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#### 

#### Edward Goldsmith

Neo-Darwinism has remained the conventional explanation for evolution only because of the primacy of the reductionistic and mechanistic Paradigm of Science. This must be abandoned if we wish to develop a satisfactory explanation of evolution.

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# On the Archaeology of the Development Idea

The idea of development stands today like a ruin in the intellectual landscape, an outdated monument to an immodest era. It is high time to set about the archaeology of this ruinous idea.

In his inauguration speech before Congress, on January 20, 1949, President Harry Truman defined the largest part of the world as "underdeveloped areas". The new world-view was thus announced: all the peoples of the earth were to move along the same track and aspire to only one goal — development. And the road to follow lay clearly ahead: "Greater production is the key to prosperity and peace." Clothing self-interest in generosity, Truman outlined a program of technical assistance designed to "relieve the suffering of these peoples" through "industrial activities", and to give them "a higher standard of living".

The idea of defining the world as an economic arena was completely new. For England and France during the colonial period, dominion over their colonies was first of all a cultural obligation. It was Lord Lugard who formulated the doctrine of the 'double mandate': economic profit was of course desired, but most important was the responsibility to elevate the 'coloured races' to a higher level of civilization. The colonialists came as masters to rule over the natives; they did not come as planners to push the spiral of supply and demand.

According to Truman's vision, the two commandments of Lugard's double mandate converge under the imperative of 'economic development'. A new world-view had found its succinct definition: the degree of civilization in a country could be measured by *the level of its production*. There was no longer any reason to limit the domain of development to resources only. From now on, people and whole societies could, or even should, be seen as the object of development.

### The Necessity of Western Hegemony

To define the economic exploitation of the land and its treasures as 'development' was a heritage of the productivist arrogance of the 19th century. Through the trick of a biological metaphor, a simple economic activity turns into a natural and evolutionary process.

It is this metaphorical background which permeates Truman's imperative to develop and allows the universal 'developed/underdeveloped' axiom to be transformed into a teleological creed: societies of the Third World are not seen as diverse and incomparable possibilities of human living arrangements, but are placed on a single 'progressive' track, more or less advanced according to the criteria and direction of the hegemonic nations. Such a reinterpretation of global history is not only politically flattering, but also epistemologically unavoidable: underdevelopment can only be recognized in looking back from a state of maturity. Development without predominance is like a race without a direction. Therefore, the hegemony of the West was logically included in the proclamation of development. It is no coincidence that the preamble of the U.N. Charter ("We, the peoples of the United Nations . . .") echoes the Constitution of the U.S. ("We, the people of the United States . . ."). To talk about development means nothing more than projecting the American model of society onto the rest of the world.

# Anti-Colonial Imperialism

At the time of Truman's speech, the pre-War colonial map of the world was undergoing total transformation. The United States, the strongest nation to emerge from the war, was obliged to act as the new world power. For this it needed a vision of a new global order. This need was ideally met by the concept of development which presents the world as a collection of homogenous entities, not held together through the political dominion of colonial times, but through economic interdependence. The U.S. could therefore establish its hegemony, not through the possession of territories, but through independent countries' openness to economic penetration. The independence process of the ex-colonies was thus encouraged, in the hope that they would automatically fall under the wing of the U.S. when they proclaimed themselves to be the subjects of economic development.

Development was the conceptual vehicle which allowed the U.S. to behave as the herald of national self-determination, while at the same time founding a new type of worldwide hegemony, an anti-colonial imperialism.

# Regimes in Search of a Raison d'État

The leaders of the newly founded nations — from Nehru to Nkrumah, Nasser to Sukarno — accepted the image that the North had of the South, and internalized it as their selfimage. Underdevelopment became the cognitive foundation for the establishment of nations throughout the Third World.

Some of the new leaders, during their struggles against colonialism, had learned their lesson about the hegemony of western productivism from the Soviet Union or through the Third International, but essentially, that did not make much difference. Nehru (incidentally, in opposition to Gandhi) made the point in 1949: "It is not a question of theory; be it communism, socialism or capitalism, whatever method is most successful, brings the necessary changes and gives satisfaction to the masses, will establish itself on its own...Our problem today is to raise the standard of the masses". Economic development as the primary aim of the state — the mobilization of the country to increase output without regard to ideological skirmishes — beautifully suited the western concept of the world as an economic arena.

As in all types of competition, the development race produced its professional coaching staff. The World Bank sent off the first of its innumerable missions in July, 1949. Upon their return from Colombia, the 14 experts presented their conclusions: "Short-term and sporadic efforts can hardly improve the overall picture. The vicious circle...can only be broken seriously through a global relaunching of the whole economy, along with education, health and food sectors". Increased production implied nothing less than the overhauling of entire societies. Had there ever existed a more zealous state objective?

From then on, an unprecedented flowering of agencies and administrations, 'guided' by numerous theories, burst forth to address all aspects of life — to count, organize, intervene and sacrifice, all in the name of underdevelopment. Traditions, hierarchies, mental habits — the whole texture of societies — were all dissolved in the planners' mechanistic models. In this way the experts were able to apply the same blueprint for institutional reform throughout the world, the outline of which was patterned on the American Way of Life. There was no longer any question of letting things 'mature for centuries', as in the colonial period. After the Second World War, engineers set out to develop whole societies, a job to be accomplished in a few years, or, at most a couple of decades.

# The Concept Torn to Shreds

In the late sixties, deep cracks began to appear in the edifice constructed in the name of development. The international elite, which had been busy piling one development plan on top of another, knitted its brow. At the ILO and the World Bank, experts realized that growth policies were not succeeding. Poverty increased in the shadow of wealth, unemployment proved resistant to growth, and the food situation could not be helped through steel factories. It became clear that the identification of social progress with economic growth was pure fiction.

In 1973, Robert McNamara, then President of the World Bank, summed up the state of affairs: "Despite a decade of unprecedented increase in the gross national product . . . the poorest segments of the population have received relatively little benefit . . . The upper 40 per cent of the population typically receive 75 per cent of all income."

Truman's strategy had failed, but McNamara immediately proclaimed another development strategy with a new target group — *rural* development and small farmers. The idea of development was not abandoned; indeed, its field of application was enlarged. Similarly, in rapid succession, unemployment, injustice, the eradication of poverty, basic

# The Shackle of Development

So, development has become a shapeless, amoeba-like word. But it remains ineradicable because its diffusion appears benign. He who pronounces the word denotes nothing, but claims the best of intentions.

Development thus has no content, but it does possess a function: it allows any intervention to be sanctified in the name of a higher, evolutionary goal. Development always implies that there are lead runners who show the way to latecomers; it suggests that advancement is the result of planned action. Even without having economic growth in mind, when someone talks of development they evoke notions of universality, progress and feasibility. They show that they are unable to escape Truman's influence.

This heritage is like a shackle. It prevents people — in Michoacán, Gujarat, Yorubaland and around the southern hemisphere — from recognizing their own right to refuse to classify themselves according to the ahead/backward schema, and their freedom to rejoice in their own diversity and wit. Development always suggests looking at other worlds in terms of what they lack, and obstructs the wealth of possible indigenous alternatives.

The contrary of development, it must be emphasized, is not stagnation. From Gandhi's *swaraj* to Zapata's *ejidos*, we see that there are striking examples of change in every culture. Distinctions such as backwards/advanced or traditional/modern have in any case become ridiculous given the dead end of progress in the North, from poisoned soils to the greenhouse effect.

Truman's vision will thus fall in the face of history, not because the race was fought unfairly, but because it leads to the abyss.

The idea of development was once a towering monument inspiring international enthusiasm. Today, the structure is in ruins. But ruins which block the path to a viable future. The task, then, is to push the rubble aside and open up new ground.

Wolfgang Sachs

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# **Biodiversity, Biotechnology and Profit:** The Need for a Peoples' Plan to Protect Biological Diversity

### by

# Vandana Shiva

The international development institutions have recently been expressing concern about the threats to the planet's biodiversity. These concerns have culminated in a global Biological Diversity Action Plan drawn up for the World Bank. The Draft Plan fails to address the forces which have caused the erosion of biodiversity in the past and is set to encourage future threats to biodiversity, especially through the biotechnology revolution. What the Third World needs is not an Action Plan that makes its germplasm available to Northern corporations, but a Peoples' Plan to prevent the erosion of these genetic resources.

The preservation of biodiversity will be a vital issue for the ecology movement during the 1990s. Genetic erosion is an ecological hazard both because it leads to the extinction of life forms which have a value in themselves, and because genetic uniformity breeds ecological vulnerability.

Much of the current rhetoric on the urgency of the need to conserve genetic resources, however, comes not from those with the concerns of the ecology movement, but from those whose aim can be described as 'commercialized conservation'. Commercialized conservation measures biodiversity in dollars and justifies conservation in terms of present or future commercial returns. It fails to recognize biodiversity as having an inherent ecological value in itself.

### The Biodiversity Action Plan

Following the Tropical Forestry Action Plan (TFAP), the World Bank has been actively pursuing the goal of a global 'Biodiversity Action Plan'. To this end, a World Bank Task Force on Biodiversity was set up. Like TFAP, the Plan for the development of a global strategy for the conservation of biodiversity was drafted by the Washington-based environmental consultancy, the World Resources Institute (WRI) in collaboration with the International Union for the Conservation of Nature and Natural Resources (IUCN), the Worldwide Fund for Nature in the U.S. (WWF-US) and the United Nations Environment Programme (UNEP).

However, the Plan lacks both a political and an ecological perspective on biodiversity conservation. Like its sister plan, the TFAP, the Biodiversity Action Plan could well exacerbate the problem.<sup>1</sup>

The plan works on the false assumptions that:

Biodiversity is a global resource;

- All nations benefit equally from the utilization of biodiversity;
- The threats to biodiversity arise mainly within developing countries;
- Genetic erosion takes place because Third World countries have severely restricted financial means and;
- Biodiversity conservation is dependent primarily on money.

These assumptions totally ignore the real causes of genetic erosion in the past and the threats posed to the maintenance of biodiversity in the future. The WRI Draft Plan ignores all discussion of genetic erosion in agriculture and reduces the issue solely to biodiversity in forests. As a result, the Plan avoids two critical aspects of biodiversity conservation. It fails to explain how commercial forces have contributed to the destruction of diversity in the past, and it diverts attention from how the same commercial forces, with new technologies, now need 'commercialized conservation' to ensure their supplies of biological raw materials .

Instead of ensuring biodiversity by incorporating the principles of diversity into agricultural and industrial processes, the Action Plan proposes 'set-asides' and 'reserves' of wilderness areas as the primary instrument for conservation. However, merely setting aside reserves in the remaining (relatively) undisturbed ecosystems of the world is a hopelessly inadequate response to the current loss of biodiversity. Noone knows how large individual reserves would have to be in order to survive in the long-term. In the Amazon, for example, isolated patches of even 1000 hectares cannot sustain themselves. Worse still, there is the danger that, once created, reserves will be used as an excuse for exploiting areas which have not been set aside. Climatic changes due to global warming — and therefore changes in the distribution of various ecosystems — is an additional factor which should be taken into consideration.

Biodiversity is not uniformly distributed across the world. It is concentrated in the tropical countries of the Third World, and is therefore primarily a Third World resource. Northern corporations and institutions have used the rich genetic diversity of the

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South as a free resource and a raw material input for their breeding programmes and seed industry. Genetically uniform seeds are then spread around the Third World as purchased 'inputs' for Green Revolution agriculture.

# The World Bank, CGIAR and Genetic Erosion

The World Bank has directly financed the replacement of the genetically diverse cropping systems of the Third World with the monocultures of the Green Revolution. It has also contributed to genetic erosion through the centralized research institutions controlled by CGIAR (the Consultative Group on International Agricultural Research) which was launched in 1970 on the initiative of the World Bank. Uniformity and vulnerability were built into the international research centres run by American and American-trained experts breeding a small range of new varieties that would displace the thousands of locally cultivated plants in agricultural systems built up over generations on the basis of centuries of indigenous knowledge.

Centralized research and genetic uniformity go hand in hand in agriculture. The CGIAR-controlled International Rice Research Institute was set up in the Philippines in 1960 by the Rockefeller and Ford Foundations, nine years after the establishment of a premier Indian Institute, the Central Rice Research Institute (CRRI) in Cuttack. The Cuttack Institute was researching indigenous knowledge of rice genetic resources, a strategy in conflict with the American-controlled aims of the IRRI. The Director of



the CRRI was removed, under international pressure, when he resisted handing over his collection of rice germplasm to the IRRI, and asked for restraint on the hurried production of the High Yield Variety (HYV) rice varieties from the IRRI. The Madhya Pradesh government then gave a small stipend to the exdirector of the CRRI so that he could continue his work at the Madhya Pradesh Rice Research Institute (MPRRI) at Raipur. Working on a shoestring budget, he conserved 20,000 indigenous rice varieties *in situ* in India's rice bowl in Chattisgarh. However, the MPRRI was itself closed down under pressure from the World Bank, as it had reservations about sending its germplasm collection to the IRRI.<sup>2</sup>

Robert Onate, President of the Philippines Agricultural Economics and Development Association observed that IRRI practices had created a new dependence on agrochemicals, seeds and debt. "This is the Green Revolution Connection", he remarked, "New seeds from the CGIAR global crop seed systems which will depend on the fertilizers, agrochemicals and machineries produced by conglomerates of Transnational Corporations.<sup>3</sup>

# **Monoculture for Genetic Diversity**

The continued spread of genetic uniformity is perversely viewed by the World Bank as a means of ensuring 'biodiversity conservation'. For example, John Spears, Chief of the Environmental Sciences and Technology Division at the World Bank has recommended the intensification of monoculture practices in agriculture and forestry in order to "preserve biological diversity" in Asia.<sup>4</sup> Already, World Bank-financed 'social forestry' projects in India are replacing genetically diverse agroforestry systems with monocultures of eucalyptus plantations serving the paper and pulp industry. Similar plantations will be expanded worldwide under TFAP.<sup>5</sup>

# **IBPGR and Gene Robbery**

The International Bureau for Plant Genetic Resources (IBPGR), which is run by CGIAR, was specifically created for the collection and conservation of genetic resources. However it has emerged as an instrument for the transfer of resources from the South to the North. Although most genetic diversity lies in the South, 81 of the 127 collections held by IBPGR are in the industrialized countries, whilst another 29 are held by institutions in the CGIAR system — and thus controlled by governments or corporations in the North. Only 17 collections are in the developing countries. As Jack Kloppenberg has observed: "There is empirical justification for characterizing the North as a 'finance-rich but gene-poor' recipient of genetic largesse from the poor but 'gene-rich' South."

The Biodiversity Action Plan could accelerate this South to North transfer of genetic resources. The World Resources Institute, in fact, praises the work of the IBPGR and cites it as a model for action on biodiversity. It states that the IBPGR works to "ensure the collection and conservation and use of germplasm so as to contribute to raising the standard of living and welfare throughout the world". Experience however, shows that the IBPGR has not contributed to equal benefits worldwide, but has used Third World resources for the benefit of the industrialized countries.

With the emergence of the new biotechnologies, the polariza-

"The emerging trends in global trade and technology work inherently against justice and ecological sustainability. They threaten to create a new era of 'bio-imperialism', built on the biological impoverishment of the Third World."

tion between the North and the South over issues of biodiversity will be aggravated, since the North will try to continue to treat the biodiversity of the South as a freely accessible global resource while creating the international legal frameworks which will enable the privatization of genetic resources through patent laws and intellectual property rights.

### **Biotechnology and Species Extinctions**

Biotechnology is seen by many environmentalists as a solution to the problem of genetic erosion. Gus Speth of the WRI, for example, states that the "world's emerging biotech industry provides many of the tools needed for environmentally sustainable growth".<sup>6</sup>

However, viewing biotechnology as a miracle solution to the biodiversity crisis ignores the fact that biotechnologies, are, in essence, technologies for the breeding of uniformity in plants and animals. Although representatives of biotechnology corporations talk of contributing to genetic diversity, the 'diversity' of corporate strategies and the diversity of life forms on this planet are not the same thing, and corporate competition cannot be treated as a substitute for evolution in the creation of genetic diversity.<sup>7</sup>

The genetically engineered products of corporate biotechnology ventures will not only be genetically uniform and ecologically fragile in themselves, but they will pose new ecological threats to other life-forms. 'Genetic pollution' from the release of genetically modified organisms is set to become a major ecological problem.<sup>8</sup> An assessment of these risks is essential for biodiversity conservation.

# Patent Protection and Third World Sovereignty

Most Third World countries view genetic resources as a common heritage. However, with the new biotechnologies, life can now be privately owned.

Corporate interests view patent protection for modified lifeforms as a prerequisite for biotechnological innovations. This issue raises a number of unresolved political questions about ownership and control of genetic resources. In manipulating life forms, biotechnologists must start from other life-forms which belong to others — for example through customary law. Genetic engineering does not create new genes, it merely relocates genes in existing organisms. Reducing complex organisms to their genetic components, which are then given an economic value through patenting, may be commercially convenient but it violates the integrity of life as well as the common property rights of Third World peoples.

With the new biotechnologies, centuries of innovation are totally disvalued. Patenting gives monopoly rights on life forms to those who manipulate genes with new technologies, totally disregarding the intellectual contribution of generations of Third World farmers, who for over 10,000 years have experimented in conserving, breeding and domesticating plant and animal genetic resources. Complex organisms which have evolved over millennia in nature, and through the contributions of Third World peasants, tribals and healers, are reduced to their genetic components and treated as mere inputs for biotechnology. The patenting of genes thus leads to a devaluation of life-forms by reducing them to their constituent parts and allowing them to be repeatedly owned as private property.

The Northern countries are using trade as a means of enforcing their patent laws and intellectual property rights on the sovereign nations of the Third World. The U.S. has accused the countries of the Third World of engaging in 'unfair trading practice' if they fail to adopt U.S. patent laws which allow monopoly rights in life forms. Yet it is the U.S. which has engaged in 'unfair practices' over the use of Third World genetic resources. It has freely taken the biological diversity of the Third World to turn in into millions of dollars of profits, none of which have been shared with Third World countries. The total contribution of wild germplasm to the American economy has been U.S.\$66 billion — more than the combined international debt of Mexico and the Philippines.<sup>9</sup>

A single wild tomato variety (*Lycopresicon chomrelewskii*) taken from Peru in 1962, has contributed U.S.\$8 million a year to the American tomato processing industry by increasing the content of soluble solids in U.S tomatoes.<sup>10</sup> Yet none of these profits or benefits have been shared with Peru.

# How Drug Firms Rob the Third World

The value of the South's germplasm for the Northern pharmaceutical industry is expected to increase from the current estimate of U.S.\$4.7 billion to U.S.\$47 billion by the year 2000. As the drug companies realize that nature holds rich sources of profit, they begin to covet the potential wealth of tropical moist forest as a source for medicines. For instance, the Madagascar periwinkle is the source of at least 60 alkaloids which can treat childhood leukaemia and Hodgkin's disease. Drugs derived from this plant bring about U.S.\$160 million worth of sales each year.

At the present rate of destruction of the tropical forests, 20-25 per cent of the world's plant species will be lost by the year 2000. Consequently, major pharmaceutical companies are now screening and collecting natural plants through contracted third parties. The British company, Biotics, for example, is a commercial broker known for supplying exotic plants for pharmaceutical screening and inadequately compensating the Third World countries of origin. The company's officials have actually admitted that many drug companies prefer "sneaking plants" out of the Third World rather than going through legitimate negotiating channels. The U.S. National Cancer Institute has sponsored the world's single largest tropical plant collecting effort by recruiting ethnobotanists to document the traditional medicinal uses of plants and other species: yet the indigenous peoples who willingly share this knowledge are unlikely ever to share in the profits from the development of new drugs or other products.

In spite of the immeasurable contribution that Third World biodiversity has made to the wealth of the industrialized countries, the corporations, governments and aid agencies of the North continue to try to make the Third World pay for what it originally gifted. The emerging trends in global trade and technology work inherently against justice and ecological sustainability. They threaten to create a new era of 'bio-imperialism', built on the biological impoverishment of the Third World.

The major drug and agricultural companies and their home governments are exerting heavy pressure on international institutions such as the General Agreement on Tariffs and Trade (GATT) and the UN Food and Agriculture Organization (FAO), to recognize genetic resources as a 'universal heritage' in order to guarantee them free access to these raw materials. International patent and licensing agreements will increasingly be used to secure a monopoly over valuable genetic materials which can be developed into drugs, food and energy sources.

