of every geological survey of the area, as well as EGAT's own maps. Although this was pointed out by Dr. Nutalai, the daily summary of the committee's deliberations stated that the committee was satisfied that the rock layers under the dam site were "more stable" than those underlying the Khao Laem and Sri Nakarin reservoirs. In fact, the committee had found no such evidence.

Other examples of bias abound. Thus the chairman of one sub-committee dismissed testimony showing that Nam Choan would destroy wildlife as "ridiculous" and "unproven". By contrast, the view that threatened animals "will be able to flee to either side of the reservoir" is being vigorously promoted. Significantly, the chairman of the whole committee, General Thienchai, is on record as saying that the Nam Choan Dam would only flood "peripheral" areas of Thung Yai.

Outside the committee rooms, EGAT is carrying out a totally unscrupulous propaganda war; members of the committee have even been flown

over a heavily deforested area and told by EGAT officials that they were flying over Thung Yai. Meanwhile local opponents of the dam have been accused of running guns to Karen separatists and of seeking to prevent the dam because of vested interests in a local mining concession. One EGAT official has gone so far as to state publicly that opponents of the dam "should be beheaded".

No Compromises

In the face of such entrenched bigotry, and with little prospect of a fair hearing in the committees, environmentalists and other opponents of the dam have appealed to the international community to exert as much influence as possible to present the Government of Thailand with the true facts.

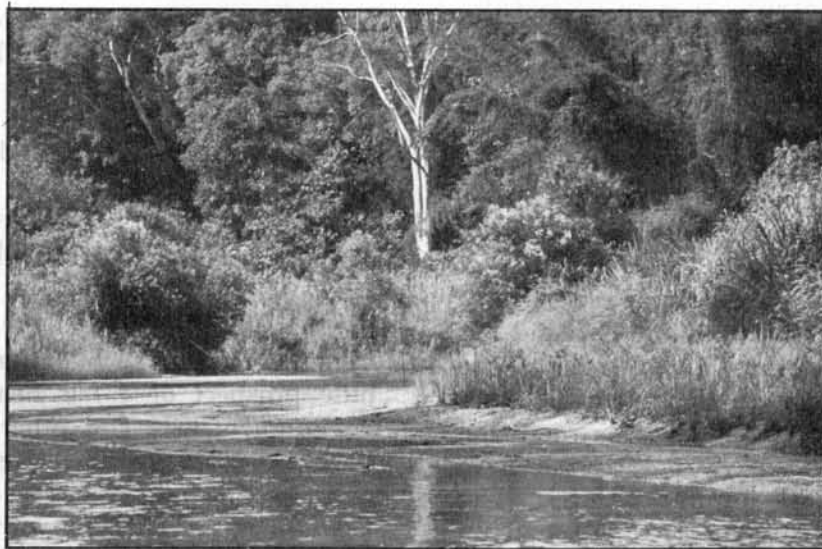
In particular, it is vital that the government is left in no doubt that building Nam Choan would mean the *inevitable* destruction of the single most important conservation area in mainland South-east Asia. Any suggestions that the adverse impact of the dam can somehow be mitigated are nothing less than grotesque wishful thinking. There are no measures that can mitigate for the total destruction of the deciduous riverine forests which would be flooded by the dam; no measures which can save the plants, insects and other creatures which will be drowned by the reservoir; no measures which can mitigate the effects of fragmenting the sanctuaries into three; no measures which can restore the migration routes blocked by the reservoir; no measures which can realistically prevent encroachment by settlers once the area has been opened up by roads; no measures that can mitigate the ecological destruction which deforestation will cause; no measures that can mitigate the inevitable changes to local weather patterns; no measures that can mitigate the cultural disruption of the local Karen; and no measures that can mitigate the effects of the dam downstream.

In truth the issue is brutally simple. Giving the go-ahead to Nam Choan would be to condemn Thung Yai and Huai Kha Kheng to inevitable destruction and to inflict a devastating catalogue of social and ecological woes on the people of Kanchanaburi province and beyond. This cannot be in the best interests of the people of Thailand and cannot, by any stretch of the imagination, be conceived of as "development".

We therefore appeal to environmentalists everywhere to make plain their outright opposition to Nam Choan by writing to the Prime Minister of Thailand, H. E. General Prem Tinsulanonda. For our part, we urge the Prime Minister to reject the Nam Choan project once and for all.

Nicholas Hildyard

Please send your letters to: H.E. General Prem Tinsulanonda, Government House, Nakorn Pathon Road, Bangkok 10300, Thailand. Please send copies of the letter to: The Bangkok Post, U-Chuliang Building, 968 Rama 4 Road, Bangkok 10500, Thailand; The Nation, 59, Soi Saeng Chan, Sukhumvit Road Soi 42, Bangkok 10110, Thailand; and The Project for Ecological Recovery, 1705 Rama 4 Road, Bangkok 10500, Thailand.



Belinda Stewart Cox

The Mae Chan River, a tributary of the Upper Kwaie Yai, which would be flooded by the Nam Choan's reservoir.

Thailand's Nam Choan Dam: A Disaster in the Making

by Belinda Stewart Cox

The Electricity Generating Authority of Thailand (EGAT) is currently canvassing for permission to build a huge hydro-electric dam in Thailand's western province, Kanchanaburi. The dam, the Nam Choan, would be the fourth large hydro-electric dam to be built in the province, all of them impounding the River Kwai of bridge fame. The Nam Choan Dam would harness the upper reaches of the river and would inflict irreparable damage on the Thung Yai Wildlife Sanctuary—the single most important conservation area in the whole of Thailand, Indo-China and mainland South-east Asia.

A quick glance at any road map of Thailand will reveal that the far western region has fewer roads, fewer urban or rural settlements and fewer people than any other part of the country. That being so, it will be no surprise to learn that the region is also guardian to Thailand's largest and finest conservation area, the Thung Yai and Huai Kha Khaeng Wildlife Sanctuaries.

These two sanctuaries form a contiguous block of almost 6,000 square kilometres (km²)—twice as large as any other conservation area in Thailand, four and half times as large as any other legally protected area in Indo-China, and almost 30 per cent larger than the rainforest reserve of Taman Negara in Peninsula Malaysia, the closest rival in size though not in forest type^{1,2}. Thus by virtue of their size, these two sanctuaries can be regarded as the single most important conservation area in Thailand, in Indo-China and in mainland South-east Asia.

Size is not their only distinction however. The two sanctuaries are also important by virtue of their vegetation types and the number of endemic tree species occurring there³. The largest proportion of forest cover is mixed deciduous forest (also known as tropical

monsoon forest), with large areas of dry deciduous dipterocarp forest and dry evergreen forest (also known as tropical semi-evergreen forest)^{4,5}. Dry tropical forest is now rarer than true tropical rainforest^{6,7}. Large tracts of relatively undisturbed dry tropical forest are rarer still⁸. Therefore, the singular importance of Thung Yai and Huai Kha Khaeng Wildlife Sanctuaries lies not simply in their being the largest conservation area in mainland South-east Asia, but in their being the largest single tract of protected dry tropical forest in mainland South-east Asia⁹. That invests them with global as well as regional significance.

Rarity is one thing, diversity another. With an altitudinal range from 250 metres above sea level to 1,811 metres, Thung Yai and Huai Kha Khaeng Wildlife Sanctuaries provide the topographic conditions for great floral diversity. Not surprisingly, that diversity is there. Within their boundaries, these sanctuaries support seven vegetation types; the three dominant forest types already mentioned (mixed deciduous forest, dry deciduous dipterocarp forest and dry evergreen forest) together with tropical lower montane rainforest on the heights, gallery evergreen forest along enclosed watercourses, patches of bamboo forest and the savannah or grassland forest from which Thung Yai takes its name (Thung Yai means "Big Field")^{10,11}. The presence of so many undisturbed habitat types in one region is very rare indeed.

Belinda Stewart Cox, a graduate of Oxford University, has been studying the behaviour and ecology of the Green peafowl in Thailand's Huai Kha Khaeng Wildlife Sanctuary. She has recently joined a team of researchers from Kasetsart and Mahidol Universities to undertake a basic survey of bird species occurring in the Mae Chan valley of Thung Yai Wildlife Sanctuary.

A cardinal feature for the area's wildlife is the existence of two main river systems which run like backbones through each sanctuary, the Upper Kwaie Yai and the Huai Kha Khaeng. The main catchment area for each river lies more or less entirely within the sanctuaries' perimeter. It is rare in Thailand to find rivers with both banks well protected. It is particularly rare to find shallow rivers in areas of gentle topography that have been spared the axe and the ploughshare. The Nam Mae Chan (the north-west fork of the Upper Kwaie Yai) and the Huai Kha Khaeng are two such rivers. Their valleys are broad, their forests deciduous. They play host to much of the area's wildlife at some point during the year, for very few animals are strictly confined to one habitat. Indeed many require different habitats at different periods of the year and, in some cases, different periods of each day.

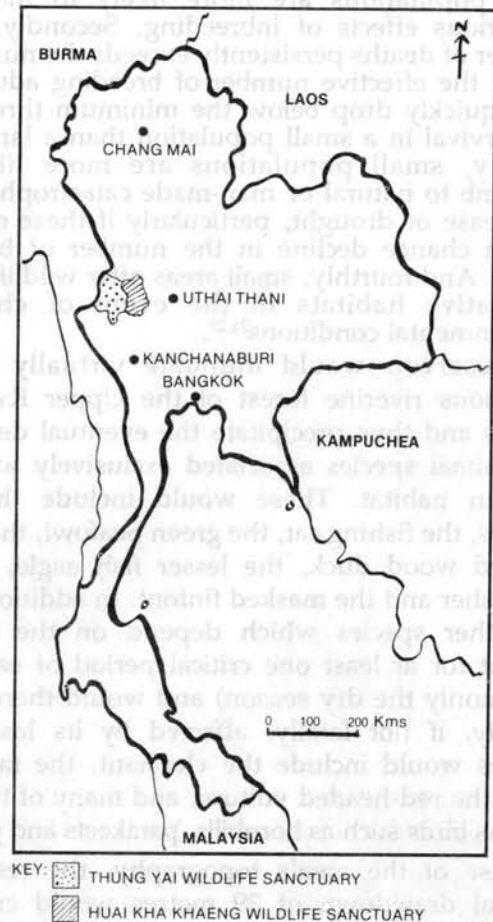
With floral diversity comes faunal diversity. Thung Yai and Huai Kha Khaeng Wildlife Sanctuaries provide refuge to a sizeable proportion of Thailand's wild animal species. It is in fact the very diversity of vegetation which helps maintain such a range of fauna. Of the 265 mammal species of Thailand¹³, 82 have so far been identified in the sanctuaries¹⁴; of the 900 or so bird species¹⁵, 415 have been identified. In addition there are known to be 89 reptile species, 30 amphibian and 52 species of fish¹⁶. All these counts are conservative, for the area is still, to all intents and purposes, biologically unknown.

Such diversity of both plant and animal species is surely to be expected, for these sanctuaries lie at the junction of the Sino-Himalayan, Sundaic and Indo-Chinese vegetation zones^{17,18}. Moreover, the presence here of all five macaque species which occur in Thailand has led to suggestions that the area may have been a Pleistocene refuge¹⁹. If so, this might further explain the high diversity of closely related bird species occurring in the same area²⁰.

Needless to say, a great many of the threatened and endangered species of Thailand are protected by these sanctuaries. Some are endemic to the region—for example Feae's barking deer, and the plain-pouched hornbill—whilst others are now found nowhere else in Thailand in viable numbers. These include the banteng (a wild ox), the wild water buffalo, the green peafowl, the red-headed vulture, the crested kingfisher, the rufous-necked hornbill and the white-winged wood duck which is endangered throughout its world range²¹. Many more species, though rare in Thailand, are relatively abundant in Thung Yai and Huai Kha Khaeng. These include the Asian elephant, the gaur (another wild ox), the Asian tapir, the tiger, the leopard, Phayre's langur, the white-handed gibbon, the short-clawed and smooth-coated otters, the Asian hare, the lesser fish eagle, the Kalij pheasant, the Burmese peacock-pheasant, the green imperial, yellow-footed and orange-breasted pigeons and the Indian tree monitor. There are other rare species too whose numbers have not yet been reliably estimated, including the clouded leopard, the Sumatran rhinoceros, the red dog, the Asiatic jackal, the hog deer, the serow, and the masked finfoot.

It is thus no exaggeration to describe the Thung Yai

Map of Thailand Showing Location of Thung Yai and Huai Kha Khaeng Wildlife Sanctuaries



and Huai Kha Khaeng Wildlife Sanctuaries as unique, for in size, vegetation, floral and faunal diversity, they have no peer in mainland South-east Asia.

The Environmental Impact of the Nam Choan Dam

The Nam Choan Dam would create a 75km long reservoir which would flood all the forest in the Upper Kwaie Yai valley system up to 380 metres above sea level and have an annual vertical drawdown of 39 metres. The consequences of this would be:

1. The reservoir would split this single conservation area into three smaller areas and thus greatly reduce the sanctuaries' ability to ensure the long-term survival (measured in decades and centuries) of the large animal species currently found there. This is so because:

(a) The reservoir will barricade the habitual migration routes upon which the large herbivores depend for access to new and varied feeding grounds through the annual seasonal cycle²². Contrary to the belief held by some of the dam's proponents, very few animals, resident birds included, will attempt to cross so deep and alien an expanse of water.

(b) The subdivided animal populations will be subject to the "species-area effect"—which dictates that, the number of species which can survive in a given area is dependent on the size of that area. Studies of island populations have shown that the smaller the area, the smaller the total number of species occurring there. Moreover, when a particular area of habitat is reduced by 50 per cent or, in Thung Yai's case, cut geographically in half (which amounts to the same thing), approximately 10 per cent of the species living in that area will eventually die out²³. There are

several explanations for these extinctions. Firstly, small populations are more likely to incur the deleterious effects of inbreeding. Secondly, if the number of deaths persistently exceeds the number of births, the effective number of breeding adults will more quickly drop below the minimum threshold for survival in a small population than a large one. Thirdly, small populations are more likely to succumb to natural or man-made catastrophes such as disease or drought, particularly if these coincide with a chance decline in the number of breeding adults. And fourthly, small areas offer wildlife fewer alternative habitats in the event of changing environmental conditions^{24,25}.

2. The reservoir would inundate virtually all the deciduous riverine forest of the Upper Kwae Yai valleys and thus precipitate the eventual demise of the animal species associated exclusively with that riparian habitat. These would include the otter species, the fishing cat, the green peafowl, the white-winged wood duck, the lesser fish eagle, crested kingfisher and the masked finfoot. In addition, there are other species which depend on the riverine habitat for at least one critical period of each year (commonly the dry season) and would therefore be gravely, if not fatally, affected by its loss. Such species would include the elephant, the tapir, the tiger, the red-headed vulture, and many of the frugivorous birds such as hornbills, parakeets and pigeons.
3. Because of the area's topography, the reservoir's vertical drawdown of 39 metres would create an encircling wasteland of rocks and dried mud many

metres wide for several months of the year. Such a shoreline constitutes an inhospitable and forbidding environment for most animals and, contrary to EGAT's predictions²⁶, is more likely to deter them from frequenting the area than to encourage them.

There are *no* remedial measures that can mitigate the effects of fragmenting the area into three and removing the deciduous riverine habitats. And without complete control of the region's rainfall, there is little possibility of stemming the dry season's receding shoreline.

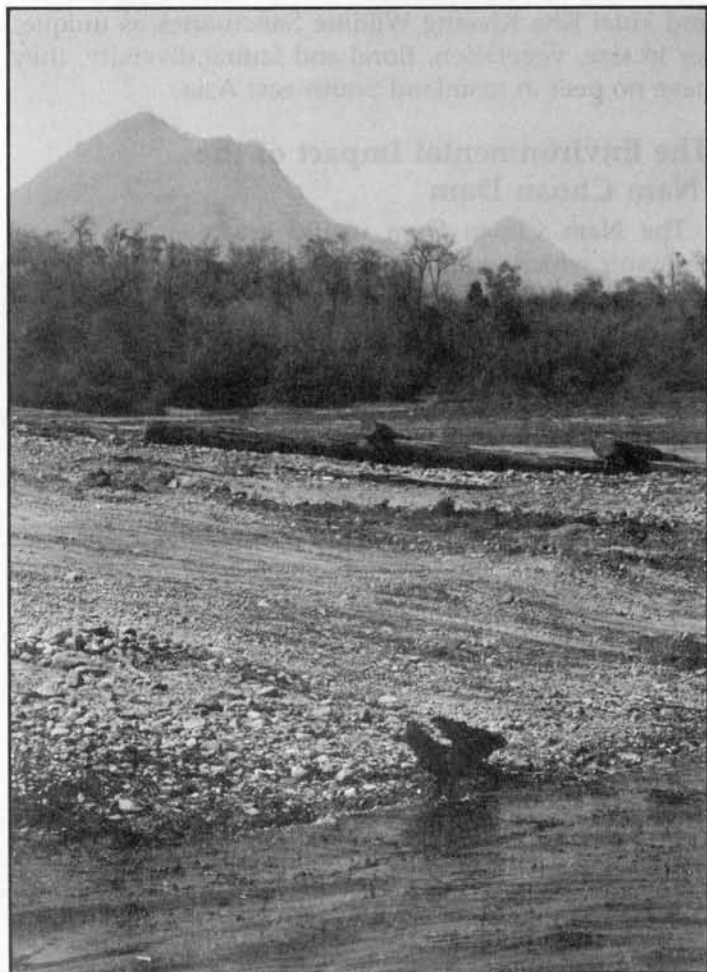
Animal Rescue Operations

EGAT expects to secure the survival of local wildlife by funding a rescue operation for those animals which are stranded by the flooding. However, the experience at the Chiew Larn Reservoir has demonstrated that while this may be good for public relations and the corporate conscience, it is no more than a palliative for the animals. Only a fraction of the area's wildlife were captured and the majority of those which were caught then died from shock, injury or the effects of captivity. Those few which survived were released, perforce, into areas unfamiliar and often unsuitable, so even they face a slim chance of survival^{27,28}. Animal relocation projects are notoriously dicey and very seldom succeed. Such a project is even less likely to succeed when the type of habitat from which animals are rescued no longer exists. Moreover, the vast majority of species—plants and micro-organisms, for example—will not be able to move at all.

The Dam's Access Roads

In order to build the Nam Choan Dam and to service both it and the reservoir, EGAT would build an access road of 140km. This would have two further consequences to the forests and wildlife of Thung Yai:

1. The road is certain to precipitate encroachment by landless and squatter farmers eager to gain access to unclaimed forest land. Such encroachment has happened at every other large dam site to date^{29,30}. It is happening already at the Chiew Larn Dam (completed in 1987) where new settlers have followed a well established practice of seeking labouring jobs at the construction site in order to stake an early claim to the land surrounding the reservoir³¹. Indeed it has already started to happen along a road built illegally by EGAT in anticipation of Government approval of the Nam Choan Project³². It is bound to happen in Thung Yai itself for forest destruction is everywhere associated with roads and navigable waterways³³. Even EGAT concedes that Thung Yai's forest will be severely threatened as a result of Nam Choan's roads and reservoir providing better access to the area³⁴. Rural to rural migration, usually to forest areas, is as common in Thailand as migration to the urban centres³⁵. Yet the Government has consistently failed to act to prevent immigration into forests made accessible by development projects despite its avowed policy to preserve 40 per cent forest cover in Thailand³⁶.
2. Increasing encroachment will be accompanied by an escalation in poaching and the illegal extraction of forest products. In the seven years since the Sri Nakarin Dam was completed, poachers have wiped out all the large animals that once lived in the Salak Phra Wildlife Sanctuary (bordering the reservoir's eastern edge) and the Sri Nakarin National Park (to its west)³⁷.



Belinda Stewart Cox

Opening up the Thung Yai Wildlife Sanctuary would encourage encroaching cultivation on a massive scale. At the Sri Nakarin Dam, downstream of Nam Choan, illegal settlers have already caused extensive deforestation (above).

The Royal Forest Department simply does not have the resources to prevent this in-migration^{38,39}. EGAT has promised 17.5 million baht (£437,000) as a one-off payment for forest protection⁴⁰. With that, it intends to set up two forest protection centres and two fully equipped mobile units. Whilst that amount might cover initial construction and equipment costs, it could not provide annual running costs of approximately 10 million baht (£250,000)⁴¹. Moreover, EGAT announced recently⁴² that it is cutting its Nam Choan budget by 140 million baht so even that inadequate allocation for environmental protection is not now expected to materialise.

EGAT's Environmental Impact Assessment Report: Wildlife Ecology

In accordance with standard practice today, EGAT commissioned an Environmental Impact Assessment Survey (EIA) for the Nam Choan Project. In theory the final report is publicly available, in practice it has proved very hard to come by. Nevertheless, a copy of the Wildlife Ecology section of the report was obtained and can probably be taken as representative of the standard of the report as a whole⁴³.

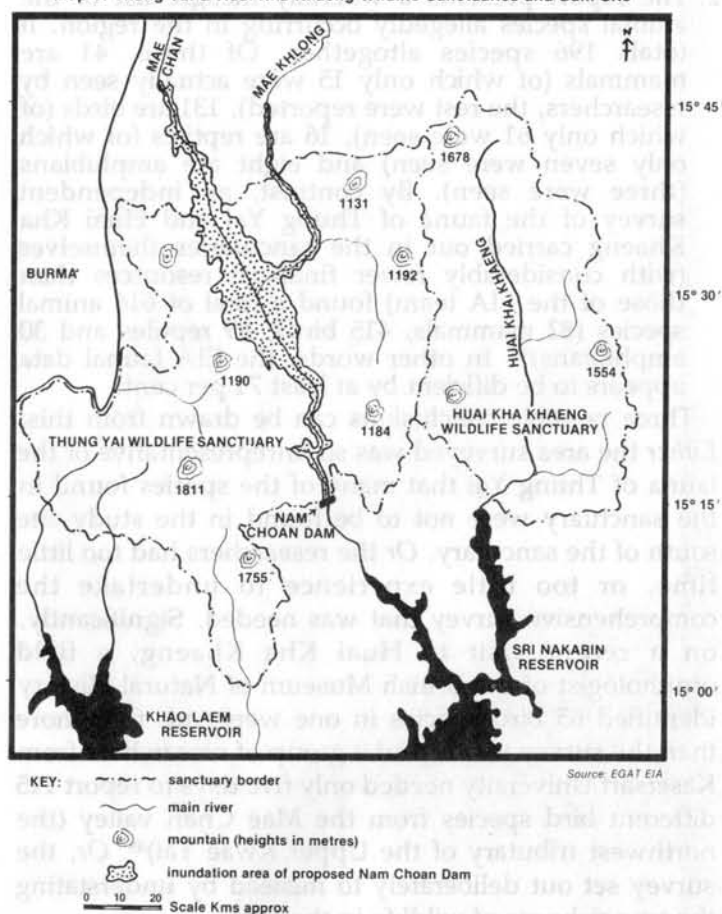
The wildlife section is as remarkable for its omissions as it is for its content. As a scientific document it is improper; as a commercial document, it is unconvincing. Either way it is inadequate, inaccurate, sloppy, misleading and, in some instances, apparently fraudulent. It is, in every important respect, an inadmissible and unprofessional document.

Unrepresentative of the Area under Threat

The original Environmental Impact Assessment Survey commissioned by EGAT was done in 1979 when the area of the Thung Yai Wildlife Sanctuary was still held by communist insurgents and was unsafe for most people to enter. The survey team was therefore obliged to carry out its fieldwork due south of the proposed inundation area with the result that its conclusions are extrapolated from data gathered at sites presumed to support the equivalent habitat to the Upper Kwaie Yai valleys and data supplied by local villagers.

It is clear from the report's list of plant species occurring in the study site that the survey area was not really at all representative of the deciduous riverine habitats of Thung Yai. Indeed there is reason to doubt whether the EIA team studied riverine forest at all, for the species list it provides includes many plants (banana *Musa paradisiaca*, barley *Hordeum* species, mango *Mangifera indica*, peppers *Capsicum*, cabbage *Brassica oleracea*, lemon grass *Cymbopogon citratus*, papaya *Carica papaya* and *Imperata cylindrica*) commonly associated with open or disturbed ground and man-made vegetable and fruit gardens⁴⁴. At the same time, the species list does not include any of the 32 riverine plants collected by the Green Peacock Project from the adjacent Huai Kha Khaeng valley which forms part of the same river system. Nor does it include any of the principal deciduous trees which characterise this region's lowland forests—the *Azelia*, *Dalbergia*, *Lagerstroemia*, *Dipterocarpus* and *Shorea* species, for example.