# Recommendations

The Third World must urgently take stock of its genetic resources, particularly those contained in tropical forests. Rather than permit the North to 'rescue' the world's tropical forests for their own economic interests, conservation measures must be undertaken for the long-term benefit of the Third World and due respect and recognition must be accorded to the knowledge and interests of its indigenous peoples.

To this end, there is an urgent need for Third World countries to promote a Peoples' Biodiversity Conservation Plan to counter the commercialized conservation plans for biodiversity. It must be recognized and steps must be taken to ensure that:

- 1. Protection of diversity has to be based on regenerating diversity as a basis of production in agriculture, forestry, energy and health care. A Peoples' Biodiversity Plan cannot support uniformity as a principle of *production* and diversity as a principle of *conservation*.
- The practice of diversity can only be ensured through decentralization. Centralized systems of research, production or conservation force the spread of genetic uniformity and genetic erosion.
- 3. The practice of diversity has been characteristic of indigenous systems of production in the Third World. Biodiversity conservation plans need to contribute to the regeneration of these systems.
- 4. The knowledge and intellectual contributions of generations of Third World 'innovators' — peasants, tribals and traditional healers — needs to be recognized and treated on an equal footing as innovation in the labs of industrialized countries to correct the distortions being introduced through the patenting of life-forms.
- 5. The contribution of Third World germplasm, from wild as well as cultivated varieties, to capital accumulation in industrialized countries needs to be recognized and compensated for in a just and humane and ecological manner, not merely as tokenism. There is injustice inherent in current technological and trade practices, which treat genetic resources which come from the Third World as

freely available while the same genetic material when used by scientists and corporations in the North is protected by patents, treated as private property and sold back to the Third World at exorbitant prices.

6. A Peoples' Biodiversity Plan needs urgently to address the issue of 'ownership' of life through patents on life forms with all its ethical, legal and political implications.

Third World governments must:

- Prohibit all researchers, social scientists and scientists who are working for foreign interests from conducting research and study on and/or collecting genetic resources in the Third World. Existing contracts or agreements to do research and/or screening and collecting of genetic germplasm should be terminated to stop the transfer of valuable germplasm to the North and safeguard the heritage of the Third World.
- Introduce legislation and institutional safeguards to protect the genetic resources of the Third World.
- Systematically monitor the activities of all transnational corporations in this field in individual countries.
- 4. Systematically monitor and analyze the activities of international agencies like GATT, FAO, WIPO (World International Property Organization) and UPOV (International Union for the Protection of New Varieties of Plants). These international organizations are dominated by the Northern countries and have been used by them to rob the Third World of its resources and the rights of Third World peoples.
- 5. Encourage and provide incentives for local research, identification and documentation of genetic resources. National gene banks, free from both transnational corporation and foreign funding, technical assistance, control and involvement should be set up. South to South cooperation should be encouraged and assistance given in the setting up of gene banks and research.

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Songhay farmer in the area of the Inland Delta of the River Niger, south of Timbuktu, Mali. The Inland Delta used to flood 19,000 km<sup>2</sup> for six months every year. Since1968, however, the area, far from being a green flood-plain through the desert, has been almost as dry as its parched surroundings. (Photo: P. McCully)

# **Time Running Out:** The Urgent Need for Tree Planting in Africa

by

R. D. Mann

The Sahel is now in its third decade of drought. Much of Africa is beset by increasing aridity, soil erosion and degradation and food shortages. It is clear that the deterioration of African weather patterns has been at the least exacerbated, if not caused, by the removal of vegetation cover, which is largely the consequence of the adoption of unsustainable modern agricultural practices. African governments must make tree-planting a national priority. There is also a critical need to recognize the wisdom of traditional farming and to make full use of the extensive ecological knowledge of the African farmer.

From 1968 to 1988 there were twenty-one consecutive years of increasing aridity over much of sub-Saharan Africa. Rainfall data from Banjul, located on the westernmost edge of the Sahel, showed that The Gambia in 1989 was in its twenty-first year of overall below-average rainfall — an average of 800 mm per year from 1968 to 1988, compared to an average of 1200 mm per year over the period from 1886 to 1967.<sup>1</sup>

There is much evidence from across the

African continent that deforestation has been a major cause of increasing aridity. Where vegetation cover is continually removed over large areas in the tropics, the resulting increase in the reflection of solar energy from bare ground, together with an increase in temperature and dust in the upper troposphere (the part of the atmosphere below around 10 km altitude where weather patterns are created) tends to prevent the formation of rain-clouds and interrupts the progress of monsoon systems. Meteorologists estimate that deforestation must affect an area of 250,000 km<sup>2</sup> before climatic changes occur.2 That area of land clearance has already been exceeded several times over - in the century prior to

1981 an estimated 880,000 to 1,228,000 km<sup>2</sup> of forest and woodland had been removed in West Africa alone.<sup>3</sup>

# Anthropogenic Climate Change

The concept of biogeophysical feedback was initially proposed by Jule Charney in 1975.<sup>4</sup> He suggested that the removal of vegetation increases the reflection of solar radiation from the earth's surface, which affects the atmospheric energy budget, intensifying the downward motion of the air in the upper troposphere, which leads to the compression and therefore warming of the lower air masses which in turn pro-

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motes aridity in the Sahel and Sahara.

The tropical atmosphere is extremely sensitive to either sea or land surface temperature changes. This was most strikingly demonstrated in 1984, when a temperature difference of less than 1° Celsius on the surface of the equatorial Atlantic was accompanied by the Intertropical Convergence Zone shifting south of the equator and remaining there.<sup>5</sup> This correlated with the persistence into 1984 of extreme drought in the Sahel and sub-Sahelian countries right across to Ethiopia, and also led to unusually heavy rainfall and flooding in the coastal zone of equatorial and south-western Africa.<sup>6</sup>

There are of course numerous major influences on global weather patterns including changes in the Northern Hemisphere circumpolar vortex, the level of solar energy output, the earth's geomagnetic field strength, the quantity of dust in the atmosphere and the El Niño ocean temperature variations --- the overall interaction of which will cause seasonal and interannual variations of the 'macro' climate.7.8 But remove vegetation cover in the tropics, and you will superimpose on the 'macro' climatic structure a significant influence which will have both immediate and long-lasting effects. The continuous removal of trees over large areas will reduce the absorption of incoming daytime solar energy; daytime air and soil surface temperatures will increase; windspeed will rise; soil structure will deteriorate; soil moisture will decrease; more solar radiation will be reflected back into the troposphere from the denuded ground; the erosion of top soil will accelerate; and as atmospheric dust-levels increase and are accompanied by a lengthening and intensified aridity of the dry season, so rainfall will become more erratic in distribution and progressively lower in overall amount.

### **Recognizing the Trend**

A paper presented at a conference held in 1985 on 'Agricultural Development in Drought-Prone Africa' warned that:

"the plausibility of feedback and atmospheric change theories makes it imperative that any plans for the semi-arid regions should take account of the real possibility that present conditions may persist into the future."<sup>9</sup>

For those who have lived and worked at village level in Africa, there is no doubt that 'micro' and 'macro' climate are linked. This has been pointed out over many years, but visiting 'consultants' and 'advisors' have chosen to ignore the reports and supporting data.

In 1975, a UNESCO document on ecological approaches to land use in the Sahel declared that: "while it may be logical to consider the present fluctuations as a short-term trend, it is prudent to take into account the possibility that it may not be".<sup>10</sup>

The drought in Africa is not a short-term cycle, it is part of a long-term humaninduced trend of increasing aridity which became worse in 1968 and has continued ever since, and it must be realized that it cannot be arrested until a considerable proportion of the tree cover which has been removed right across Africa over the past 150 years is replaced.<sup>11</sup>

# Traditional versus Modern Agriculture

In the Sahel and sub-Sahel, the connection between the expansion of the area devoted to the cultivation of annual export crops and the desertification process is obvious. Whole rural communities have been and are still advised to clear woodland areas at the expense of ecological stability, leaving behind a trail of exhausted land.

Farmers in these regions used to take the precaution of planting several varieties of sorghum and millet which had different moisture requirements in order to safeguard against variable rainfall. But with the adoption of cotton and groundnuts for export, they now plant those varieties which produce more, but which require good rainfall to do so, and they thus run the risk of producing nothing at all if drought occurs.

Temperate farming techniques cannot be transferred unaltered to the tropics. The Sahelian, Sudano, and woodland areas of Africa all receive irregular rainfall. Where nitrogenous fertilizers are used, the initial growth of crops can be much increased, but if subsequent rains are insufficient or late the plants will then create their own drought conditions, having used up too much of the moisture through rapid growth induced by the fertilizer application.12 In these circumstances, the local crop varieties, giving medium yields under stressful conditions without the use of artificial fertilizers, have a sure advantage and exhibit the wisdom of traditional food-production methods. Furthermore, where rainfall is sparse, chemical fertilizers used on their own, without replenishment of the essential organic material in the soil, can

accelerate the breakdown of the otherwise cohesive structure of sandy-loam soils and actually hasten the hardening process of clay soils.<sup>13</sup>

In the Machakos District in central Kenya, for instance, the rural people were for generations intimately aware of the fragility of their marginal lands which they farmed with great care. But the introduction of so-called 'modern' agricultural techniques to the Machakos District has aggravated the consequences of low rainfall there to the verge of disaster. Some of the farmers are now trying to return to traditional methods of cultivation using their own local drought-tolerant crops, but time, they fear, is running out.<sup>14</sup>

Africa cannot afford any further adoption of unsuitable 'foreign' farming methods, which now, with runaway human numbers, have brought into question the fitness for human habitation of large parts of the African continent.

# **Inappropriate Technology**

Many new tools, or forms of crop husbandry, have been designed and tried unsuccessfully in farming systems in Africa just because it was 'assumed' that a particular task was limiting or onerous, or that traditional crop production methods were giving poor yields.<sup>15</sup>

For example, over the period 1963-65, a total of 673 tractors were distributed between 41 Farmers Co-operative Unions throughout Tanzania, the intention being to facilitate land preparation for food and cash crops. By 1986, 22 of the Unions had decided not to continue the tractor hire service due to the impossible financial burden this had imposed upon them, quite apart from the social upheaval and serious soil erosion also caused by the adoption of this 'foreign' technology .16 In the 1940s in Northern Senegal, farmers were alarmed at the introduction of the 'Western' mouldboard plough because they saw that it inverted the soil, a tillage practice totally at variance with the requirements of their soil and climate. By 1961, a considerable amount of their best farming land had been lost due to wind and water erosion through the use of the plough.17

The truth is that the farmers' knowledge of the environment in which they work is highly complex and organized, and research will only be useful if it is consistent, rather than at odds with, well-tried traditional methods.<sup>18</sup> Thus in areas with high average soil temperature and frequent dry winds, the need is to break the soil without inverting it, in order to collect and store as much moisture as possible and to delay the natural decay of vegetation.<sup>19</sup>

Yet in Senegal, the 'Westernized' agricultural policy of the 1963-67 drive to increase groundnut production was still pushing the concept of deep cultivation. The researchers behind the massive expansion of groundnuts believed that it was "necessary to transform the working habits of farmers in an entire area" to conform to the introduction of a package of inputs including implements. It is a sad reflection that, on the eve of the Sahel famine, the same source stated: "Barring a climatic catastrophe, an increase of 25 per cent on the average productivity of fields planted to groundnuts should be achieved by the end of this year (1968)."20 Within three months of that statement, the present drought had begun — a drought intensified by decades of over-exploitation of the region's vegetation and soils. The inevitable consequence of that deep cultivation policy was to increase top-soil losses by wind erosion during the drought years. Much of northern Senegal is now sand; the top-soil and trees are gone.

# The Suitability of Traditional Tools

Basic tools for producing crops have been developed over centuries through the ingenuity of African farmers in matching specific tillage and resource-conserving requirements. The Ethiopian 'ard' plough,

for example, cannot be improved upon, given the conditions under which it has been designed to work. The wooden-beam ard plough lifts and breaks the soil. That is precisely what it is meant to do. It was never intended to invert the soil, for the farmers are well aware that to do so would create a greater risk of erosion. The ard plough produces a rough ridged tilth, leaves dead vegetation on the surface, and the several passes in different directions give the best conditions for rainfall penetration and least run-off. Its unique design allows it to be dismantled and carried across the shoulder between home and fields. Yet there have been many attempts to introduce ploughs of foreign origin into Ethiopia, contrary to that accumulated local wisdom.21

# **Increasing Aridity in Ghana**

Ghana was once renowned for its extensive forests and woodland savannah, but that has changed drastically. Between 1937/38 and 1980/81, the area of closed forests in Ghana was reduced by 64 per cent from 47,900 km<sup>2</sup> to 17,200 km<sup>2</sup> and open woodland declined by 37 per cent from 111,100 km<sup>2</sup> to 69,800 km<sup>2</sup>.<sup>1</sup>

A period of many years of increasing aridity in Ghana culminated in a severe drought in 1983. Bush fires swept through the countryside on a scale never seen before. Rainfall at Kumasi over the period from 1969-86 was down 17 per cent compared to the period from 1950-68.<sup>2</sup> Kumasi was once in the forest zone, but is no longer, due to extensive tree felling.

When I visited Ghana between March and May 1987, the rains were reported to be late throughout the whole country. Even in the rainforest zone in the southwest of Ghana, well levels were declining, and domestic water shortages were reported to be the most urgent village problem.<sup>3</sup> Farmers within the forest zone were saying that rains were heavier and commenced earlier in the past when there was more tree cover.

From Nkawkaw in Eastern Region, down the escarpment and across the Afram Plains in the south-east of the country, there was evidence of repeated bush fires which have destroyed valuable woodland, farms and forestry plantations. It is said that rains in this area have decreased by 60 per cent since the Akosombo dam was completed in 1965. Many farms have been abandoned due to low rainfall. Lake Botsumtwi, near Kumasi, is evaporating faster than it is replenished by rainfall; the lake level fell by 2.4 metres between 1972 and 1987. The hillside slopes both inside and outside the lake crater were heavily forested as recently as 16 years ago, but have been progressively thinned out and cleared with only remnant patches of forest now left.

The water table in the Winneba area on the coast of Central Region has fallen considerably since the 1960s. In the same area, the river Ayensu, which rises via many tributaries from within the remaining rainforest, has had a much reduced flow during each dry season since 1981/82. A visit to the Brimsu Dam, the reservoir serving the town of Cape Coast, in April 1987, showed a very low level calculated to be sufficient for a further three months. Only two weeks later the reservoir ran dry.<sup>4</sup>

In 1985, Robert Loggah, Director of the Christian Service Committee in Tamale, drew specific attention to the need for assistance in supporting all forms of agroforestry at the farm-level. He warned that if the trend of converting forest zones to grassland savannah was not halted, this would lead to a disastrous situation of reduced food production, declining soil fertility and water supply problems.<sup>4</sup>

Just two years later the reality of that prediction had become apparent throughout Ghana. In the Tamale/Yendi/Saboba area of northern Ghana, the rains were already two months late by the beginning of May 1987. Surface reservoirs had dried up in most places and many people were having great difficulty in finding water. The temperature measured on the bare ground on 8th May 1987 at Yendi Agricultural Station was an average of 67° Celsius (153° Fahrenheit) from 10am to 5pm with a midday peak of 72°C (162° Fahrenheit) compared to a maximum of 40°C (105° Fahrenheit) recorded under the shade of trees on the same site.<sup>5</sup> Increased aridity in the North has been made much worse by the large-scale annual burning of grass and woodlands. Uncontrolled burning creates soil erosion, depletes soil fertility and degrades forests.<sup>6</sup>

The situation in Ghana is serious. Not only is Ghana affected by its proximity to the Sahel, but it is also now being significantly affected by internal deforestation. If this present trend of denudation by felling of trees and uncontrolled bush fires is not halted and reversed, there will be further changes in local climate patterns along with a deterioration in soil fertility and reduced food-crop production in all parts of the country.

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To refer to indigenous agricultural tools as 'primitive', implying that they are outof-date or of low value, is a display of profound ignorance and indicates a total lack of awareness of the ingenuity and skills of African farming communities.

# The Value of Traditional Farming

African farmers have a precise understanding of their environment. They have a vocabulary of hundreds of names of trees and grasses.<sup>23</sup> They can rate the fertility of a piece of land by the physical characteristics of the soil; they can assess the number of seasons for which it can be cropped, and the number of years for which it must be rested before such results can be obtained again. Their indicator of initial fertility is the presence of climax vegetation and their index of returning fertility is the succession of vegetational phases that follows cultivation.

What is more, the traditional agricultural system as practised by shifting cultivators was characterized by diversity and complexity. Such mixed cropping spread harvest effort, provided security in case of crop failure, and, by creating a varied environment, avoided serious losses to pests and diseases. It also meant that the soil was almost continuously protected from the destructive influences of wind and rain.

It was an ecologically sound system wherever the ratio of land to people was high enough, and was well matched to woodland conditions at that time. Few of the men and women who practised it had ever been formally educated, even at primary school, yet they carried in their heads an extraordinary fund of scientifically sound knowledge about plant species and soil qualities.<sup>24</sup>

But now the whole environment of small-holder farmers in Africa is changing



under the disruptive combined forces of deforestation, soil erosion, monocropping and the influence of rising livestock populations.<sup>25</sup>

### **Deforestation Equals Land Loss**

In 1958, Ignatieff and Page of the United Nations Food and Agriculture Organization (FAO) warned of the consequences of applying modern intensive agricultural techniques to the vast areas of Latosols (reddish soils with a high clay, aluminium oxide and iron oxide content) in Africa which stretch across from the west coast to the Sudan and down to Zambia. They stated that clean clearing and monoculture would result in disastrous soil depletion and erosion; that an almost continuous ground cover is essential to prevent leaching of nutrients; that mineral fertilizer use can upset the balance among plant nutrients in these tropical soils; and that mineral fertilizer can never substitute for the beneficial effects of mulch and growing vegetation in the maintenance of soil structure and fertility.<sup>26</sup>

The removal of vegetation, and the erosion of laterites and associated soils, can result in the formation of a rock-hard soil surface. In parts of West Africa, removal of the thin forest for the cultivation of cotton and groundnuts increases the drying of the soft laterite enough to harden it under the very feet of the farmer.<sup>27</sup>

Where land suited to permanent tree crops and grazing is brought under 'Westernized' monocropping, it rapidly becomes degraded and quite useless. In many cases an irreversible hardening of laterite soils occurs, and in consequence much precious land is being lost. Reclamation is only possible if action is taken quickly. Vegetation is the only agent known to prevent or reverse the hardening process, trees and other woody perennial plants being the most effective.<sup>28</sup>

# Deforestation, Soil Erosion, Starvation

Soil erosion is one of the most fearsome threats facing mankind. When the top-soil has gone, the land can no longer produce food, and people starve. Over much of Africa, soil erosion is already a major problem. On a continent where the vast majority of people live directly off the land, the consequences of further deterioration could be catastrophic.<sup>29</sup>

The Brandt Report, *North-South: A Programme for Survival*, published in 1980, mentioned 27 times the urgent need for reforestation and environmental improvement in developing countries.<sup>30</sup> Yet its repeated appeals for greater political recognition of the crisis facing millions of people were not turned into action. In a report on the critical famine situation in Africa in 1984, the Independent Commission on International Humanitarian Issues warned:

- That the process of deforestation and desertification had been set in motion by economic policies that at best neglected and at worst disrupted the productivity of traditional farming systems;
- That the felling of trees, the overgrazing by livestock, the pressures of increasing populations and the continuation of destructive agricultural practices had all contributed to desertification and had substantially altered normal rainfall patterns;
- That the survivors of that crisis will inherit a massively degraded environment, barely capable of supporting them without extensive rehabilitation;
- That disasters of similar and even greater magnitude will certainly occur in Africa unless short-term relief efforts are translated into long-term development programmes that address the underlying causes;
- That hope lay in those small-scale agroforestry tree and crop programmes, as well as effective micro-catchment water projects, which had already been successfully implemented by small-



Kabyé farm in northern Togo. The Kabyé are renowned for their ability to farm rocky land and are referred to as 'stone peasants'. (Photo P. McCully)

holder farmers; these should be studied and replicated systematically, where feasible, across the continent;

• That tree planting should become a national priority in every African country, and that regional centres should be established for applied research into agroforestry and tree cropping, including minimum tillage and contour farming.<sup>31</sup>

Whilst the huge efforts put into shortterm relief aid are highly commendable, they are surely temporary. No amount of supplying seeds and tools to farmers on barren landscapes is going to be of any long-term use unless there is simultaneous practical assistance with the protection of entire rainfall catchment areas by terracing, grazing control, the planting of soilretaining vegetation cover, and tree-planting. Such a programme of regeneration should run through all rural activities and be planned by the village people themselves.<sup>32</sup>

If action is not taken now the droughts will continue and intensify; this will make additional areas barren and useless for any form of field-crop or livestock production, and starvation will increase.