Map of Thung Yai & Huai Kha Khaeng Wildlife Sanctuaries and Dam Site



The report's list of animal species is similarly unfaithful as a reflection of the fauna of Thung Yai or Huai Kha Khaeng Wildlife Sanctuaries. Some species which should be listed are not. These include the Assamese macaque, the clouded leopard, the red dog, nine species of bat, the short-clawed and smooth-coated otters, three species of tortoise, the green peafowl, the white-winged wood duck, the crested serpent eagle, the lesser fish eagle, the black baza, the wreathed hornbill, the crested kingfisher and many of the smaller birds. Other species of birds which are listed are in fact atypical forest inhabitants being more commonly associated with disturbed environments or human settlement. These include the cormorants, the bat hawk, the house crow, the magpie robin and the barn owl.

An Inadequate Survey of the Flora and Fauna

The paucity of plant and animal species recorded in the EIA report is remarkable:

1. The reports list of the plant species found in the survey area totals only 118 different species. That is a poor sample of the total number of plant species likely to occur in a tropical riparian habitat with the diversity of Thung Yai. In the deciduous forests of the Huai Kha Khaeng Wildlife Sanctuary, it is not uncommon to find 100 different tree species in one quadrat of 100 square metres (one hectare)⁴⁵. That figure does not include the many shrubs and herbaceous plants found at ground level. Nor does it reflect the fact that in tropical forests, the curve of the number of species per hectare increases with each adjacent hectare. If the first hectare yields a count of 100 tree species, the next one might increase the number to 150. In a temperate forest the increase is more likely to be two⁴⁶.

2. The report presents a woefully meagre list of the animal species allegedly occurring in the region. It totals 196 species altogether. Of these, 41 are mammals (of which only 15 were actually seen by researchers, the rest were reported), 131 are birds (of which only 61 were seen), 16 are reptiles (of which only seven were seen) and eight are amphibians (three were seen). By contrast, an independent survey of the fauna of Thung Yai and Huai Kha Khaeng carried out in the sanctuaries themselves (with considerably fewer financial resources than those of the EIA team) found a total of 616 animal species (82 mammals, 415 birds, 89 reptiles and 30 amphibians)⁴⁷. In other words, the EIA faunal data appears to be deficient by at least 71 per cent.

Three possible conclusions can be drawn from this.

Either the area surveyed was so unrepresentative of the fauna of Thung Yai that many of the species found in the sanctuary were not to be found in the study site south of the sanctuary. Or the researchers had too little time, or too little experience to undertake the comprehensive survey that was needed. Significantly, on a recent visit to Huai Kha Khaeng, a field ornithologist of the British Museum of Natural History identified 65 bird species in one weekend, four more than the survey team. And a group of researchers from Kasetsart University needed only five days to report 115 different bird species from the Mae Chan valley (the northwest tributary of the Upper Kwaie Yai)⁴⁸. Or, the survey set out deliberately to mislead by understating the true richness of wildlife in the area.

An Improper and Unprofessional Presentation

In a professional and scientific evaluation of the kind that an EIA should be, it is proper to provide details of the precise location of the study area, a map of the habitats represented there, the methods used to survey the vegetation, the time of year the survey was carried out, the number of man/hours spent in the study area and a list of the references used to substantiate all claims.

In this EIA, there is no such information. Summary statements are made on the area's carrying capacity—the number of animals per species that a given area can sustain on a long-term basis—without any supporting data. Similarly, species are categorised according to their presumed ability to adapt to the altered environment. So, for example, we are told that 10 per cent of the mammal species listed have the potential to adapt to cultivated areas but we are not told which species, how this conclusion was reached or why it should be relevant to the survey.

Confident assertions are made that four common plant species (including *Imperata cylindrica* which causes acidosis in mammals and is therefore unpalatable except when young) provide the essential year-round food for all animals. That is absurd. Animals are not a homogenous group and their food requirements are as dissimilar as they are. Some are carnivores, some herbivores, some frugivores, some folivores, some eat insects, some seeds, some fish, some are omnivores and others, like king cobras feed on only one thing—other snakes. Moreover, it commonly takes months and months of extensive fieldwork to ascertain the year-

round feeding requirements of just one species of bird or mammal so few scientists would volunteer such statements about species occurring in an area that has never yet been studied.

Major Omissions from the EIA Report

The EIA fails to recognise the singular importance of the combined area of the Thung Yai and Huai Kha Khaeng Wildlife Sanctuaries to the conservation of Thailand's natural resources. It notes merely that Thung Yai covers 3,200km² and is one of the most important wildlife habitats of its kind in Thailand. Other omissions from the report include:

- The failure to realise that the habitat composition of Thung Yai and Huai Kha Khaeng is unique. No other conservation area in Thailand supports as many large areas of dry tropical vegetation types with species deriving from all three of the major oriental habitat zones—Sino-Himalayan, Indo-Chinese and Sundaic. For which reason, no conservation area in Thailand outside the Tenasserim range is likely to support as many endemic plant species. The report states glibly but without substantiation that "the forests in the flood zone are typical of forests in central and northern parts of Thailand". It is perhaps worth recalling that the survey was not carried out in the flood zone.

- The failure to recognise that by far the most serious impact of the reservoir is not the fact that it would remove a modest four per cent of the total forest area, but rather that this four per cent represents virtually all the deciduous riverine habitat of the Upper Kwaie Yai valleys. Moreover the reservoir would trisect the sanctuary, block migration routes and subdivide the animal populations.

- The failure to acknowledge that the Thung Yai and Huai Kha Khaeng Wildlife Sanctuaries are the only protected areas in Thailand still supporting largely unviolated deciduous riverine habitats and that the Nam Chaon Dam would obliterate one of those two river valleys. Two others, the Kwaie Yai and Kwaie Noi, have already been obliterated by the Sri Nakarin and Khao Laem Dams.

- The failure to appreciate the systemic nature of habitats, plant and animal associations. A conservation area must be regarded as a whole, as a system of intricate, interacting communities in which the relationship between plants and animals is one of mutual dependence. A change in one part of the system is bound to have serious consequences for the whole. To analyse the constitution of an area such as Thung Yai, it is not enough merely to draw up lists of the species occurring there.

- The failure to investigate, or even to recognise, the deleterious impact the reservoir would have on the insect populations of the valley basin. The insect communities of the Upper Kwaie Yai region are likely to be as unique as the floral communities. Data collected in the adjacent Huai Kha Khaeng river valley support this. The majority of insect species occurring in the Upper Kwaie Yai valleys will be habitat, if not plant, specific. By destroying the riverine habitat, the reservoir will eradicate the insect species associated with it and the diet of a great many birds and fish⁴⁹.

- And the failure to point out that the lacustrine environment of the Nam Chaon Reservoir would be very different indeed from the present riverine environment, and that many of the fish species will fail to adapt to the new conditions. The reservoir will not have the shallow, vegetated shoreline that the river has. So there will be no plants, and therefore no

insect nymphs or larvae for the nursery fish of some species (such as carp). As a result, there may be no nursery fish of some species for the nursery fish of carnivorous species (such as cat fish) to feed on. In most places, the reservoir will be deep (therefore dark and minus the shallow, riffled substrate of a river) and is likely to be poorly oxygenated. That will alter the physical and chemical conditions of the habitat and is bound to have a dramatic effect on the survival prospects of many river fish. In short, because fish are highly responsive to environmental conditions and because few riverine fish are adapted to a lacustrine environment, the likelihood of a drastic reduction in the number of fish species must be considered⁵⁰.

Sloppy, Misleading or Fraudulent?

The EIA report maintains that only six of the mammal species listed are national rare species and that none of the bird, reptile or amphibian species are rare. This is nonsense. Thirty five of the mammal species they report are protected, and individually listed, under the 1960 Wild Animal Preservation and Protection Act. Three (the Javan rhinoceros, the serow and the wild water buffalo) are "national reserved species"; 25 are "first category protected" species and eight are "second category protected"⁵¹. At least 15 (3 reserved, 9 first category, 3 second category) protected mammal species are missing from their list. Likewise, all but six of the bird species are protected by the 1960 Act and a further 10 (at least) are missing. Three of the reptile species are protected under Thai law (the angel spotted gecko, the common flying lizard and the Indian garden lizard) and the Indian or yellow tree monitor, though relatively common in Thung Yai and Huai Kha Khaeng, is globally threatened and therefore appears in the IUCN *Red Data Book*. Missing from the EIA list are three tortoises (the giant Asiatic, the impressed tortoise and the elongate tortoise) which are protected. The first two are globally threatened. The only true statement concerning species status deals with amphibians. They are correct in saying that none of the amphibian species listed are protected under Thai law. Nonetheless, two of the species missing from the EIA list (the Asiatic giant frog and the giant Asiatic toad) are globally threatened⁵².

Besides these errors of fact, the EIA appears deliberately to mislead by emphasising one point while ignoring other much more significant points. So, for example, we are told that "the new reservoir would create favourable conditions for most bird species" because "water birds would find it easier to catch fish". Of the list of 113 bird species, only 13 could possibly be described as water birds, five of those 13 do not generally feed on fish, while 11 of them favour shallow, well-vegetated rivers or marshy environments. In other words, only two species of that 113 (the large and little cormorants) would benefit from a lacustrine environment and they are not representative of the region's avifauna⁵³. Meanwhile, the report makes no mention of the effect the reservoir would have on the forest birds which dominate its species list.

Similar examples litter the EIA report. We are told that otters will prefer the reservoir to today's river; that large mammals will benefit from the year-round water supply; that reed warblers, coucals and whistling teal

will build their nests on the shoreline. These suppositions are derisible. The otters found in this area favour clear, shallow, well-shaded rivers⁵⁴; the large mammals benefit already from a river which flows year-round; and the shoreline will be a wide expanse of rocks and mud without shade or cover at just the time of year that most birds breed (the end of the dry season).

Besides the misleading and fraudulent use of information, the EIA report is, in general, just sloppy. For example, the grass *Apluda mutica* appears three times in the plant list (nos. 31, 33 and 41) and each time it is given a different local name and a different frequency in the study area. We are told that six out of 41 mammal species are abundant in the study area and that represents 17 per cent. It does not. It represents 14.6 per cent. Mistakes of this kind are understandable, but they have no place in a professional survey which is supposed to be addressing an issue of national importance.

Despite the evident inadequacy of the EIA and despite the fact that it has been safe to travel throughout the sanctuary since 1982, the government has never commissioned a survey of the proposed reservoir basin itself. It should do. To contemplate a project of this kind, a project which would entail so much destruction, without first insisting that the area be properly surveyed by an independent professional body is as irresponsible as it is dishonest toward the great majority of the people of Thailand.

The Costs Involved

When the Nam Choan Project was first mooted in 1979, the World Bank was to be the main financial backer. However, the project's economic viability and likely environmental impact were such that the Bank gave it only a marginal rating even then and its support was conditional on the full backing of the Government of Thailand. The Thai Government demurred in 1982 in the face of unprecedented local and international opposition to the project based, in part, on the discovery of gross factual errors in EGAT's claims^{55,56}.

In 1984 the project was revived. However, this time the World Bank revoked its support on the basis that it could no longer regard the project as warranted. In the intervening years since the project was first evaluated, oil prices had fallen; the demand for energy in Thailand was less than had been predicted; and local supplies of natural gas could now meet much of the extra demand for energy. Furthermore, the Bank would require a complete re-examination of the project to endorse it anew but had no plans to undertake such re-examination⁵⁷.

Japanese banks are the project's new financial backers through the Japanese Overseas Economic Co-operation Fund⁵⁸. EGAT's estimated cost of the project in 1981 was 13,000 million baht (£325 million). That estimate has not been up-dated. Others calculate the actual minimum cost to be very much higher because EGAT has not included within the Nam Choan estimate several expenditures directly associated with the project, such as the cost of building a thermal power station nearby to fill the breach when drought renders Nam Choan's turbines inoperable or the compensation

for damage to land, fish populations and water quality down river⁵⁹.

Furthermore, not only does the cost analysis for the Nam Choan Project fail to debit the value of the land, forest or species that will be forfeited or the loss of tourist potential, it actually credits the Dam budget with the value of the timber to be cleared from the reservoir basin, to the tune of approximately 639.7 million baht (£16m)⁶⁰. Critics have argued that if trees and bamboo in the total area to be cleared by EGAT for the reservoir, access roads and transmission lines were harvested on a renewable basis, the annual return would be 225.8 million baht (£5.6m)⁶¹. And if trees and bamboo were harvested from the whole of Thung Yai (the total area of possible encroachment as a result of the dam) on the same sustainable basis, the return over 50 years would be 7.8 billion baht⁶². That loss of potential should be offset against the value of the energy that can be guaranteed from a dam whose life expectancy is only 100 years because its reservoir is so vulnerable to erosion and landslides⁶³. Should the Government then decide to re-establish the dry tropical forest of the reservoir basin (approximately 200km²) to the status it holds today (even assuming this were possible), it would cost an estimated 45,114,381,000,000,000 billion baht⁶⁴. A project to reforest an area of degraded dry tropical forest in Costa Rica has been undertaken on the strength of 25 years full-time research in the area (see *The Ecologist*, Vol 17, Nos. 4/5). But even so, it will take 200 years before the forest looks like primary forest, and 1,000 years before it is primary forest again⁶⁵.

What the Nam Choan Dam will Provide

The dam will contribute a little over one per cent more energy to the national grid⁶⁶; but only when there is enough water to drive the turbines. There is unlikely to be enough water all year, every year. According to newspaper reports, late or limited rains have caused the hydro-electric dams to shut down for several months in at least four of the last nine years. And recently EGAT admitted⁶⁷ that cancellation of the Nam Choan Project would not result in power shortages. There are several other means of energy production in Thailand besides dams, including substantial domestic deposits of oil and natural gas⁶⁸. Furthermore, in an article in EGAT's own newsletter of May 1986⁶⁹, one contributor argues that EGAT could increase the generating capacity of its existing hydro-electric plants by replacing the generators with newer, more efficient models. This solution would remove any need for the Nam Choan Dam and would cost very much less to effect.

Who Will Benefit Most from the Dam?

The people of Kanchanaburi and Ratchaburi provinces downstream from the dam will not benefit from Nam Choan. For, contrary to recent assertions⁷⁰, the dam cannot help local farmers with irrigation because the only legal farms in the region are located south of the Sri Nakarin Dam so the Nam Choan water will feed it before it can feed any fields. Besides which, the energy from Nam Choan is already destined for the industrial suburbs of Bangkok⁷¹. Nor can a one per cent contribution to the national energy supply make a great

deal of difference to the lives of the average Thai⁷².

The companies who win the contracts to supply the dam equipment will, presumably, benefit. But these may not be Thai companies. All eighteen of the companies who equipped the Sri Nakarin Dam were Japanese⁷³. The dam provides aspiring politicians with a good opportunity for political manoeuvring⁷⁴, though as such, it can also backfire⁷⁵. And of course one must suppose it benefits EGAT. But as Dr Nart said, "What is good for EGAT is not necessarily good for Thailand or the majority of Thai people, particularly when the great bulk of the social and environmental costs, and the loss of potential, are in no way met by the company"⁷⁶.

Conclusion

The Nam Choan Dam would emasculate the finest wildlife conservation area in mainland South-east Asia for very little real economic gain. The bottom line of the debate is this: could the one per cent more energy produced, minus the cost of producing it, outweigh the cost of the damage the dam would do? The answer must surely be "no". So miniscule an increase in energy cannot possibly make a significant contribution to the development of Thailand whereas a conservation area of this magnitude does make a significant contribution to the kingdom's protected area system and to its ecological well-being.

References

1. S. Chettamart, U. Kutintara, S. Vejaboosakorn, K. Praktong and S. Vivajsirin, *Assessment of National Parks, Wildlife Sanctuaries and Other Preserves Development in Thailand*, Kasetsart University for Royal Forest Department and National Environment Board, Bangkok, 1987.
2. J. MacKinnon and K. MacKinnon, *Review of the Protected Areas System in the Indo-Malayan Realm*, International Union for Conservation of Nature and Natural Resources, 1986.
3. T. Smitinand, *The Flora of Thung Yai and Huai Kha Khaeng Wildlife Sanctuaries*, The Forest Herbarium, Royal Forest Department/Faculty of Forestry, Kasetsart University, Bangkok, 1987.
4. S. Bunyawachewin, *The Last Important Tropical Lowland Forest in Thailand*, Forest Ecology Unit, Royal Forest Department, Bangkok, 1987.
5. S. Nakasathien, N. Bhumpakkapan and S. Simcharoen, *Forest and Wildlife Ecology in Thung Yai Naresuan and Huai Kha Khaeng Wildlife Sanctuaries*, Wildlife Fund Thailand, Bangkok, 1987.
6. J. Chermas, "How to Grow a Tropical Forest", *New Scientist* 23 October, 1986.
7. C. Holden, "Regrowing a Dry Tropical Forest", *Science* Vol 234.14 November, 1986.
8. International Union for the Conservation of Nature, Conservation Monitoring Centre, Cambridge, England.
9. Royal Forest Department, Bangkok, 1987. A recent survey (completed in November 1987) of the forest cover of Thung Yai Wildlife Sanctuary using 1:15000 aerial photographs has revealed that 0.1 per cent of the forest has been newly cleared and less than 0.5 per cent is secondary growth. The remaining 99 per cent shows no signs of encroachment.
10. S. Nakasathien, *op cit*, *supra*, Note 5.
11. W. Theeraprasart, *The Upper Quae Yai Project (Nam Choan Dam): The Agony of the Land*. Paper presented at the "People and Dams" Regional Workshop of the Society for Participatory Research in Asia, New Delhi 5-10 September 1987.
12. P. Stott, Personal communication January 1988. Department of Geography, School of Oriental and African Studies, London University.
13. B. Lekagul and J. McNeely, *Mammals of Thailand*. Association for the Conservation of Wildlife, Bangkok, 1977.
14. S. Nakasathien, *op cit*, *supra*, Note 5.
15. P.D. Round, (in press) *The Status and Conservation of Resident Forest Birds in Thailand*, International Council for Bird Preservation, Cambridge.

16. N. Bhumpakkapan, U. Kutintara and N. Naksatit, *The Wild Fauna of Huai Kha Khaeng Wildlife Sanctuary*. Dept. Forest Biology, Kasetsart University, Bangkok (in Thai), 1985.
17. T. Whitmore, *Tropical Rainforests of the Far East*. Clarendon, Oxford (2nd edition), 1984.
18. T. Smitinand, *op cit*, *supra*, Note 3.
19. A.A. Eudey, *Differentiation and Dispersal of Macaques (Macaca spp.) in Asia*, Ph.D. Dissertation, Univ. of California, 1979.
20. P. Round, *op cit*, *supra*, Note 12.
21. International Wetlands Research Bureau, The Wildfowl Trust, Slimbridge, Gloucestershire.
22. W.Y. Brockelman, "The Nam Choan Project: Evaluation of Effects on Wildlife", in Sribhibhadh et al (eds.) *Consider the Costs: A Position Paper on the Nam Choan Dam*. Wildlife Fund Thailand, Bangkok, 1987.
23. W.Y. Brockelman, *op cit*, *supra*, Note 21.
24. M.L. Shaffer, "Minimum Population Sizes for Species Conservation", *Bioscience* 31, 1981.
25. S. Srigosamart, *Animal species diversity and survival: Nam Choan's implications for Thung Yai*, Department of Biology, Mahidol University, Bangkok, 30 November 1987.
26. Electricity Generating Authority of Thailand, *Upper Quae Yai Project. Environmental and Ecological Investigation. Final Report Vol II*. Bangkok, 1980.
27. P. Lovisuth and S. Nakasathien, "Rescued from a man-made flood", *Bangkok Post* 6 December, 1987.
28. S. Nakasathien, *The Effect to Wildlife of the Chiew Larn Dam*, Research Unit, Wildlife Conservation Division, Royal Forest Department, Bangkok, 1987.
29. S. Sudara (in press) "Do we have to lose it to appreciate it?" in Sribhibhadh, Jutarogool and Mead (eds.) *Consider the Costs: A Position Paper on the Nam Choan Dam*. Wildlife Fund Thailand, Bangkok.
30. L. Jaturapol, "Where does the deforestation buck stop?" *The Nation* 7 December, 1986.
31. S. Nakasathien, *Personal communication* 1987.
32. *The Nation*, "Secret EGAT road a haven for profiteers", 23 November. October, 1986.
33. A. Arbhahirama, D. Phantumvanit, J. Elkington and P. Ingkasuwan, *Thailand Natural Resources Profile*, Thailand Development Research Institute, Bangkok, 1987.
34. EGAT, *op cit*, *supra*, Note 24.
35. S. Sermsri, *Population Growth and Environmental Change in Thailand*, Paper presented at The Siam Society Symposium "Culture and Environment in Thailand", Chang Mai, 1987.
36. K. Chunkao, "Forest Resources", in Arbhahirama et al (eds.) *Thailand Natural Resources Profile*. Thailand Development Research Institute, Bangkok, 1987.
37. Wildlife Research Centre, Conservation Monitoring Centre for Thailand, Mahidol University, Bangkok.
38. S. Chettamart, *op cit*, *supra*, Note 1.
39. W.Y. Brockelman, "Nature Conservation" in Arbhahirama et al (eds.) *Thailand Natural Resources Profile*, Thailand Development Research Institute, Bangkok, 1987.
40. S. Nokeplub and S. Kanwanich, "Arguments rage over Thailand's last great forest", *Bangkok Post* 27 April, 1982.
41. S. Chettamart, *op cit*, *supra*, Note 1.
42. *Bangkok Post*, "At 18, EGAT moves toward self-sufficiency in energy generation", November Supplement, 1987.
43. EGAT, *op cit*, *supra*, Note 24.
44. R. Hastings, *Personal communication*, 9 December, 1987. Economic and Conservation Section, Royal Botanic Gardens, Kew, London.
45. N. Naksatit, *Personal communication*, Khao Nang Rum Wildlife Research Station, Huai Kha Khaeng Wildlife Sanctuary, 1987.
46. P. Stott, *Personal communication*, *op cit*, *supra*, Note 11.
47. S. Nakasathien, *The Impact of the Upper Kwae Yai Electricity Generating Project on Forest, Wildlife and Fisheries*. Research Unit, Wildlife Conservation Division, Royal Forest Department, Bangkok, 1987.
48. N. Bhumpakkapan et al, *A Species List of Birds Recorded in the Mae Chan Valley*, Thung Yai Wildlife Sanctuary, 21-25 May, 1987. Forest Biology Group, Kasetsart University, Bangkok (unpub).
49. M. Brendall, *Personal communication*, December 1987. Department of Entomology, British Museum of Natural History, London.
50. G. Fryer, *Personal communication*, January 1988. The Freshwater Biological Association, Cumbria.
51. J. Jintanagool, A.A. Eudey and W.Y. Brockelman, "Species Conservation Priorities in Thailand" in *Species Conservation Priorities in the Tropical Forests of Southeast Asia*. International Union for Conservation of Nature, 1984.
52. B. Groombridge, *Personal communication*, IUCN Conservation Monitoring Centre, Cambridge, 1988.
53. International Wetlands Research Bureau. *Personal communication*, *op cit*, *supra*, Note 20.
54. T. Prayurasiddhi and P. Rojanadilok, *A Critique of EGAT's 1980 Wildlife Environmental Impact Report*. Wildlife Conservation Division, Royal Forest Department, Bangkok, 1987.
55. *The Nation*, "EGAT accused of misinformation on Nam Choan project", 1 October, 1982.
56. N. Tuntawiroon and S. Samootsakorn, "Thailand's Dam Building Programme: Past, Present and Future" in Goldsmith E. & Hildyard N. (eds.) *The Social and Environmental Effects of Large Dams*. Wadebridge Ecological Centre, Cornwall, UK, 1984.
57. Relayed to US Senator D'Amato and detailed by him in a letter to Dr Mitchel of Yale University dated 29 July, 1985.
58. Normita, *Bangkok Post* 27 December, 1987.
59. Tuntawiroon and Samootsakorn, *op cit*, *supra*, Note 56.
60. S. Nakasathien, *op cit*, *supra*, Note 47.
61. S. Bunyawachewin, *An Estimate of the Costs Required to Re-Build a National Forest on the Scale of Thung Yai*, Forest Ecology Unit, Royal Forest Department, Bangkok, 1987.
62. S. Nakasathien, *op cit*, *supra*, Note 47.
63. P. Nutalai, "Earthquakes and the Nam Choan Dam", in Sribhibhadh, Jutarogool and Mead, *A Position Paper on the Nam Choan Dam*. Wildlife Fund Thailand, Bangkok, 1987.
64. S. Bunyawachewin, *op cit*, *supra*, Note 61.
65. Holden, *op cit*, *supra*, Note 7.
66. N. Thongtham, "All for one per cent of electricity?" *Bangkok Post*, 29 May, 1987.
67. *The Nation*, "EGAT rules out power shortage even if Nam Choan project axed", 27 September, 1987.
68. *Far East Economic Review*, November 1987.
69. Reprinted in Sribhibhadh et al, *op cit*, *supra*, Note 22.
70. *Bangkok Post*, "Anat: Nam Choan Dam to help expand farmland", 7 December, 1987.
71. Normita, *Bangkok Post* 13 December, 1987.
72. P. Hirsch, "Social Implications of the Nam Choan Dam, Thailand", Paper presented at the "People and Dams" Regional Workshop of the Society for Participatory Research in Asia, New Delhi 5-10 September 1987.
73. Electric Power Development Co. Ltd. *History of Srinagarind Hydroelectric Development Project; Bright Lights for Thailand*. EPDC, Tokyo, Japan.
74. *The Nation*, "Chavalit supports dam project", 28 May, 1987.
75. *The Nation*, "Chavalit criticized for supporting dam project", 20 May, 1987.
76. Tuntawiroon and Samootsakorn, *op cit*, *supra*, Note 56.

WADEBRIDGE ECOLOGICAL CENTRE

A Major Study of THE SOCIAL AND ENVIRONMENTAL EFFECTS OF LARGE DAMS

by Edward Goldsmith and Nicholas Hildyard

Volume 1: Overview

Volume II: Case Studies

Volume III: Bibliography

Price: £30 per volume (Individuals, Environmental Groups and Third World Institutions); £45 per volume (Institutions); (airmail postage £10 per volume extra).

Complete Set: £80 (Individuals, Environmental Groups and Third World Institutions); £120 (Institutions); (airmail postage £30 per complete set extra).

Please send your cheque/postal order to Ecosystems Ltd., Worthyvale Manor Farm, Camelford, Cornwall, PL32 9TT, U.K.

Nam Choan: Benefits for Whom?

by Philip Hirsch

The Electricity Authority of Thailand (EGAT) is adamant that Nam Choan will benefit Thailand both socially and economically—bringing tourism to the region, preventing illegal settlement and ensuring the country's electricity supplies. Such claims are of dubious validity. Moreover, the dam will have profound social effects for both the local people and those living downstream.

Many of the arguments put forward in favour of dam construction are phrased in terms of the social benefits said to accrue. In the case of Nam Choan, the arguments are broadly as follows. Being primarily concerned with electricity generation, EGAT (the Electricity Generating Authority of Thailand) places the main emphasis on the need for increased generating potential. According to EGAT, the "development" of Thailand is dependent on such an increase, due to the needs of industry in urban areas and the rapid electrification programme in rural areas that is currently linking half a million new households per year to the national grid. It is claimed that new capacity is needed by the mid-1990s in order to avoid shortages.

Wary of giving too much emphasis to the hydro-electric importance of Nam Choan, EGAT is also keen to stress the multi-purpose nature of the dam. Since 70 per cent of the Thai population still depend on agriculture, much of which is rainfed and subject to drought, any project that promises increased irrigation potential has immediate social appeal. Nam Choan, it is claimed, will greatly increase the irrigability of the Lower MaeKlong watershed area by increasing the storage capacity of the system. Other than agriculture, the recreational "benefits" of the dam are extolled as a moneyspinner and therefore a source of employment for local people to be created by the dam. With tourism now Thailand's top foreign exchange earner, this is an especially important consideration.

In addition to using these "positive" arguments for Nam Choan, EGAT has attempted to pre-empt opposition to the dam in a number of nega-

tive ways. Foremost is the claim that large areas of the Thung Yai reserve (see p.212) and the surrounding area have already been encroached upon and that it is only a matter of time before the area is illegally cleared anyway. Construction of roads and increased numbers of officials in the area, it is said, will help to control illegal activity. Moreover, the timber that is extracted in relation to dam construction will be cut legally and be liable to tax.

A Question of Supply

To justify construction of the Nam Choan Dam in terms of its contribution to Thailand's development via increased electricity demand begs a number of questions. The first is the fundamental question of whether high-energy industrialisation and rapid rural electrification are in fact suitable priorities for development. Seventy per cent of the Thai population still depend on agriculture for a living, and electricity affects their lives mainly in increasing demand for unaffordable consumer goods.

Until that question is addressed, however, it must be assumed that electricity consumption will continue to rise, since national policy makers are firmly set on industrial expansion and rural electrification. But what is the likely scale of the increased demand? EGAT has revised forecasts downward since Nam Choan was first proposed, due to a number of factors including a slowdown in Thailand's economic growth rate after the end of the 1970s. Since Nam Choan would supply less than 2 per cent of total electricity generation capacity, small changes in demand forecasts can alter radically the "necessity" or otherwise of the project.

In addition, since the total contribution of Nam Choan to the national grid supply would be so small, it is easy for EGAT to argue that within a

short space of time (six years in the case of Nam Choan), Thailand will be short of electric power if the dam is not built. Using such an argument, the smaller the project, the more urgent it can be made to appear! Of course the fallacy in such an argument is that it begs the question of alternative sources of supply. Even if Nam Choan were to be built, new generating potential would still have to be found, given EGAT's demand projections. In effect, therefore, the tradeoff is not between sufficient electricity with Nam Choan and insufficient without, but rather between generating electricity with Nam Choan or in some other way. Once this is recognised, the "anti-development" label EGAT attaches to dam opponents wears thin.

The main alternative means of electricity generation in Thailand are lignite—and oil—or gas-powered stations. EGAT has argued in favour of hydro-electricity because it employs an apparently free resource, namely water, thus reducing the need for expensive fossil fuel imports. There are several holes in this argument. First, accounting must include interest repayments on foreign loans secured to construct the dam; in economic terms, these are just as much running costs and a drain on foreign exchange as are oil imports. Second, to see large dams as permanent sources of power is fallacious, since siltation limits their life, and all existing dams in Thailand have had their projected life reduced due to increases in siltation following upstream deforestation. Third, lignite deposits in Lampang and offshore oil and natural gas in the Gulf of Thailand will provide increasing supplies of these fuels without affecting the balance of trade. Fourth, recent falls in oil prices have dramatically altered the once favourable trade-off between hydro-power and other forms of generation. Fifth, many of the

Philip Hirsch is based at the Department of Geography, University of Sydney. He carried out sixteen months of anthropological fieldwork in Thailand's Uthaitani Province.

costs of dam construction are not accounted for due to their status as public goods (for example, forest reserve land) or because of difficulties in precise economic valuation (for example, threatened species, many of which are still unknown but may have important economic benefits). Other "externalities" of dam construction, such as the adverse downstream effects of the dam (see below), are also ignored in the accounting. In sum, once we recognise the tradeoff between different forms of power generation, the issue becomes clear: expansion of hydroelectric power cannot cater indefinitely for continuous growth in demand for electricity, since there is a physical limit to the number of appropriate sites, and the real costs of dams relative to other forms of generation increase with each successive move up fragile watersheds. The fact that Nam Choan would require extensive encroachment on the finest area of protected forest in the country suggests that the tradeoff point has long been reached.

The Myth of the Multipurpose Dam

The multipurpose nature of Nam Choan is highly illusory. No new land will be brought under irrigation as a result of the dam, since all the water released from the dam will enter the Srinakharin Reservoir. The only potential irrigation advantage of Nam Choan would be to increase the storage capacity of the Upper Khwae system for use on existing irrigated areas in the Lower MaeKlong watershed. Of the reservoir's capacity, one third is in dead storage, which means that it can never be used for irrigation. More significant is the fact that EGAT would be reluctant to release water down to the minimum level during the dry season, since it would take sixteen and a half months to refill the reservoir assuming no water at all was released from the dam.¹ Previous experience has shown that the irrigation advantages of large dams in Thailand have been limited, since the releases of water from the dams are timed to suit the needs of the Electricity Generating Authority, who control the dam, rather than the Royal Irrigation Department or farmers, who have no say over when water is released.



Belinda Stewart Cox

A Karen village. The Karen are one of two tribal groups living within the boundaries of Thung Yai. At least 2000 people would be displaced by the dam. The Karen have said they would rather die than leave their lands.

Tourism: An Unlikely Prospect

EGAT argues that Nam Choan will prove a major tourist attraction. However, the limited recreational advantages of the reservoir are revealed by EGAT's own figures. Since the maximum normal water level would be at 370 metres above sea level and the minimum at 331 metres, the draw-down would be 39 metres. An annual vertical variation of this magnitude implies a zone often hundreds of metres wide which is devoid of obvious life. No permanent recreation facilities can be built at the shores of the reservoir, since the shoreline is constantly moving. The relatively high "live" storage capacity of the reservoir thus serves to destroy its supposed recreation potential. In addition, the recreation value of the Thung Yai and Huay Kha Khaeng forests would be destroyed as a result of dam construction. This recreation value is not limited to the substantial number of foreign tourists who would much rather visit a pristine wildlife reserve than a dam site, but also includes urban Thais who are increasingly in need of open space and faced with ever declining areas of forest. In addition, there are the local people for whom access to the forest has long been part of a way of life but who are never taken into account since this form of recreation generates no obvious addition to the national coffers.²

Encouraging Encroachment

EGAT's argument that the area would be encroached on regardless

of the dam, and that accessibility increases the possibility of government control over such encroachment, flies in the face of all experience. It is true that the area has started to be encroached upon by illegal loggers and farmers in search of land—primarily along the road that EGAT cut illegally to the dam site in 1981, to the chagrin of the Royal Forestry Department. In every case of road construction into a previously forested area, loggers and settlers have not been far behind, and officials have been either directly involved in illegal forest exploitation or ineffective in stopping it. I carried out 16 months' anthropological fieldwork among recent settlers in nearby Uthaitani province, and the key element in deforestation and settlement of that area was the construction of roads into the area, initially for logging concessionaires. Encroachment certainly would have taken place even without these roads, but more slowly, in a more orderly and less violent manner, and with a far less rapid and destructive impact on the forest environment than was the case.

Impact on Local People

Two tribal groups live within the boundaries of Thung Yai wildlife reserve. They are the Hmong and the Karen, both relying on shifting cultivation for their livelihood. The Hmong would be less directly affected by the dam since they farm at higher altitudes and are seminomadic. The Karen, however, live in permanent villages at lower alti-

tudes, several of which would be flooded by the dam's reservoir. Altogether, some 2000 people would be displaced. EGAT has encompassed resettlement in its plans. However, resettlement schemes in the past have often been disastrous failures, both for the people concerned and for the areas in which they are resettled. The Thai authorities do not recognise the right of tribal groups to carry on shifting cultivation, branding it as destructive of the forest and illegal, since no land rights are held by those concerned. As a result, resettlement is in permanent settlements, which traditional shifting cultivators soon abandon, often selling the land to lowland settlers and moving on to clear new areas. There is thus a triple forest loss associated with dam construction: the area flooded by the dam, the resettlement area designated by the authorities, and the new areas cleared by those who object to forced resettlement. Meanwhile, increased accessibility of the shifting cultivators' swidden lands can be expected to lead to violent conflict with the arrival of lowland permanent cultivators.

Downstream Consequences

Apart from the direct impact on those upstream of the dam, construction of a dam the size of Nam Choan threatens to affect people beyond the area of the dam itself. These externalities can be gauged from the experience of the Srinakharin Dam. Due to problems of leakage, the reservoir took almost three years to fill before electricity could be produced and water released; Nam Choan would take exactly two years assuming no river flow below the dam and no leakage. The effect of stopping the flow of the Khwae Yai is to allow intrusion of saline water at the estuary of the MaeKlong River. In 1981, such salt-water caused an estimated 600 million *baht* of damage to coconut plantations in Samut Songkhram province. The farmers were not compensated, as EGAT denied responsibility and blamed drought for the damage.³ Another downstream consequence of dams that is difficult to quantify but which threatens livelihoods is the loss of nutrients for shallow water fisheries. The construction of Nam Choan would further reduce the supply of such nu-

"In every case of road construction into previously forested areas, loggers and settlers have not been far behind"

trients to the Gulf of Thailand, which is already severely depleted of fish. There is also a "downwind" cost in the loss of moisture from evapotranspiration that results from loss of forest cover, and this in turn can exacerbate the drought suffered increasingly frequently by farmers in rain shadow areas to the east of Nam Choan. In 1987, Uthaitani farmers' upland crops have been ruined by severe drought, which is in part attributable to deforestation to the west.

Increasing Centralisation

On the face of it, Thai society is relatively open, and the fact that the issue has achieved its present prominence in the press attests to this fact. Nevertheless, for a number of reasons, the debate is far from balanced. First is unequal access to information, with EGAT preferring to release information as late as possible in order to be able to present the dam as a *fait accompli*. In 1982, the Prime Minister's Office issued a letter forbidding public servants, including academics, to speak out against Nam Choan, while at the same time EGAT had access to public radio to release a constant stream of propaganda in favour of the dam's construction. Many questions have been raised concerning EGAT's feasibility studies and Environmental Impact Assessment (see p.215), yet resources have not been made available for an independent study of the dam's impact. Even more serious is the way in which EGAT tries to stifle public opposition. At times, this verges on the ridiculous: thus, in early 1987, a senior official stated that opponents "should have their heads cut off". More serious is the securing of a statement of support for the dam by the Army Commander-in-Chief, which has the effect of intimidating those who would contribute to the debate openly and objectively.

Immediate Prospects

There is every indication that

EGAT is set on construction of Nam Choan Dam and is pressing for a definite Cabinet decision within the first quarter of 1988. Yet a number of uncertainties remain. One is the source of funding for the dam. EGAT states that funds are expected from IBRD and OECF; yet both of these agencies deny having received a request for funding or committed funds. The more significant uncertainty arises due to the strength of feeling against construction of the dam that has built up in Thailand and abroad, as a result of the campaign against Nam Choan.

On the international front, Friends of the Earth (FoE), the Asia-Pacific People's Environment Network (APPEN), and the International Dams Newsletter (IDN) are all opposed to Nam Choan. Inside Thailand, the Project for Ecological Recovery (PER), World Wildlife Fund (Thailand), student environmental clubs, and a local citizens' group in Kanchanaburi Province have all taken up the issue. Of great significance is the public opposition to Nam Choan by the Royal Forestry Department, and in November 1986 this led to conflict between officials of this department and EGAT.

What is important is to get as much information as possible concerning the dam and to be able to answer EGAT on its own terms. That requires an understanding of EGAT's tactics and vested interests. Coordinated opposition to Nam Choan at various levels (local, national, international) and among different groups (farmers, academics, students, conscientious government officials) is a pre-requisite to the saving of the finest remaining area of tropical forest in mainland Southeast Asia.

References

1. In 1987, the reservoirs of many of the major dams in Thailand reached critically low levels due to drought in the dam watersheds, threatening to halt hydroelectric power generation.
2. Another aspect of the forest to consider in Thailand is its role as a traditional source of spiritual renewal according to Buddhist belief and practice. This could also be seen as an important "recreational" function in its role as a non-western type of "relaxation".
3. This is a particular bone of contention between EGAT and opponents of Nam Choan, since EGAT supported its assertions by using false rainfall statistics that were four times too low in order to make its case for drought as a cause of the damage.

Earthquakes and the Nam Choan Dam

by Prinya Nutalai

The Nam Choan Dam is to be sited near six active earthquake fault lines. Should an earthquake occur, the consequences would be disastrous.

Until very recently, it was believed that Thailand was an earthquake-free zone, largely because there were no records of previous earthquakes for foreign academics to study or refer to and no translations made by Thai academics for them to read. Significantly the first seismograph in Thailand was only installed in 1963 at Chiang Mai. Provided that dams could withstand vibrations of only 0.1g (where g stands for the acceleration of the gravity of the earth), engineers did not even make provisions against the dangers of earthquakes. It is now clear, however, that Thailand has at least six active fault lines—and that, if built, the Nam Choan Dam would be particularly at risk.

Geology and Earthquakes in Western Thailand

In the western part of Thailand and the eastern part of Burma, there are six faults, each more than 300 kilometres (kms) long, of these, some are more than 600 kms long, namely the Sagaing Fault which passes through Sagaing and Pako (both cities in Burma); the Pan Luang Fault and the Tonggi Fault which pass through the Shan State of Burma running down towards the Moei-Uthai Thani Fault; and the Si Sawat Fault in Thailand. The latter fault, situated in the bottommost part is Three Pagodas Fault, (see Figure 1).

All six of these faults lie in the same direction indicating that they were caused by the same pressure system inside the earth. They also are still active, as seen from the following examples of earthquake records:¹

- **The Tonggi Fault:** On 23 May 1912, there was an earthquake, its epicentre situated between Mandalay and Tonggi in Burma. The quake registered 7.9 points on the Richter

scale causing devastation to several big and small cities in Burma such as Mandalay and Memyo. The tremors from that earthquake could also be felt in Thailand.

- **The Sagaing Fault:** On 23 March 1785, during the reign of King Rama III, there was an earthquake along the Sagaing Fault, its epicentre situated between Angwa and Sagaing. Chao Phya Tipakornwongs in Bangkok described the earthquake as follows: "... there was an earthquake at 8 pm. People throughout the Kingdom were frightened not knowing what had happened. Houses seemed as if they were going to collapse, while rathouses rocked to and fro like waves ..."

Reports of damage in Burma indicated that none of the country's temple tops survived the earthquake. All the buildings in Angwa collapsed and the people who lived inside were buried under the debris. The Great Temple of Ming-kun, which is the biggest temple in the world, collapsed. On both sides of the river between Amornpura and Angwa, there were several landslides ranging in width from 5 to 20 feet.

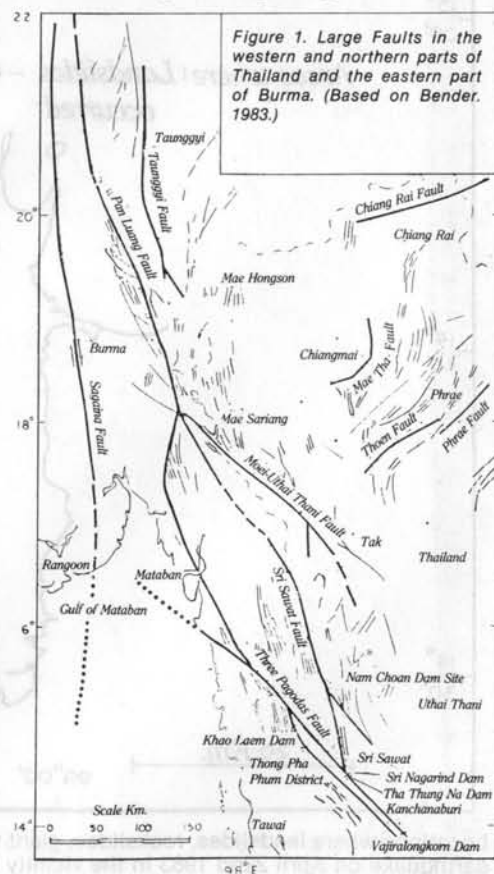
On 5 May 1930, there was another earthquake along the Sagaing Fault centred at Pako. The quake registered 7.3 points on the Richter scale and was one of the most violent earthquakes in Burma. Almost all of Pako was destroyed, and more than 500 people perished. The earthquake also caused devastation over an area of 220,000 square miles, including parts of Thailand.

On 3 December 1930, a third earthquake occurred along the Sagaing Fault, registering 7.3 points on the Richter scale, its epicentre situated at Payu city in Burma. Tremors occurred three times on 3 and 4 December. Railway bridges were damaged, and railroad tracks twisted. Several fissures and faults appeared in the ground. At least 36 people died and several others were injured. Several provinces in Thailand including Bangkok were affected by the earthquake.

- **The Three Pagodas Fault:** On 21 March 1959, there was an earthquake along the Three Pagodas Fault at Klong Do, in Muang district, Kanchanaburi Province. The *Siam Nikon* newspaper, dated 25 March 1959, reported: "All of a sudden, there were rain storms and roars of thunder and a heavy downpour of rain. At the same time, there was an earthquake and a thunderous noise in the earth. An instant later, a fissure developed in the ground across the village 300 metres long, 1-2 metres wide and 150 centimetres deep, greatly frightening the villagers."

After construction of the Khao Laem Dam, a seismic station was set up at the dam area, and it was reported that during the first three months after its installation (March-June 1986), 165 earthquakes in the adjacent areas were registered.²

- **The Moei-Uthai Thani Fault:** On 17 February 1975, there was an earthquake along the Moei-Uthai Thani Fault registering 5.9 points on the



Richter scale, its epicentre situated near Tha Song Yang district, Tak province. This earthquake could be felt throughout the Central and the Northern regions, and caused slight damage to houses.

- **The Si Sawat Fault:** On 22 April 1983, there was an earthquake along the Si Sawat Fault registering 5.8 points on the Richter scale, its centre situated on the eastern side of the reservoir of the Sri Narakind Dam in Kanchanaburi province. This earthquake caused a crack more than 4 kms long and the movement of entire blocks of rock in opposite directions. It also caused landslides into the reservoir and large waves in the reservoir.

From all the available data on earthquakes in Thailand and adjacent areas from 1902 to 1987, Mr Shreshtha, a post-graduate student from Nepal at the Asian Institute of Technology, has calculated rock slippage on both sides of the six identified faults. He found that during the past 85 years both sides of rock in the

Three Pagodas Fault moved 32 cms in opposite directions, while at the Si Sawat Fault rocks moved 6 cms in opposite directions.

Dams in Kanchanaburi Province

At present, there are two large dams in the Mae Klong River basin, namely the Khao Laem Dam across the Kwai Noi River astride the Three Pagodas Fault, and the Sri Narakind Dam across the Kwai Yai River astride the Si Sawat Fault. In addition, there are two small dams, namely the Tha Tung Na Dam, astride the Si Sawat Fault, and the Vajiralongkorn Dam, astride the Three Pagodas Fault. All of these dams have been designed to withstand vibrations from earthquakes of just 0.1 g.

The movement of rocks in opposite directions on both sides of faults, besides causing vertical and horizontal shock waves in the form of earth-

quakes, may cause cracks in the rocks, displacement of rocks, landslides and sandslides into the reservoirs, and/or giant waves in the reservoirs that could cause flooding. Building dams across active faults is thus to tempt fate.