# Commercial Logging and Deforestation

Agroforestry is not new to Africa; the symbiotic relationships between trees, crops, and animals have long been recognized and applied by farmers and pastoralists as the very key to survival.<sup>33</sup>

The present frantic exploitation of forests in the Ivory Coast, Ghana, and Guinea-Bissao, however, is a practice 'imported' from the industrialized countries. It is greatly exacerbating environmental degradation and it is a matter which needs immediate attention and control.34 The 1985 International Tropical Wood Agreement, which covers hardwood exports from Africa, whilst recognizing the need to conserve tropical forests, at the same time called for an expansion of output.35 In 1939, the volume of wood exported from Ghana was 42,450 cubic metres. By 1987, it had risen to 1,471,600 cubic metres per annum, a 34-fold increase. The forest which produced this timber is now less than one-fifth the area of what it was in 1923. At this rate, with the exception of certain reserves, the Ghanaian rainforests will disappear within a generation.

In 1817, when the commercial extraction of *Khaya senegalensis* 'Gambian mahogany', was starting in The Gambia, local people were at first unwilling to cut and prepare the timber for shipping. However, over the next century, thousands of loads were shipped to England, and by 1910 the trade in Gambian mahogany had to cease as all exploitable trees had been cut.<sup>36</sup> It should be clearly understood that this particular tree was not even used for firewood or construction in the villages; rural people were fully aware of its value as part of their own habitat. Its leaves and bark have important medicinal uses, and it was known to play an essential part in the hydrological cycle, especially where it grew in quantity in the vicinity of streams and rivers and traditional rain-fed rice areas.

Rural people are indeed well aware of their surroundings and perfectly capable of recognizing the danger of depleting tree resources on which they depend.

# The Need for Action Now

There is now an urgent need for the practical application of existing knowledge to stop the spread of desertified areas and to revegetate denuded regions. The skill of agroforestry and the potential for rehabilitation of Africa's land has always been right there with the village farmers and the pastoralists. What is desperately needed is the will of government administrations, aid agencies, and professional people to recognize and facilitate the use of this vast store of rural expertise.<sup>37</sup>

Africa's arid regions are edging towards catastrophe. An area of 635,000 square kilometres has already been over-run by desert in the past 50 years, and the semiarid belt 300 to 1100 kilometres wide stretching across the continent is becoming sterile.<sup>38</sup> Time for Africa is running out fast; as soil is eroded and the micro-climate continues to disintegrate across the whole continent, field-crop and livestock-production is decreasing yet further, and widespread hunger is increasing in frequency.

The basic link between the removal of ground cover and increasing aridity must be clearly understood. Also, there is a pressing need for field workers to be able to perceive, through the eyes and minds of rural communities, practical methods of stemming the tide of decreasing productivity by enabling the wisdom of village people to be used in their own forward planning. There is an urgent need to identify all possible information on indigenous soil and water conservation methods and agroforestry systems aimed at stabilizing the food production base, and to go to the assistance of Africa's rural people who for years have deserved that their depth of knowledge be understood.<sup>39</sup>

Rural Africans are deeply concerned and daily aware of their predicament. They will certainly involve themselves in soilconservation and tree planting, but only if they are properly consulted in the first place and can decide themselves on the inputs they require to break the deadly cycles of poverty. There is still hope for recovery, but extreme care will be required as any uncontrolled expansion of land-use will inevitably lead to increased ecological deterioration, thus risking the irrevocable erosion of the entire food production base of the continent.<sup>40</sup>

Above all, however, a massive tree planting and agroforestry campaign is needed, making the fullest use of the vast human potential within the communities of Africa.

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# **Silent Spring: The View From 1990**

by

Shirley A. Briggs

In Silent Spring, published in 1962, Rachel Carson awoke the world to the consequences of intensive chemical agriculture for the environment and human health. Now, nearly three decades later, although more and more people accept Rachel Carson's assessment, the chemical industry is as strong as ever and the volume of pesticides produced continues to increase each year. In the United States, legislative changes have resulted in the banning and restriction of several of the chemicals mentioned in Silent Spring, but new formulas enter the market every year despite evidence of their adverse effects.

"We stand now where two roads diverge. But unlike the roads in Robert Frost's familiar poem, they are not equally fair. The road we have long been travelling is deceptively easy, a smooth superhighway on which we progress with great speed, but at its end lies disaster. The other fork in the road — the one 'less travelled by' — offers our last, our only chance to reach a destination that assures the preservation of our earth." Rachel Carson Silent Spring

Rachel Carson is credited with making 'ecology' a household word. In explaining how pesticides can affect the fabric of nature, *Silent Spring* gave to the general public an inspiring understanding of the natural order and its vulnerability to humanity's activities. Rachel Carson made people realize that industrial society is blind to this knowledge and that the makers and users of synthetic pesticides are extremely powerful and often ruthless.

Although there is now a growing acceptance of the message of *Silent Spring*, its opponents still maintain their assault against it.<sup>1</sup> In the 28 years since its publication, essential backing for those scientists advocating sounder pesticide policies has come from ordinary people who have seen their own lives and the future of their children at stake. It is only through these people and the influential Government officials whom Rachel Carson reached directly through the book, that concrete changes have been made.

# **The Initial Impact**

Silent Spring's message was not to the liking of those institutions with close contacts with the chemical industry. Some reviewers argued that she exaggerated her case: others that the book was full of errors, although we at the Rachel Carson Council have yet to be shown a valid example. Others took a heavy-handed approach.

The Velsicol Chemical Company, for example, tried in the summer of 1962 to persuade Houghton Mifflin not to publish *Silent Spring*, objecting to its material on chlordane. Louis A. McLean, Secretary and General Counsel, explained their stand:

"Unfortunately, in addition to the sincere opinions by natural food faddists, Audubon groups and others, members of the chemical industry in this country and western Europe must deal with sinister influences, whose attacks on the chemical industry have a dual purpose: (1) to create the false impression that all industry is grasping and immoral, and (2) to reduce the use of agricultural chemicals in this country and in the countries of western Europe, so that our supply of food will be reduced to east-curtain parity. Many innocent groups are financed and led into attacks on the chemical industry by these sinister parties."2

The same assertions are still made today by those who prefer to question their opponent's motives rather than face facts and issues squarely and objectively.

Claims from industry that we will be doomed without unlimited pesticides are hardly credible in view of estimates that losses to agricultural pests have doubled or tripled since the introduction of the new synthetic toxics. Formerly innocuous insects have become pests when their predators and parasites have been killed by pesticides, and many kinds of pests have become resistant to pesticides. Pimentel et al have calculated that even a complete stop in synthetic pesticide use would result in only relatively small increases in crop losses.3 With alternative farming methods, this crop loss could be reduced. The costs to producers would also be considerably lower. The many other costs measured in terms of damage to health and the environment, further question the claimed advantages of our current pesticide practices.

# The Rising Tonnage of Poisons

Silent Spring recorded a rise in the production of pesticide active ingredients in the United States from 124,259,000 pounds in 1947 to 637,666,000 pounds in 1960. By 1986, according to Environmental Protection Agency (EPA) figures, production had risen to 1.5 billion (thousand million) pounds for the range of products cited by Rachel Carson, and U.S. use was about 1.09 billion pounds, allowing for exports and the small amount imported. If wood preservatives (fungicides), disinfectants and sulphur, are taken into account, the figure for U.S. pesticide usage in 1988 is 2.7 billion pounds. U.S. pesticide production (not including the latter three categories) is about one quarter of the world total, so the annual burden on the earth must be about 6 billion pounds of these products.4 The US Environmental Protection Agency

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Bust of Rachel Carson by Una Hanbury in the National Portrait Gallery. Photographed by Shirley A. Briggs. (Copyright Rachel Carson Council, Inc.)

(EPA) does not offer production data on the expanded list, though the impact of the three additional classes of pesticides is also a major consideration.

Pesticides form only a part of the exploding volume of often toxic petrochemicals used in drugs, plastics, solvents and many other products. The overwhelming majority of these chemicals remain inadequately tested, if tested at all, for possible toxic effects to humans and other animals, and for their impact on the environment.

First in the chemical industry, and then in the general public, a belief has arisen that the use of toxic chemicals is required to permit our current way of life. Many in the industry seem to emphasize finding new ways to use toxic synthetic materials rather than envisioning new products for necessary functions and then devising non-toxic means of making them.

Our lives have become dominated by petrochemical products which have replaced those once made of traditional materials such as wood, glass, metal, and natural fibers. This has happened primarily because large-scale production has made products of synthetic materials cheaper in immediate purchase price than those made of traditional, non-toxic materials. However, when total costs are considered, including the adverse effects on human health and the environment, the synthetics may be far more costly.<sup>5</sup>

### Attempts at Control

The Environmental Protection Agency was established in 1970 to regulate environmental contaminants including pesticides. It was preceded in 1969 by the National Environmental Policy Act (NEPA) that requires the environmental cost of all Federal activities to be examined in an Environmental Impact Study (EIS). The Council on Environmental Quality was set up to evaluate these studies.<sup>6,7</sup> Laws to enforce acceptable standards for clean air and water, reinforced more recently by the Superfund Law to deal with toxic waste dumping, have further defined EPA's purpose.

Some state and local governments followed with reinforcing legislation, setting in place the machinery to accomplish much of the reform suggested in *Silent Spring*. Where results have been disappointing, we find the usual impediments of inadequate determination and funding, and the formidable political and economic opposition from the industries and allied interests whose profits and reputations are at stake.

In 1972, the basic law authorizing Federal regulation of pesticides, the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) was drastically altered by Congress to require that all products then on the market be scrutinized and tested to

fill all gaps in their data record.8 Pesticides had previously been checked only for immediate toxic effects on some non-target creatures. Since the U.S. Department of Agriculture, which had previously been in charge of pesticide registration, had never denied registration to any product submitted, whatever its record, the legislation called for an enormous testing and evaluation programme. Old products were to be brought up to standard, while all new pesticides submitted would be thoroughly tested for immediate and long-term effects on human health and the environment. Those chemicals found to pose "unreasonable risks" were either to be sharply restricted in their uses, or banned for all or most uses. All testing, which is the responsibility of the producers, was to be completed within a few years.

# **EPA's Performance**

This legislation should have provided a good basis for regulating pesticide use and should have encouraged the increased use of biological controls, sounder mechanical procedures, and emphasis on pest-resistant crops.

But, this has not happened. A few exceptionally hazardous pesticides have been taken off the market or restricted in use, but very few have made their way through the whole battery of tests required, or if so, they have not had these results conclusively assessed by EPA. There are about 1400 active pesticide ingredients involved, of which about 600 are used frequently enough to be of importance. About 150 of these are of critical importance because of the scale of use or hazard. By EPA definition, an 'active' ingredient is one that affects the target pest. So-called 'inert' ingredients, which include contaminants, solvents, surfactants or other material in the formulated commercial product, may be even more biologically potent and toxic to many forms of life. Producers were allowed to include these constituents under "trade secrets", and so were not required to reveal them (EPA was restricted from revealing them). After many complaints, in 1986 EPA finally issued a list of those active ingredients that they consider most dangerous and which will have to undergo testing.

In 1984, the National Academy of Sciences published a graph showing what percentage of various classes of chemicals in use in the United States had been tested sufficiently to permit a sound evaluation of human health hazards.<sup>9</sup> Pesticides came out better than most of the categories, but even here only 10 per cent satisfied the basic requirements. There was some good data for 24 per cent, a scattering of information for another 28 per cent, and *none* for 38 per cent.

In 1986, an assessment of current pesticide regulation from the General Accounting Office (GAO), stressed the limited nature of registration by EPA. Registration does not mean that a product is safe, nontoxic, harmless to people and pets, or is 'approved' by EPA.<sup>10</sup> It is illegal for a producer to claim any of these attributes. EPA simply follows a prescribed formula for balancing risks and benefits from use of a pesticide. However great the risks, if the benefits appear greater, the pesticide may be registered.<sup>11</sup>

The risks are often borne by those who are exposed to the pesticide at some distance from its application, from eating the crop on which it was used, drinking water into which it has seeped, touching contaminated soil, or breathing drifting spray. Benefits may be calculated in terms of the short-term profits to the crop grower who uses the product, but it often seems that the clearest advantage accrues to the manufacturer. In its report, GAO recommends that labels on pesticides be required to give more adequate precautions, and details as to whether or not the ingredients were thoroughly tested.

# **Inadequate Testing**

Progress in testing pesticides has been slowed by a number of factors. The EPA Office of Pesticide Programs took several years just to decide which tests should be made to fill specific data requirements. Guidelines for pesticides to be used on food crops were to be more stringent than for those on non-food crops, and products to be used on domestic animals were of more concern than those affecting wild animals. Laboratory standards were debated at length, and the rigour of testing was adjusted for different sites. Less concern was shown if products would be used in sparsely populated areas.

As the process dragged on, pressure increased to weaken the rules, and in 1980 the Reagan administration declared its intent to eliminate many environmental regulations. Many tests were made optional. When the final round of documents on testing procedures were sent out for public comment, they revealed that EPA did not plan to test non-herbicide pesticides for their possible adverse effects on "Silent Spring is credited with giving the essential impetus to the whole range of anti-pollution laws which came into force in the 1970s, so it is ironic that the law regulating pesticides, FIFRA, is the weakest of them all."

plants. Yet the Rachel Carson Council found 83 non-herbicides known to harm plants, so we listed them in our comments. The lone person at EPA concerned with non-target plants phoned to ask for our references. Though most must have been listed in EPA files, he had no way to track them down since no one had thought to sort this information into the computer. It is not only lack of resources and concern that has stalled EPA efforts, but sometimes just a lack of imagination.

EPA convinced Congress that the registration process was intolerably slow because they claimed that full testing would have to be done on all of the approximately 45,000 commercial pesticide products. This, they claimed, at the rate they were going, might take well into the 21st century. In fact, testing is only done on the active ingredients, mainly among the 150-600 most used. Congress reacted by granting EPA's plea for "conditional registration". This allows a new product to be put on the market while the testing is being done; if the results are too alarming it can later be withdrawn, restricted, or banned. The purpose of the 1972 law, which directed EPA to proceed briskly with the testing of pesticides, was thus effectively compromised. Since 1978, when conditional registration was added to the law, it has often been used for new pesticides as well as for older ones. At the last count, about 40 per cent of new pesticides have been introduced onto the market while tests were still being completed. Some of these are extensively used.

Environmentalists have tried to strengthen FIFRA since 1972, but have effectively been thwarted by pressure from the producers and users of pesticides. In 1988, some of the main concerns of the environmental lobby were dealt with by amendments to the law. EPA is now required to complete the re-registration process by 1997. This new requirement had one immediate effect: many producers simply asked that their registrations be withdrawn. Either they knew that test results would be adverse, or they felt that profits from these products did not warrant the cost of the tests.

# **Fraudulent Testing**

A review of the often labyrinthine processes through which EPA operates raises some basic questions. Should one agency be given the combined functions of gathering information, assessing it, enforcing the resulting regulations and policing compliance? Is it reasonable to expect the producer who applies for registration of a product always to conduct the required testing honestly, or to hire a commercial laboratory to perform it without prejudice? Large amounts of money are at stake. Indeed, in 1978 it was found that some 200 major pesticides had been registered on the basis of fraudulent tests performed for various producers by the privately-owned Industrial Bio-Test Laboratory. As a result, some countries withdrew the suspect pesticides, but the United States and Canada divided the evidence between them and spent years reviewing the tests and having manufacturers repeat the many invalid tests. Even now, if we know that a product was registered on the basis of tests by the Industrial Bio-Test Laboratory, we should check its present credentials.

Silent Spring is credited with giving the essential impetus to the whole range of anti-pollution laws which came into force in the 1970s, so it is ironic that the law regulating pesticides, FIFRA, is the weakest of them all. Instead of focusing on the reduction of toxic contamination, as with the laws for air, water or dump sites, it has complex and even contradictory purposes that make it difficult to administer. The procedure for cancelling a pesticide registration allows the manufacturer numerous ways to delay or confound the process.

For many years, one clause of FIFRA made it almost impossible to take a product off the market even where it had been found to qualify for suspension. If EPA wanted a banned pesticide to be immediately removed from the market, the Agency had to compensate the producer and others holding stocks not only for the commercial value of the product, but also for the storage and disposal costs of the stocks. For only one chemical, this could amount to far more than the Agency's entire pesticide budget for one year. Usually therefore, EPA had to allow existing stocks to be sold until exhausted, no matter how dangerous. (Other manufacturers

found to have a defective or dangerous product are not treated so indulgently. The Government can require the recall of defective automobiles, for example, without compensating the offending manufacturers.)

# **FIFRA** Amendments

The 1988 amendments to FIFRA largely removed this problem. All holders of a pesticide at the time of suspension or cancellation are no longer to be indemnified, except for a few end-users, such as farmers, who may have bought the product unaware of its uncertain status. Such payments will come from the U.S. Treasury Judgement Fund, not the EPA operating budget. Any other payments will be made only by special authorization by Congress. These amendments also made other longsought improvements, including tighter control for enforcing compliance, higher registration fees by which the industry will help pay more of the registration costs, and increased criminal penalties for knowingly violating any FIFRA requirement.

The 1972 revision of FIFRA made the pesticide user legally responsible for damage from his application, though this is still more honoured in principle than in practice. It also established the category of 'Restricted pesticides', to be used only by certified operators. This was intended to protect the public from the most dangerous products, but it falls short of this goal in at least two respects: in the inadequate requirements for certification, and in the places where these products may still be used. Perhaps the least protected are the farm workers who must apply pesticides and work in treated fields, with little protective clothing and without a suitable delay allowed before re-entry into contaminated areas. Until a 1987 ruling by the Department of Labor, they were also usually denied sanitary and washing facilities and clean drinking water.

Finally, FIFRA is the only major environmental statute that does not provide for citizen suits against violations. This is an essential tool to assure Government compliance.

MAJOR	TECHNICAL	REPRESENTING
RESEARCH	MEETINGS	GEOGRAPHY
PROJECTS		
Karakoram,	Counter-urbanisation	National curriculum
Pakistan		
1980	Early industrialisation	Geography in education
Kora,	M25 & development	Funding fieldwork
Kenya	AR BANK STREET	
1983	Wetland conservation	O.S. & I.U.C.N.
Wahiba,	Sea bed resources	NERC & ESRC
Oman		
1986	Climatic change & policy	UGC Earth Science review
Maraca,	Aid & environment	Countryside Commission
Brazil		terret and state Physics and
1987	G.I.S.	London Planning Comm.
Kimberley,	Acid rain	Select committees on:
Australia		Overseas aid
1988	Britain's rural future	Agriculture & food UK Space policy
	Arid land strategies	Remote sensing
	2 and an and a second second	Greenhouse effect
Over 350 researchers:		
geographers, social	A forum for academics	
scientists, ecologists	consultants, civil	An effective voice for
and earth scientists	servants & policy	geography at many
working together.	makers.	levels.
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# The Regulation of DDT and Chlordane

The history of the regulation of DDT and chlordane shows how the cumbersome system has operated. When EPA was established, a suit to ban DDT was already underway against the previous regulating agency, the U.S. Department of Agriculture, brought by the Environmental Defense Fund (EDF). With the switch of authority to EPA, the EDF lawyer found that he had allies in the competent young lawyers who first manned the EPA Office of General Counsel. Their opponents were still the Department of Agriculture and the manufacturers of DDT, both of which could muster formidable legal talent. Taking the very slides and test results with which the producers had claimed that DDT had only minor toxicity beyond insects, the expert pathologists enlisted by EDF and EPA demonstrated that the tests had in fact shown serious hazards, including cancer and the neurological damage common to the chlorinated hydrocarbons. Most alarming was evidence of irreversible and continuing harm to many forms of wildlife. Once in the environment, DDT could not be contained, and would continue to wreak its damage for decades as it persisted and moved about the earth.

Since DDT was removed from the United States market in 1972, some critically endangered species have begun to recover. Many of these are large, conspicuous birds at the top of food chains. They are especially susceptible to DDT but also easy for wildlife experts to count and test. Bald eagles and brown pelicans, though still threatened by other pesticides, carry far less DDT now than in the early 1970s.