Earthquake-Related Damage to Dams: Some Examples

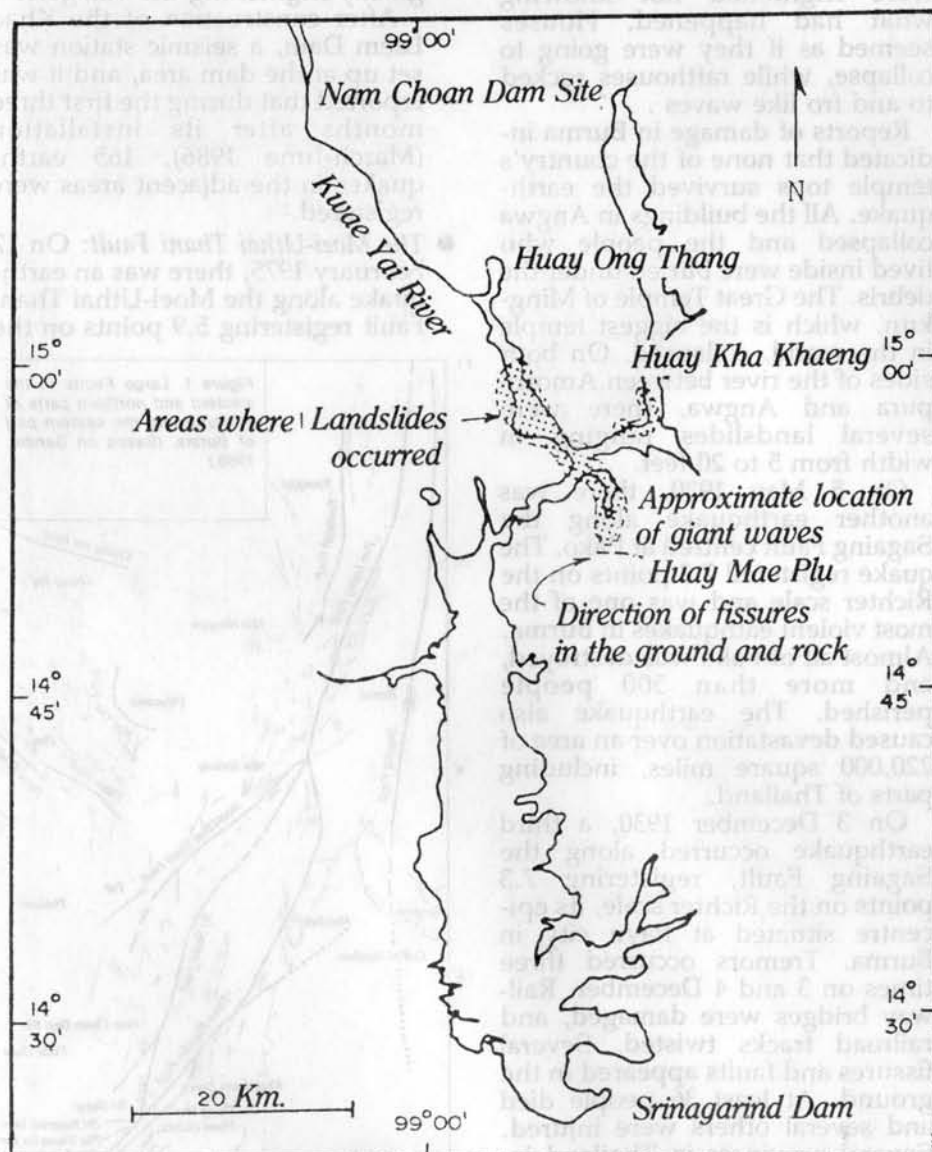
1. The Movement of Rocks Along the Fault

The Baldwin Hills Dam is situated on the western side of Los Angeles, California between the airport and the city. First storing water in 1951, this dam was recognised as an example of engineering excellence with regard to design, construction, and maintenance procedures. The efficiency of the dam was also monitored over a 12 year period. At 11.30 hours in the morning of 14 December 1963, water was heard flowing from the spillways by dam wardens and mud and water were found leaking from the back of the dam. Attempts were made to block the leaks with sand bags from 12.20 hours until 13.30 hours, when it was realised that the leaks could not be stemmed. People downstream of the dam were then evacuated: nonetheless five lives were lost. Insurance companies paid immediate compensation for property damaged by mud and water, and several law suits followed.

When the site was surveyed prior to the construction of the dam, it was known that there were three faults beneath the dam. But the surveyors believed that the faults were not active. Since the dam was to be located in an earthquake-prone area, it was designed to withstand a horizontal acceleration of gravity of 0.2 g. Surveys carried out after the collapse of the dam found that there were movements of rocks on both sides of the faults which caused the dam to crack.

2. Tremors from Earthquakes

The Van Norman Dam is situated in the San Fernando valley north of Los Angeles and was put into service in 1918. On 9 February 1971, there was an earthquake registering 6.4 points on the Richter scale. Its epicentre was situated 14 kms from the dam. The earthquake caused water to flow over almost the entire crest at the northern end of the dam. Fortun-



Locations where landslides, rockslides, giant waves and fissures occurred as a result of an earthquake on April 22nd 1983 in the vicinity of the proposed dam site. (Data from EGAT)



WWF Thailand

The Baldwin Hills Dam, damaged as a result of the movement of rocks along a fault line.

ately the tremors lasted only 15 seconds and were not followed by others.

3. Landslides into Reservoir

The Vaiont Dam is a concrete arch dam, 265 metres high, and is situated near Belluno, Veneto Province, Italy. During the night of 9 October 1963, rock masses on the left side of the mountain slope slid into the reservoir causing tidal waves which splashed over the dam and washed away all the houses in the village of Longarone, south of the dam. Over 2,600 people perished. When the water reached the Piave River about 1.6 kms south of the dam, the waves were 70 metres high.

The dam is still in good condition, but the quantity of rocks which slid into the reservoir blocked water north of the dam rendering it inoperative.

Damage to Partially Constructed Dams

The Auburn Dam across the American River in California was a concrete arch dam, 210 metres high. After the foundation work was almost finished in 1978, there was an earthquake registering 5.8 on the Richter scale, the epicentre situated 64 kms from the dam. After the earthquake, the State of California issued orders to discontinue construction of the dam and carry out a safety survey. The study took five years to complete and cost US\$ 25

million. It was found that an active fault passes under the foundation of the dam. The builders tried to push for the dam's completion since more than US\$ 500 million had been spent. The dam was redesigned as a riprap dam, at an estimated cost of US\$ 2 billion. However, the State of California refused to give the go-ahead. Then, in February 1986, water flowed over a 73-metre-high earth diversion dam causing it to collapse. Water gushed out at a rate of 25,000 cubic metres per second. (The amount of water was six times the amount of water in the Chao Phraya River at its highest level during flooding.)

Nam Choan and the Risk of Earthquakes

Given that both the Three Pagodas Fault and the Si Sawat Fault are still active, there is a very real possibility of earthquakes occurring that could damage dams in the area, or even cause them to collapse. What would happen to Nam Choan if an earthquake caused fissures in the ground, as at the Sri Nakarind Dam or the Khao Laem Dam? And how can we be sure that such an event will not happen?

In 1985, Mr Peerawat Poonthong, a post-graduate student of the Department of Water Resources Engineering at the Asian Institute of Technology, prepared a mathematical model depicting the collapse of the Sri Nakarind Dam under various conditions, and found that the level

of water in the Mae Klong River in Kanchanaburi Province would rise by 4 metres within 4-5 hours after the collapse of the dam.

In making the decision to build or not to build the Nam Choan Dam, consideration must be given to the safety of the people who live in the Mae Klong River basin. Those who have the authority to approve its construction must bear in mind that they are responsible for the lives and property of the people of Kanchanaburi Province. If disaster results from the collapse of the dam, the people who authorised its construction must be prepared to face relatives of the deceased, the injured and those who have lost their property as a result of such a disaster, with the conviction that they made the best decision with a clear conscience and the concurrence of the academics who acted as their consultants, and that the disaster was really unavoidable. They must also surely be prepared to explain this to relatives of the victims after such a disaster.

This article is extracted from Dr Prinya Nutalai, "Earthquakes and the Nam Choan Dam", in P. Sribhibhadh, R. Junkarogool and E. Mead (eds.) *A Position Paper on the Nam Choan Dam*, Wildlife Fund, Thailand, 255 Soi Asoke Sukumvit, Bangkok.

References and Notes

1. Those who are interested in the data on all the recorded earthquakes in Thailand may refer to Prinya Nutalai, *Series on Seismology, Volume II: Thailand*, Sopit Sodsi and E. P. Arnold, 1985.
2. Data from the Education and Research Division, Meteorology Department, Thailand.

Laguna Verde: The Nuclear Debate in Mexico

by Bill Weinberg

Mexico is planning to start up its first nuclear power station at Laguna Verde in the state of Veracruz. Opposition to the plant has given rise to a powerful anti-nuclear movement and an increasing awareness of ecological issues.

It is unusual to see so many people on the street so early on a Sunday morning in Xalapa, the capital of the Mexican state of Veracruz. But this Sunday is the first anniversary of the Chernobyl disaster and Xalapa is the town closest to Laguna Verde, the site of Mexico's first nuclear power plant. Nobody in Xalapa has a good word for the plant—it seems as if nearly every home and business has a sign in the window that says, "No a Laguna Verde!" Each march against the plant has brought out more people than the one before it. So, on the morning of April 26, 1987 after the two small buses which had been chartered by the organisers to shuttle the protesters to the plant had both been filled and there were still people who needed lifts, the demonstrators took to the middle of the street and began stopping public city buses. Within a half hour the demonstrators have commandeered enough buses (and enlisted the cooperation of their drivers) to get everybody out to the plant.

When we arrive at the plant, fifty kilometres away on the Gulf Coast, a string of pick-up trucks and vans are intentionally stalled across the highway, bringing all traffic to a halt directly in front of a make-shift stage which is set up just outside the gates of the plant. A long line of vehicles builds up before the roadblock. For the next hour, a captive audience of commuters, truck drivers and bus passengers witnesses the demonstration and listens to the speakers on the stage.

After the demonstration, a Mexican photographer for *National Geographic*, with an obvious passionate love for the land and its history, drives me to a secluded cove with a view of the plant. He tells me that this is where Cortez made his first settlement after landing on the site where the city of

Veracruz is today. He points out a sheer mountain several kilometres inland and tells me that is where the Indians who dominated this region before the arrival of the Spanish, descendants of the Olmecs, Mexico's "mother civilisation", buried their kings. "This is where civilisation began on the continent," he says. Then, turning to look across the dunes at the power plant, he adds: "... and that is what may end it..."

Mexico's Nuclear Programme

Activists in Mexico's growing anti-nuclear and Green movements generally believe that the explanation for the government's unwillingness to abandon the Laguna Verde project lies in the desire for prestige, and point to a basic contradiction in the psychology of Mexico's rulers. While championing "Third World" causes and maintaining vocal criticism of US policy in Central America, Mexico's government nonetheless wants to be identified with the industrialised "First World". This is especially true of the US-educated "technocrats", who have gained the upper hand in the current administration of President Miguel de la Madrid. A functioning nuclear plant is an important symbol of "First World" prestige, even as landless peasants migrate by the hundreds of thousands to dismal shanty towns on the outskirts of Mexico City. The Institutional Revolutionary Party (PRI), which has been ruling Mexico for more than fifty years, is caught between its "revolutionary" heritage which demands that it stand up to the US (on at least a few token issues, such as Central America) and its "institutional" heritage which demands that it emulate the US.

A few years ago, Mexico was moving towards developing its own nuclear technology and industry, but the economic crisis of the past decade has taken its toll. Uramex, the state-

run uranium mining company which was exploiting reserves in Chihuahua, Oaxaca and Baja California, was closed two years ago. While there is one research reactor at a government laboratory outside Mexico City, plans to start another at Mexico City's National Autonomous University have been abandoned. So both the fuel and the technology for Laguna Verde are imported from the United States.

The history of Laguna Verde itself is a familiar one in the nuclear industry. When construction began in 1970, it was projected that the plant would be operating by 1974, the first of twenty reactors to be completed by the year 2000. It is only now—seventeen years later—that the Federal Electric Commission (CFE), the national government power utility, is readying Laguna Verde for operation despite mounting opposition. Construction was never started on any of the other nuclear plants.

The delays in construction cannot be blamed on government indifference to the programme. Indeed, the Mexican authorities have leant over backwards to support the nuclear industry. Thus, in 1974, President Luis Echeverria, an ostensible "leftist", passed the Law-Decree of Civil Responsibility for Nuclear Damages, which was dubbed by critical journalists "the Mexican Price-Anderson Act". (The Price-Anderson Act is the US law of 1957 which limits the nuclear industry's liability in the event of an accident.) The Mexican Law-Decree completely frees "nuclear operators" from any liability for damage which is "manifested" more than ten years after a nuclear accident. A Mexican citizen who is diagnosed as having cancer ten years and one day after exposure to radiation in a nuclear accident cannot sue. The Law-Decree thus laid the legal groundwork for the country's ambitious nuclear programme, serving as an industry safety-net.

Bill Weinberg recently spent six months researching ecological issues in Mexico and Central America. He is based in New York.

Public Opposition

The failure of Mexico's nuclear programme to live up to expectations was largely due to the drastic devaluation of the peso in the early 1980s and the economic chaos known throughout Mexico and Central America as "*la crisis*". However, public opposition also played a role. While the overwhelming majority of Mexicans know little, and care less, about the nuclear power plant on their Gulf Coast (being basically concerned with economic survival), there is a burgeoning ecology movement which, while small, is well-organised, extremely vocal and quickly growing.

The issue of an accident at Laguna Verde is one which is being pushed by the Mexican ecology movement and summarily dismissed by the CFE. Laguna Verde was designed by, and built under the direction of, General Electric. General Electric nuclear plants use the controversial "pressure-suppression" containment shield. In this type of containment, the steam produced by an overheating reactor is channelled into a "wetwell", a chamber filled with cold water which causes the steam to condense, thereby relieving the pressure on the wall of the containment building. The actual wall of the containment building in such systems is therefore smaller and less expensive than in other reactor designs. At the Chernobyl plant (which, although considerably different from General Electric plants in many respects, also used this containment system) there was an explosion of such force that the channelling system was overwhelmed and the containment wall was blasted open.

The BWR Controversy

The particular design used at Laguna Verde, the Boiling Water Reactor Mark II, has been a source of great controversy in the US.

In 1984, three Ohio utilities filed suit against General Electric for damages of approximately \$4 million after the cancellation of the Zimmer nuclear power plants which were built on the Mark II design. In 1986, the utilities added the charge of fraud to the case, claiming that General Electric had known that the Mark II design was faulty when they sold it.



A demonstration against Laguna Verde on the anniversary of the Chernobyl disaster attracted more than 10,000 protesters.

The utilities cited a 1975 internal General Electric engineers' report which recommended that the company halt sales of the Mark II reactor. The "highly confidential" report was leaked to Congress by the engineers after they quit General Electric that same year.

Further claims are made by Robert Pollard, a former official of both the US Atomic Energy Commission (AEC) and its successor the Nuclear Regulatory Commission (NRC) who resigned in 1976 because he "didn't believe the agency was doing what it was set up to do." Pollard, now working for the Union of Concerned Scientists, maintains that the AEC and NRC have known about the defects in the General Electric containment system for years but have refused to act on this knowledge and, indeed, covered it up. Pollard cites an internal AEC memo from 1972 in which a high-ranking AEC official, Joseph Hendrie, dismisses the idea of "discouraging further use" of the pressure-suppression containment system because it

"... could well be the end of nuclear power. It would throw into question the continued operation of licensed plants, would make unlicensable the GE and Westinghouse ice condensor plants now in review, and would generally create more turmoil than I can stand thinking about."

Pollard filed a request under the Freedom of Information Act for the AEC memo when Hendrie became chairman of the NRC. The memo was twice denied to Pollard, who only succeeded in procuring it in 1978, when Hendrie was secure in his position as NRC chairman.

There are currently 49 nuclear power plants in the United States with pressure-suppression containment. Thirty-nine are General Electric Boiling Water reactors Mark I, II or III. The remaining ten are Westinghouse Pressurized Water Reactors which use a pressure-suppression system known as "ice-condensor" because in the event of an accident the resulting steam is condensed by passing through baskets of ice, rather than a pool of water.

Selling to the Third World

In the 1970s, as the nuclear industry foundered and the number of cancelled orders for new plants in the US mounted, contractors like General Electric began looking to developing countries to sell their wares. According to Lynn Wallace of General Electric, the company has built 21 nuclear plants with pressure-suppression containment abroad—in Spain, Italy, Switzerland, Japan, Taiwan and Mexico. Of these, five are Mark II reactors—two in Japan, one each in Italy and Switzerland,

and Laguna Verde in Mexico. In addition, General Electric has licensed foreign companies to use their pressure-suppression design.

Pollard maintains that the safety standards for nuclear exports are even looser than for domestic plants. Pollard reviewed extensively the Westinghouse Bataan reactor in the Philippines (which has been scrapped by the Aquino government) and claims that "the US government simply doesn't review the safety of nuclear exports. Westinghouse really cut some corners on the Bataan reactor."

Activists in Mexico maintain that Laguna Verde is doubly dangerous as both a Mark II reactor and an export. Finally, it is located in an area which has experienced seismic and volcanic activity in the past.

The Politics of Laguna Verde

Opposition to Laguna Verde has not been divided along lines of right and left, as nuclear issues frequently are in the US. Much of the opposition is coming from a Green movement which sees itself as having little in common with either the right or the traditional left. On November 9, 1986, over 4,000 protesters marched to the gates of Laguna Verde, demanding a popular referendum to decide the future of the plant. The anti-nuclear coalition, organised by such groups as the National Ecologist Alliance, includes *campesinos* (peasants) and local fishermen as well as artists, students and intellectuals. Even the Catholic church took a strong stand against the plant in December 1986, when eight bishops and the archbishop of Veracruz state issued a declaration denouncing the project. On April 26, 1987, the "Chernobyl Anniversary" demonstration brought out more than 10,000 protesters.

Opponents of the plant are increasingly thinking in terms of such militant actions as roadblocks and massive boycotts of electricity at peak hours. Meanwhile CFE spokesmen continue routinely to dismiss allegations that the plant is unsafe as "lies" and PRI officials consistently refuse to consider the idea of a national referendum.

The various ecology groups and government agencies both have friends in SEDUE, the Secretariat of

Ecology and Urban Development. Created by the PRI in 1984 amidst much fanfare, SEDUE has been criticised by some radical ecologists as a mere sop to pacify the Green movement. However, the fact that the PRI felt moved to throw the movement a sop is an indication of the movement's growing power—at least in Mexico City's intellectual circles.

SEDUE has important connections to the more prominent ecology groups, and is potentially in a position to influence the government against Laguna Verde. SEDUE's last director, Carrillo Arena, was asked to resign after government buildings he had designed collapsed in the earthquake. His replacement, Manuel Camacho Solis, is generally held to be more concerned with "ecology" than "development" and has made statements against Laguna Verde—but even he has privately cautioned ecology groups against anti-nuclear demonstrations.

Manuel Camacho Solis has assured the public that Laguna Verde "will not go into operation until maximum safety is guaranteed." However, more powerful figures in the government are pushing for an immediate start-up. Among the most prominent of these are Juan Eibenschutz, CFE assistant director, and Alfredo del Mazo, who is both Secretary of Energy and Secretary of State Industries. These men lead a small but powerful cabal in the PRI who earnestly believe in nuclear energy. They are insistent not only on starting Laguna Verde, but also on building more nuclear plants. Their attitude is summed up by the statement of a prominent PRI politician who is a member of their camp: nuclear power is the "technology of the future that we as Mexicans must develop."

Worker Opposition

However, their plans may be thwarted by dissent from amongst the nuclear workforce itself. In 1977, a "Democratic Tendency" within the United Syndicate of Electric Workers of the Republic of Mexico (SUTERM), a union controlled by the massive, corrupt and PRI-linked national labour organisation Confederation of Mexican Workers (CTM), split to form a new organisation. The new

organisation, a radical break from Mexico's traditional organised labour establishment, contained nearly all of the nation's nuclear workers and was dubbed the Nuclear Industry Workers' Union (SUTIN). SUTIN's politics have been characterised by many in the ecology movement as "old left" or "Trotskyist". David Bahena, the leader of SUTIN, frequently quotes Lenin to the workers.

For several years, SUTIN was split on the issue of Laguna Verde, but there was general consensus that the government was not looking at nuclear energy realistically. A strike by SUTIN in May 1983 was designed to force the government into taking a stance on the role nuclear power would play in Mexico's industrial development. The decision to strike was a "political-economic" one and was not over labour issues. One of SUTIN's most serious criticisms was that the nuclear programme only perpetuates Mexico's dependence on the US. Talking to a reporter about the strike two years later, David Bahena complained that by importing the technology from the North, Mexico "would buy everything and develop nothing". Bahena questioned why government funds were being spent in this way. "In a country where one-third of the population does not have electricity and where there is abundant petroleum, nuclear power is not so attractive. The union is not interested in plants being built just to generate electric megawatts. We're interested in for what and whom?"¹

At present, SUTIN is opposed to Laguna Verde, although it is not anti nuclear power. Another SUTIN leader, Arturo Whaley, has characterised Laguna Verde as "the biggest financial failure in the history of Mexico." Ironically, this very failure may be contributing to the pressure to start the two Laguna Verde reactors. When construction began in 1970, the plant was slated to be complete in four years at a cost of \$263 million. Seventeen years later, to abandon the plant after spending \$3 billion would be politically embarrassing, a painful reminder of Mexico's \$100 billion foreign debt—and of widespread accusations that much of the borrowed money was wasted.

Whaley also claims that "Working conditions in most industries in

Mexico are barbarous" and cites the risk of worker contamination. Indeed, workers have in recent months been quitting Laguna Verde in massive numbers, claiming that they are being overworked at risk to both themselves and the plant. Anti-nuclear organisers speculate that the CFE wants to have the plant ready for operation as soon as possible in response to the growing power of the opposition.²

Intellectual Support

The opposition gained a great deal of respectability when "El Grupo de los Cien", a group of one hundred prominent intellectuals formed in 1985, came out against Laguna Verde. In a joint letter to President Miguel de la Madrid, written fifteen days after the Chernobyl accident, *El Grupo de los Cien* demanded the immediate closure of Laguna Verde. Including such notable figures as Octavio Paz (author of "The Labyrinth of Solitude" and a former Mexican ambassador to India) and Gabriel Garcia Marquez (author of "One Hundred Years of Solitude" and generally considered Latin America's foremost writer), the group's statements carry considerable weight.

Support of the Right

Whereas in the United States and Europe, the Political Left has embraced the anti-nuclear movement while the Right generally supports the nuclear industry, this has not been the case in Mexico. The only political party which is managing to present any challenge whatsoever to the hegemony of the PRI is the right-wing National Action Party (PAN). Whilst the PRI's right-wing opposition is tightly organised and gaining ground, while the PRI's left-wing opposition is hopelessly fragmented into an alphabet soup of separate groupings—the PMT (Mexican Workers' Party), PRT (Revolutionary Workers' Party), PSUM (Mexican Unified Socialist Party, which has links to the leadership of SUTIN), and so on. These groups, which are all relatively powerless and, to a certain extent, mutually hostile, occasionally form coalitions in order to front a common candidate in an election, but such efforts are short-lived and unsuccessful. By contrast,

it is widely recognised that the PRI frequently has to resort to fraud in order to defeat the conservative PAN.

PAN has reluctantly picked up the issue of Laguna Verde as another weapon in its crusade against the PRI. The wealthy farmers who make up PAN's constituency in Veracruz are against the plant because they fear that it will drive down the value of their land. Meanwhile, the leftist parties are all more or less Marxist in orientation and insensitive to (if not downright suspicious of) ecological concerns. The Mexican Workers' Party and the Revolutionary Workers' Party have taken a lukewarm stance against the plant. As one anti-nuclear activist put it; "They are against the plant in words only, and few words at that." The strongest opposition to the plant comes from the Green-oriented groups whose concerns also include halting the destruction of the last of Mexico's tropical rainforest, halting the illegal traffic in exotic tropical birds, preserving the traditional indigenous methods of agriculture and natural medicine and organising educational programmes on diet, nutrition, recycling, and so on.

Perhaps a hopeful sign of change in the mutually dim view that the traditional left and the ecology movement take of each other lies with the two most prominent members of *El Grupo de los Cien*. Octavio Paz, who in his youth drew inspiration from Emiliano Zapata's peasant uprising in the Mexican Revolution, has since become disillusioned with nearly all Latin American revolutionary movements. Garcia Marquez, on the other hand, remains close to Fidel Castro. Yet both of them have been willing to speak out against Laguna Verde—despite the fact that Cuba currently has plans to build five nuclear reactors (two of which are already under construction), the technology being imported from the USSR, much as Mexico's nuclear technology is imported from the USA.

The Coming Showdown

Another hopeful sign is the fate of Mexico's second planned nuclear power plant: it was stopped before construction even began. As soon as the government began talking about building a second nuclear plant at

Lago de Patzcuaro, Michoacan, in the late 1970s, the local *campesinos* and fishermen organised an effective opposition. Their grassroots coalition ORCA (Organisation Against the Contamination of Lake Patzcuaro) drew large demonstrations in nearby cities. The most persuasive argument was that Lake Patzcuaro is visited by thousands of Mexicans every year who come to visit the towering island statue of Morelos (the priest who led a peasant insurrection in the Mexican War of Independence) and to feast on the lake's famous whitefish. It was argued that the plant's coolant would have raised the temperature of the lake, killing off the whitefish and thereby sabotaging the local economy. The government abandoned plans for the Patzcuaro plant in 1981. Since then ORCA has remained active on ecological issues, such as petitioning SEDUE for reforestation programmes designed to fight erosion, a chronic problem throughout Mexico.

But of course it is more difficult to stop a plant which is 99 per cent complete than one which is still in the planning stage. Juan Bozzano, an activist with the National Ecologist Alliance and Xalapa Anti-Nuclear Committee, feels that the ecologists have already won the debate on the dangers of the plant. The local populace, clergy and news media have already decided against the plant—they now only need political action to force that decision on the government. Bozzano says that he draws inspiration from the Bataan plant in the Philippines, where massive strikes and protests were launched to stop the project. After it was revealed that the Marcos dictatorship had received multi-million dollar payoffs from Westinghouse in exchange for the contract, President Corazon Aquino ceded to public pressure and cancelled the project. The Bataan plant, completed in 1985, is now slated to be dismantled. "We have already won intellectually," says Bozzano. "Now we have to organise to win politically." Let us hope that political victory comes soon—and that Laguna Verde goes the way of Bataan.

References

1. *The Mexico City News*, March 20, 1985.
2. *Diario de Xalapa*, April 17, 1987.

The Scientist, the Stockman and the Animal

by Joanne Bower

Modern intensive livestock rearing is not only cruel but it is also ruinous to the health of both animals and humans. Scientists make bad stockmen. It is time for a return to traditional husbandry.

"Goethe said it was no use trying to wrest the truth of Nature by using the screws and levers of science—we can only get at the facts that way. To get at the truth, the significance, the quality, we need another instrument. The spanner we need for that is imagination. Science deals with how things are assembled, imagination with the value and significance of that assembly."

John Stewart Collis
The Vision of Glory

The scientific contribution to agriculture has enormously increased the sum of human knowledge, reduced human drudgery, boosted production and brought about a situation where, in theory, no-one need hunger. These splendid advances however, have a darker side—a ravaged and polluted countryside, unemployment, unsaleable food surpluses in a world where millions are under-nourished or actually starving, health hazards and the conversion of what was once animal husbandry to animal production on conveyor-belt principles.

Science cannot operate in a vacuum. There are political, social, ethical and humanitarian factors which, especially in agriculture, should be considered when new techniques are developed. Agriculture deals with life, which sets it apart from all other industries.

Chasing increasing production

Unfortunately for animals, the post-war need for food stimulated research aimed at increased produc-

tion with little or no attention being given to other concerns. The feeding of humans was paramount, together with the usual regard for monetary gain, and scientists rose to the challenge. Animals were subjected to various processes which at one time would have been impossible without massive loss of life. Keeping them in high density in enclosed buildings, without exercise, without daylight, without bedding and fed a high energy diet, was made feasible by the routine administration of antibiotics, hormones and other drugs, lavish use of disinfectants and insecticides. The chemical industry seemed to have the answer to all problems.

The animals responded—when they did not succumb—with greater productivity, an inevitable consequence of their diet and immobility, but widely claimed to be a proof of their wellbeing. This was quickly denied by the Brambell Committee, set up in 1964 as a result of popular disquiet, to examine the welfare of intensively kept livestock. "The argument," said Brambell, "is that in the absence of any scientific method of evaluating whether an animal is suffering, its continued productivity should be taken as decisive evidence that it is not. *This is an over-simplified view and we reject it.*"¹

It has since been widely acknowledged that the "biological performance" with which animals reacted to new methods was in fact no guarantee of health or contentment, but to this day ignorant people still say, and possibly even believe, that if animals are productive all must be well with them. A recent example was the Mother Superior of a convent keeping battery hens who maintained that

as they laid eggs there could be nothing wrong with the system. Meanwhile, methods which had been developed to produce more food for humans quickly became dependent on food which could be more economically fed to people direct: commercial feedstuffs like oil-cake, soybean meal, grains, cassava and manioc meal. "With these," as Englehard Boehncke points out, "the ruminant becomes a competitor with humans in the struggle for food."²

Laymen concerned about animals as sentient beings were the first to question intensive methods in public, Ruth Harrison's book *Animal Machines* having spelled out exactly what was going on. Some farmers actually gave up keeping livestock rather than accept factory techniques.

The farming lobby countered critics by arguing that intensive units kept animals warm, dry, well-fed, free from internal parasites, and that a stockman could observe them more easily indoors than out on range. Although there was some truth in this, it certainly did not apply to broiler chickens, so thick on the ground that a mechanic called in to correct a faulty appliance at one intensive farm, could not reach it without treading on the birds ("Don't worry about that" said the owner, "just tread on them"³); nor to hens kept in cages, where the attendant has to stand on the bottom rows in order to peer into those on the top row, at the back of which birds may be dead or dying. (It is only recently that it has become mandatory—thanks to an EEC decision—to inspect birds once a day.)

W. H. Parker, former Superintendent

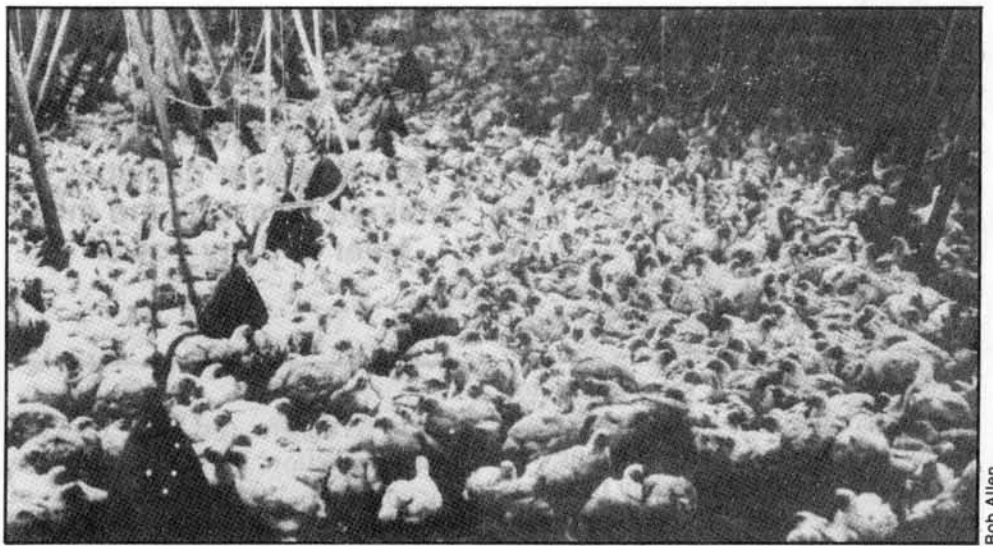
Joanne Bower is Hon. Secretary of the Farm and Food Society, 4 Willifield Way, London NW11 7XT.

ing Veterinary Investigation Officer for Wales for the Ministry of Agriculture, has admitted that "commercial pressure is, in the nature of things, directed towards the use of drugs and biological agents in the treatment and control of disease," but adds that the ideal would be to maintain health without them. "Every use of a drug, however necessary, should be accompanied by a subtle sense of disappointment because husbandry has fallen short of the ideal".⁴ The fact that intensive units cannot be run without drugs seems convincing proof that husbandry in them does fall short of the ideal—that it is, in fact, not husbandry at all, but a production process in which the animal is, to quote the farming press, a "machine tool and nothing more". Parker fully recognises that "best results are achieved when the farmer, his stockman, if he employs one, and the veterinarian are in partnership to plan the husbandry of the stock and to adapt it to changing circumstances and needs."

Man-made Disease

It has now become clear that some diseases have emerged as a direct result of scientific "advances" which have produced an abundance of animal protein beyond our needs, and which we are now advised threatens our own health. The man-made diseases resulting from intensive agriculture include those which affect the metabolic system of animals, as a result of their inability to cope with the demands of high production coupled with the strains of modern intensive husbandry and feeding.⁵ The diet of animals kept in intensive units is usually quite different from what the animals would eat if foraging for themselves. Grazing animals have the ability to seek out certain plants which contribute to their health. Cattle, especially, have a high degree of selectivity, and may choose plants only at a certain stage of growth.⁶

Admittedly, animals can go short of food or even starve if kept extensively and neglected. Conversely, over-feeding and an unsuitable diet can result in suffering, disease and a shortened life. Concentrates fed to the high-yielding dairy cow can cause indigestion, impaction,



Bob Allen

Chickens in an intensive unit. A mechanic who could not reach a faulty appliance without treading on birds reports being told, "Don't worry about that, tread on them."

tympany, rumenitis, ketosis and acidosis.⁷ Professor Webster, of Bristol University, speaking at a Convention for the Protection of Farm Animals in Brussels in November 1985, said that selective breeding of the dairy cow had produced an animal more suited to the economic needs of man than the physical needs of the animal. The modern cow could be compared to a racing car running very fast on high-grade fuel. The amount of metabolic work done by a high-yielding cow was equivalent to our running six hours a day every day of our lives.

Professor Sambraus, of Munich University, on the same occasion, said intensive rearing of beef animals was also based on human requirements rather than those of the animal, and demonstrated severe behavioural disturbances consequent upon such systems. Attempts to promote growth and accelerate oestrus in heifers have resulted in their calving at eighteen months instead of two and a half years, but milk yield has suffered and their productive lives appear to have been shortened. It is suggested that rapid growth induces a fundamental defect in the animal's physiology.⁸

Experiments to increase the number of lambs born at one time have also produced metabolic strain on the ewes, and although this research continues, as long ago as 1975 Twardock, Symonds, Sandom and Rowlands concluded that two lambs seem to be the optimum that can be efficiently supported by the ewe.⁹ They concluded that if "littering" of sheep becomes a common system of

husbandry it must be recognised that there is a concomitant danger of low birth weight and an increase in lamb mortality.

What the scientist achieves in productivity, nature thus degrades or destroys. This is also evident in the development of the modern Friesian dairy cow, designed by scientific manipulation to yield vast quantities of milk, but whose mothering ability is adversely affected. "She eats too much for a suckler cow, she gives far too much milk for one calf, and her udder is altogether the wrong shape, so that the new-born calf often has extreme difficulty in finding a teat, since they tend to be much closer to the ground than he has been programmed to expect."¹⁰

The housing of animals without any exercise, with or without growth hormones, is known to predispose animals to excessive loss of bone mineral and to osteoporosis.¹¹ This is seen in dairy cattle, pigs and broiler chickens. According to the Association of Veterinarians Concerned about Animal Husbandry (AVCAAH), other common diseases of animals which are likely to be exacerbated by intensification and "modern livestock trade practice" are neonatal scours (diarrhoea), pneumonia, salmonellosis in calves; E coli septicaemia, infectious bronchitis, egg-drop syndrome and fatty liver syndrome in poultry; and neonatal scours, enzootic pneumonia, swine dysentery, atrophic rhinitis, streptococcal meningitis, gastric ulceration and thin sow syndrome in pigs. (The dairy cow is also widely afflicted with mastitis and lameness.)

Also listed are artificially induced conditions "directly consequential on restrictive intensive systems", including feather-pecking, pecked vents and cannibalism in poultry, foot and claw deformities and lesions in pigs and poultry, tail and ear-biting in pigs, compulsive sucking, licking and hairballs in calves.

In its Manifesto, AVCAAH warns that because "some of the cardinal signs of good health are lacking in stock in some intensive systems . . . modern farm staff, who may never have had experience of really healthy animals, may accept the sub-optimal as normal." It goes on to add: "Some common conditions of traditional husbandry which one might have expected to be reduced by the close control offered by intensification, remain as widespread as before: examples are sarcoptic mange and ascariasis of pigs."¹²

Problems of Chemical Fertilisers

Other man-made problems in livestock result from intensive grassland management. High potassium and

"High levels of nitrate in grass are suspected of causing liver damage, retained placenta and milk fever in dairy cows."

nitrate fertilisers certainly increase grass production, but they reduce the concentration and availability of magnesium to the grazing animal, resulting in hypomagnasaemia, or grass tetany, in cattle. It is also more "economic" to sow a single species of grass with a low magnesium content, depriving the animal of the benefit of the wide variety of grasses and medicinal herbs which once characterised our pastures.

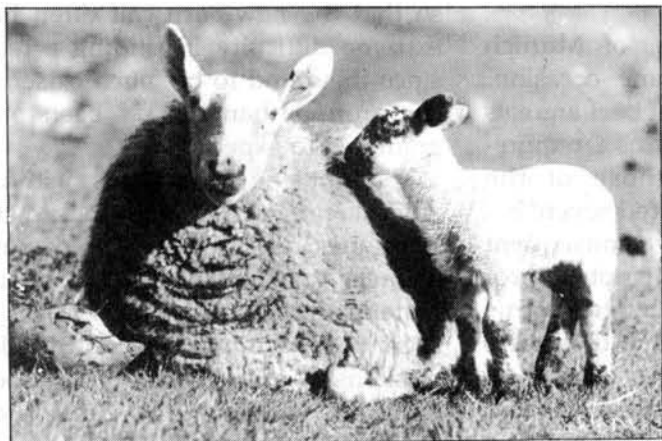
Parker recalls "one of the most famous biological experiments in history in Cambridge at the turn of the century" when Hopkin fed rats on food synthetically prepared to meet the known needs of carbohydrate,

protein and minerals, with the intention of proving that this fulfilled the animals' needs just as effectively as natural foods. He was astonished that the animals did not thrive at all.¹³ An equivalent experiment is now being carried out with the use of NPK artificial fertiliser, which, according to the scientists, provides everything that the soil needs. It is now realised that this is not the case and animals feeding on artificially fertilised grass are deficient in trace elements. Furthermore "excessive amounts of potassium lead to poor fertility in dairy cows grazing on intensively fertilised pastures."¹⁴ High levels of nitrate in grass are suspected of causing liver damage, retained placenta and milk fever in dairy cows.

Abnormal Behaviour

Although there has been much research relating abnormal behaviour to the deprivation intrinsic in intensive farming, scientists are now coming up with the theory that while the concept of "internal drives" may have some validity, there is, for

For them . . .



. . . It's a matter of Life or Death

The Vegetarian Society is constantly working to educate the country to go vegetarian.

We organise cookery courses, offer membership, produce a magazine and a Handbook, free literature and recipes, advice, educating children and campaigning for animal rights.

We support non-animal research that strengthens the argument that a vegetarian diet is good for humans (as well as for the farm animals).

We need YOUR help to continue our essential work.

THE VEGETARIAN SOCIETY UK, PARKDALE, DUNHAM ROAD, ALTRINCHAM, CHESHIRE, WA14 4QG. 061-928 0793.

Charity No. 259358

Seeking a source of scholarly articles from outside your own field? . . . Considering ways to overcome intellectual fragmentation and to achieve greater unity between contemporary disciplines? . . . Interested in exploring links between religion, values, and contemporary scientific knowledge? Then consider:

Zygon

Journal of
RELIGION & SCIENCE

Writers in **ZYGMON** attempt to yoke together (zygon) the thinking of various contemporary disciplines with articles on topics such as:

cosmic evolution and human purpose • quantum physics and the theory of knowledge • thermodynamics, creation, and values • energy, human values, and the environment • relationships between biological and cultural evolution • sociobiology, ethics, and theology • the implications of recent neurobiology for the social sciences and the humanities • artificial intelligence and human consciousness • ritual in human adaptation • cooperation and aggression in sociocultural evolution • genetics, religion, and human altruism • genetic engineering, persons, and the sacred • concepts of God and scientific materialism • truth in science and religion • religion's role in war and peace • creationism and evolution

Recent and current authors include: Raymond J. Barnett, biology . . . David Bohm, theoretical physics . . . Margaret Boden, philosophy and psychology . . . Elise Boulding, sociology . . . Kenneth Cauthen, theology . . . Ralph Wendell Burhoe, theology and science . . . Hiram Caton, intellectual history . . . R.G.A. Dolby, history, philosophy, and social relations of science . . . Robin Fox, anthropology . . . James P. Henry, research psychiatry . . . Alice Kehoe, anthropology . . . Donald M. MacKay, communications theory . . . Donald Michie, machine intelligence . . . Mordechai Rotenberg, social psychology . . . Michael Ruse, philosophy of biology . . . Hans Schwarz, theology . . . Roger Sperry, psychobiology

SUBSCRIPTION FORM

Name _____
Address _____
State _____ Zip _____ Country _____

Check appropriate box(es)

☐ \$25 Individuals (outside U.S. \$27*) ☐ \$32 Institutions (outside U.S. \$34*)
☐ \$20 Students (outside U.S. \$22*), when verified by professor
(*includes \$2.00 for outside U.S. postage)

Make remittance payable in U.S. dollars to: **Zygon**
Send to: **Zygon: Journal of Religion & Science**
Box 2764 — Rollins College — Winter Park, Florida 32789-4496 USA

many types of behaviour, a component which needs an external stimulus for its expression.¹⁵ This seems to suggest that an animal is not frustrated by deprivation if it only reacts to something which triggers a certain behaviour. This idea is supported by findings that "the behavioural signs associated with frustration do not change" for example when caged hens are provided with litter, although "the hen will indulge in copious and prolonged scratching and dust-bathing." The introduction of a nesting box for caged hens, however, has been found to reduce considerably signs of frustration prior to egg-laying. This appears to be one of those grey areas in which jobs for laboratory scientists may be provided indefinitely and no final conclusion ever reached. Indeed, as Marian Stamp Dawkins points out, "There may be states of suffering which other animals experience of which we humans have no knowledge."¹⁶

Numerous experiments are devised to "prove" or "disprove" suffering. Some years ago there was a theory that if an animal synthesised protein it must be contented, but this notion seems to have been discarded. Meanwhile, other research continues, including the measurement of hormone concentrations in the blood and the weight of adrenal glands. Marian Dawkins concludes, however, that "even all available measurements put together might give only a very distorted and incomplete idea of the changes in mental state that are going on."

Anthropomorphism

Many scientists, and those who do not want to admit that some of our treatment of animals in intensive units is morally unacceptable, have a horror of "anthropomorphism". It is, however, usually these same people who believe wholeheartedly in the value of animal experiments in relation to human problems. We are ourselves part of the animal kingdom and, without any question, share many characteristics, both physical and mental, with other creatures.

William Thorpe, the eminent ethnologist, in an Appendix to the Brambell Report,¹ stated quite firmly, "There can be little doubt that all the animals with which the farmer is concerned have a pain sense similar in

"The welfare of animals has played at best a minor part in ministerial and official thinking."

type if not degree to that of man." On the subject of deprivation he added;

"Whilst accepting the need for much restriction we must draw the line at conditions which completely suppress all or nearly all the natural instinctive urges and behaviour patterns characteristic of actions appropriate to the high degree of social organisation as found in the ancestral wild species, and which have been little, if at all, bred out in the process of domestication. In particular, it is clearly cruel so to restrain an animal for a large part of its life that it cannot use any of its locomotory behaviour patterns."

Yet, twenty odd years after this was written, birds and even pigs are still put into battery cages, sows and calves into stalls where they cannot turn round. Pressure of public opinion is slowly bringing changes, but the proponents of such systems still maintain that they are in the animals' best interests and it is being "anthropomorphic" to condemn them.

Andrew Fraser, however, asserts that

"suffering cannot be determined objectively, and we must rely ultimately on a subjective judgement. Undoubtedly this will always be so."¹⁶

This is the conclusion of a top scientist, and he is not alone. AVCAAH's Manifesto states:

"Attempts to assess objectively pain and distress in animals are commendable, but they will never arrive at a definitive answer: in research, for every question answered, more pose themselves, and this is especially true of the subject of animal behaviour. If we continue to avoid taking difficult decisions under the cloak of the need for yet more fundamental research, the solution to urgent problems will be indefinitely postponed and we shall be guilty of moral cowardice."

Bold words from members of a profession deeply involved in intensive

animal production. Marian Dawkins condemns anthropomorphism, but adds:

"All we can say with any certainty is that emotional states in humans seem to be associated with the activation of the nervous system and that the components of the nervous system, the nerve cells, seem to be very similar in all animals that have been looked at. We can also say that there are many similarities in brain structure between ourselves and other mammals, particularly in those areas of the brain, such as the hypothalamus, which are known to be associated with emotions in ourselves."¹⁸

Dawkins concludes "When all the evidence has been accumulated, we have to return again to analogies with ourselves for the final verdict," but adds "the effort of finding scientific ways of studying animal suffering is not made unnecessary just because in the end we need analogies with ourselves." These, she holds, "may be misleading unless firmly tied to evidence from all possible sources about those other species . . . we should be humble enough to try to collect that evidence."

The Brambell Committee judged that in the absence of any positive proof of suffering, "we consider that it is morally incumbent upon us to give the animal the benefit of the doubt and to protect it as far as possible from conditions that may be reasonably supposed to cause suffering."

Stockmanship

Domestic livestock would survive and, in many instances be better off, without much modern scientific research. The animals would not survive without the stockman, unless they were turned loose to revert to their wild state (where, according to William Thorpe, they might do surprisingly well). The difference between the scientist and the stockman is that the scientist cannot enter fully into the life of the animals he uses. He can record such things as the growth-rate, temperature, heart-beat, breeding pattern, cerebral reaction and so on in animals under laboratory conditions, all of which may have their uses; but the stockman knows the animals in his charge (provided there are not too many of them: no-one can "know" 500 sows

or 10,000 chickens). He knows their normal and abnormal behaviour, their relationship with their fellows and their response to various external factors, including himself. The good stockman has "empathy", something which the scientist, by the very nature of his calling, cannot afford. This brings a response from the animal which cannot be scientifically measured.

Research has recently shown what must have been known to stockmen for centuries, that kindness to cows increases their milk yield, yet the Pharmaceutical Industry is determined to increase milk production by injecting cows with the hormone Bovine Somatotrophin (BST). Even farmers have objected to this, but it must be added apparently more because it will turn consumers off milk than for any ethical reasons.

It is held that large intensive livestock holdings demand a higher standard of stockmanship than traditional farms, and this is true, but such a demand is rarely met. Indeed, the 1980-81 Parliamentary Select Committee on Agriculture saw a risk that a type of worker would be introduced more attuned to machinery and book-keeping than to animals, who could be inclined to regard his charges simply as so much raw material.¹⁹ Specialists, while agreeing that this was partially true, told the Committee that they thought it could be cured by training. Dr Lean, for the Universities Federation for Animal Welfare, argued that those who had been through a stockmanship course were "quite passionately interested in the general welfare of their animals" and that even if they had personal preferences not to like certain forms of intensive situations, they went out of their way to look after the animals as well as possible in those circumstances. (The Committee observed drily "This speaks well for the training, though it implies less enthusiasm for intensive systems.") The Brambell Committee found that "it is important to try to induce some sense of vocation in the students; there is a real danger that large-scale intensive methods involving great numbers of animals, possibly in surroundings which are uncomfortable to man, can lead to a debasement in the stockman's attitude to the lives of which he has responsibility."

Need for Licensing

It is a major anomaly, frequently pointed out, that, until recently, a licence has been required to keep one dog, but not any numbers of livestock, and there is now some suggestion that both stockmen and premises where stock are held should be licensed. The AVCAAH states: "There is no licensing system for farming enterprises. Anyone, however ignorant or unsuitable, can call himself a farmer and set himself up to order the lives and welfare of hundreds or thousands of animals and birds in effective total secrecy."²⁰ It seems incredible that licensing should not have been introduced early in the days of the development of intensive livestock-keeping, if not before.

While appalling conditions have been reported both for intensively and for extensively kept stock at times, the far greater numbers of animals involved in intensive systems have meant a proportionately greater amount of suffering. Clamping down on such suffering is difficult due to the highly unsatisfactory wording of legislation which makes it an offence to cause "unnecessary" suffering to livestock.²¹ Yet, the very nature of most intensive systems entails a certain amount of suffering which therefore is considered "necessary" and which no true stockman would accept. "Veterinarians will see little difference between species in respect of the conditions in which it is humanely acceptable to keep them. None of us would condone submitting dogs or cats or horses or cage birds to environmental conditions in any way approaching those to which calves, pigs and poultry are subjected under some intensive systems."