After DDT was banned, the lawyers turned to the closely related pesticides for which they had enough evidence to ensure their cancellation. They repeated their method with success for aldrin/dieldrin (aldrin degrades to dieldrin; both are more toxic than DDT). Next came the closely related chlordane/heptachlor. As the comparable evidence was presented, the administrative law judge presiding was puzzled by evidence provided by the producer, Velsicol, who claimed to have found no positive data for cancer. As the impasse continued, the EDF and EPA lawyers feared that the judge's perplexity might lose them the case, with a domino effect as doubts cast on chlordane might reflect back on previous cases. They agreed to settle for a gradual phasing out of chlordane/heptachlor. This solution did not provide any legal finding of fact on car-

# Pesticide Regulation in Britain

In Britain, as in the U.S., many pesticides have been approved in the past on the basis of data which would now be considered inadequate. The U.S. launched its review of past approvals in 1981; Britain followed in 1985.

Britain's review is far from exhaustive. It failed to include the growth promoter 'Alar', until media attention forced the British Government to do so.<sup>1</sup> When the Government's Advisory Committee on Pesticides finally assessed the evidence that led the U.S. to ban 'Alar', it pronounced it safe for continued use. Eventually the product was withdrawn from the market only upon the initiative of the manufacturer.

The sorry history of the current review has demonstrated that the Ministry responsible for controlling pesticides, the Ministry of Agriculture, Fisheries and Food (MAFF), refuses to recognize that it lacks the necessary resources to control pesticide safety, even if the will existed. In the U.S., the Environmental Protection Agency has over 100 staff working on the review of pesticides and admits it will be unable to complete the study until well into the next century. MAFF, in contrast, with a staff of less than ten working on the same review, claims it will be able to complete it satisfactorily in 12 years. In truth, it will only be the results of the U.S. studies which will locate the possible pesticide poisons still lurking in our food.

The inadequacy of the current review is only the latest evidence of the British Government's dilatory approach to pesticide control. In the U.S., pesticides have had to seek statutory approval ever since 1947. By contrast, pesticide approval in Britain was, until 1985, controlled by a voluntary code agreed between MAFF and the pesticide producers and suppliers. Even though there were proven cases of suppliers flaunting that code, the British Government only introduced a statutory approvals system when forced to do so by the E.E.C. Commission - not for environmental or health reasons, but because the existing system was seen as a barrier to trade.

# Pesticide Usage

Britain also lagged behind the U.S. in giving users a legal duty to follow the usage instructions set out on the label. Control over pesticides in the U.S. was first introduced under the 1947 Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) and food law enforcement officers have extensive powers to take samples at all levels of the food chain. In Britain, until the passage of the Food and Environment Protection Act (FEPA) in 1985, any prosecution for misuse would have had to rely on the general terms of the Food Act. No successful prosecutions ever took place under this Act. This situation is unlikely to improve now, even though users do have a statutory duty to follow the application instructions on the label of a pesticide container.

Control over health and safety is exercised by the Agricultural Inspectorate of the Health and Safety Executive (HSE), yet they have too few staff or powers to ensure that compliance takes place. Critics of MAFF and its cosy relationship with the agrochemical industry would welcome greater involvement of the HSE in the control of pesticides, since it is less likely to be compromised by any duty to promote agricultural output. However, the substantial increase in the HSE's duties entailed in implementing the Food and Environment Protection Act, were initially supposed to be met with no additional staff.

# **Pesticide Residues**

As the range of approved pesticides grows, testing for their residues becomes ever more complex. The largest number of tests is carried out for organochlorides such as aldrin/dieldrin and chlordane/heptachlor; ostensibly because many of these are now banned or restricted, but in truth, because these are the easiest and cheapest to detect. Other groups of pesticides are now more extensively used than organochlorides, so the testing programme is not adequate to detect new problems as they arise.

The MAFF sub-group responsible for monitoring residues, the Working Party on Pesticide Residues in Food (WPPR), has, in none of its regular reports, listed any testing programmes which would have detected daminozide, the active ingredient in 'Alar', even though it has been a known carcinogen for many years.

We are still paying the price in Britain for past mistakes in pesticide approval. Every analysis of cod liver and halibut liver oil reported in the 1986 report of the WPPR detected DDT residues, whilst a limited survey of breast milk indicated that breastfed infants could exceed the WHO Acceptable Daily Intake (ADI) for this persistent compound.<sup>2</sup> Nor can we be sure that we are not still contributing to this problem. Both the 1986 and 1989 WPPR reports found evidence of continued illegal use of DDT on green vegetables.<sup>3</sup> Removal of approvals for dieldrin in 1989, and aldrin, planned for 1992, come only after milk and eels have been found to contain residue levels which would result in some consumers exceeding the WHO ADI for these compounds.

On average, Britain conducts only one chemical analysis for every 6,500 tonnes of food imported - and few of these tests would include an analysis for pesticide residues. Even when contaminants are found, little action is taken. The WPPR reported in 1986 that all samples of processed pork and poultry from China contained a technical grade of lindane which had never been approved for use in Britain. The Government's response ("discussions . . . to encourage a reduction in this contamination") had such little effect that by the time of the 1989 report the highest levels found had increased sixfold. Having consistently opposed the introduction of legal limits on residues in food, the Government now claims that it is the lack of such limits which has led to its failure to restrict these imports. The planned introduction of such laws has only occurred because a 1988 European Community directive left it with no alternative.

The U.S. authorities do ban unsafe imports. They do prosecute those who misuse pesticides. For all its failings, the EPA does have a clear mandate to safeguard the environment and human health. It stands as enduring evidence that the message of Rachel Carson did have some practical effect in the U.S. In Britain that evidence is still lacking.

Peter Snell

Peter Snell is a freelance consultant in public health and food law. He is coauthor of Food Adulteration and How to Beat It (Unwin Hyman, 1988).

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3. M.A.F.F., Report of the Working Party on Pesticide Residues (1985 to 1988), Food Surveillance Paper No. 25, H.M.S.O., London, 1989. cinogenicity, protecting Velsicol from possible damage suits on that issue, and it did not have the finality of a legal decision through the regular cancellation process. Administrative decisions can be more easily reversed. This 1978 settlement gradually removed chlordane/heptachlor from the market by 1982 for agricultural and most other uses except termite control and dipping of non-food plants. Subsequent findings confirmed the carcinogenicity of chlordane/heptachlor, and the illegal withholding of evidence by Velsicol, but EPA did not re-open the case to put this information into the legal record.

# The Worldwide Impact of Silent Spring

The history of pesticide regulation and use in the United States, although inadequate, is on the whole more encouraging than the world picture. We have been helped by a responsible democratic form of government which has given us the Freedom of Information Act through which private citizens have managed to pry vital data on pesticides from Government agencies.<sup>12</sup>

In other major industrialized countries, the situation is often less favourable. In a 1981 report, Ross Hume Hall pointed out some of the problems in Canada:

> "Pesticide companies have made it clear that for most of their products, the Canadian market does not warrant extensive testing in the Canadian environment. They state that if forced to pay for such testing, they may withdraw their products. The cost is borne by the public whether in price of pesticides or in taxes. Should it be left to the international chemical companies to set policy whether or not pesticides are tested under Canadian conditions?"<sup>13</sup>

Our responsibility in the United States goes far beyond our borders. While we may not require testing in a range of conditions greater than our own, most other countries rely on us for precedents and data on pesticides even if they do not always follow our policies. The smaller and less industrialized countries are at special risk. They are under pressure to permit the sale of dangerous products and lack the facilities to appraise the hazard or enforce protective rules. In an effort to make the necessary information available, the United Nations Environment Programme (UNEP) has established a centre for information on toxics, and publishes the Inter"Whether from one severe exposure or a succession of small ones, human tolerance to pesticides may become so low that people cannot function in their usual home or work environment."

national Register of Potentially Toxic Chemicals, based on information from national governments and private sources.

Even UNEP finds that many national governments, no doubt at the insistence of the chemical companies, refuse to release much of their data, claiming they are 'trade secrets'. Though the United States Supreme Court has ruled that information on the toxicity and environmental fate of a pesticide is not a trade secret, and should be made available to the public, EPA insists that those seeking information should obtain it through the complicated process of the Freedom of Information Act.<sup>14</sup>

We all pay the price of international laxity. When pesticides, the use of which the United States does not permit, are freely used in other countries, perhaps supplied by producers in the United States, much comes back in imported food. Air and water carry residues to the ends of the earth. It was not long into the era of synthetic pesticides that DDT was found in the Antarctic.<sup>15</sup>

We continue to learn more about pesticides. We now know that the transformation products formed as pesticides break down in the environment and our own bodies are sometimes far more dangerous than their parent products. Resistance of pests to pesticides is now much more widespread than when *Silent Spring* was written.

### **Doctors and Lawyers**

The response of most of the medical profession to the message of *Silent Spring* has been disappointing. Doctors are still taught little toxicology, and victims of chemical poisoning may have great difficulty finding a doctor who can recognize the symptoms, much less know what may be done about them. Whether from one severe exposure or a succession of small ones, human tolerance to pesticides may become so low that people cannot function in their usual home or work environment. General physical and mental health may deteriorate. For especially vulnerable people, finding a safe haven from the prevailing toxic exposure or the unthinking pesticide practices of neighbours may be almost impossible.

Victims of 'chemical trespass' need lawyers versed in the field, as well as doctors. The growth of environmental law has been impressive, but the need for lawyers to take individual cases still exceeds the supply. In 1973, a notable case was brought by the National Resources Defense Council, Environmental Defense Fund, National Audubon Society and Sierra Club against the U.S. Agency for International Development (AID) to make them stop using U.S. tax money to fund foreign governments' purchase of pesticides, the use of which is not permitted in the U.S. The environmentalists won the case, which stopped the practice and required AID to issue an Environmental Impact Statement (EIS) for their whole pesticide programme. From the many public comments on the EIS, AID have learned much and have adopted a more enlightened policy.

# The Growth of Citizens' Groups

The Rachel Carson Council, established after Rachel Carson's death in 1964 in accordance with her wishes, for many years found itself almost alone in trying to keep abreast of pesticide research, in providing a wide range of information to individuals and groups, and in attending technical EPA hearings on proposed action. In recent years, however, the Council has been joined in much of this by new national and regional groups, notably the National Coalition Against Misuse of Pesticides, and the Northwest Coalition for Alternatives to Pesticides. They carry on Rachel Carson's tradition of combining a careful, scientific approach with public education. On the international scene, the Pesticide Action Network concentrates on problems in less industrialized countries.

We who deal directly with individuals and local groups have learned much from those who come to us for information. They have kept us in close touch with the growing number of people throughout the world who have understood the message of *Silent Spring*. We have been continually impressed by something that Rachel Carson had learned: even those with little academic or technical training have the capacity to grasp essential principles and to seek and comprehend very complex technical studies. The chemical industry defend their secrecy about their products by claiming that the public could not understand the data, and would just 'panic' if they were to be given it. In fact, what industry fears, is that once the issues are understood, and the data is available, citizens can organize themselves to persuade officials to take suitable action.<sup>16</sup>

# The Other Road

Encouraging progress on the "road less travelled by" has come from private efforts to find sound pest control methods. Work toward non-chemical controls had languished since World War II when synthetic chemical pesticides were embraced as the solution to almost all agricultural problems. Only a few university and government departments continued research on the solutions outlined by Rachel Carson. The concept of Integrated Pest Management (IPM) was defined by scientists working with biological controls, notably the late Robert van den Bosch and his colleagues in California. Gradually their work gained credence and somewhat better funding, with the boost from Silent Spring.

IPM leaves toxic chemicals as a last resort to be handled as precisely as possible in minimum amounts. Like most ways of dealing cooperatively with nature, IPM requires a detailed knowledge of pests, crops and localities, with continuous monitoring and experienced workers. The appeal of the quick-fix has to yield to concern for sustaining fertility and preventing the poisoning of the land, water and produce in the long-term. Attentive and industrious farmers, for example, can use low-till methods without resorting to the massive herbicide applications insisted upon by departments of agriculture. Some laws now specify IPM as the proper policy for state and national government, but the pursuit of this aim has not been vigorous.

In the years since *Silent Spring*, soil, water, air and the tissues of living creatures have become increasingly contaminated. We have set loose forces that we do not understand and cannot control. The dangers on the superhighway have increased, and the probability of diverting most traffic onto the other road has lessened. Whether we can do so depends on the growing numbers of people who understand Rachel Carson's message and are prepared to take action in line with their beliefs.

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The Mekong in northern Laos. (Photo: Sari Taussi)

# **Remaking the Mekong**

#### by

# Larry Lohmann

As the global market economy pushes into the former battlefields of Indochina, a longcontemplated plan to build a huge system of hydroelectric dams on the Mekong and its tributaries is once again being taken seriously. Western and Japanese businesses and aid agencies are working together with a UN-affiliated agency to draw up and implement the scheme. The Thai, Laotian, Kampuchean and Vietnamese villagers whose livelihoods would be undermined by the dams have not been consulted.

For over 25 years, a scheme to build a massive complex of dams on the 600,000 km<sup>2</sup> lower Mekong River basin, has been quietly evolving at the Bangkok-based Secretariat of the Interim Committee for Coordination of Investigations of the Lower Mekong Basin (Mekong Committee), a little-known intergovernmental organization supported by the United Nations and over a dozen bilateral aid agencies.

The original plan envisaged as its centrepiece a string of immense power dams on the 2,400 km mainstream of the lower Mekong from Luang Prabang in Laos to Sambor in Kampuchea, backed by nearly 100 tributary dams. It has been described as "the biggest, most ambitious and expensive development project of all time."<sup>1</sup> Hundreds of thousands of people would have been displaced and thousands of square kilometres of river valley and forest flooded.<sup>2</sup>

For various reasons, however - the Vietnam War and its aftermath, lower than expected power demand, and the simple unwieldiness and environmental destructiveness of the scheme - little of the original plan ever got off the ground.3 None of the mainstream dams has progressed beyond the feasibility study stage, and only a few Secretariat-planned tributary projects have been built. These include, in Thailand, the Nam Pung, Chulabhorn, Sirindhorn and Nam Pong Dams, and in Laos the small Selabam and Nam Dong schemes. All were on line by about 1970. The only Secretariat-planned international hydropower project to have been constructed so far is the World Bankfunded, 150 megawatt Nam Ngum Dam on a Mekong tributary in Laos, commissioned in 1969 to supply electricity to Thailand. From 1970 through the mid-1980s, the Secretariat's hydroelectric schemes stayed on the shelf, with only relatively low-budget projects in irrigation, surveying, river navigation and fisheries being implemented.<sup>4</sup>

### New Plans for the Mekong

All that, however, may be changing. Through a new, pared-down master plan, the Secretariat is once again trying to bring hydroelectric dams to centre stage. Over four-fifths of the US\$5.25 billion the Mekong Committee has recently suggested be spent on Mekong projects by the year 2000 would go for power schemes.<sup>5</sup> These include, in likely order of construction:

 The US\$120 million Pak Mool dam, to be built with an installed capacity of more than 100 megawatts by the French firm Sogreah on the Mool tributary in northeast Thailand.<sup>6</sup> This project, which would erode local fisheries, damage religious sites and drown rapids valuable for tourism, has been approved in principle by the Thai Cabinet but has been de-

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layed by determined resistance from the hundreds of villagers it would displace;<sup>7</sup>

- · The Nam Theun 2 earthfill dam on the unspoiled upper reaches of the Theun tributary in one of Laos' best remaining primary forests. A 600 megawatt project was originally contemplated, at a cost of \$805 million.8 In the wake of environmental objections from Lao officials, however, a scaleddown \$200 million, 140 megawatt plant is now under feasibility study by Australia's Snowy Mountains Engineering Corporation.9 In theory, the project could later be expanded up to its economically optimum size of 1200 megawatts; driving up the price to \$1.2-\$1.5 billion.10
- The 400 megawatt Nam Chern scheme in Thailand.
- The \$3 billion Pa Mong concrete gravity dam across the mainstream of the Mekong between Laos and Thailand upstream of Vientiane.11 The installed capacity of this project would be 2250 megawatts but, due to variations in flow, firm power would be a mere 485 megawatts.12 The Swedish firm, Swedpower, is currently studying various aspects of Pa Mong, and, as with other large Mekong Committee projects, Australian, Swedish or Japanese firms would be likely to play leading roles in construction.13
- The Yali Falls hydropower schemes for the upper reaches of the Se San tributary in the highlands of southern Vietnam. A small 24 megawatt overflow weir project could be succeeded by a \$500 million rockfill dam feeding a 480 megawatt power plant.<sup>14</sup> The catchment area includes moist tropical forest.<sup>15</sup>

# The Secretariat's Role

How many dams will actually be constructed depends, officially, on the wishes of the national governments of the four lower Mekong countries — Laos, Thailand, Kampuchea and Vietnam.<sup>16</sup> Like many technocracies, the Secretariat — in which Western and Japanese experts play influential roles — portrays itself as merely offering policy options for these governments to choose from.

Nevertheless, the Secretariat is likely to

play a significant role both in moulding governments' thinking and in organizing and facilitating the integration into the global economy of Indochina's newlyavailable resources. By restricting the choices that are actively studied to those with which its technical staff and consultants are most comfortable, the Secretariat ensures that few genuine alternatives to conventional hydropower source development will be proposed to the region's governments. And by securing, with governments' permission, bilateral- and multilateral-agency funding for dam feasibility studies by corporations, the Secretariat helps put businesses in a position where they can use their influence to win contracts and get projects approved.

The Secretariat's practice of using public funds in a way which benefits networks of corporate contractors may soon be further streamlined, moreover, by a system of financing which would give private firms even greater control over Mekong river development. The so-called BOOT (buildown-operate-transfer) system, endorsed in June 1989 by the World Bank, would allow private businesses to build, own and operate power dams in Third World countries for decades before transferring them to the ownership of national governments. Loans required for the construction of dams built under the BOOT system would not require state guarantees and would be paid off by the business consortium running the dam. Engineering firms seem solidly in favour of the BOOT system, which is being considered for the Nam Theun 2 dam as well as for projects in Pakistan and other countries.17.18

# Economic and Political Background

Contributing to the chances that the Secretariat's new hydroelectric plans will be implemented are a number of factors related to the changing economy and politics of the region.

One is the Thai government's decision, in the wake of dwindling military hostilities in the region, to offer Thailand as a 'springboard' to help the world economy to gain access to the nascent markets and little-exploited resources of Indochina and Burma.<sup>19</sup> This move fits neatly with the Mekong Committee's pre-existing plans for basin-wide hydroelectric development. Power dams will build the production and consumption capacity of the newly-opened countries, feed Thailand's own industrializing economy, and provide lucrative work for foreign construction companies.<sup>20</sup>

Another development favouring the Mekong Committee's plans is Thailand's difficulty in meeting its own burgeoning electricity demands.21 While there are still schemes to build power dams in the mountainous north, west and south, the country's technically-feasible hydroelectric sites are being used up fast.22.23.24 In particular, almost no unexploited sites remain in the flat, dry plateau that constitutes the country's northeast.25 Existing dams, moreover, are often so depleted of waterlargely due to deforestation in their catchment areas - that it is difficult for them to satisfy both irrigation and power demands. What sites do remain tend to be in forested areas whose destruction is beginning to seem, even to some elements of Thailand's élite, of questionable wisdom.

A final check to the construction of further dams in Thailand is the growing popular resistance to them. Recent years have seen local movements and uprisings against planned dams on the Kwae Yai, Mool, Yom and Klong Yan rivers.<sup>26,27,28,29</sup> These stem mainly from the struggle to preserve local livelihoods against the ever more insistent encroachments of the modern industrial economy.<sup>30</sup> Conservationist criticism of hydropower development plans for protected areas is also on the rise.<sup>31</sup>

Such considerations obviously favour shifting dam construction, where possible, to neighbouring countries. When the neighbouring countries are, like Laos, thinly-populated, full of high valleys rife with hydropower potential, unlikely to harbour much unmanageable popular resistance to 'development projects', and well out of the focus of international environmentalist attention, the option appears that much more attractive.32 All this, again, meshes well with the Secretariat's overall orientation toward creating an ever more 'efficient' international division of labour at the expense of local interests, the need to preserve unspoiled areas, and sustainability.

# Environmental and Social Effects

A look at two of the best-studied of the proposed Indochinese dams — Nam Theun 2 and Pa Mong — suggests some of the environmental and social effects of the proposed dams.