The AVCAAH came to the conclusion:

"The actual people running the site know that their jobs depend on showing a profit. However repugnant they may think the system, they are scarcely likely to criticise it. Indeed, since no man likes it to be thought that his daily actions are reprehensible, they are likely to rationalise and defend what they are doing. In this way one may see the susceptibilities of otherwise sensitive people being blurred."²²

Animal welfare workers are only too aware of this situation.

The Select Committee on Agriculture has commented:

"We have gained the impression that within the UK Departments, the whole weight and thrust of policy has, until recently at least, been directed towards ever greater productivity and profit, and that the welfare of the animals concerned has played at best a minor part in Ministerial and official thinking. Today, whether owing to more enlightened ideas, or in response to public pressure, animal welfare is receiving more attention, but we have a feeling that it is still regarded as a tiresome complication engendered by vocal sentimentalists who need to be placated at minimal cost to producers' profits. To the extent that this is true, it is high time for a change of attitude."

Unfortunately, until now most research has been paid for by those with a vested interest in intensive methods, but there are signs of the beginning of a change of attitude as advocated by the Select Committee. Not only are animal welfare groups getting involved in research into more humane methods of livestock-keeping, but the government and the industry itself, as a result of pressure, are exploring alternative systems, including various ways of keeping laying hens other than in batteries. Veal-calves are now not always condemned to crates (indeed, there has been a half-hearted move by the government to phase these out), but may be reared in open-sided strawyards—not ideal, but a great improvement. One of the most encouraging developments is that of the family pig unit, partly funded by the Farm Animal Care Trust, at the Edinburgh School of Agriculture. Here pigs are found to thrive when kept outside in family groups, including the boar—a natural way of life about which any stockman would be enthusiastic. Now ways of making this commercially viable are being researched. This seems to be the right approach: first find what suits the animal and then think about making it profitable. In this the stockman and the scientist could co-operate most fruitfully.

The role of the scientist in animal husbandry is not questioned, especially in the fields of nutrition, bacteriology and epidemiology. There are aspects of current practices, however, which are extremely disturbing,

including deliberate increase in productivity in a part of the world already groaning under the burden of food surpluses. These include attempts to suppress an animal's natural growth controls, increasing milk yield beyond an animal's ability to cope with the side-effects, inducing prolificacy in ewes and cattle.

In the preface to a publication by the British Association for the Advancement of Science on Factory Farming in 1970, J. R. Bellerby pointed out that "it may be observed that one aspect of the scientist's role is to place all the pertinent evidence before the people, so that they may make their own judgements of value." Whether scientists could be trusted to do this is perhaps doubtful. Since most of their research is funded by commercial firms—or because they may have their eye on these for future preferment—they are not always as objective as they might be. A veterinary professor, now head of a leading agricultural college, in an article in *AgriTrade* in 1982 (when he was employed by a feed firm) reminded his readers that they were already committed to an acceptance of an intensive livestock industry within the framework of the British agricultural feed industry: "All of us, directly or indirectly, obtain part of our livelihood by supplying goods and services to the animal sector of British agriculture, and it therefore behoves all of us to exert all the influence we can to ensure the future wellbeing of livestock production in this country." (Not of livestock, but of livestock production.) So too, a Ministry microbiologist, quoted in *Farmers Weekly* of 17th May 1985 on the subject of feeding broiler litter to beef cattle, stated: "Any ration that can give 1 kg of weight gain a day for as little as 50p an animal has got to be right economically." Other aspects of this practice apparently did not concern him.

The Editor of *Poultry World* (February 1987) described a chicken as a factory: "You supply the raw material—contained in its feed—give it the best possible environment—housing—and it produces end products, which in this case are eggs and (alas) waste in the form of muck." The complete alienation of the poultry industry from agriculture is indicated by the regret that chickens have to produce

muck—once considered a valuable fertiliser.

These appear to be value judgements, although not based on ethical or humanitarian considerations. It does seem essential that some authority, in the field of husbandry as elsewhere, should control research, especially that concerned solely with achieving short-term economic goals. Until we can emancipate ourselves from the "does it pay?" principle where living things are concerned, the real cost of many developments will be borne, not only by the animals, but by consumers and the environment. Perhaps the answer lies in the Code of the Belgian Association of Veterinarians: "With science and with heart."

References

1. Report of the Technical Committee to Enquire into the Welfare of Animals Kept under Intensive Livestock Husbandry Systems. (The Brambell Report) Cmd 2836, HMSO, London.
2. Engelhard Boehncke, *The Role of Animals in a Biological Farming System*, Farm and Food Society.
3. Ruth Harrison, *Animal Machines*, p14 (Vincent Stuart).
4. W.H. Parker, *Health and Disease in Farm Animals*, Pergamon Press, Oxford.
5. Jack M. Payne, *Metabolic Diseases in Farm Animals*, Heinemann Medical Books, London.
6. Andrew F. Fraser, *Farm Animal Behaviour*, Bailliere Tindall, London.
7. *Metabolic Diseases in Farm Animals*, op. cit. (supra note 5).
8. Ibid.
9. Ibid.
10. John Webster, *Calf Husbandry, Health and Welfare*, Granada.
11. *Metabolic Diseases in Farm Animals*, op. cit. (supra note 5).
12. *Manifesto of the Association of Veterinarians Concerned About Animal Husbandry (AVCAAH)* c/o P.G.C. Dunn, BVSc, MRCVS, Alstonby, Shinfield Road, Reading, Berks.
13. *Health and Disease in Farm Animals*, op. cit. (supra note 4).
14. *The Role of Animals in a Biological Farming System*, op. cit. (supra note 2).
15. Roger Ewbank, *The Behavioural Needs of Farm and Laboratory Animals*, Universities Federation for Animal Welfare, 8 Hamilton Close, Potters Bar, Herts.
16. Marian Stamp Dawkins, *Animal Suffering*, Chapman and Hall.
17. *Farm Animal Behaviour*, op. cit. (supra note 6).
18. *Animal Suffering*, op. cit. (supra note 16).
19. *First Report from the Agriculture Committee Session 1980-81: Animal Welfare in Poultry, Pig and Veal Calf Production*, HMSO, London, 1981.
20. *Manifesto*, AVCAAH, op. cit. (supra note 12).
21. *Agriculture (Miscellaneous Provisions) Act 1968*, HMSO, London.
22. *Manifesto*, AVCAAH, op. cit. (supra note 12).

Available now

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.

Price: Institutions £15 (US \$25)
Individuals and Third World
Institutions £7.50 (US \$12)
Please add £2.00 for surface postage
(Cheques payable to Ecosystems Ltd)

Wadebridge Ecological Centre,
Worthyvale Manor, Camelford,
Cornwall PL32 9TT, UK

From Fragmentation to Wholeness:¹ A Green Approach to Science and Society (Part I)

by Alwyn Jones

Science has become the only acceptable form of knowledge in modern industrial society. But its reductionist approach has led to a fragmented view of the world, with an understanding of particular aspects of reality being gained at the expense of the whole. Such a fragmented worldview lies at the heart of the ecological crisis confronting us today.

Although the philosophical foundations of modern science can be traced back to the rationalism of Plato and the empiricism of Aristotle,² the interest of these writers in the acquisition of knowledge, in common with Greek intellectual life in general, lay primarily in the contemplation of reality rather than in any desire to change the world. On the other hand, the emergence of the modern scientific attitude, of which a central feature is "action-in-the-world", owes much to the work of the seventeenth century philosophers Descartes and Bacon.³ Whereas Descartes, through his distinction between *res cogitans* (mind) and *res extensa* (matter), laid the conceptual framework for this new approach to reality, it was Bacon who gave the approach its rationale. For him, knowledge of the world acquired through scientific endeavour was not to be the mere object of contemplation, but should be put to work so that the human race could ultimately assume mastery and control over nature in the pursuance of its own interests.

From this perspective, knowledge is regarded not as an end but as a means, expressed and applied in technology, by which humans assume power over the material world. A high premium is thus attached to the growth of knowledge because it is on this that the enhancement of human powers through the development of technology depends. Moreover in Bacon's view knowledge had to be wrested from nature through a process of confrontation by which nature would be forced to give up its secrets; such secrets would not be revealed "willingly" so nature had to be treated as an antagonist and "bullied" into submission within highly contrived and artificial "experimental" conditions determined by the human investigator. Berman puts the point well:

"(For Bacon) knowledge of nature comes about under artificial conditions. Vex nature, disturb it, alter it, anything—but do not leave it alone. Then, and only then, will you know it. The elevation of technology to the level of a philosophy had its concrete embodiment in the concept of the experiment, an artificial situation in which nature's secrets are extracted, as it were, under duress".⁴

The Experimental Approach

It is clear that for Bacon a distinction can be made between subject and object, the observer and the

observed. But, as Capra argues, Descartes makes an unambiguous conceptual distinction between these two realms:

"The birth of modern science was preceded and accompanied by a development of philosophical thought which led to an extreme formulation of the spirit/matter dualism. This formulation appeared in the seventeenth century in the philosophy of René Descartes who based his view of nature on a fundamental division into two separate and independent realms; that of mind (*res cogitans*), and that of matter (*res extensa*). The 'Cartesian' division allowed scientists to treat matter as dead and completely separate from themselves, and to see the material world as a multitude of different objects assembled into a huge machine".⁵

This distancing of the thinking subject and an objective reality "out there" is the framework within which Western scientific thought has developed. It is a fundamental presupposition of science that the mind, as an independent entity, is able to experience and grasp objective reality through the senses. Moreover, because it is assumed that objects in reality themselves have an independent existence—that is, independent of the observing subject—it is possible to corroborate our observations of reality with those made by others. It can be argued that such corroboration is made possible through the use of various methods and practices, especially controlled experiments, which have gained universal acceptance in the scientific community. As long as such techniques are adopted any single observation of reality can in principle be replicated, and verified or refuted, by an infinite number of observers.

It is this *method* of approach which has given science its ascendancy over other forms of knowledge in advanced industrial society. At the core of this method is the principle of *analysis*, in which the scientist, through making observations of *selected* parts or elements of reality, seeks to uncover causal connections between them within the framework of universally applicable laws and theories. Priority is thus given to the parts over the whole, the presumption being that a knowledge of the whole can gradually be built up from a detailed understanding of the relationship between the parts. The model of reality which emerges from this is of a vast machine whose fundamental characteristics can be understood by an analysis of its parts and the laws which govern their working.⁶

There is no doubt that the institutionalisation of this approach as the basis for the acquisition of knowledge

Alwyn Jones is Senior Lecturer in Sociology at the Polytechnic of Wales, Treforest, Pontypridd, Mid Glamorgan, CF37 1DL.

in advanced industrial society has in some respects been applied with spectacular success in areas such as medicine, agriculture and engineering. But such success has not been achieved without cost: indeed cases of iatrogenic⁷ illness in medicine, and technological disasters of the magnitude of Bhopal in India in 1984, and Chernobyl in the Soviet Union in 1986, seem to be occurring with ever greater frequency. Such events—and many more examples could be given—ought to lead to a questioning of the epistemological basis upon which technological development depends: in short our critique should be directed at the scientific paradigm itself.

Science and the State

But science derives its authority very largely from the fact that it is a form of knowledge which has been perceived as being particularly suited to the resolution of problems associated with our attempt to achieve mastery over the material world. As it is the aim of industrial societies to achieve such mastery, the objectives of science become synonymous with those of the State, with any attack on science being regarded as an attack on society itself. Not only does this ensure that the status of scientific knowledge is preserved, but also, and perhaps more importantly, protects such knowledge against competing epistemologies. This conjunction between State and science has been poignantly called into question by Feyerabend:

“Science is much closer to myth than a scientific philosophy is prepared to admit. It is one of the many forms of thought that have been developed by man and not necessarily the best . . . as the accepting and rejecting of ideologies should be left to the individual it follows that the separation of state and church must be complemented by the separation of state and science . . . Such a separation may be our only chance to achieve a humanity we are capable of, but have never fully realised”.⁸

For Feyerabend the institutionalisation of science has meant that in the popular imagination, especially in the advanced industrial societies, and increasingly everywhere else, science has come to be equated with the only true knowledge, ‘facts’ which do not have the authority of science behind them are thereby written off as having no epistemological status at all. By ‘radically monopolising’⁹ what is to be taken as knowledge in society, science delimits the area within which alternative routes to truth are possible. The outcome of this must be a restriction of human liberty.

Fragmented Knowledge

As we have seen, for Descartes the principle of *analysis* was a central feature of scientific activity. This presupposes not only that there is an objective world “out there”, detached from the observer, but also that it is composed of basic elements or building blocks which it is science’s purpose to discover in order to understand the whole. Descartes was able to make the assumption that such a discovery was possible by asserting that Mind (consciousness) and Body (matter) are separate entities, with Mind having an essentially nominal, or passive, role in which it receives and interprets

information obtained through the senses from the external world. This approach, apart from denying a positive role for consciousness has the effect of *fragmenting* reality into discrete elements so that separate analysis of the causal relationships between the parts is possible. But by acting in this way, there is a tendency to perceive reality as though it is fragmented, with interactions between the parts operating mechanistically, rather than being dynamically integrated in an infinite web of interconnectedness without beginning and without end. But as Bohm says it is *wholeness* which is real and because of this

“man, with his fragmentary approach, will inevitably be answered with a correspondingly fragmentary response. So what is needed is for man to give attention to his habit of fragmentary thought, to be aware of it, and thus bring it to an end”.¹⁰

This mode of fragmentary explanation has been compounded by the development of highly specialised and well defined disciplines in both the natural and social sciences, which, although relatively isolated from each other, have sought to explain the whole through the construction of theories specific to their respective perspectives. This approach is subject to what we shall call here ‘the searchlight effect’¹¹, in which the work of the scientist is analogous to a beam of intense light which gives detailed knowledge of that part of reality on which it is focused at the expense of an understanding of the rest of the whole which remains in utter darkness. Such disciplinary reductionism in which specific explanatory frameworks remain isolated and unconnected with the whole to which they all relate would seem to be an inevitability in the context of an epistemology which is fragmentary in its orientation.

But if we are to grasp the whole a new perception of reality is necessary:

“What is called for is not an *integration* of thought, or a kind of imposed unity, for any such imposed point of view would itself be merely another fragment. Rather all our different ways of thinking are to be considered as different ways of looking at the *one* (my italics) reality, each with some domain in which it is clear and adequate. One may indeed compare a theory to a particular view of some object. Each view gives only an appearance of the object in some aspect. The whole object is not perceived in any one view but, rather, it is grasped only *implicitly* as that single reality which is shown in all these views”.¹²

The Implicate Order

Bohm bases his argument for a “one reality” on the distinction he makes between the “implicate” and “explicate” order. For him, it is the explicate order, the world of objects as they appear to us through our sense experiences, with which Cartesian science is primarily concerned. But underlying this is the “one reality”, the *implicate* order, in which each part of reality both contains, and is enfolded into, the whole. Part and whole thus become inextricably interwoven with each implying the existence of the other. Sheldrake in his notion of “formative causation” seems to have come to



R  n   Descartes. His division of the world into *res cogitans* (mind) and *res extensa* (matter) "allowed scientists to treat matter as dead and completely separate from themselves, and to see the material world as a multitude of different objects assembled into a huge machine."

similar conclusions in his development of a new holistic perspective in biology.¹³

By advancing this thesis, Bohm calls into question the distinction Kant made between 'phenomena' (that which can be perceived through the senses) and 'noumena' (things in themselves). Although, as Scruton¹⁴ has argued, there is some ambiguity as to the precise meaning Kant attached to these terms, it does seem that the notion of 'phenomena' relates to physical objects in the world as they *appear* to us in sense perception, whereas 'noumena' refers to an *unknowable* reality which lies behind such appearances. As we have seen, it is Bohm's contention that the *unfolded* explicate order can be grasped through the senses, and is therefore similar to Kant's 'phenomena'. On the other hand, evidence from the new physics, indicates that there is *one underlying ultimate reality*, the *en-folded* implicate order, corresponding to Kant's 'noumena', which can be intuitively grasped in consciousness if not through direct sense experience. What this implies is a breakdown of the Cartesian scientific paradigm so that

" 'in here' and 'out there' will cease to be separate categories and thus . . . will cease to make sense. If we are in an ecological, systemic, permeable relationship with the 'natural world', then we necessarily investigate 'that world' when we explore what is in the 'human unconscious', and vice versa. Kant's *Ding an sich* (noumena) is thus no longer unknowable".¹⁵

For Berman the rejection of the Cartesian divide between Mind and Body will allow for an expansion of

consciousness as the unconscious mind, which he is equating with Kant's 'noumena', is released from the repression of fragmentary thought. There seems to be a parallel here between Berman's position and Bohm's point in which he argues for different theoretical perspectives to be regarded as being about *one* rather than several different realities. Indeed, once reality is perceived in this way the interconnectedness of matter and mind, the central feature of the implicate order, will be brought to consciousness.

The implications of this line of approach are profound. Not only is a case being made for the rejection of the Cartesian dichotomy, but it is also assumed that consciousness is an *active* participant in the construction of reality. This approach is not unfamiliar to certain perspectives in the social sciences, but the belief in an external world is so entrenched in the natural sciences that any suggestion of the knower and known being inseparable would seem to violate what is probably the most fundamental presupposition in the epistemology of science.

Man Versus Nature

The Cartesian split between mind and body has both reinforced, and contributed to, the Baconian idea that the progress of the human race depends upon the assumption of increasing mastery over the natural world.¹⁶ Though a belief in apartness from nature does not of itself give authority to humans to act in this way, the implications of such an epistemology become clear once set against the background of powerful legitimising traditions which have developed in western thought. It is not the place to debate these issues here, but such an attitude to nature reflects not only the Judaeo-Christian tradition, but also such intellectual developments as utilitarianism, evolutionary theory and Marx's notion of *Homo Faber*, all of which give legitimacy to the view that nature is a resource to be exploited for the use of humans.

Moreover, the virtually unequivocal attachment to industrial growth and expansion in advanced industrial societies depends upon continual advances being made in scientific knowledge. Indeed, the acquisition of such knowledge is perceived as being the fundamental prerequisite for the development of technology upon which industrial society relies for its ever greater mastery and control of nature.

This has meant that the *conception* of knowledge has itself been debased because 'science', which has its roots in the Latin word *scire* 'to know', and literally means any form of knowledge, has been narrowed down to refer to a *method* of empirical enquiry by which we seek to gain knowledge of the *material* world. The effect of this, as Feyerabend¹⁷ has argued, is to exclude the possibility that there may be other ways of 'knowing' which are equally as valid as science. Moreover, precedence is given to knowledge of material reality at the expense of other possible existences. Weber has referred to this process as the 'disenchantment of the modern world', a sentiment seemingly echoed by Sale in the following passage:

"The ideas of the scientific paradigm transformed completely the attitudes of Western society toward

nature and the cosmos. Nature was no longer either beautiful or scary but merely *there*, not to be worshipped or celebrated, but more often than not to be *used*, with all the ingenuity and instruments of a scientific culture . . . within limits if needs be, heedless of limits if possible, but used—*by humans, for humans*".¹⁸

Though Sale has clearly over-emphasized the specific role of science as a determinant in the changes which have taken place in western culture we do not have to look far before we find examples of the impact such instrumentalist attitudes have had on the quality of both our physical and social environments.

The Fragmentation of Reason

The externalisation of nature, and the belief that knowledge of it can be put to the use of humankind, have contributed to the fragmentation of reason in advanced industrial societies.¹⁹ In short the intellect has become divided against itself by being increasingly restricted to the evaluation of the most effective means of achieving a particular goal or purpose without applying its critical gaze to the end or purpose itself. This is what Weber meant by the 'rationalization of the modern world': namely, an essentially instrumentalist world view in which means, based especially on criteria of efficiency and utility, become redefined as ends and operate as the prime motivating force in the culture.

The contribution made by science to this inversion of means and ends cannot be overestimated. It is axiomatic to Cartesian thinking that objective knowledge of the world can be acquired without the intrusion of values. Such an assumption thus renders scientific knowledge particularly amenable to the resolution of *technical* problems, in which questions of value are regarded as having no place. But a crucial issue emerges as to whose interests are served by a science concerned primarily with technical control? Whereas the instrumentality of reason effectively silences public debate over the ends or purposes of life, science's presumed objectivity, and its high degree of complexity, make its epistemological claims, and their application, similarly inaccessible to public assessment. But without such an assessment, an instrumentally oriented science and technology implies not just control over nature, but *ever more effective control and domination over society itself*.

A Wholistic Approach

But our 'apartness' from nature, upon which science's claim to be "value neutral" is based, is *apparent* not real. It is derived from our capacity to be consciously aware of ourselves as *separate* beings in what we have earlier described as Bohm's notion of an unfolded *explicate* order. But this must be the limit of consciousness within the framework of an epistemology which stresses separateness rather than a *relationship* between the parts which make up the whole. What is needed is the development of an holistic epistemology which postulates the *oneness* of all reality with a total embeddedness of all the parts in the whole. From this perspective:

"The universe is no longer seen as a machine, made up of a multitude of objects, but has to be pictured as



Francis Bacon. "For Bacon, knowledge of the world acquired through scientific endeavour was not to be the mere object of contemplation, but should be put to work so that the human race could ultimately assume mastery and control over nature in the pursuance of its own interests."

one indivisible, dynamic whole whose parts are essentially interrelated and can be understood only as patterns of a cosmic process".²⁰

Once such an approach is adopted the way will be open for the emergence of an intuitive awareness that we are an integral part of nature, of that which we seek to dominate and control: and we shall see that any abuse of nature is at the same time *an abuse of ourselves*.

The Newtonian Machine

Although Descartes and Bacon were influential in creating the appropriate *philosophical* ideas for the modern scientific world view, it was through the work of Isaac Newton in the seventeenth century that these ideas became the basis for the *practice* of science. Indeed, as is made clear by Capra in the following passage, Newton's contribution to the development of physics in particular, and to science in general, is inestimable:

"Newton developed a complete mathematical formulation of the mechanistic view of nature, and thus accomplished a grand synthesis of the works of Copernicus and Kepler, Bacon, Galileo, and Descartes. Newtonian physics, the crowning achievement of seventeenth-century science, provided a consistent mathematical theory of the world that remained the solid foundation of scientific thought well into the twentieth century".²¹

Newton's underlying metaphysical view owes its origin to Greek atomist theory, normally associated with Democritus, in which it is believed that *all* matter is composed of fundamental material elements or particles

(atomic structures) which, although separate from each other, nevertheless possess the common characteristics of indivisibility, indestructibility and changelessness. According to Newton, the eternal state of movement or motion of these elements is *the* fundamental aspect of the material world. Such motion is determined by the law of gravity, the force which governs not only the movement of these elements but, through them, that of all reality. The picture which emerges from this is a highly deterministic one in which reality is analagous to a continuously operating machine, composed of isolated parts, which relate *externally* and mechanistically together to make the whole.

Fundamental to this notion of a determined universe is Newton's assertion that time and space are absolute categories. Though not themselves part of the material world, they nevertheless provide the environment within which all motion takes place. The assumption that time flows continuously and evenly on a past/present/ future linear progression is consistent with determinism in which explanations are expressed sequentially in causal terms. And the notion of absolute space recalls Descartes' *res extensa*, because for him, as for Newton, it is only against the background of a three-dimensional space that objects acquire their status of having a separate identity not only from each other but also from the human observer.

There is no doubt that Newtonian physics has been successful not only mathematically as a model of the universe, but also in the way in which it rapidly established itself as the basis for scientific investigation in the eighteenth and nineteenth centuries. Apart from the developments in physics to which Newton's theory gave rise, its successful empirical application in other scientific disciplines such as astronomy and chemistry demonstrated its versatility and, not surprisingly, raised hopes that the theory could be used to explain the whole of reality. But as we have seen in our earlier discussion of Bacon and Descartes, such knowledge was to be acquired not for its own sake but for essentially instrumentalist ends: *the control and manipulation of nature*.

As Berman says this has meant a new perception of reality in which there has been a shift from the asking of metaphysical 'why' questions to those which seek knowledge of 'how' reality actually works:

"The most important change was the shift from quality to quantity, from 'why' to 'how'. The universe, once seen as alive, possessing its own goals and purposes, is now a collection of inert matter, hurrying around endlessly and meaninglessly, as Alfred North Whitehead put it. What constitutes an acceptable explanation has thus been radically altered. The acid test of existence is quantifiability, and there are no more basic realities in any object than the parts into which it can be broken down. Finally, atomism, quantifiability, and the deliberate act of viewing nature as an abstraction from which one can distance oneself—all open the possibility that Bacon claimed as the true goal of science: control".²²

A Challenge to Society

For Berman, mathematical quantification and empirical observation of a material world estranged from the observer's consciousness and values thus lie at 240

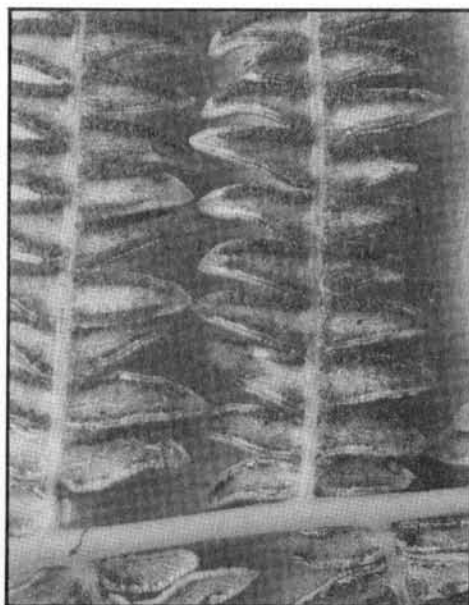
the heart of the Newtonian paradigm. Such an approach has long been the basis for the generation of knowledge in the natural sciences, and to some degree in the social sciences as well. Although Newton's gravitational theory, which sought to explain all reality, came under successful challenge in the nineteenth century from such developments as Maxwell's electromagnetic field theory and Darwin's theory of evolution, it was not until the advent of the twentieth century that it faced its greatest test. This new challenge came from within physics itself beginning with Einstein's special and general theories of relativity, and continuing into the contemporary period with the development of quantum theory. A particular feature of these new approaches was that the critique, *especially that of quantum theory*, extended beyond a specific evaluation of Newton's laws of motion to the epistemological presuppositions upon which all scientific thought is based.

This has serious implications for advanced industrial society because of the extent to which scientific knowledge is centralized in such a culture: any critique of the epistemological foundations of science must *ipso facto* be a critique of society itself.

To be continued. The second part of this article will be published in the next issue of *The Ecologist*.

Notes and References

1. I am indebted to Chapter 1 of D. Bohm's *Wholeness and the Implicate Order* (Ark, 1983) for the use of "From Fragmentation to Wholeness" in the title of this paper.
2. See: M. Berman, *The Reenchantment of the World* (Cornell University Press, 1981, pp.27-28) for a discussion of this topic.
3. Whilst it is recognised that the ideas of Descartes and Bacon need to be set against the historical circumstances in which they arose, it is not the intention to debate such issues here.
4. M. Berman, *op cit*, *supra* note 2, p.31.
5. F. Capra, *The Tao of Physics*, Fontana, 1976, p.21.
6. See: F. Capra, *The Turning Point*, Wildwood House, 1982, Chapter 2.
7. Iatrogenesis is used by I. Illich in *Limits to Medicine* to mean doctor-induced illness.
8. P. Feyerabend, *Science in a Free Society*, New Left Books, p.295.
9. Radical monopoly in the context in which it is used here means that science has so monopolised what is regarded as knowledge in society that other forms of knowledge are downgraded accordingly. For a discussion of this concept, see for instance I. Illich, *Energy and Equity*, Calder and Boyars, 1974, pp.58-59.
10. D. Bohm, *op cit*, *supra* note 1, p.7.
11. See A. McBeath, 'The Need for a Social Philosophy' in W.D. Birrell *et al* (eds), *Social Administration*, Penguin 1973, pp.283-284.
12. D. Bohm, *op cit*, *supra* note 1, pp.7-8.
13. R. Sheldrake, *A New Science of Life*, Blond, 1985. See especially pp.234-247 for an excerpt of a discussion between Sheldrake and Bohm in which they compare and contrast their respective perspectives.
14. R. Scruton, *Kant*, Oxford, 1982, pp.42-46.
15. M. Berman, *op cit*, *supra* note 2, p.149.
16. A. Jones, 'Beyond Industrial Society: Towards Balance and Harmony', *The Ecologist*, Vol. 13, No.4, p.145.
17. P. Feyerabend, *op cit*, *supra* note 8. See also: P. Feyerabend, *Against Method*, Verso, 1978.
18. K. Sale, *Dwellers in the Land: The Bioregional Vision*, Sierra Club Books, 1985, p.17.
19. A. Jones, 'The Violence of Materialism in Advanced Industrial Society: An Eco-Sociological Approach', *The Sociological Review*, Vol. 35, No.1, 1983, pp.20-23.
20. F. Capra, *op cit*, *supra* note 6, p.66.
21. *Ibid*, pp.48-49.
22. M. Berman, *op cit*, *supra* note 2, pp.45-46.



Bracken or Brake, *Pteridium aquilinum*. In the past, bracken was regularly harvested for a whole host of purposes. Fern ash, in particular, was highly valued as a source of potash, used in the manufacture of soft soaps and glass.

Bracken: Friend or Foe?

by Marjorie Sykes

Bracken is often portrayed as a pest, taking over valuable grazing land and poisoning sheep. But in the past, it proved a valuable crop. Why not again?

In Autumn, lovers of upland landscape often admire the vast expanses of tawny bracken painting the lower slopes with colourful splendour. But to the hill farmer bracken is simply a pest species and an encroaching one at that.

Bracken or brake (*Pteridium aquilinum*) is our most common British fern, an aggressively invasive coloniser, spreading rapidly through its creeping underground rhizomes which send up at intervals the tall branched fronds, generally four to six feet high, though in exceptionally favourable situations they may reach a height of 12 to 15 feet. In primeval times bracken was a plant of the woodlands, and it still does flourish under trees, but it has also colonised heaths, moors and hillsides which were formerly covered with grass. It is rarely found above the 2,000 foot contour, usually stopping short at 1200 to 1500 feet. It thrives in acid conditions, but it will tolerate almost any kind of soil, so long as it is sufficiently well aerated.

The degree of bracken's invasiveness may be gauged from the fact that a really vigorous plant is estimated to possess some 1300 feet of underground shoots. Not only does it shade out all its competitors and ruin valuable grazing, but shepherds

also dislike it for its encouragement of fly and the way in which it can conceal sheep. Moreover, if animals develop a taste for it, it can prove poisonous in the long term.

Man and the Spread of Bracken

Ironically, man himself is indirectly responsible for the rapid spread of bracken. He has drained water-logged areas which were formerly unsuited to its growth; he has reduced the competitive power of hill grasses through intensive grazing; he has replaced the black cattle which formerly ranged the fellsides by sheep, whose lighter tread does not break down the young fronds to the same extent; he has burnt off heather so that bracken can compete effectively and eventually replace it. Now he is struggling to control the plant that has so profited from his own activities.

Deep ploughing will do it, for the rhizomes are frost sensitive and will die of cold or desiccation if exposed, but ploughing is not practicable on steep and rocky hillsides. Here the traditional method of control has been repeated cutting over several years, which exhausts the plant and finally suppresses it. But this is a long and arduous process; two cuts a year for three consecutive years will

reduce the height and density, but will not kill the rhizome. To achieve that, it is necessary to cut three times a year for four consecutive years.

Today, of course, various herbicides are used, though with rather erratic results, the problem being to penetrate the immense amount of underground material. An acre of land may contain 20 to 50 tons of rhizomes beneath the surface. There is also the problem of how one applies chemicals on steep and difficult land; spraying from the air would seem at first sight the answer, but in hilly regions this is a tricky business because of wind drift. Since acid soils encourage bracken, regular liming has been suggested as a remedy, but again there is the problem of application. Experiments have even been carried out to encourage disease in bracken (or "the brackens", the weighty plural which the dalesman always accords to this foe) but the plants perversely thrived on the injected viruses!

Harvesting Bracken

Our modern sophisticated society regards bracken as completely useless, except for the few hill farmers who may still cut it for litter, but it was not always so. In past centuries bracken, generally called simply

"fern" by most country people, was regularly harvested for a whole host of purposes. At the end of the 17th century, Celia Fiennes travelling through Staffordshire reported that "the whole Country are employ'd in cutting it up". In Radnorshire, in the latter part of the 19th century, Francis Kilvert commented; "The fern cutters were hard at work on the Vicar's Hill mowing the fern with a sharp ripping sound. The mountain and the great valley were blue with mist and the sun shone brilliantly upon the hill and the golden fern." In the Welsh hills it was often brought down to the valley on sledges.

It was also extensively cut in North Lancashire and the Lake District, whose farmers also used the sled. At Cartmel, Bracken Day was an annual fixture when the Lord of the Manor authorised the start of bracken cutting. So-called bracken ovens may be seen at Whin Scar, low circular walls within which the bracken was burnt.

Uses of Bracken

The resulting "fern-ash" was then bagged and sold as a valuable source of potash, used in the manufacture of soft soaps and glass. Celia Fiennes wrote of it being made up into balls for washing and scouring, the principal market for the Cannock cutters

being London. "The whole Country are employed in cutting it up and burning it in heapes for the sake of the ashes, which they make fine and rowle them up in balls and so sell them or use them all the year for washing and scouring, and send much up to London, the ashe balls being easily sent about."

Pack horses would convey the fern-ash from Cannock Chase to London, and from the hills to the coast of Cumbria and Wales whence much was exported on small coasting vessels putting in at such little ports as Bangor, Conwy and Trefriw. As an example of the money which humble people could make from bracken-cutting, we may cite the story of Nancy Roberts of Dolwyddelan who was anxious to raise money in the religious revival at the end of the 18th century for the building of a small chapel. She burnt bracken, producing 30 pecks of ash which delivered at Trefriw wharf ready bagged for shipment brought her 6s. a peck.

Bracken was also used on farms as bedding for livestock; it stacks very compactly and cuts well into bales. It is non-conducting and warm, making good dry cosy litter for horses, cattle and pigs. In its green state it was also used extensively to make the foundations of hay stacks and

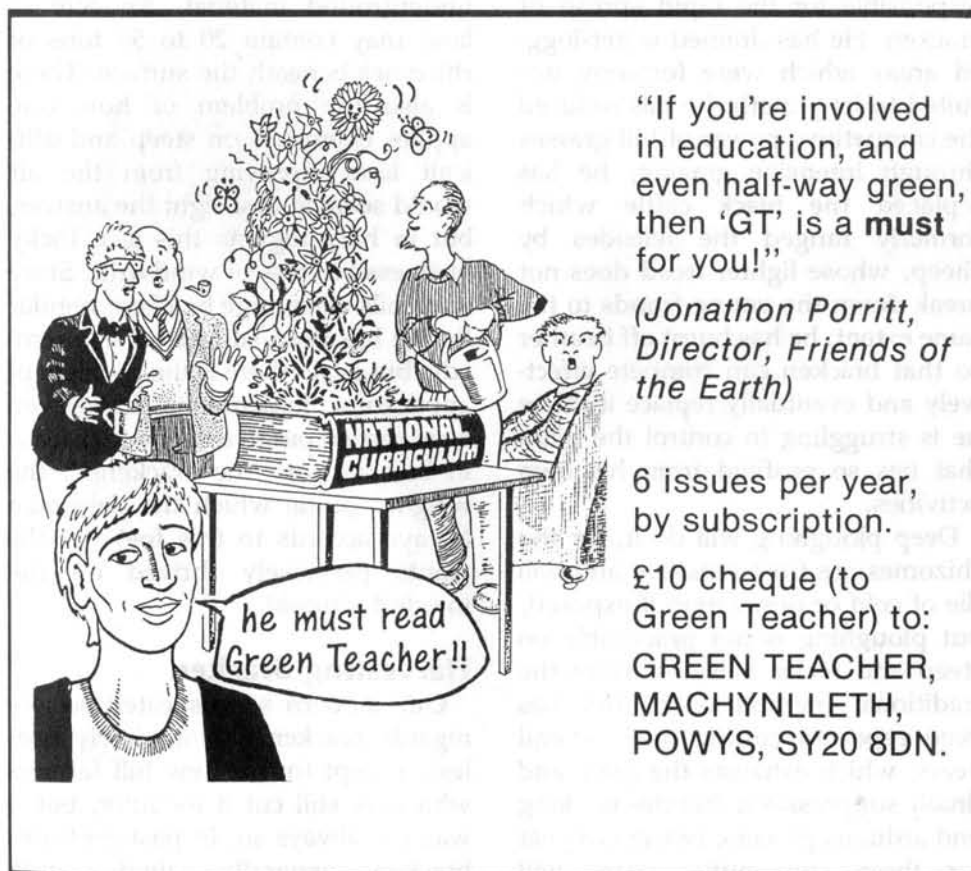
corn ricks. A good deep layer of bracken raised the hay or corn several feet off the ground and did not let any damp rise up into the crop. It aerated the stack, the loose texture of bracken allowing air to circulate underneath, and it was also rat-proof, for rats will not gnaw through bracken, which makes their mouths sore. Similarly bracken was used for storing root crops in frost-proof clamps. Potatoes in particular keep very well in dry, springy bracken.

The coarser parts and roots were stewed to produce what was called "brake water", used in tanning. Bracken was also used to stoke the old-fashioned bread ovens as an alternative to faggots of furze, and even served in some areas as a material for thatch.

It was valued for packing purposes, growing conveniently handy in hilly slate-producing areas for use in protecting the slates. It could be used round a variety of small goods carried in panniers by pack animals and farmers often sold it to pottery manufacturers to put round their finished wares—the potteries demanded huge quantities of packing materials, especially in the days before smooth canal transport and pneumatic tyres on land.

Bracken-ash could even be employed in the actual manufacturing process, to make a glaze for ceramics. Bernard Leach described its use in *A Potter's Book*: "40 parts of bracken-ash, 40 of feldspar and 20 of pike clay produce a thick white matt glaze equally good for wax-resist and over-glaze painting. This is due to the bracken's high percentage of alumina and magnesia. The old Chinese potters knew this and burnt bracken and limestone together to make a flux for their porcelain glazes". So far as I know, this use is confined to the craftsman potter, so there can be little commercial future here.

It is one of the dilemmas of our modern society that a plant which once was valued for a wide variety of purposes has now become a mere scourge. Where once it contributed its modest quota to the farmer's livelihood, it now demands the expenditure of large sums on its extermination.



"If you're involved in education, and even half-way green, then 'GT' is a **must** for you!"

(Jonathon Porritt, Director, Friends of the Earth)

6 issues per year, by subscription.

£10 cheque (to Green Teacher) to:
GREEN TEACHER,
MACHYNLLETH,
POWYS, SY20 8DN.

Green Britain or Industrial Wasteland?

Sandy Irvine reviews Green Britain or Industrial Wasteland?, edited by Edward Goldsmith and Nicholas Hildyard, and concludes that, though a valuable book, it shirks many of the important issues facing the Green Movement.*

In *Green Britain or Industrial Wasteland*, Edward Goldsmith and Nicholas Hildyard have put together a very useful collection of essays on some festering sores in our own backyard. However, the book's focus is narrow in ways other than purely geographic. Frank Fraser Darling and Raymond Dasmann once discussed an ecological approach as one in which "all human activities must be appraised and managed in the light of their effects on all the other components of the ecosystem" (my emphasis). Goldsmith and Hildyard have concentrated largely on those activities with direct and specific impacts on the environment, omitting issues such as population, lifestyles, social and economic institutions and policy, culture and values except in the odd passing comment. This creates some important gaps.

That said, let me quickly stress that the book is the best single guide not only to the local activities of factory farmers, junk food fabricators, radiation releasers, pollution purveyors and their ilk but also the complicity of successive governments. The various contributors maintain a very high standard. The best are those that present the excuses of officialdom, industry and pro *status-quo* academics and scientists—and refute them. Nonetheless, I have my reservations.

Population Problems Omitted

I was very surprised by the absence of any articles on Britain's population size and structure. Given that our little island is not a closed system, any discussion of carrying capacity is fraught with difficulty. But this does not mean that it



should not be attempted. Indeed, nothing could be more important than getting to grips with the problem of how many people can be supported at what levels of energy and material consumption sustainably long into the future. Of course, once everyone decides that this cannot be done for their own country or region, then the problem becomes the responsibility of no one and we are headed for long-term disaster in the manner of Hardin's *Tragedy of the Commons*. Furthermore, it is not squarely recognised that we Britons can only exist in such numbers and in such lifestyles by drawing on the resources of future generations, by the exploitation of the poor in the Third World and by appropriating the habitats of other species for our own demands.

Theoretical Gaps

I would have also welcomed more emphasis on the need for what Daly and others call the 'steady-state' economy without which all the impacts described will return in one form or another, overwhelming the many sensible reforms suggested (tighter controls, more filters, and so

on). Some important theoretical questions are not properly discussed. For example, we often talk of a society in greater "harmony with nature" or "ecologically based" policies. What exactly does this mean for our environment which has been human-made several times over? What, in such a situation, is the 'right use' of the land, beyond the subjective preferences of this or that lobby? Much energy, for example, is expended defending open moorlands which are the product of intense environmental degradation.

Or, to take the example of tree cover from another direction, does it matter that we have so deforested our island? Are there yardsticks of a more "objective" nature that shed light on what should be minimum levels of forest cover to preserve certain species for the long-term well-being of our patch of the planet? In tropical areas, the consequences of removing the jungles quickly become apparent, making the need for preservation crystal-clear. In temperate areas such as our own, nature provides fewer guides to wise policy.

True, the book's purpose is to spotlight what we are up against, with specific reference to the governmental record: but we should also be discussing all aspects of *why* we think it matters (beyond, for example, human health risks) and what we are arguing *for*. Too many chapters stop abruptly with a bald call for 'fundamental change'.

Urban Pressures

Within the framework chosen by the editors, the biggest single gap is the urban dimension to the problem. The single chapter on the built environment, by Ken Powell, is an expression of environmentalism at its most subjective, concerned with

* Polity Press, £25.00 (Hardback), £6.95 (Paperback). Available from: *The Ecologist*, Worthyvale Manor, Camelford, Cornwall.

the defence of historic buildings and townscapes. I share the author's tastes but would have liked his views supplemented by a more ecological approach. This could have looked at the inputs and outputs generated by the "metabolism" of today's conurbations.

Modernisation

However, my main reservations about the actual content (as opposed to what has not been included) concern the editorial introduction and the more 'political' pieces.

The introductory essay by the editors usefully links the various contributions, showing how big business, civil servants and politicians function as a system in defence of further environmental degradation and resource depletion. They make some pertinent points about scientific evidence and safe limits. I was less happy with their concept of 'modernisation' which struck me as too abstract and historical.

In their capacity as *Ecologist* editors, Goldsmith and Hildyard have employed a better conceptual

framework than that permitted by 'modernisation' which could be said to be happening at any moment of change since Adam and Eve. They also put too much emphasis on what they call "a critical shift in our attitude towards the management of our resources and the running of our economy. The accent is *now* on the... maximising of short-term gain" (my emphasis). Well, there's nothing new in this and often what stopped past societies from ecologically self-destructing (which, of course, many did) was lack of technological power, not different attitudes (which is not to say that some traditional groups did not have a more ecologically appropriate cosmology). The white settlers in America are probably unsurpassed in their greedy and mindless destruction. Moreover, just as important as attitudes are structural constraints which, for example, drive farmers to squeeze even more surpluses out of their soil and livestock.

Political Bias

Most contributions, directly in the case of Chris Rose's 'Conservation

and the Conservatives', lambast the Tory party. It's a pity that thought was not given to the problem of why the Tories remain so popular. More importantly, there is no equivalent critique of the other major parties. This is fair enough at one level, given Mrs Thatcher's record length in office: however, it is a question that cannot, in the long run, be avoided. Do the policies of Labour and the Alliance *significantly* point to the right answers or are they still part of the problem?

I would have liked to have seen separate chapters reviewing both the actual track record and the underlying assumptions of the Opposition parties. In particular, a serious discussion of socialism, the dominant ideological alternative, especially its Labour variety, would have been most useful. Programmatically and ideologically, socialism is a creature that is committed to technocracy, centralisation, materialism and the attainment of cornucopian abundance. It is a tradition that has consistently opposed the analysis underlying the "limits to growth"



EUROPEAN ENVIRONMENT REVIEW

The Journal of European Community and International Environmental Policy and Law.



The **European Environment Review** is an international, multidisciplinary journal providing a unique forum for the presentation of information and views on all aspects of environmental protection. The Review is dedicated to strengthening the links between the many disciplines and sectors of society involved in creating and implementing environmental legislation. By so doing, it is hoped to foster international progress in the development of responsible solutions to environmental problems.

SAMPLE COPY REQUEST FORM

Return to: Toni Connors,
Graham & Trotman Ltd,
Sterling House,
66 Wilton Road,
London SW1V 1DE

Please send me a sample copy of
the **European Environment
Review**

NAME _____

POSITION _____

ORGANISATION _____

ADDRESS _____

POST CODE _____

COUNTRY _____

ZN

thesis and the whole concept of ecological scarcity. At best, it has fought for more public access, more planning controls and better health and safety, including tighter pollution standards. It shows no signs of recognising that the problem resides in the very quantity and quality of the productive forces themselves, ones that Mr Kinnock claims he can expand even faster than Mrs Thatcher. Life *might* be fairer under Labour but we would still be on board the *Titanic* heading for the iceberg, with the boilers being stoked up even faster.

Many reasons suggest that the Labour Party leopard will never change its spots, not least its traditional ideology, its dependence on trade union bureaucracy and its base in the old industrial heartlands. The Liberals and the Social Democrats similarly address, at best, some of the symptoms but not root causes. Who else is there? Pitifully small but aspiring to be the voice of the future, not the past, is the most novel political manifestation of this century—the Green movement. Goldsmith and Hildyard give the last three chapters to three representatives of this eclectic social movement—Jonathon Porritt, director of the pressure group Friends of the Earth, Nick Gallie of the direct action Greenpeace, and Lindy Williams of the Green Party.

Reform or Revolution?

No one has done more than Jonathon Porritt to popularise Green ideas through his writings, public meetings and media appearances. His chapter on the dilemmas and choices facing environmentalists, on what is the enemy, how we are going to fight it and what to put in its place, is characteristically vigorous and direct, with perhaps a little bit of excess rhetoric. He is surely right to suggest that we want and need both *reforms*, not least to halt further damage and open doors for positive initiatives for the future, and *revolution*, in the sense of a thorough transformation, not the Marxian overthrow of one class by another. I am less sure that “sustainability is . . . the key”. This begs so many questions such as sustainability of what for whose benefit? The US

Life might be fairer under Labour but we would still be on board the *Titanic* heading for the iceberg, with the boilers being stoked up even faster.

Forestry Service was an early practitioner of sustained yield yet it has triggered many bitter battles with environmentalists; the Sami people have had their valleys flooded to provide sustainable hydro-electricity for the big cities. David Ehrenfeld in particular has spotlighted the contradictions regarding the conservation of ‘non-resources’.

I am even less sure of the author's contention that a suitable model is to be found “in the writings of Fritz Schumacher and Barbara Ward”. No doubt they were instrumental in a lot of people changing their thinking. I do not think there is much green philosophy (in the sense of, say, the ‘deep ecology’ school), or hard economic theory (compared to, for example, Herman Daly and Nicholas Georgescu-Roegen) nor ecology (compared to, say, the Sears, the Odums and the Ehrlichs of this world).

Porritt argues the need to find common ground between various single issue movements. Defining the boundaries of what is green is as easy as estimating the length of a piece of string and the last thing the Green Movement needs, given its puny strength, is factional heresy hunting. Yet glossing over real differences not just of emphasis but of basic values and direction can only store up trouble for the future. A lot of what Porritt calls ‘primarily spiritual work’ is, sometimes, not unlike the ‘culture of narcissism’ dissected in the writings of people like Christopher Lasch. Bill Devall and George Sessions have cogently demonstrated the anti-ecological elements of so-called new age movements. How can you reconcile the propaganda of Oxfam with what is foolishly dismissed as ‘neo-Malthusianism’? Either conventional politicians will change their ways or they most likely won't and we have to decide which. We cannot advocate serious energy conservation

and environmental protection at the same time as increased coal-burning. The network of ‘The Other Economic Summit’ (TOES) seems to be riding a number of horses galloping in opposite directions, from genuine ‘steady-state’ economics to an increasingly turquoise kind of Keynesianism. Finally, there is the example of the destructive in-fighting in Die Grunen, where the conflict between the red and green poles of the party seem to suggest that the laws of politics are the opposite of those of magnetism.