Nam Theun 2, which would supply most of its electricity to Thailand, is to be built



in an extensive mountainous primary forest harbouring a host of rare wildlife including Asian elephant, duoc langur, imperial pheasant and sooty babbler.<sup>33</sup> Two proposed protected areas which would be affected by the dam, the 1618 km<sup>2</sup> Nakhay Plateau (formerly a royal hunting reserve) and the adjoining 1627 km<sup>2</sup> Nam Theun area, have recently been assigned high priority for field survey by the International Union for the Conservation of Nature and Natural Resources (IUCN) and the Swedish-supported Lao Forest Resources Conservation Project.<sup>34</sup>

These areas, though as yet virtually biologically unexplored, are regarded as worthy of urgent concern on several grounds. Both contain prime tracts of tropical mountain evergreen forest (90 per cent of Nam Theun's forests falls into this category and 40 per cent of Nakhay Plateau's), and Nakhay Plateau is dominated by additional swathes of dry evergreen forest. Nam Theun, moreover, is a crucial example of a 'moderately high' wild area; 85 per cent of its territory lies between 500-1000 metres above sea level.<sup>35,36</sup> Finally, both areas retain well over fourfifths of their original forest cover.<sup>37</sup> Forests south and west of the impoundment zone are also rated highly by naturalists.<sup>38</sup>

Close to the meandering, sandybanked Theun River itself, meanwhile, grow the only natural stands of Pinus kesiya and Pinus mercusii in the Annamite mountain range between Laos Vietnam.39 and Caves and sinkholes abound near the river, and fish species diversity in the many long-undisturbed habitats of the steeply-plunging alpine streams is likely to be extremely high.40,41

So far, this remote wilderness has been subject to scant human interference, aside from some limited logging near the area's single road, Highway 8 to Viet-

nam, and the scattered rice agriculture practised by the few thousand hilltribe inhabitants.42 Construction of Nam Theun 2, however, would probably lead to ecological and social devastation across the whole area. Depending on whether the likely initial design for a 140 megawatt plant is expanded to a 600-800 megawatt scheme, an area of up to 530 km<sup>2</sup>, or the size of Lake Geneva, could be flooded.43 Approximately 2000 hilltribe people would have to be evacuated to make way for a reservoir of this size, and wildlife populations would be split, making them more vulnerable to inbreeding and extinction.44,45

Water from the dam's reservoir, much of it deoxygenated, is scheduled to be diverted into a stream in a neighbouring river system, necessitating dredging and damaging fisheries and agriculture far downstream.<sup>46</sup> Flow in the Theun River itself would be reduced to a fraction of its present level and the water rendered undrinkable even by animals.<sup>47</sup> Malaria-carrying mosquitoes would find an "ideal breeding ground" in the "vast" drawdown area between the high- and low-water marks of the shallow reservoir, and the risk of liver fluke, lung fluke, schistosomiasis and filiariasis would also increase.48

No less damaging would be the effects of dam-related construction. Quarries would be dug, timber taken out, transmission lines laid and over 200 km of road built or upgraded.<sup>49</sup> All of this, in addition to obliterating forest and stream habitat directly, would inevitably bring in new settlers, loggers and wildlife poachers. A World Bank-sponsored study concludes that the area's "undisturbed forests of great variety" would be "irrevocably affected".<sup>50</sup>

# Pa Mong

Environmental and social problems connected with the Mekong-spanning Pa Mong project, by contrast, would centre less on deforestation and more on the degradation of aquatic and agricultural systems and on resettlement.

By increasing river flow in the dry season and decreasing it in the wet, Pa Mong would disrupt both coastal ecosystems and longstanding patterns of farming more than 1200 km downstream in the Mekong Delta in Vietnam. Time-tested patterns of agriculture based on riverine sedimentdeposition would be altered, as well as the balance between fresh and salt water.51 Although Secretariat staff claim that by reducing the intrusion of salt water into the Delta during the dry season, the dam would help bring more land under rice cultivation, they also admit that the current "cropping pattern is very well adapted to the present pattern of salinity", and that any change would require heavy new investment.52.53 Secretariat officials also contend that the increased dry-season flow afforded by Pa Mong would alleviate the problem of acid sulphate soils in the Delta, but again some of the Secretariat's own findings suggest otherwise.54 As one recent document notes, "prevention of salinity intrusion would . . . inhibit the natural fertilization and neutralization of acid sulphate soils by marine sediments in rice fields which are often used for shrimp and prawn culture."55

Of equal concern is the threat to the Mekong's fisheries, which provide local peoples with much of their protein. A wide variety of species, including giant catfish more than two metres long, now have free run of the river. A natural phenomenon which provides Kampuchea with one of the most prodigious freshwater fisheries in the world occurs every year when the normal flow of the huge Tonle Sap lake into the Mekong reverses, and the expansive Tonle Sap floodplain is filled, providing fish with a protected area in which to grow.<sup>56</sup> The possible effects on fish spawning and migration of Pa Mong and other Secretariat projects (including a \$350 million 'regulator' planned for the mouth of the Tonle Sap) remain unclear, but are hardly likely to be positive.<sup>57</sup>

Closer to the dam itself, erosion along the river's banks would be increased, necessitating, by the Secretariat's own estimate, \$80 million in additional investment.<sup>58</sup> The facts that average power production at the dam would be low and that live storage at the reservoir could quite rapidly fill with silt, moreover, raise questions about the dam's economic viability in the long term.

A more immediate concern is resettlement. Worries about the problems which would result from trying to resettle a quarter of a million villagers have already caused the Secretariat to abandon plans for a high Pa Mong dam (with a full supply level [FSL] at 250 metres above sea level) in favour of a more modest project with a FSL at 210 metres.<sup>59</sup> But even under the scaled-down scheme, more than 42,000 people would have to be evacuated from the dam site (three-quarters of them from Thailand and one-quarter from Laos).60 Issues of human rights aside, the current Thai government is likely to be so concerned about the scale of the possible grassroots resistance implied by such numbers that it will put off a decision on the dam for some time.

To help fulfil its billing as a 'multipurpose' dam, water from Pa Mong's 600-1000 km<sup>2</sup> reservoir would be lifted over a divide to feed irrigation systems in Thailand's Chi and Mool tributaries before rejoining the Mekong further downstream.<sup>61</sup> Because irrigation in northeast Thailand tends to bring salt to the surface quickly, this last scheme would be extremely detrimental to soil fertility in the long term.

# Institutionalized Neglect of Environmental and Social Issues

The current set-up of the Mekong Committee's Secretariat virtually ensures that environmental and social issues of the kind sketched above remain undervalued, understudied or even undiscovered until projects are well past the planning stage. This is due to several reasons.

First, as V.R. Pantulu, outgoing Chief of

the Secretariat's environmental section, notes, companies studying the environmental impact of dams seldom want to dismiss a likely-looking project on environmental grounds for fear they will not be hired to do other work.<sup>62</sup>

Second, as elsewhere in the world of hydroelectric planning, it is often tacitly assumed from the start that a proposed dam should be built and that environmental and social analysts should restrict themselves to determining how to mitigate the inevitable side-effects.<sup>63</sup> As John Milton, an early critic of the Mekong Committee's schemes, noted in 1972, Mekong projects have been promoted "on the assumption that a series of large dams would be a good thing" without serious enough attempts "first to study the region, the social system, the culture and values of the inhabitants".<sup>64</sup>

Third, few environmental costs are included in cost-benefit analyses, and what environmental studies are done in advance are often inadequate.65 A hefty two-volume Swedish corporate appraisal of the Yali Falls hydropower project in Vietnam, for example, contains almost no discussion of environmental issues.66 This lacuna is hardly surprising, given that the staff of the Secretariat itself evidently have limited incentive to seek a full understanding of the nature and history of environmental problems in the region. V.R. Pantulu, for example, is quoted in a 1988 article as saying that dams do not destroy forests in themselves but only through poorlyplanned resettlement.67 This flies in the face of evidence from, for example, Thailand, where dam construction has been a leading direct cause of depletion of valuable lowland riverine forest through valley flooding and where resettlement schemes, no matter how technically 'well-planned', have invariably led to increased encroachment, given current geographical and political realities.68

Another Secretariat staff member blames reduced reservoir capacity due to deforestation on 'hilltribes', implying that a solution to this chronic problem of hydropower projects lies not in reconsidering dams themselves but in controlling tribal agriculture.69 This ignores the facts that in many areas where dams are plagued by deforested catchment areas (for example, in Thailand's northeast), no hilltribes exist, and that at all of Thailand's major hydropower dams which are now suffering from damaged catchment areas, deforestation has been due primarily to improved access, corporate logging, and encroachment and upland export agriculture practised by lowlanders responding to the demands of the world market system.<sup>70</sup> The officials' casual approach to the facts is often matched by an indifferent attitude toward the environmental burden dams place on future generations. When asked how long it would be before the Pa Mong reservoir silted-up, the same staff member that accused the hilltribes of reducing reservoir capacity, invoked a *deus ex machina* in the form of as-yet-undeveloped mechanical "silt-stirrers" which would keep solid particles from building up behind dams.<sup>71</sup>

A fourth reason why environmental issues are unlikely to deter Secretariat planners from proposing destructive dams lies in the Mekong Committee's disregard of the concept of consultation. Nearly two decades ago, John Milton observed that "no real effort ha(s) been made to consult the people affected . . . no one asked those 20 or 30 million people how they saw their needs and problems, or asked them what they wanted . . . the assumption had long been made that those dams were going to be built; the only questions were how many, where, and how."<sup>72</sup>

Today, at the headquarters of the Secretariat in central Bangkok, there seems to be a more sensitive appreciation of the need for public relations, but still little interest in bringing villagers, environmentalists and the public into the planning process. The Secretariat's reasoning on this is, ostensibly, that technicians cannot have "villagers looking over their shoulders" while they are studying dam possibilities, that the public cannot understand dam plans, that residents need not know about plans unless they are certain to be put into action, that the release of information would lead to land speculation harmful to villagers, and that any need for consultation is adequately served by the provision that leaves to national governments all decisions to study and to build.73

# **Planning Strategy**

This lack of public participation serves the purposes of the planners well. A project which is exhaustively mapped-out without participation or knowledge of the people affected, as many Secretariat-planned projects are, tends naturally to acquire a momentum of its own. One design choice leads to another until in the end even elementary suggestions from the public might require tearing the whole thing up and starting again.<sup>74</sup> It becomes difficult to question plans on the conceptual level (especially if one is unaware of them until Fisherman on the Nam Ngum reservoir in Laos. The Nam Ngum dam is the only Mekong Committee-planned international hydopower project which has so far been implemented. Fish yields in the reservoir suffered a precipitous decline in 1986. (Photo: Mekong Committee)

the last moment) and even more difficult to challenge the influence of the companies, technocrats and bureaucrats who have a growing material stake in them. In this way, critics of any already-planned project are forced into the role of "negativists" or "troublemakers" who "reject everything without any positive alternatives to offer." At the same time, governments sometimes find it awkward to do anything but approve the project more or less as planned. This sort of planning tends to lead to a political choice between acrimonious polarization and the repression of all opposition. This, of course, is very much what the planners require.

As the Mekong Committee is well aware, leaving decisions to authoritarian national governments ensures, in many cases, that popular participation will be excluded.<sup>75</sup> This is doubly convenient for Secretariat planners, since it not only keeps people from interfering with dam plans before they are complete, but also provides a convenient excuse for any difficulties that arise later as a result of a lack of participation or knowledge from those affected. One can always say that it was the governments involved, and not the Secretariat, which kept plans secret or prevented participation.

# **Other Problems**

In practice, of course, the Secretariat faces many problems with getting its international plans off the drawing board which do not have to do with participation or the environment. Political distrust is one. Thailand, concerned that its electricity might be cut off in case of hostilities, is reluctant to become overly dependent on power imports from Laos. At the same time, Laos needs guarantees that Thailand will buy the bulk of the electricity it produces before it commits itself to such giant projects.<sup>76</sup>

Questions of inequity also arise. Even from the Secretariat's point of view, the mainstream Pa Mong dam between Laos and Thailand would be more beneficial to the latter than the former.<sup>77</sup> And many Laotian officials are concerned about being transformed into a 'hewer of wood



and drawer of water' for a Thai economy which is swiftly depleting itself of both.<sup>78</sup> According to an April 1989 document prepared by Swedpower, Laos is balking on the originally-planned 600 megawatt power plant at Nam Theun 2 "mainly due to environmental concerns".<sup>79</sup> These allegedly have to do with the large size of the required reservoir, which would drown the area's rare pine forests.<sup>80</sup> Laos also appears more reluctant than Thailand to commit resources to Pa Mong.<sup>81</sup>

None of these problems need prove insurmountable, however. The Nam Ngum dam, which has been exporting electricity to Thailand for two decades even through war and border disputes, provides an example of how political distrust might be overcome. Larger economic powers, meanwhile, can resort to the debt ploy, if necessary, to stifle Laotian protests about being forced to underwrite the environmental costs of Thai economic expansion. Laos' debt-to-exports ratio may reach 32.7 per cent by 1994. One of the few things that could bring that figure down would be electricity exports from a large Nam Theun 2 project.82

# Resistance

What sort of opposition might succeed in opening up the Mekong Committee and its Secretariat to democratic and environmentally-informed criticism? Experience suggests that several levels of resistance are significant.

The first and most important level is that of the village. For many rural Southeast Asians, the loss of subsistence guarantees associated with local land, forests and streams will always be anathema, even if this is done in the name of creating a more globally 'efficient' use of resources. The Secretariat cannot but regard this point of view as an anachronism, an unwillingness to accept that the purported 'greater good of the greater number' in modern economic terms must always come first. Conflicts between the two groups are thus likely to arise again and again.

A second, related level of opposition can be anticipated from national governments eager to defuse popular anti-dam movements of which their political opponents could take advantage. In countries such as Thailand, even purely local opposition to development projects can easily be 'magnified' by coalition governments in this way, much to the frustration of technocracies such as the Secretariat and the Electricity Generating Authority of Thailand. This has probably already happened in Thailand in connection with the Pak Mool and Pa Mong dams.

Another type of resistance is likely to arise from factions within the governments of countries whose resources are being endangered by the globally 'rationalized' patterns of exploitation Mekong Committee projects represent. The current divide within Lao officialdom on how much Thai exploitation of Lao natural resources should be permitted is one example, and is forcing a certain amount of replanning.

A final category of opposition can be generated outside the region, by Western and Japanese environmentalists allied with independent Southeast Asian groups. These groups are capable of challenging, and indeed in the past have challenged, the use of public money from the First World to finance, through the Mekong Committee, the destruction of Indochina's environment. They can thereby help to open up the planning process to scrutiny, more democratic procedures, and possible replacement. The voice of Australian forest activists, for example, is likely to be especially effective in the debate over Nam Theun 2, given the role their country is taking in planning the dam, and Swedish environmentalists will have an important part to play on the Pa Mong issue.

A fuller version of the following notes is available from The Ecologist, Station Road, Sturminster Newton, Dorset, DT10 1BB, U.K.

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# Evolution, Neo-Darwinism and the Paradigm of Science

by

# **Edward Goldsmith**

Neo-Darwinism does not provide a satisfactory explanation for evolution, and however resilient it may prove to criticism, it must eventually give way to a more realistic theory. This can only occur if we abandon the reductionistic and mechanistic Paradigm of Science which Neo-Darwinism so faithfully reflects.

Decades ago, Haldane predicted that facts would soon emerge which would show that natural selection was not an adequate explanation of evolution. Waddington had similar thoughts. "I think", he said at the 1969 Anspach Symposium, *Beyond Reductionism*, that "we are going to see extraordinary changes in our ideas about evolution quite soon."<sup>1</sup> Yet, although the deficiencies of Neo-Darwinism have become increasingly apparent in recent years, and criticism has mounted on almost every front, it remains the official scientific explanation for evolution.

There appear to be two reasons for its continued dominance: the first is that it is the only theory of evolution that is or appears to be fully consistent with the 'Paradigm of Science'. The second is that the critics have not yet provided a coherent alternative to Neo-Darwinism but have rather sought to modify it in different ways so that it might incorporate their various criticisms. Thus Waddington's view of evolution is a long way from that of Huxley, Simpson, Dobzhansky and the other formulators of the Synthetic Theory (the latest version of Neo-Darwinism), yet his ideas — such as that of 'genetic assimilation' which simulates Lamarck's inheritance of acquired characteristics — were formulated in such a way that they could (with a certain stretch of the imagination) be reconciled with the official doctrine.

The criticisms of the Neutralist School (which tried to show that a large proportion of mutations could be regarded as neutral *vis-a-vis* adaptation) also seem to have been incorporated into Neo-Darwinist thinking. Although King and Jukes originally called their famous paper 'Non-Darwinian Evolution', they also seem to have remained firmly within the Darwinian fold.<sup>2</sup> So too have the advocates of Punctuated Equilibrium (Gould, Stanley and Eldridge) although Darwin considered that 'Saltationism' was irreconcilable with his theory.

Until recently, it has only been in France, to my knowledge, that we find a few critics who are willing to abandon Neo-Darwinism and even to trace the ancestry of their ideas on evolution to Lamarck. By contrast, in the English-speaking world, few scientists have openly supported Lamarckism for fear of ridicule, or worse still of being hounded out of the scientific community. On the other hand, in France, Wintrebert was an avowed Neo-Lamarckian. So too was Grassé whose writings are equally ignored in the English-speaking world (except by Arthur Koestler, who quotes a number of passages from them in his superb last book *Janus*<sup>3</sup>). Other interesting authors such as Cuenot, and Vandel, were distinctly Neo-Lamarckian, but then it could be argued that the French intellectual tradition is very different and that the French are notoriously chauvinistic about their own intellectuals. However, even the French Neo-Lamarckian critics have yet to make a clean break with Neo-Darwinism. Their failure to do so is clearly not out of allegiance to Darwin nor to the fathers of Neo-Darwinism — but rather because they are still wedded to the Paradigm of Science itself, which Neo-Darwinism so slavishly reflects.

My feeling, indeed my conviction, is that a realistic and coherent theory of Evolution will be proposed and accepted only once a clean break is made, not only with Neo-Darwinism but also with the sacrosanct Paradigm of Science, which paints a very distorted view of the world.

Let us see why.

# Compartmentalization

First of all, science is divided up into a series of separate disciplines, each one of which specializes in trying to understand specific life processes at different levels of organization and sometimes different aspects of those processes. Because the different disciplines have developed for so long in isolation from each other, they are rarely compatible, and hence today's much vaunted multi-disciplinary research can occur only on a very superficial level.

In order to rationalize, and hence legitimize, what, in effect, is a totally arbitrary division of the subject matter to suit the requirements of scientific method, *the world must be seen to reflect the same arbitrary divisions*, which in reality it does not. On the contrary, the biosphere — or the world of living things — is a single continuum, and the basic feature of living things and processes is both their similarity and their interdependence.

For instance, behaviour, ontogeny and evolution at all levels of organization are very similar processes. They can be shown to be governed by the same general laws, and are also inextricably linked with each other.<sup>4</sup>

Thus to say that a population has evolved is to say that neither its ontogeny nor its behaviour are the same today as they were at some moment in the remote past. To understand evolution is thus to understand ontogeny and behaviour — the processes that have actually undergone change.

It is only because science is compartmentalized in this way that it is possible to maintain the Weissman and Bateson thesis that there is no feedback between behaviour and evolution, a thesis "Empiricism is dead in theory, but not in practice, in so far as the scientific method which consists in the empirical examination of things under controlled laboratory conditions is still the only scientifically acceptable method of acquiring information."

which has recently been further sanctified by Crick, who refers to it as the "central dogma" of molecular biology. According to this dogma, the instructions that determine the evolutionary process are seen as issued blindly without being influenced by their effects on the processes they give rise to, a phenomenon that is unknown in the living world and that is cybernetically impossible in an adaptive process.

Baldwin, Waddington, Schmallhausen, Piaget and a number of other students of evolution, have tried to get round the problem by postulating a feedback mechanism of a type that is compatible with the Paradigm of Neo-Darwinism. But it is only when ontogeny, behaviour and evolution are seen together as parts of a single process that we can begin to understand their vital interrelationship.

The compartmentalization of knowledge also allows students of evolution to make a totally artificial distinction between behaviour occurring *within* the internal environment of an organism and that occurring *outside* it. It is only by insisting on that arbitrary dichotomy that the idea of natural selection, closely associated as it is with the 'struggle for survival' (Darwin suggested the two might be different terms for the same thing) can possibly be postulated as the basic mechanism of evolution.

The notion put forward by Roux that selection occurs at different levels of organization within the internal environment of an organism — even at the level of the cell, the tissue, etc. — was never really accepted, partly, at least, because natural selection and the struggle for survival were difficult to envisage within an internal environment where co-operation and homeostasis were so marked.<sup>5</sup>

The internal factors postulated by a number of writers - including Haldane, von Bertalanffy and Lancelot Law Whyte (with whose name this notion is usually associated) - to complement natural selection by the external environment, were never clearly defined. Waddington prefers to speak of "epigenetic canalization". If we insist on the selection doctrine, as Waddington does, then to say that epigenesis (the development of the embryo within the womb) imposes constraints on the nature of the mutations that prove viable and survive, is to say no more than that genes are subjected not only to selection indirectly, as the phenotype (the living product of the embryological process) which they help to determine struggles for survival in its own external environment (the only type of selection that is really accepted by the Neo-Darwinist doctrine), but also to selection within its internal environment. Yet Waddington would not accept this. Selection within the internal environment was a concept he wished to avoid, largely I am sure, in the interests of maintaining his respectability within the scientific community. In his elaborate model of the evolutionary process, in which he distinguished four different sub-processes, internal selection significantly plays no part.

Waddington, in fact, saw ontogeny (the development of an

individual organism) and phylogeny (the evolution of a species) as being fundamentally different, and consequently subjected to different laws. Ontogenetic development is clearly goal-directed since it leads to the development of a relatively standard phenotype. It is also dynamic, and highly co-ordinated since all the different stages are closely interwoven into what is incontestably a single strategy. It is also highly stable ('homeorhetic' in Waddington's language) since it avoids any diversion from its optimum course (or 'chreod' as he referred to it). Thus it displays precisely all those features that are religiously denied to the evolutionary process, both by Neo-Darwinists in general, and by Waddington himself. If science were not compartmentalized, and if the workings of the living world were accepted, then scientists would have to admit that all life processes are designed according to the same pattern, and it could no longer be maintained that development and evolution are so totally different.

# Empiricism

Because the scientific method is based on empiricist philosophy which regards all knowledge as primarily obtained by random observations - the principle of induction - the world must be seen as organized in a manner that justifies the use of this procedure. Empiricism today is very difficult to reconcile with our knowledge of perception and cognition. Perception is not the objective measuring instrument that it should be if empiricism were to make sense. Our knowledge of behaviour tells us too that the mind at birth is not the tabola rasa which it must be if we are to maintain the myth that all knowledge is the product of observation. The young of even the most modest forms of life are known to be in possession of considerable knowledge at birth. Moreover, knowledge is not just an accumulation of data, it is an organization of data, and organizing activities can go on in the mind without their being triggered off by external stimuli. Thinking, in fact, is just as much a source of knowledge as is observation, which in any case involves thinking, since, as we now know, observation involves interpreting data in the light of the mental model or 'cognitive map' that we have built up in our mind - and which reflects the experience of our species, our culture, and our upbringing.

Empiricism is dead in theory, but not in practice, in so far as the scientific method which consists in the empirical examination of things under controlled laboratory conditions is still the only scientifically acceptable method of acquiring information.

# Induction

But it is not empiricist philosophy alone that has crumbled — so has the associated principle of induction. Popper dealt it a devastating blow and since then it has been finished off by just about all serious epistemologists.

Induction — the random accumulation of data — does not occur in the natural world. No living organism builds up knowledge in this way. But scientists in their laboratories are still supposed to go on performing piecemeal experiments and publishing their results in *Nature*. The knowledge thus derived is not supposed to be built up systematically as part of a co-ordinated strategy, as it is among living things functioning as homeotelic parts of the biosphere.<sup>6</sup> Instead, it is built up or accumulated in a purely random manner — or at least in a manner that is random to the achievement of what should be the scientist's goal — that of developing an effective and coherent model of the world we live in.

# Randomness

To justify this method, the world must be seen as random. Yet, on the contrary, the world's most obvious feature is its extraordinary orderliness. Hence scientists opt for the second best position, which is to insist that it has at least been brought into being by random forces.

The belief in randomness is necessary if scientists are to justify the notion of causation - or rather the view that the world has been brought into being by a random series of physical causes. The metaphysical assumption that evolution is essentially random rather than orderly and goal-directed or teleological, denies what must be one of the most essential features of life processes. Darwin referred to such random 'causes' as 'random variations' - Neo-Darwinists refer to them as 'random mutations', 'random recombinations', random 'genetic drift' or random 'gene flow'. Nor is anything expected to co-ordinate those random changes other than natural selection - a crude mechanistic device, to whose action is attributed the ordering or organization of random changes into complex organisms such as Homo sapiens, and the complex societies into which humans organize themselves. It is an unlikely tale. But it remains a scientific dogma.

### Mechanism

Scientific methodology is the same for the study of animate as well as inanimate things. Scientists have no means of dealing with the phenomena that characterize life and distinguish it from inanimate objects — such as consciousness, understanding, the ability to predict, creativity, imagination, intelligence, purposiveness, dynamism, the maintenance of stability, co-operation, altruism, mutualism, and self-regulation. They have no alternative but to deny that such phenomena exist or to assert that their existence is of a speculative or metaphysical nature.

Living things are assumed to be nothing more than special types of machines. This — the mechanistic assumption — is as unjustified as is that of randomness or of compartmentalization. Indeed scientists who like to point out the substantial differences between humans and all other living things (only a vague 'analogy' is said to obtain between a human and an ape, let alone a human and a fiddler crab) insist how similar are the workings of humans and machines, although it is clear to all that a human is incomparably more like a fiddler crab or even a virus, than to even the most sophisticated machine that our technologists can dream up.

Woodger points out how unjustified is the mechanistic assumption.<sup>7</sup> Scientists cannot seriously state that an animal is a machine, all they can do is admit that an animal must *be taken to be a machine* if it is to be studied by means of scientific method.

But if, in order to apply scientific method, we are forced to make such a preposterous assumption — one that forces us systematically to ignore all those basic features of living things that differentiate them from non-living things — then the scientific method must be radically deficient and the sooner it is abandoned the better.

It is largely so as to paint a purely mechanistic picture of the



Darwin as seen by Punch in 1882.

evolutionary process, and hence so as to make evolution conform to the Paradigm of Science, that scientists have readily accepted the Neo-Darwinist thesis. In terms of that simplistic doctrine, evolution is seen as the outcome of the interaction between two machines — on the one hand, a generator of randomness, and, on the other, a sorting machine that arranges them into two piles: the 'fit' (that is those that are good at propagating their genes) and the unfit (those that are not).

### Causality

This brings us to yet another feature of scientific method — the notion of causality. Every process is seen as caused by some physical event that must precede it in time. This is a strange relic of the Newtonian world-view — a crude and simplistic notion as are the other assumptions of mainstream science.

It is partly at least so as to respect the principle of causation that teleology is taboo, for it would imply that the future is capable of causing things to happen in the present, which is contrary to the dogma.

The insistence on the principle of causality has a number of consequences. It forces scientists to seek a mechanistic or physical explanation for every event. It forces them to see the biosphere as random, since to accept the orderliness of a spatiotemporal process is to accept that it is goal-directed or teleological, which is irreconcilable with the principle of causality. To formulate a non-teleological explanation for the obviously teleological evolutionary process is a remarkable feat, and yet it is one that is essential to Neo-Darwinism. In reality, the principle of competition for survival is highly teleological. Moreover, the behaviour of the 'environment' (a concept which is never clearly defined) is also teleological since it does not select living things in a random manner, but *according to a precise teleological criterion*, that of their 'fitness' or ability to procreate. The principle

of causality also leads scientists to see a system as essentially managed from the outside, rather than being self-regulating. In this way, scientists deny yet another of the basic features of living things.

In Neo-Darwinian terms, the genes are seen as veritable little dictators. Yet they are themselves subject to the control of the chromosomes and the genome, the larger organizations of information (or cybernisms) of which they are part. In reality, the latter desperately try to maintain their stability in the face of disturbances of all kinds, including those that could be brought about by gene mutations, as does the phenotype itself.

In essence, only those gene mutations survive that are compatible with both the optimal structure of the genome as well as that of the phenotype. The implication is that genetic mutations play only a minimal role in evolution — a conclusion that can only be reconciled with Neo-Darwinism by resorting to the most ingenious mental and linguistic conjuring tricks.

Once again, scientists, in order to maintain the myth of 'causality', are made to depict life processes in a totally misleading way, one which effectively obscures those features of living things that distinguish them from inanimate things.

### Passivism

The need to see behaviour as essentially 'stage- managed', and living things as inert mechanistic robot-like devices that only do things when prompted to do so by a manager, the need also to see them as random and hence as incapable of any purposive initiative, causes scientists to insist that they are passive rather than dynamic and creative. Thus individuals are made to evolve by gene mutations selected by their environment, and are considered to do so through no effort of their own. The absurdity of that notion becomes apparent when one considers that the environment also consists largely of other organisms, and that these are thereby expected to play a dynamic role. Yet no one has thought to explain why the organism under consideration should be passive, whereas organisms not under consideration, which are nonetheless part of the anonymous environment, should be active or dynamic. Such embarrassing questions are simply not asked. In reality, such one-way processes are not found in the natural world. Thus, far from dictating evolutionary changes, genes, as already mentioned, are themselves subject to control and modification from the system of which they are part. And while environments select responses from living organisms, those same environments are themselves subject to modification by such responses. Yet neither of these two evident facts have been accepted by those within the Neo-Darwinist fold.

Waddington clumsily got round the first of these specific problems with his canalization theory. He also got round the second by admitting the ability of living things to choose their own environment, as did Elton. But if living organisms can choose to leave one environment in order to move to another, *they are taking an initiative*, and if they can take one initiative why can they not take others, such as those required to change their environment to suit their requirements, in this way avoiding the need to emigrate and to adapt to a strange environment which would probably force them to undergo very much more drastic changes? It should be evident that living things affect their environment in the same way as they are affected by it, that in fact, living processes are circular or two-way rather than uni-directional.

If we accept such multidirectional influences we should then

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no longer accept the Neo-Darwinist thesis that evolutionary change is merely 'selected' by the environment. We would instead, like Piaget, have to see such changes as the result of 'mutual adjustment', and as subject to the constraints imposed by the hereditary endowment of the systems involved as well as those imposed by the larger system of which they are part.<sup>8</sup> Once again, the desire to abide by Neo-Darwinism and the Paradigm of Science has led scientists to deny a further essential feature of life processes: their dynamism.

# Creativity

If scientists refuse to face the fact that living things are dynamic, still more do they refuse to face the equally evident fact that they are creative. Mechanical devices clearly cannot transform themselves into new and more perfected things on their own initiative. Such behaviour, among other objections, would be teleological.

Interestingly enough, it was this refusal to accept the creativity of living things which for a long time led many scientists to insist on the principle of 'pre-formation'. The phenotype was seen to exist in the fertilized egg in a minute form which grew in a simple mechanical way into a foetus and eventually into an adult. The alternative theory — 'epigenesis' — took a long time to be accepted, and is still impossible to explain in the light of the Paradigm of Science.

The refusal to accept the creativity of the evolutionary process has forced those scientists who take the Neo-Darwinist paradigm seriously to provide science fiction explanations for the origin of life. Francis Crick (the co-discoverer with James Watson of the genetic code for which both won Nobel prizes) considers that our complex biosphere could not have evolved (that is by the Neo-Darwinist process of course) in the short time available to it, that is the 3,000,000,000 years since life began. Instead, claims Crick, life must have originally come to earth from some other planet in the form of bacteria sent over in a rocket of some sort. This is no spoof; it is absolutely what Crick says and since his thesis is formulated in the appropriate 'scientific' language, it is not apparently regarded in any way as being incompatible with the Paradigm of Science. Indeed it may even be essential to postulate such a thesis if the Neo-Darwinist thesis is to be sustained and if the dynamic and creative features of living processes are to be denied.

It is indeed ironic that scientists should regard it as more scientific to trace the ancestry of living things on our planet to bacteria which arrived in a rocket three thousand million years ago than to admit that living processes such as evolution are goaldirected, dynamic and creative.

### Reductionism

Another feature of the scientific method is that it is reductionist or 'analytical', to use the term preferred by scientists. Thus, scientists seek to understand the nature of matter by breaking it up into its component parts for separate examination, preferably under controlled laboratory conditions.

To rationalize that approach, scientists try to make us believe that the world is made up of a multitude of discrete, mechanistic units, the way they are organized being of no consequence for understanding how they function — hence the inference is that they can be understood in isolation from the system of which they are part, and at the same time, that they can be shifted about, changed and transformed at the whim of their human manager.

Thus the gene comprised of three DNA bases is taken to be the atom of hereditary information, just as the 'reflex' is the atom of behaviour, the 'sense-datum' the atom of perception, the 'engram' the atom of memory and the 'bit' the atom of information — an approach that is now fortunately under attack.

With regard to the gene, it is now generally admitted that it rarely acts on its own, in isolation from the rest of the genotype.<sup>9</sup> Indeed phenotypic changes are now seen as being determined by the joint action of many genes (polygenism), while at the same time each gene tends to contribute to changes affecting many different features of the phenotype (pleotropism).

Lewontin even suggests that the process of inheritance would be better understood if we developed a "geneless" theory of heredity.<sup>10</sup> The chromosome, rather than the gene, he feels is the correct unit of study. It would be very much more realistic of course to regard the genome as the unit, better still the gene-pool, and even better still the pattern of information (cybernism) constituted by all the information that is organized within an ecosystem and on the basis of which its behaviour is mediated.

The reductionist approach makes it impossible to understand life since one of the most important features of living processes is their hierarchical organization. This tends to be ignored by scientists, or, if admitted, its implications are denied or ignored since the very notion of organization is in effect incompatible with the reductionistic approach embodied in the Paradigm of Science. Indeed, how can the atoms of behaviour be studied in controlled laboratory conditions, hence in isolation from each other, when they are organized and hence subject to the constraints of the whole? How can one explain the development of organization in mechanistic terms? Selection may sort individuals out into two categories, the fit and the unfit, but how can it cause them to organize themselves into larger entities? How can one quantify organization save in term of Shannon and Weaver's quite inappropriate concept of information?

The failure to accept the hierarchical nature of the biosphere leads scientists studying evolution to insist that selection only occurs at the level of the individual. Evolutionary changes affecting populations as a whole are seen by Neo-Darwinists as exclusively the result of changes occurring to their individual members. Thus they deny that adaptation (by selection or whatever other processes may be involved) occurs at any other level of organization, whether it be that of the cell, the organ, the family, the community, the population, the ecosystem or the biosphere itself.

But what is so special about the individual? Why should all evolutionary change within the vast hierarchy of the biosphere originate at that particular level rather than at any other? There is no evidence of any kind to justify such a dogma. If we were to face the principle of the unity of life and the similarity of all life processes, we would realize that the mutual adjustment of systems to their specific environment within the constraints imposed on them by the larger systems of which they are part, must occur at all levels of organization within the hierarchy of the biosphere.

To think otherwise implies that systems are incapable of mutual adjustment, and must be controlled from the outside by forces occurring at other levels of the hierarchy. Such a tenet is contrary to the principle of self-regulation, and suggests that such systems are passive rather than dynamic, and robot-like rather than life-like. It is only in terms of the outdated Paradigm of Science that it is possible to maintain such a view of the process of adjustment or adaptation.

It is only when one recognizes the hierarchical nature of the

biosphere and of its component systems and sub-systems that one realizes what is the true nature of the environment, which in terms of the Neo-Darwinist thesis, is supposed to do the selecting. I repeat that Neo-Darwinists have never defined the environment; it is just something that is 'out there'. Yet, they attribute to it the capacity to select and therefore to perform a task requiring considerable discrimination. Thus we find the environment selecting for all sorts of different qualities other than the original quality of fitness. Waddington talks of selection for flexibility and canalization. One also reads of selection for teleonomic behaviour and selection for co-operative behaviour. Selection becomes an almost omnipotent force capable of doing virtually anything, in particular of causing life processes to adapt with incredible subtlety to almost any conditions. Selection, as Grassé suggested, has become a sort of God, a totally undefined mystical force, an environmental super-entelechy or super-élan vital.11

Once the hierarchical nature of the biosphere is understood, the most important principle to emerge is that the environment of any system, together with the system itself, *constitute the larger system*, *of which the system is but a part*. This larger system is by definition a self-regulating unit of behaviour within the biosphere, and is not the random and anonymous environment of the Neo-Darwinists.

Largely through the work of Paul Weiss we also know that systems at all levels of organization 'control' or 'co-ordinate' their constituent parts, and thus assure that they fulfil those differentiated functions that are required to maintain the integrity and stability of the larger systems of which they are part.<sup>12</sup> The larger system (i.e. the environment) thus exerts pressure on the individual systems that comprise it to assure that they 'fit in', not that they are 'fit' in the individualist sense of the term.

Those that 'refuse' to fit in, of course, are eliminated or 'selected out' by the larger system.

#### Progress

One of the basic assumptions of the Paradigm of Science is the notion of progress. Evolution has always been seen as a process of change from a low level to a high level of organization, a move in the direction of increasing complexity, however teleological this might sound. The concept of progress was modelled on the fashionable late-eighteenth and nineteenth century notion of social progress, and it actually preceded the theory of evolution. "Progress in the organic world", Erasmus Darwin, Charles Darwin's grandfather wrote, "is analogous to the improving excellence observable in every part of the creation such as in the progressive increasing in the solid or habitable parts of the earth from water and in the progressive increase in the wisdom and happiness of its inhabitants."13 Progress is clearly not seen as a random change but rather as a highly teleological one. Moreover, the idea of progress leads one to see living organisms as geared to perpetual change, in particular in the direction of ever increasing complexity.

Yet this movement masks another basic feature of living processes, which is their highly conservative nature. Their goal is not change nor increased complexity, but *increased stability*, the homeostasis of Cannon and now of Lovelock. That the achievement of stability is the overriding force becomes clear when one considers those life processes which occur within the internal environment. It is less apparent when one refuses to face the essential similarity of all life processes, and postulates — on the basis of processes occurring in the external environment in isolation from all others — that they alone provide the model for evolutionary change. In fact, the ethologist Thorpe has noted that the problem for Neo-Darwinists is as much to explain how little living matter has changed over hundreds of millions of years as it is to explain the process of evolution itself. In terms of the Neo-Darwinist paradigm, it should be inexplicable that the basic raw materials of living things, protein and DNA, have remained unchanged for aeons — that the basic features of eukaryotic cells (cells with nuclei) have remained very much the same since they first developed some thousand million years ago.<sup>14</sup>

Even that archpriest of science, Monod, regarded "l'invariance" as one of the three basic features of living things.15 Von Bertalanffy also regarded the influence that the past exerts on living things to be one of their two main features — the other being the hierarchical nature of organization. If one examines those human societies that are capable of self-regulatory and adaptive behaviour (that is tribal societies living within their natural environment), it becomes clear that rather than being geared to perpetual change as is our disintegrated, atomized society, they are, on the contrary, geared to the maintenance of stability, the preservation of their social structure, cultural pattern and natural environment. Such societies survive, not because they produce more offspring than their neighbours but because they are organized in that way that assures the maintenance of the most stable relationship possible with their specific environment. Stability is undoubtedly the goal of living organisms and their ability to maintain their stability in the face of change is perhaps their most impressive achievement. It was that feature of living things that led Dreisch to reject the mechanistic thesis and to postulate his particular brand of vitalism - he felt that one could not explain the extraordinary ability of living things to maintain their integrity in the face of external disturbances, without postulating some sort of life-principle.

# Organicism

The trouble with vitalism is that it does not tell us very much. To have any meaning such terms most be related functionally to the other constituents of the living world.

The modern variant of vitalism, is 'organicism'. Organicists maintain that when processes reach a particular level of organization, they develop qualities that were not previously present, a concept first formulated by Lloyd Morgan and often referred to as 'emergence'.

Organicists thereby hold that it is the level of organization that we associate with living processes that confers on them their specific features — those that distinguish them from inanimate objects. Organicism is an essential notion, one that underlies the writings of Alfred North Whitehead, Paul Weiss, Arthur Koestler, Ludwig Von Bertalanffy, Jean Piaget and even Conrad Waddington.

The Neo-Darwinist thesis, however, utterly fails to provide an explanation for the development of organization. If inanimate matter like specks of dust, billiard balls or pebbles on a beach were 'selected', they could indeed be arranged into two specific piles. Those heaped in one of the piles could, for specific purposes, be labelled as 'fitter' than the others, although fitness could no longer be defined in terms of differential reproduction, since such inanimate objects cannot reproduce themselves.

But such matter, as already mentioned, could not be made by selection to organize itself into ever more complex and sophisticated forms. Selection, in fact, does not explain organization, *it*  assumes it. In that respect, Neo-Darwinism totally begs the question. Selection, or more precisely what in the real world most closely resembles 'selection', that is mutual adjustment, does not explain evolution. It is on the contrary simply one of the mechanisms developed by evolution, one that is performed with ever greater precision and discrimination as living things become more complex and more sophisticated. Neo-Darwinists have got the whole thing the wrong way round.