Potis and Poets

I sometimes think that the word ‘green’ blurs two distinct and, beyond a certain point, incompatible tendencies. The first could be called the POTI tendency—Politics of the Individual, oriented around the self and characterised by ideas such as rebirthing. The other is the POET tendency—Politics of Ecological Thinking, of which *The Ecologist* is an obvious example. Honestly facing up to genuine divergences should still be compatible with a willingness to work together where appropriate. Porritt could not be expected, given his background and current position, to explore too far where experienced greens should devote the bulk of their energies. In any case, the choice will often be affected by personal circumstances. He bravely notes in passing some of the contradictions and negative side-effects of single issue campaigning.

Direct Action?

Nick Gallie presents a spirited case for the kind of campaigning typified by Greenpeace and clearly explains the theory and practice of non-violent direct action. Unfortunately he rather overstates the case and ignores important problems.

Gallie cites concrete examples but I found his linking of cause and effect not totally convincing. On p350, he claims victory over France in the south Pacific in 1972 but, five pages later, we are back at Muroroa to find certain nuclear tests still going on. More importantly, he omits reference to the continuing popularity in France of the governments which not only supports the

testing of nuclear weapons but also the disgusting attack on Rainbow Warrior. With respect to Windscale, I think it might have been appropriate to mention some of the other organisations that have also been fighting this menace. Gallie's account is a bit like a green version of Superman.

What of the dangers of this kind of orientation? Gallie can see none. But breaking the law, whatever its justification, unavoidably creates hostages for the future. On what basis could we consistently turn round in a greened society and punish those who illegally go on polluting and the like? Why is it

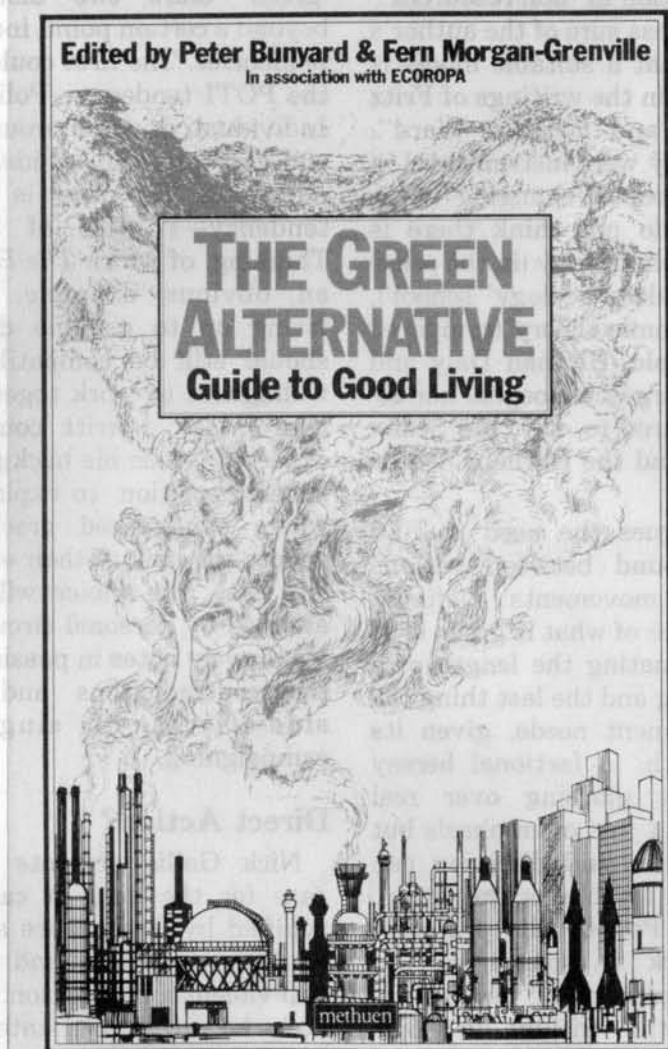
morally right for us to break the law but not the National Front? I do not pretend to have the answers but I do not think we should avoid the questions.

Party Time?

Finally, we have Lindy Williams from the Green Party. Responses to her short piece will partly depend on how one defines politics and perceives the nature and role of party organisation. Lindy Williams adopts an approach of, 'gosh, what a nice set of ideas we Greens have'. Which will, I fear, not do very much to persuade those who think that parties suffer from intrinsic defects,

ones which make them so often so destructive of the very purposes and ideals they claim to serve. Indeed, history contains an overflowing catalogue of broken promises, sell-outs, opportunism, corruption, stultifying orthodoxies, bureaucratic sclerosis and the like in the annals of parties of radically different hues. Smaller parties can be even more vulnerable to all the negative potential of unhealthy small group dynamics. Despite their seeming unattractiveness for the purpose, they too can attract the power-seekers because there are many who seem to relish being admirals in a navy, however small the fleet, and who block outward expansion in membership and influence rather than lose status. All kinds of organisations face these problems but they become acute for advocates of a new society particularly for Greens, given the contradictions between their beliefs, such as decentralisation and consensus, and the need to function effectively in circumstances not of their choosing.

Lindy Williams does not reveal how well the Green Party is avoiding these pitfalls. Readers would have been better served if the organisation had been painted warts and all. Perhaps greater editorial direction should have been given with regard to the kind of questions she should have asked. For example: Does the green revolution in fact need a party? If so, in what ways? Does the Green Party have a coherent philosophy, one comprehended by its members? Is the high membership turnover symptomatic of a failure to harness and develop new recruits? Does its programme satisfactorily make the links between the issues raised in the book, with a comprehensive diagnosis and set of remedies? Given the obvious fact that society is not homogenous, does the Green Party identify those social groups (as opposed to humans in general) likely to welcome an end to the status quo? Does it raise demands that can act as a transitional bridge between green ideals and the hopes and fears of the non-converts? It is a pity that Lindy Williams did not give at least some indication of her thoughts on these matters. Answering them



Our beautiful planet is threatened, not just by chemical, biological or nuclear war, but quite simply by the way we live.

By posing and answering some 500 questions this timely book shows what we can do to stop the collapse of the environment by taking the 'green' alternative.

PRICE NET £2.95 plus 40p p&p from:

**The Ecologist, Worthyvale Manor Farm,
Camelford, Cornwall, PL32 9TT.**

would take another book but some key points stand out.

Problems with the Greens

First, there would appear to be a crisis of leadership in the Green Party, part of which results from a hostility to the very concept itself. Yet it rests on the realities of the unevenness of consciousness, commitment and ability in any group. The purpose of positive leadership is to make clear the best insights, skills and experiences available within an organisation to the membership. It means having those best equipped coordinating a democratically agreed programme of activity so that it multiplies what could be achieved by individuals and small groups acting on their own. Interestingly, the dangers of undemocratic abuses are greatest in organisations without the proper structures which control 'the hand on the duplicator'. The key to democracy is more likely to be found in accountability and the power to recall rather than the wasteful 'rotation' principle. This crisis is reflected in a consistent lack of resources for the work done at the centre of the Party and indeed a great deal of sheer inefficiency (as during the last General Election).

Second, there also appear to be problems at the level of basic policy analysis. For example, the party literature and spokespersons often demand energy from 'clean coal' (have they eliminated carbon dioxide releases, let alone the problems of subsidence and ground water contamination around mining facilities?). Too often, more and more demands are made for greater human rights (for instance, for freedom to live and move around wherever one pleases) yet equal attention is seldom given to human responsibilities and the restraints these demand. A last example of inadequate thinking can be found in Williams' article itself where the author repeats a popular piece of exaggeration that 'exploitation of the planet inevitably involves exploitation of people'. Nonsense! While it has often been the case, there is plenty of evidence of environmental degradation by essentially classless societies not characterised by any kind of ex-

ploitation. Similarly, some malign technologies were adopted, not to oppress but to serve human needs. From the case of the impacts of mass recreation, it can be seen that greater democratisation in terms of both leisure opportunities and physical access may well in themselves bring increased environmental destruction. A political perspective that does not integrate such issues must be judged inadequate.

Third, Lindy Williams reflects a one-sided emphasis on the Parliamentary Road to the greening of Britain. Politics cannot, however, be confined to the making of a cross on a ballot paper once every five years. Indeed, one of the great strengths of the establishment is that it fights on all fronts in a conscious and organised manner. Green politics should be about the formulating and raising of practical policies and demands in a concerted manner in whatever forums are available—trade unions, professional bodies, planning enquiries, community groups and within single issue campaigns. Too often, the Green Party sits and sucks its thumb, dreaming of what it would do in the distant event of electoral victory, rather than planning interventions in issues of the here and now. Ultimately, the role of a party is ideological, involving what Gramsci referred to as a struggle for hegemony in the battle of ideas. Independent philosophers and analysts also play a vital role but they are more likely to lack the essential feedback that comes from public campaigning.

A Plea

I have focussed so much on the more overtly political aspects, not to wash dirty linen in public, but because our problem as greens of whatever orientation is how to change the world, not just document its ills. *The Ecologist* has done the latter so well—could I plead for more attention to the former?

Sandy Irvine

Our Dying Planet

EARTH by Anne and Paul Ehrlich, Thames, Methuen, £14.95

Earth is the book that accompanied the three part British television series of that name. It is a very well produced volume, illustrated by superb pictures which themselves almost tell the story. As an accessible overview of the global ecological crisis, *Earth* has few if any rivals. The basic diagnosis of and remedies for the ills chronicled is particularly clear and direct. Sad to say, since the days of the *Blueprint for Survival*, our analysis of what is wrong, and why, has been befogged by the rhetoric around such phrases as "development without destruction", "poverty is pollution" and "good growth". The Ehrlichs have done an excellent job in restoring a basic framework for thinking through our problems. Of the book's many merits, a number stand out.

First, there is the emphasis that the crucial environmental problem is not the depletion of this mineral or the health hazard of that pollutant but rather ecological simplification and the undermining of what the Ehrlichs call the "free services" that maintain the overall well-being of the planet and for which technological substitutes are either non-existent or impossibly expensive on any significant scale.

Second, the authors clearly demonstrate that the root cause of the current crisis cannot be pinned on just one factor but results from the explosive interaction of population increase, greater energy and material throughput in the economy and use of inappropriate technologies, all of which affect (and are affected by) the kind of institutions and values dominant in modern society. There are, of course, those who would blame it all on, for example, the capitalist system. But, as the Ehrlichs show, many of our ills go back to the birth of agriculture and even before, the earliest hunters having been the cause of species extinctions. Indeed most of the driving forces of destruction today (male machismo is nicely illustrated by a photo of John Wayne at

his most butch) have no *necessary* connection with any particular economic mode of production. Similarly, all classes, not just the hated "bourgeoisie", contribute to the disastrous pressures that the book graphically portrays (for example consumer demand for hamburgers fuelling further clearances of Amazonian forest to make way for cattle ranching).

Third, the Ehrlichs forcefully underline the role of population growth as a problem in its own right and one that magnifies most others. Conversely, a stabilisation then a reduction in human numbers is a precondition for any long-lasting resolution of our ecological predicament. Even so, attaining such goals may mean going further than even the Ehrlichs envisage. In particular, it could well involve a serious look at ideas such as Boulding's proposal for what he called "transferable birth licences". It is a sad reflection of our collective inability to face up to the dynamics of the problem that such ideas cannot even be rationally discussed in most circles.

These are only some of the many insights to be found in this excellent work. However, what is really refreshing is the ability of the Ehrlichs to see the problem as a whole. It must be said that Paul Ehrlich has received a great deal of abuse in his time. Here, for the public at large to read, is abundant evidence of true compassion and commitment to justice in human affairs though, I suspect, his critics on both the left and right, will be too blind to see it.

I would have welcomed more discussion of the problems of translating what seems so true at the macro level to a persuasive policy for localities where it is so hard to argue that resisting more golf courses, more ripping up of hedgerows, more ploughing under and paving over is vital to the protection of the biosphere as a whole. So much of the assault upon Mother Earth stems from the cumulative consequences of these small and seemingly insignificant decisions through which the 'industriosphere' relentlessly overexpands.

I would also have appreciated more stress on the crisis of ecology

as a crisis of culture and character. Perhaps the requirements of the TV series for visual material led to a greater concentration on the concrete rather than the abstract. Insufficient attention is paid to the role of anthropocentric ideologies in our abuse of the environment. The Ehrlichs seem to adopt a position of 'responsible stewardship'. This still embodies some notion of being above and apart from the natural world. Moreover, the kind of technological power we have today is always likely to tempt the most well-

meaning of stewards ("power corrupts . . ." etc). Finally, the tangible presence of nuclear power stations and missile bases perhaps has the effect of diverting our attention away from the much more diffuse but equally significant revolution in genetic engineering. Here, often in the name of good stewarding of resources, steps are being taken down a slippery slope where, I believe, both angels and greens should fear to tread.

Sandy Irvine



The Fluoride Debate

Dear Sir,

In his defence of fluoridation D. Jackson (*The Ecologist* Vol 17, No 2.) stated: "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. . . ." It is good to learn that fluoridationists now admit that their classic research was inadequate. But the implication that more recent studies are adequate must be challenged.

Professor Jackson was the principal author of the Anglesey fluoridation study (*British Dental Journal* Vol 138, and Vol 158, 1985). It compared a fluoridated off-shore island with a mainland non-fluoridated town. As I pointed out in *Nature* (Vol 324, 27 Nov 1986), "Apart from its questionable late selection of a known high-carries non-fluoridated 'control' population different from that originally planned, without pre-fluoridation information on the populations being compared—making its 'strictly blind conditions' worthless—its concluding assertion of 'the universal finding that caries experience in a fluoridated community is consistently lower than in neighbouring non-fluoridated communities' is shown to be untrue by the many studies cited in Dr Diesendorf's Commentary (*Nature* Vol 322, 1986)."

Other examples are the two 1986 fluoridation studies in the *Journal of Dental Research*. One, by Curzon et al (Vol 65, p421), reports an impressive 100 per cent inverse correlation between

natural water fluoride and dental decay in seven Texas towns. Impressive, that is, until one reads that the towns were selected out of "a number" (unstated) of Texas towns which had been previously surveyed. The seven were stated to have been selected "as demonstrating high and low concentrations of Li and F" (the chosen values of "high" and "low" were not stated) and "as having populations large enough to provide an adequate sample for dental examinations (again the actual population and sample sizes not stated)."

The other study claimed to show "dental benefits of limited exposure to fluoridated water in childhood" (Burt et al Vol 61, p1322). A three-year longitudinal study of children, aged 6-7 years at commencement, compared dental decay levels of the children who had lived part of their lives in fluoridated places with the children who had not. The authors reported lower decay levels for the former, but admitted that those children came from higher socio-economic backgrounds, which usually results in lower decay levels anyway. But that was no problem to the fluoridationist researchers. They claimed to have "used multiple regression to assess the relative effects of these variables" and produced "results" in a table which showed that it was fluoride which caused the difference after all! Details of the statistical method they used, and the weightings for the variables, were not given. But it must have been powerful statistical magic—because the difference in decay levels between the compared groups, measured as "DMFS" (average number of decayed, missing and filled tooth surfaces) even before the magic was applied, was less than one tooth surface. Even though "statistically significant", that difference could hardly be clinically significant for such young children over three years, given the great subjective variability in diagnosis of caries.

Recent fluoridation research, like the paradigm's classic research, relies on selection and/or manipulation of data to achieve its desired results. Both kinds exemplify the truth of Diesendorf's concluding remark in his above *Nature* Commentary: "Perhaps the real mystery of declining tooth decay is why so much effort has gone into poor quality research on fluoridation, instead of on the more fundamental questions of diet and immunity."

Yours faithfully,
John Colquhoun,
Auckland,
New Zealand.

Classified

MISCELLANEOUS

BADGES! Can publicise your group or campaign. Your designs made by Workers' Co-op. BASCOP, 16 Haldon Road, Exeter, Devon EX4 4DZ (0392 35991).

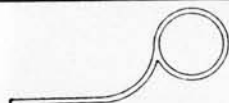
ECOLOGY MINDED BES COMPANY, Sailing Ships and Publishing, requires further investment. Details from Gramerley, Ball Hill, Hartland, Devon EX39 6BX.

THE FELLOWSHIP OF THE ARK. The creation of a non-denominational community in the Canadian Rockies. Build your own house. Walk the earth in a sacred manner and love your neighbour. 'For the time of the end is also the time of the great beginning'. Contact: Christabel Escott, Ascott Farm, Stadhampton, Oxford (0865 891067).

NEW GROUND. Journal of Green Socialism, *Special Women's Issue*. Pesticide and the Third World. Feminist Architecture at Work. Ethnic Minority Womens' Involvement in Environmental Issues. International Nuclear Free Zones: A Feminist View. Green versus Red: Women speak from both Sides. Send £0.75 plus 0.40 p+p to SERA, 26-28 Underwood Street, London N1 7JQ.

SUPPORTIVE COUNSELLING

Supportive counselling by experienced Analytical Therapist. Help offered in the resolution of inner conflicts and the development of self-generative potential, in either individual or group settings. Telephone 01-372 5101.



The Symbol

The sloping line symbolises the principle of **ECONOMIC GROWTH**. The circle in the end stands for the way out; the principle of **RECYCLING**.

This symbol is used on:

ECOSCRIPTS: a series of original publications, reprints and translations in the field of ecology and ecosophy. **ECOSCRIPTS:** aim at furthering mankind's ecological consciousness.

(Published by the Foundation for Ecological Development Alternatives) Netherlands **ECOSCRIPTS** are available from **THE ECOLOGIST**, Worthyvale Manor Farm, Camelford, Cornwall PL32 9TT, U.K. Tel: (0840) 212711. Write for price list of English language **ECOSCRIPTS**.

CLASSIFIED ADVERTISING

(Pre-paid only)

Display £2.00 per s.c.c. Min. 3cm.

Semi-display £1.40 per s.c.c. Min. 3cm.

Word rate: 20p per word. (Min. £4.00).

Box Nos. £1.00 extra.

Send text to:

Maria Parsons, Advertising Dept,
The Ecologist,
Worthyvale Manor,
Camelford, Cornwall PL32 9TT UK.

DIARY DATES

NEW SOURCES AND PROBLEMS IN URBAN TRANSPORTATION NOISE. One-day meeting organised in collaboration with the Chartered Institute of Transport, 23 May 1988, Society of Chemical Industry, Belgrave Square, London. Contact meeting organiser: R N Galbraith, Sandy Brown Associates, 1 Coleridge Gardens, London NW6 3QH. (Tel: 01 624 6033).

PIPELINES AND THE ENVIRONMENT, 8-10 March 1988, University of Aberdeen Centre for Environmental Management and Planning in association with Pipes and Pipelines International, PO Box 21, Beaconsfield, Bucks HP9 1NS. (Tel: 04946 5139).

EUREM 88. 9th European Congress on Electron Microscopy, York, UK 4-9 September, 1988. For details contact Congress Secretariat, The Royal Microscopical Society, 37/38 St Clements, Oxford OX4 1AJ.

WILDFLOWER WEEK—May 21-30, 1988. The Royal Society for Nature Conservation will again be running a national Wildflower Week this year sponsored by Gale's Honey. A full Presspack is available as well as photographic material. For details contact Julia Knight, Kingsway Public Relations Limited, 10 Doughty Street, London WC1N 2PL.

THE CENTER FOR PROFESSIONAL ADVANCEMENT announces the following courses: Effective Project Management (April and July 88), Baghouse Dust Collection Systems (April 88), Piping Design, Analysis and Fabrication (April 88), Gas Turbine Technology (May 88), Machinery Failure Analysis and Prevention (May 88), Corrosion in the Oil Industry (May 88), Uses of Chemicals in the Oil Industry (June 88). For details contact: The Center for Professional Advancement, Palestrinastraat 1, 1071 LC Amsterdam, The Netherlands.

EAST ANGLIAN EXHIBITION OF NATURAL HEALING. 16 and 17 April Springlodge Community Centre, Witham, Essex from 10 am to 5 pm. Sponsored by the Association of Natural Medicine. Further details from J Hardy, Brierley, Main Road, Boreham, Chelmsford, Essex. (Tel: 0245 469851).

The First UK **HEALTHY CITIES** Conference to be held in Liverpool 28-30 March 1988. For further information contact David Bamber, University of Liverpool. (Tel: 051 709 6022 ext. 2107/2179).

HOLIDAYS AND COURSES:

ANDALUSIAN SIERRAS. Rambling, naturalist, pony-trekking summer holidays. Fascinating wildlife, wonderful scenery, 2 weeks from £285 including full board in picturesque white villages, activities, excursions. Lindsay Chapman, 6 Kipling Place, Eaton Ford, Cambs PE19 3RG. Tel: 0480 212540.

INTERNATIONAL WORKSHOP on Sustainable Futures Modelling to be held at Hotel Ladyhill, Singapore, April 4-9, 1988. For information write to: Mr Anupam Saraph, Information Centre on Development Policy Modelling, Systems Research Institute, 17-A Gultekdi, Pune 411037, India. (Tel: 212 420323).

DORDOGNE, FRANCE. Informal Holiday Course May and October. Over 25 species wild orchids within minutes of Farm. Rich limestone ecology. No collectors please. Self-catering except communal breakfast. Marcel Lewin-Poole, 11 Edward Road, Canterbury CT1 1UH.

Weekend Courses for 1987/88 at the Centre for Alternative Technology include Blacksmithing, Solar Collectors and Systems, Low Energy Buildings, Windpower, Organic Gardening, Healing Herbs and many more subjects. For information write to: Lesley Bradnam, Centre for Alternative Technology, Machynlleth, Powys, Wales SY20 9AZ or Tel. 0654 2400.

WELSHWALKS. Come and see for yourselves and learn how the past and present farming and forestry practices affect the countryside. Guided or unguided walking holidays. Near Alternative Technology Centre. Vegetarians very welcome, as are children.

Send for brochure:
Talbotdrain,
Uwchygareg,
Machynlleth,
Powys SY20 8RR.
Tel: 0654 2192.



CALL FOR PAPERS

14TH INTERNATIONAL CONGRESS ON IRRIGATION AND DRAINAGE, RIO DE JANEIRO, BRAZIL, APRIL-MAY 1990

The Congress topics are: ● The influence of irrigation and drainage on the environment with particular emphasis on impact on the quality of surface and ground waters. ● The role of irrigation in mitigating the effects of drought. ● Socio-economic and technological impacts of mechanised irrigation systems. ● Real time scheduling of water deliveries.

Last date for submission of draft papers is 30 November 1988.

Contact: Secretary, International Commission on Irrigation and Drainage, 48 Nyaya Marg, Chanakyapuri, New Delhi 110 021 (India)

Save the Forests : Save the Planet

A PLAN FOR ACTION



THE ECOLOGIST has launched a campaign to save the world's tropical forests. In our last issue (Vol.17 No.4/5), we proposed a fourfold plan for saving the forests:

1. That the Third World's debts be exchanged by international agreement for the guaranteed protection of the world's remaining tropical forest:
2. That a massive re-forestation programme with trees selected for their ecological rather than commercial value be undertaken:
3. That the destructive development programmes which are the root cause of deforestation—namely plantation schemes, large dams, ranching schemes, colonisation programmes and road programmes—be phased out:
4. That current development policies be radically revised in favour of ecologically sustainable policies, based on satisfying local needs rather than international markets.

We are petitioning the United Nations to convene an emergency meeting as rapidly as possible to draw up an Emergency Action Plan on deforestation, based on that put forward by *The Ecologist*. We need a million signatures to support this petition. For forms, write to *The Ecologist*, Worthyvale Manor, Camelford, Cornwall UK PL32 9TT.

Donations towards the cost of this campaign should be sent to the *Ecological Foundation*, Lower Bosneives, Withiel, Bodmin, Cornwall, UK.