### The Paradigm of Science

This brings us to the crux of the matter. Since Darwin's time and, in particular, since the rediscovery of Mendel's work "the emphasis", as Waddington states, "has been placed on the *discreteness* of *individual genes*, the *randomness* and *non-relational nature* of the mutation process, and the unimportance of the reaction of the *organism* to its environment."<sup>16</sup> This is a means of rationalizing the Paradigm of Science.

It is because Neo-Darwinists conceive of evolution as proceeding in this reductionist and mechanistic manner that Neo-Darwinian theory has gained such wide acceptance among scientists. It is because Neo-Darwinism so admirably fits in with the Paradigm of Science, not because it provides an accurate picture of the real processes involved, that it is today the official doctrine of science.

It is also because Lamarckism and the Neo-Lamarckism of certain French and Swiss students of evolution such as Bergson, Wintrebert, Guenot, Piaget and Grassé poorly satisfy the requirement of the Paradigm of Science that such scientists are rejected with indignation, if not derision. There is another factor: the Paradigm of Science provides, in its turn, a rationalization and hence a legitimization of the Paradigm of Industrialism which is, in effect, the religion of the industrial society in which we live.

Indeed it suits the purposes of our economists, technologists and politicians to pretend that living organisms are machines, since the benefits provided by the state and the formal economy cater above all for humanity's mechanistic needs. Such benefits are quantifiable and must be for both commercial and electoral reasons. They are atomistic which they must be if they are to be quantifiable, and they cater for humanity's most rudimentary needs, leaving unsatisfied those that are more specifically human, in particular social, ecological, aesthetic and spiritual needs. To admit the existence of the latter needs, worse still to show that traditional vernacular cultures were perfectly designed to satisfy them, is to expose the terrible shortcomings of the modern State and the formal economy and must go a long way towards revealing that it is those two aberrant institutions that are ultimately responsible for the terrible problems we face today.

### Conclusion

It is the thesis of this article that in order to understand evolution one must reject the Neo-Darwinist thesis and indeed the Paradigm of Science itself that this thesis so faithfully reflects.

We, must also see evolution and life processes in general *as* displaying precisely the opposite features to those that they are held to display by Neo-Darwinists and mainstream scientists in general.

Rather than being atomistic they are highly organized and hierarchical; rather than being mechanistic and hence passive and non-creative, they are *living*, *dynamic* and *creative*; rather than being random they are *ordered* and *highly purposive*; rather than being geared to perpetual flux in the direction of some mysterious undefined goal which is usually referred to as 'progress', they are *highly conservative* and seek at all costs to preserve their *stability*. Rather than being brought about by some single physical event or 'cause' that preceded them in time and hence managed by some atomistic, mechanical and external force, they are *self-regulating* and subject to the influence of their past and of the *hierarchy of spatio-temporal systems of which they are part*. Rather than being explicable in quantitative terms, which assumes their atomistic and mechanistic nature, they can only be understood in the qualitative language appropriate for expressing their highly sophisticated capacity for *creativity*, *improvisation* and *innovation*.

Of course, to adopt such a view of life processes and of evolution, the overall life process, would, among many other things, force us to reconsider very radically our attitude to the living world, and what we are doing to it.

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# The Politics of Deforestation

THE FATE OF THE FOREST: Developers, Destroyers and Defenders of the Amazon, by Suzanna Hecht and Alexander Cockburn, Verso, London, 1989, £16.95, (hb), 266pp.

Since the first white explorers set foot on its soil in the 1490s, Brazilian Amazonia has exerted an extraordinarily rich hold on Western imagination; as the land of El Dorado and of fierce female warriors. Travellers of the eighteenth and nineteenth centuries, saw the region as "the last unwritten page of Genesis", virgin forest untouched by (destructive) human hand.

But, ask Hecht and Cockburn, "If a region is denied its true history how can its future honestly be discussed?" The authors therefore attempt to let the Amazon and its inhabitants — usually relegated to the role of primitive exotics — tell their own story. Combining the political, economic, mythological and ecological strands of a violent and complex past with much original research, they offer both a history of Brazil's Amazon rainforest and recommendations on what must and can be done to save the region from impending obliteration.

Hecht and Cockburn show that the current ecological degradation and social convulsions are "merely the latest surge in a long epic of annihilation" characterized by the plundering of its abundant natural resources, and the exploitation of labour through slavery and debt peonage. However, it was not until the early 1970s that the forest began to be destroyed on a largescale, and the previous struggle of the inhabitants of the forest against exploitative labour relations was transformed into a fight to save the land itself.

The authors claim that the factors propelling deforestation can be directly traced to the US-backed military coup of 1964, and the Generals' decision to open up the region to investment and colonization, thus consolidating the country's borders and integrating the Amazon into Brazilian national life. Massive financial incentives offered as bait to entrepreneurs from the south were eagerly grasped, precipitating an influx of tens of thousands of speculators and migrants in their wake, and setting off the biggest land boom in Brazil's history.

Several common misconceptions about the causes of deforestation in Amazonia are firmly refuted. For example, although clearance for pasture has accounted for 85 per cent of deforestation, this is chiefly owing to the land and mineral rights which can be claimed under pasture, rather than the 'hamburger connection', or international capital being invested in ranching. Since the sixties, battles over land claims, rocketing inflation, enormous mineral and timber wealth, spiralling land prices, avoidance of expropriation for agrarian reform and the Government's infrastructural development policies, have all contributed to the "context of frenzied land speculation", which continues today. Hecht and Cockburn insist that the impact of the multinationals is secondary: exacerbating rather than creating the process of destruction.

Brazil's decimation of its Amazonian forests - around 10 per cent have been lost — has been primarily viewed by the outside world as an environmental catastrophe, with the struggles of the two to three million people who live within the forest of lesser or no importance. The assassination of Chico Mendes, their most prominent leader, at the end of 1988, coincided with the awakening of Western mass consciousness to the global environmental threat. Mendes became the international environmental movement's first martyra "St Francis of the forest", in the authors' ironic phrase - when in fact he was a very radical union organizer and one of the founders of the Workers' Party in Acre. (This depoliticization is likely to be particularly glaring in the Hollywood movie being made about Mendes' life.)

One of the most important aspects of the book is that Hecht and Cockburn fully integrate political, cultural and economic questions into an ecological context, showing that this is a battle for land and resources between those who make a sustainable living from the trees and those who profit from the forest's destruction. Contrary to the conventional perception of the forests as virgin wilderness, occupied only by a few backward forest people, Hecht and Cockburn emphasize that the Amazon is the result of millennia of human use.

They assess the various solutions to the problem proposed by those from outside the Amazon — national parks, debt swaps, the 'internationalization' of the region ---and conclude that these solutions may preserve the trees, but they would further lock the forest people who depend on the trees for their livelihood and culture into their historic position of servitude and poverty. Any proposed solution which addresses the problem from a purely conservationist approach cannot work because this ignores the real nature of deforestation and biological degradation, which is political. This recognition leads inevitably to the position which underlies The Fate of the Forest, and Hecht's work in general: social justice is inseparable from ecological protection. If the rainforest is to be saved, the Indians, rubber tappers, peasants and fisherfolk who inhabit it --- the "defenders" of the title - must be supported in their resistance.

Hecht and Cockburn endorse the National Rubber Tappers Council's 'Forest Peoples' Manifesto' (which calls for the creation of 'extractive reserves') as proposing the only economically and ecologically viable form of land use, although they warn that unless the development of extractive reserves is elaborated at a local level — not by planners and politicians from Brasilia or overseas - they will fail. Indian activist Ailton Krenak is interviewed in an appendix: "The property of the people cannot be commercialized. An extractive reserve is not an exchange item ... It is a good that belongs to the Brazilian nation, and people will live in these reserves with the expectation of preserving them for future generations."

The Fate of the Forest manages to be both academic and popular. Written in a slightly formal, always elegant style, it lacks some of the caustic passion of Cockburn's journalism, but the book's sheer scope alone makes it an essential read for anyone with an interest in the Amazon.

Kim Hendry

Kim Hendry is a freelance journalist.

# **Ecological Marxism**

ECOLOGICAL ECONOMICS, by Juan Martinez-Alier, Blackwell, Oxford, 1989, £29.95 (hb).

Nearly all the major themes of the modern debate about economics and the environment were considered in some depth by thinkers in the late nineteenth or early twentieth century. In the 1880s, Clausius first applied his concept of entropy to the economic process.Podolinsky and Sacher pioneered the concept of energy productivity in the sense of an energy output/input ratio. Geddes and Adams sought to relate this ratio to historical periods of human civilization. In 1902, Pfaundler produced one of the first realistic studies of the carrying capacity of the Earth. In 1922, Frederick Soddy mounted a thorough ecological critique of economic growth.

"One of my most persistent questions", writes Martinez-Alier, "is why the recognition of the school of ecological economics which has objectively existed since the 1880s, is unacknowledged even by its own members?" One reason for this is that these authors all accounted their economics in physical units, especially in those of energy, instead of monetary units.

The price system is the central nervous system of conventional economics, and rejecting its primacy was quite enough to relegate those who did so to the outer darkness of the discipline.

Such an approach implies the rejection of the whole principle of commensurability. Martinez-Alier discusses this with regard to the work of Otto Neurath:

> "A capitalist factory would decide which of two production plans to adopt by comparing the net amount of money it would make from each. Production plans for the economy, however, could not be based on a common unit of measurement. How could we compare, unless in different units, the protection of human labour with the protection of coal deposits?

Rejection of commensurability through prices also implies rejection of the market as the allocative mechanism, which in turn implies a predominantly planned economy, and so Martinez-Alier's favoured economic system is a "kind of ecological Marxism". In his introduction, Martinez-Alier states: "Universal egalitarian ecological utopianism is one 'appropriate ideology' for the poor people of the world (against both the ideologies of 'waiting for economic growth while preserving inequality' and 'to each country its adaptive, appropriate technology')".

However, ecological Marxism is not an inevitable outcome of an ecological economic analysis. Indeed, several of Martinez-Alier's authors fall into the trap of Social Darwinism, which rationalizes human inequality as the outcome of natural selection rather than human or class conflict. Martinez-Alier repeatedly criticizes this tendency among the early ecological economists, and champions those, like Josef Popper-Lynkeus or Karl Ballod-Atlanticus, who reject it.

Martinez-Alier is at pains to stress the 'rational-empiricist' nature of his ecological utopianism. He has no time for a holistic approach, "whatever irrationalities or mysteries that word might hide". He calls Rudolf Steiner a quack and Fritjof Capra a "Californian mystic", and utterly rejects the "irrational, apocalyptic 'ecologism' in which 'back to nature' is taken to mean 'back to God and religion'."

Martinez-Alier appears ambivalent with regards to peasant farming. Although he states that modern agriculture involves "farming with petroleum", and stresses "the indisputable superiority of traditional peasant agriculture for the conservation of fossil fuels", such agriculture offends his egalitarian instincts. Thus, in his analysis of Chinese agriculture he is led to conclude that: "The substitution of the work given by humans and animals, or the organic fertilizer they provide, and of the fuel they collect from forests and agricultural byproducts, would not put an appreciably greater burden on world fossil-fuel reserves." In fact, it would add 0.1 ton per person per year to primary energy consumption which may, as Martinez-Alier states, be small compared to the five tons per person per year average in industrial countries, but which is still a very significant absolute increase in energy consumption when applied to 20 per cent of the world's population. It would surely be more consistent with the books' general message to suggest that the agricultural way forward now in both North and South is to seek to develop high-yield organic farming which would achieve both environmental and egalitarian objectives.

In spite of its faults this is a most valuable book. It rescues from oblivion thinkers who have an enormous amount to offer in the context of the environmental crisis. It gives detailed insights into physical accounting procedures in contrast to the still chrematistic (money-based) nature not only of economics in general but of environmental economics too (see, for example, the recently published 'Pearce Report'). It points the way to a much broader, interdisciplinary basis for economics in line with much of the thrust of institutional, evolutionary or socio-economics, and with the fledgling Living Economy school.

Finally, the book has a welcome and explicit political dimension. One does not have to be an ecological Marxist to be convinced that ultimately the decisions to save or sacrifice the environment are political in nature.

#### Paul Ekins

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# Learning Long-Term Reactions

NEW WORLD NEW MIND: Changing the Way We Think to Save our Future, by Robert Ornstein and Paul Ehrlich, Methuen, London, 1989, £13.99 (hb), 301pp.

Reading the early part of this book, a childhood memory came to mind with great clarity. When I was in my mid-teens, full of an exciting new awareness of my surroundings, my father would sometimes smile and say that there was nothing new under the sun. To me, thinking literally,

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Further information and sample copies are available from Springer-Verlag, 8 Alexandra Rd., London SW19 7JZ, England this was absurd. The world was full of things, from nuclear weapons to electric clocks, that were of recent invention; did the Ancient Greeks have these? But what he meant, and what is Ornstein and Ehrlich's central concern, was that the mind of man has not changed throughout its history, despite the enormous changes that it has wrought. Mind development has not accompanied material development. Our ten thousand year old mind cannot cope with the world we have created, and unless we address that, we are in serious trouble.

Evolution favoured our ancestors with limited perceptions and quick reflexes. We are no exception — although our brains are proportionately larger than those of any other vertebrate, they were developed for survival. By 35,000 B.C. our brains had stopped evolving. Almost all our biological evolution occurred long before we became the most successful animal on the he planet. The brain that evolved for our survival on the East African plains took us to the moon, still responding fast, still not taking a lot of notice of the wider picture.

Evolutionary changes happen over millions of generations. But enormous cultural changes, such as the universal private car, television, the possibility of mass destruction, can take place in one or two generations.

The authors quote the boiled frog syndrome — if a frog is put in a saucepan of water and the temperature raised slowly enough, the frog will not notice and will eventually die, having made no attempt to escape. Similarly, humanity seems unable to detect the gradual, lethal trends by which population and economic expansion will boil the planet.

This is an extremely deft, insightful statement of our contemporary predicament, with evidence upon evidence, example upon example. Seldom understated, it is true, and occasionally in need of a firmer editor, but an analysis which strikes the chord of obvious accuracy. What is the solution? Firstly, suggest Ornstein and Ehrlich, education to improve the critical accuracy of our thinking and decisionmaking, and centering on adaptability to an ever-increasing rate of change. Anthropology and ecology should be taught more widely to emphasize the fragility of our modern world and our modern society. Agriculture, climate and energy should receive more emphasis, as should evolutionary biology and cultural diversity. Economics, the limits to growth and the limits of the planet would be central. "The key goal of a new curriculum will be to encourage students to think about the nature of their own minds and the limitations on their own thinking, about underlying physical and biological principles that govern the world, and about long-term trends in that world."

More immediately, the media, govern-

ment departments, and institutions can all contribute to a new awareness. But they all have to be persuaded to overcome their in-built tendencies to sensationalism, their preoccupation with the short-term, simple greed, and (most insidious) an assumption and belief that all 'progress' is desirable and irreversible, that what we do today is inevitably better than what we did yesterday. Science and technology must progress despite the possible consequences; GDP must increase. These fallacies should be pointed out as frequently as possible.

We now have available to us an unparalleled amount of information about the world, its realities and fragilities. We have to consciously alter our traditional preconceptions in order to accurately understand and evaluate this information.

This book offers a new analysis and understanding of the human predicament, and if the approaches to developing a new consciousness are not new, they are unarguably sound. It could sometimes be accused of over-simplification, but its central insights are most valuable, and it is recommended.

John Valentine

John Valentine is a stonemason by trade, working in building restoration in London. He is author of Power Corrupts (with Hilary Bacon, 1981) and Atomic Crossroads (1985).

# A Greyer Shade of Green

THINKING GREEN, edited by Michael Allaby, Barrie and Jenkins, London, 1989, £14.95 (hb).

GUIDE TO GAIA, by Michael Allaby, Macdonald Optima, London, 1989, £6.99 (pb).

The prolific Michael Allaby is back again with "an anthology of essential ecological writing", and a layperson's introduction to the Gaia hypothesis.

The choice of writings which Allaby includes in his anthology shows that he is at odds with many of the fundamental principles and analyses of the Green Movement. He ignores the best radical green analyses of global exploitation and domination. No mention is given to the critiques of, for example, Ivan Illich and John McKnight on bureaucratization and professionalization; Leopold Kohr and Kirkpatrick Sale on centralization; and Carolyn Merchant and Elizabeth Dodson Gray on the links between patriarchy and other forms of domination.

The piece by Fritz Schumacher on Buddhist economics, which has undoubtedly

influenced large numbers of people, is included, but this has now been surpassed by Herman Daly's writings on a steadystate economy (which identify possible mechanisms, unlike the piece Allaby includes from J.S. Mill). The anthology contains no critiques of the sticking plaster environmental economics of cost-benefit analysis and 'polluter must pay' taxes, and ignores some superb writings on the notion of the 'technofix', for example, Eugene Schwartz's Overskill and Kenneth Watt's The Titanic Effect. Allaby instead finds room in Thinking Green for a derisory piece on coal and nuclear power from the London Daily Telegraph, the standard of which can be judged by its claim that "it is easy to store nuclear waste", and that nuclear power is "inherently safe".

A green anthology should surely have found space for the proposals for a political-administrative restructuring around 'bioregions', on which much work is being done in North America. There is a particularly exciting literature on other technological alternatives, for example, Wes Jackson and Bill Mollison on ecofarming, Malcolm Wells on 'gentle architecture' and numerous writers on solar energy.

Finally, for a book that purports to 'look again' at environmentalist literature, it is indeed remarkable that there is so little on personal lifestyle choices and environmental ethics. Robert Waller's 'Be Human or Die', is included, but it only represents the surface of a deep well of literature associated with writers such as John Cobb, Richard Routley, Arne Naess and J. Baird Callicott. The links between green values and green political action has also generated some significant articles, such as Sigmund Kvaloy's 'Ecophilosophy and Ecopolitics'.

Some of the most profound ecophilosophies can be found in the wisdom of tribal peoples. Writings from anthropologists such as Marshall Sahlins and Colin Turnbull, however, are ignored by Allaby. On the issue of 'Third World' maldevelopment, it would have been appropriate to have given the platform over to people like Anil Agarwal and Jimoh Omo-Fadaka rather than Western ex-prime ministers such as Brandt and Brundtland.

Allaby gives some space to the pressures on the environment from population and technological choice, though a third variable, personal consumption levels, is buried in the extract from *Blueprint for Survival* rather than given the coverage it deserves with, for example, an extract from Ted Trainer's *Abandon Affluence*. Most importantly, Allaby fails to show the interaction between all three, something superbly achieved in that truly 'essential' piece of ecological writing, Paul Ehrlich and John Holdren's critique of 'One-dimensional Ecology' (published in *The Ecologist* when Allaby was an editor).

# BOOKS DIGEST

In Guide to Gaia, Allaby sets himself the daunting task of outlining, "in plain, every-day English", the history of the Earth, the development of its animate and inanimate phenomena and their interdependence and interrelationships, in support of the idea that the Earth itself is a living organism, Gaia. Guide to Gaia is acknowledged as a tribute to James Lovelock, who developed the Gaia hypothesis, and Lovelock's dismissal of much environmental and social concern as nothing but "global hypochondria", and his belief that our problems are "no more than growing pains", appears similar to Allaby's own viewpoint.

Allaby attacks the environmental movement, likening it to a latter-day Miltonian cult, which believes individuals to be clones of Adam and Eve, fallen from grace "through vanity and desire for knowledge". The concerned environmentalist is a quasi-religious guilt-ridden freak, who sees "our desire to liberate ourselves from the constraints imposed by our environment, to 'dominate nature'... no more than egotism, the arrogant defiance of Satan".

Some space is given to dealing with a few misconceptions and criticisms of the Gaia hypothesis. Allaby refutes the accusation that the hypothesis is teleological, yet he states: "It may be that the planet is preparing itself . . . for the increasing output of the Sun". He also claims that "most human actions can be explained fully only if such final causes are taken into account because when you or I perform an act usually we do so for a reason, that is, to achieve some objective." Surely the perception of human beings as wholly rational creatures was abandoned long ago? Allaby might explain why his example of himself building a bookshelf is basically different from, say, a beaver building a dam.

Allaby firmly believes in the technofix. He implies that inter-planetary travel will solve our problems. That humans will colonize other galaxies, travelling through space in capsules. This he says is the role for us humans: the 'seeds' of the earth, dispersing, to grow on fresh planets. He argues that the only alternative to the excess burning of fossil fuels that can provide "the amount of energy we need" is nuclear power. Allaby believes that "energy conservation measures... are difficult, and not necessarily cheap, to implement" and argues that this blighted source of energy is easy and affordable, at least for the richer countries. If the richer countries used more nuclear power, then poorer countries would be able to continue to burn fossil fuels. This is quite simply ludicrous.

Sandy Irvine and Alec Ponton

Sandy Irvine and Alec Ponton are co-authors of A Green Manifesto (Optima, 1989). Books which are covered in the digest may be given full-length reviews in forthcoming issues.

 CLEARING THE AIR: A Global Agenda, by Hilary F. French, Worldwatch Paper 94, Worldwatch Institute, Washington, January 1990, \$4/£2.50, 54pp. Available in the UK from Worthyvale Manor, Camelford, Cornwall, PL32 9TT.

According to French, more that a billion people live in communities that do not meet WHO air quality standards and lakes and streams and forests are dying because of acid rain. French declares that the conventional technological solutions to the problem are hopelessly inadequate and that: "Restoring air quality depends on restructuring the energy, transportation, and industrial systems that generate the pollutants."

 ECOLOGICAL ENGINEERING: An Introduction to Ecotechnology, edited by William J. Mitsch and Sven Erik Jørgensen, Wiley Interscience, New York, 1989, 472pp.

A text book for applied ecologists and "environmental and natural resource managers". The editors define ecological engineering and ecotechnology as "the design of human society with its natural environment for the benefit of both". The book examines the perspectives of this new discipline, looks at examples of it in practice in waste and water resource management, and explores its economic, ecological and educational aspects.

 ANIMAL EXPERIMENTATION: The Consensus Changes, edited by Gill Langley, Macmillan, Basingstoke, 1989, 260pp.

A wide-ranging overview on the subject which addresses questions of practice and philosophy, policy and politics. The contributors are internationally recognized authorities in fields which range from pain in animals to animal rights philosophy, and from human-animal relations to the refinement of experimental methods.

• THE THREATENING DESERT: *Controlling Desertification*, by Alan Grainger, Earthscan, London, £9.95 (pb), 369pp.

This comprehensive book identifies overcultivation, overgrazing, poor irrigation management and deforestation as the four main direct causes of desertification. Grainger quotes estimates that a quarter of the Earth's land surface already suffers from at least moderate desertification, with an area of agricultural land the size of Senegal being desertified every year.

 OZONE DEPLETION: Health and Environmental Consequences, edited by Robin Russell Jones and Tom Wigley, Wiley, Chichester, West Sussex, 1989, £35 (hb), 280pp.

These are the edited proceedings of an international conference held in London in November 1988 and sponsored by a number of organizations including Friends of the Earth UK. Papers are included from the leading scientific and medical authorities on ozone and global warming as well as representatives from the environmental, political and commercial lobbies, making this the best detailed overview available on the subject.

 THE GREENHOUSE EFFECT AND UK AGRICULTURE, edited by R.M. Bennet, Centre for Agricultural Strategy, Reading, 1989, 144pp.

The proceedings of a conference of agricultural and climatological researchers held in July 1989. The papers discuss the Government's response to the Greenhouse problem, the effects of climate change upon crop yield and animal production, and its implications for fertilizer and agrochemical use.

• HOTHOUSE EARTH: *The Greenhouse Effect and Gaia*, by John Gribbin, Bantam, London, 1990, £14.95 (hb), 273pp.

A further addition to the current deluge of books explaining the causes and consequences of climate change. Gribbin explains the complicated science of the biosphere in clear and accurate language. He concludes with a "crumb of comfort": "(if) human society collapses under the strain (of climate change), there will still be life on Earth, and conditions may settle down to something resembling the climatically lopsided but biologically flourishing planet of five to ten million years ago."

Patrick McCully



# Shell and Eucalyptus Plantations

Dear Sir,

We were sorry to see the article in your January/February issue on commercial tree plantations in Thailand by Larry Lohmann which gives a totally false and misleading impression of Shell's forestry activities. May we please be allowed to set the record straight?

The project, which, we must emphasise, is still in the planning stage, is being developed fully in accordance with the Government's policy which is to encourage forestry plantations in order to protect, not destroy, the natural forests. Trees would only be planted on land that has already been denuded. We have said clearly that we will not be cutting down any of the remaining forest trees in the area.

We categorically deny that Shell Thailand would force people to sell their land. The company will only acquire the use of the land from those who agree to surrender their rights voluntarily. Those who do not wish to will of course have the right to remain where they are and to continue to make their living off their land. However, by providing new jobs, housing and education and health facilities, the project will bring considerable economic and social benefits to the community.

The article is critical of Eucalyptus but there is no evidence that planting fast growing species, including suitable species of Eucalyptus, in the right place for the appropriate purpose causes harm. We agree that there have been problems with some Eucalyptus plantations, but with sound management, proper research and careful monitoring of the plantation development, we believe that these can be avoided.

We recognise that there are valid concerns over the development of commercial tree plantations and it is right that these should be aired. In the development of our forestry business we have certainly tried hard to listen to, and take account of, expert opinion. Indeed, in the case of the Thailand project a study is currently being carried out by the International Institute for Environment and Development, an independent and highly reputable scientific organisation, in order to make certain that the environmental aspects are fully taken into account.

It would be a great pity if ill-informed and destructive criticism were to slow the development of sensitively planned and properly managed forestry plantations which will make a major contribution to solving some of the world's pressing economic and environmental problems.

Yours truly,

M. Le O. Herbert

for Shell International Petroleum Company Limited Shell Centre London SE1 7NA

Readers might like to know that since Larry Lohmann's article went to press, the following events have occurred:

• On 22 January, 156 employees of the Soon Hua Seng conglomerate were arrested for encroaching on and damaging 64 km<sup>2</sup> of forest reserve in Chachoengsao, where they were clearing land to plant eucalyptus.

A week later, following the seizure of illegally-cut logs, bulldozers and tractors at another site where Soon Hua Seng had hoped to plant eucalyptus, formal charges of forest encroachment were filed against the company's president, Senator Kitti Damnerncharnwanit, and the company's eucalyptus planting license revoked. Witnesses reported that the company's emplovees at the second site had been "heavily armed", equipped with radio equipment, and that they had "burned and buried" trees uprooted from the forested area. Soon Hua Seng had 'bought' rights to some of the land nearby from local villagers. These villagers had in fact no legal title to this land, being allowed under the law only to farm the plots they occupied and pass them on to their heirs. It is not surprising, therefore, that the 'selling' price was a bargain £120-135 per acre. "Coercion and violence were sometimes necessary to convince villagers to sell their land-use rights."

Responding to the growing scandal involving Soon Hua Seng and other eucalyptus planters, Prime Minister Chatichai Choonhavan announced on 31 January that the Government would revise its commercial reforestation policy nationwide. "The Government will review whether it should allow commercial reforestation for the production of paper pulp", the Prime Minister said, adding that the environmental effects of large-scale commercial reforestation are uncertain and noting that "eight million Thais" live in National Reserve Forests slated for eucalyptus. Government eucalyptus policy is thus in a state of flux.

• In another recent development, the Indian corporation, Birla, has pulled out of its planned eucalyptus operations in Ubon Ratchathani, citing local popular opposition.

# **Errors and Timidity**

Dear Sir,

Your 'Open Letter to Mrs. Thatcher', (*The Ecologist*, Vol. 20, No.1, January/February 1990) regarding the Tropical Forestry Action Plan (TFAP) contained some errors of fact and some errors of judgement. First the facts:

Contrary to your statements, Mrs. Thatcher has not donated £100 million to TFAP. She has said her government aims to commit a maximum of a further £100 million to tropical forestry activities over the next three years. The money will be administered by the British Overseas Development Administration (ODA), not by the nongovernmental and UN agencies behind TFAP. It will be spent according to ODA's own environmental and other standards.

The Ecologist, unlike foresters themselves, seems to equate 'forestry' with commercial tree plantations. Foresters see their craft as the intentional management of natural or man-made forests for the rational production of goods and services — including timber, non-timber forest products (fruits, nuts, resins, rattans), soil and water conservation and the conservation of biological diversity.

TFAP embraces all of these elements of forestry. But it is not concerned with forestry alone; it also tries to address the various agents of deforestation, most of which are outside of the forestry sector. These include such activities as ranching, slash-and-burn agriculture, resettlement schemes, dam building, surface mining, etc. Thus TFAP also considers ways to improve the management of the land around the forest.

TFAP has come a long way since its inception. It has succeeded in improving donor coordination and reducing waste through the duplication of donor experts. Participants in TFAP include not only the donor forestry experts, but several critical NGOs (IIED, IUCN, WRI and WWF). This broadening of the plan's base has meant that more attention is given to grassroots participation, sustainable development and nature conservation. Guidelines on these issues have been produced for TFAP country missions. Attention to the deforestation issues and the volume of forestry aid have increased.

But there is much room for improvement. In many countries, TFAP has failed to involve high-level representatives of the finance, planning and agricultural ministries. In other countries, grassroots involvement lags behinds. A UNDP study showed that ecosystem conservation issues were getting much attention in some countries, little in others. The TFAP Advisors Group is aware of these shortcomings and is working to remedy them. Mixed results in the early years of a global effort are hardly surprising: one would be naive to expect otherwise.

No, throwing money into forestry work will not solve these problems. Money spent badly in the wrong places could exacerbate them. Thus we suggest the following uses of British money:

1. ODA's forestry department should be provided with the staff necessary to identify, monitor and evaluate more projects and programmes according to the often excellent existing guidelines.

2. Rather than focusing exclusively on projects, ODA should devote more attention to assisting policy reform in beneficiary countries. It makes little sense to spend money on isolated conservation efforts in countries where the government is still subsidizing deforestation (i.e. Brazil). It is equally useless to invest in improving the management capacity of a forest authority if that body is going to be starved for funds by a government with no interest in sustainable forest management.

3. Many governments interested in managing forests better lack trained foresters and sound data. In such cases, ODA should engage in long-term efforts to build the elements of an efficient forest service.

Finally, *The Ecologist* has been uncharacteristically timid in damning British civil servants with a broad brush. You suggest these have been afraid to give Mrs Thatcher hard facts about unpleasant realities, and have given poor advice. If you know of such civil servants, then perform a useful public service and name them. IIED has worked closely with many of ODA's forestry staff, and we have no doubts as to their integrity.

#### Yours faithfully,

Dr Caroline Sargent Director Forestry and Land Use programme International Institute for Environment and Development 3 Endsleigh Street London WC1H 0DD

#### The Editors Reply:

In Mrs Thatcher's UN speech, she stated that the £100 million would be given "mostly within the framework of the Tropical Forestry Action Plan".

The World Rainforest Movement is currently conducting a country-by-country review of the National Forestry Plans submitted under the TFAP process. These reviews will be published in our next issue.

### The BST Controversy

#### Dear Sir,

Companies in the United States and the United Kingdom are developing BST for use in the dairy industry to improve the efficiency of milk production. The research is being conducted according to strict and long-standing procedures established by both governments and not it secret. Samuel S. Epstein's article ('BST: The Public Health Hazards', *The Ecologist*, Vol. 19, No. 5, September/October 1989) does not serve your readers' understanding of the product in that his conclusions are exaggerated and he uses tactics to create mistrust in the regulatory review and approval process, as well as erode consumer confidence in the safety of milk and milk products.

While it is impossible to respond to all allegations raised by Epstein in this limited space, I would like to comment on those implying a negative impact on the wholesomeness of milk.

With but few exceptions infants in the US are breast-fed or fed heat processed infant formula products. According to market research data collected by Ross Laboratories, some three per cent of infants are fed cow milk or evaporated milk in the first six months of life.1 In the latter half of the first year of life, cow milk or evaporated milk is fed to 53 per cent of infants. With but rare exceptions the cow milk has been heat processed (pasteurized) and the evaporated milk, like infant formula, has been heat-treated. Since BST, a protein, is denatured or inactivated by heat treatment the concerns expressed by Epstein regarding the potential for exposure of infants to BST becomes a non-issue. Furthermore, the concentration of BST in the milk of cows injected with BST does not exceed the concentration of BST in the milk from nontreated cows; hence Epstein is creating a straw man. To imply that milk from BSTtreated cows will put infants at risk is totally inconsistent with the practice of infant feeding in the US, the low concentrations of BST in raw milk, its ease of digestion and the sensitivity of BST to heat processing.

Factors that influence the composition of milk, both human and cow, have been extensively studied and reviewed.2 The Recommended Daily Dietary Allowance (RDA) for energy intake by lactating women is approximately 500 kcals more that the energy requirement for a nonpregnant or non-lactating woman. Since it requires about 850 kcals of energy to produce a litre of milk, there is a shortfall of 300 to 400 kcals.3 In other words women who are lactating are advised or required to mobilize body fat to meet their energy requirement for milk production. While this situation may be looked upon as negative energy balance, it is the appropriate way to shed that increase in body fat associated with pregnancy. The negative energy balance that follows parturition in the cow resembles this situation.

The fatty acid composition of human milk is highly variable, reflecting in part the fatty acid composition of the maternal diet.<sup>4</sup> With restriction in energy intake the fatty acid composition of human milk resembles that of depot fat; that is there is an increase in content of long chain fatty acids. It should come as no surprise that cow milk fat should show similar changes in composition during periods of negative energy balance.

Transitory changes in relative concentrations of whey and casein in milk do not effect the nutritional value of such milk for human use. Infant formula products with a reduced content of casein and an increase in concentration of whey proteins have been used in infant feeding for the past three decades. At the present time, approximately 40 per cent of formula-fed infants receive formulas with a 60:40 ratio of whey to casein. Cow milk has a whey to casein ratio of 15:85. Reduction in the casein concentration of infant formula products has been without any discernable effect on clinical performance of infants.

The transport of intact protein across the epithelium of the human gut by the process of pinocytosis has been recognized for many years. This mechanism is one that contributes to sensitization of individuals to foreign proteins. While the leaky-gut syndrome may be a factor in producing that 1-2 per cent of infants with adverse reactions to foods on an immunologic basis, other factors are of equal if not greater importance. Firstly, there is the inate capacity of a protein to promote antibody formation. Secondly, there is the question fo the dose response — how much of a protein load is being thrust upon the gut? Thirdly, is the potentially offending protein readily denatured either prior to ingestion (heat processing) or by pH or enzymatic degradation within the gut?

Species-specific BST occurs naturally in mammalian milks in low concentrations, even in the milk of cows treated with BST. Furthermore, it has been demonstrated that BST is rapidly digested in the gut, thus significantly reducing its potential as an allergen.

Food antigens causing allergic reactions tend to be glycoproteins with a molecular weight between 18,000 and and 36,000 daltons. Unlike BST, such proteins are generally heat and enzyme resistant.

Epstein raises the issue of peptide absorption. According to Matthews, the maximum size of a peptide entering the intestinal mucosa by carrier-mediated transport may be limited to a tripeptide.<sup>5</sup> Adibi and Morse have studied absorption of tetraglycine by the human gut and found no evidence for intact absorption.<sup>6</sup> Tetrapeptides, like higher peptides, require brushborder hydrolysis before absorption.

Based upon these observations, there appears to be little scientific basis for concern regarding the ability of ingested BST to sensitize man.

I am sure Epstein's conclusions on the other effects of BST on the cow herself can also be challenged as flawed in interpretation.

Yours faithfully,

L.J. Filer, Jr., M.D., Ph.D. Professor of Pediatrics (Emeritus) University of Iowa Iowa City Iowa 52242 USA

#### References

1 Martinez, G.A., 'Milk feeding trends in the United States 1955-1985', pers. com., 1986; Martinez, G.A. and Krieger, 'Milk-feeding patterns in the United States', *Pediatrics* 76, 1985, 1004-1008; Martinez, G.A., Ryan, A.S. and Malec, D.J., 'Nutrient intake of American infants and children fed cow's milk or infant formula', *Am. J. Dis. Child* 139, 1985, 1010-1018.

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Recommended Dietary Allowances, Food and Nutrition Board 10th Edition, National Academy of Sciences Press, 1989, 34-35.

4 Filer, op. cit., supra 2. 5

Op. cit., supra 3.

Matthews, D.M., 'Intestinal Absorption of Pep-6 tides', Physiol. Rev. 55, 1975. 537-608.

#### Samuel S. Epstein Replies:

Dr Filer's assertion that BST research "is being conducted according to strict and long-standing governmental procedures" is ludicrous. The FDA (Federal Drugs Administration) is now being investigated by US Congressional Committees, the Government Accounting Office, and the Inspector General, for a wide range of charges including suppression of information, political favouritism and harassment of an ex-senior staffer who raised substantive objections to the BST review process.1,2 These charges are consistent with recent evidence on the reckless irresponsibility of the FDA with regard to large scale contamination of milk with antibiotics, feed additives and animal drugs,3 with the recent firing of the FDA Commissioner following a major scandal with regard to corruption in the regulation of generic drugs, and with evidence from a series of Congressional investigations one of which concluded: "The FDA has consistently disregarded its responsibility . . . repeatedly put what it perceives are interests of veterinarians and the livestock industry ahead of its legal obligation to protect consumers . . . jeopardizing the health and safety of consumers of meat, milk and poultry.'

Filer's dismissal of hazards to consumers from BST reveals gross bias or ignorance. Contrary to Filer, proteins and their breakdown products can be allergenic and immunogenic following ingestion. Additionally, Eli Lilly research has demonstrated that attachment of a foreign methionine molecule to Human Growth Hormone increases its allergenicity, thus substantiating the likelihood of similar toxic effects from methionyl-BST.5 The basis for these and other concerns, particularly relating to hazards to infants from contaminants in milk from BST treated cows, including BST and its breakdown products, stressor hormones, growth factors, antibiotics and viruses, has been recently published in detail,6 none of these concerns have been investigated by industry or the FDA.

Finally, it should be noted that Filer has failed to respond to repeated requests for a reply as to whether he is or has been a consultant or contractee of the BST industry.

Yours faithfully, Samuel S. Epstein, M.D. Professor of Occupational and Environmental Medicine School of Public Health University of Illinois College of Medicine at Chicago Box 6998 Chicago Illinois 60680 USA

#### References

Anderson, J. and Van Atta, D., 'Scientists Suspicious of Milk Hormone', The Washington Post, September 8, 1989.

Schneider, K., 'FDA Accused of Improper Ties 2 in Review of Drugs for Milk Cows', New York Times, January 12, 1990.

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# An Ecologist Manifesto

#### Dear Sir.

With reference to Michael Redclift's article, 'The Green Movement in Eastern Europe' (The Ecologist, Vol. 19, No. 5, September/ October 1989), I suggest the following:

"A green spectre is haunting Europe: the spectre of ecologism". Thus, a revised edition of the Communist Manifesto may be introduced. "Ecologism is recognized as a force by all the powers of Europe. The moment has come for the ecologists to explain to the world their point of view, their aims and their tendencies", the introduction to this new Manifesto might continue.

The Manifesto itself would then confirm that "the history of every society up to our days has been the history of class struggles": "oppressors and oppressed have maintained a war without interruption which has ended either by a revolutionary transformation of society or by the destruction of both the antagonistic classes".

Explaining the present situation in terms of a class struggle, the Manifesto would point out that today's oppressed class is nature, which has come to replace up to a point the proletariat, as the ruthlessly exploited section of the living world, providing the oppressors with the profits of the goods it has created without receiving anything in return.

The war against nature being currently waged, the Manifesto would state, will end either by the revolutionary transformation of our society into an ecologistic one, or by the destruction of both nature and industrialized mankind, the latter being made up of the capitalist bourgeois class and also of part of the proletariat seduced by the bourgeois values.

Yours faithfully, **Godofredo Stutzin** Cam. El Alto Parc. 14 Arrayán Santiago - 34 Chile



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The Royal Society for the Encouragement of Arts, Manufactures and Commerce are organising two seminars. Saturday, 21 April, 10 am to 5 pm, Winchester College, Winchester: The Future Countryside: visions for the South. Friday, 27 April in the afternoon, Kedleston Hall, Derbyshire: The Future Countryside: visions for the Midlands. Furter details from RSA, 8 John Adam Street, London WC2N 6EZ. Tel: 01-930 5115.

THE CENTRE FOR PROFESSIONAL ADVANCEMENT is presenting various courses during May and June: Regulation of Biotechnology in the Food Industry; Autoxidation of Food Stuffs; Effective Project Management; Industrial Corrosion; Understanding and Managing Water in Food Systems; Food Extrusion Technology and many more subjects. Details from Palestrinastraat 1, 1071 LC Amsterdam, Netherlands. Tel: 020 662 30 50.

Seminar —WATER PRIVATISATION—ONE YEAR ON. The seminar will be held at the Institution of Civil Engineers, 1-7 Great George St., Westminster, London SW1P 3AA on 14th November 1990. Further details from the above address. First Announcement and Call for Papers—IWBM 91: WATER AND THE ENVIRONMENT. International Convention Centre, Birmingham, 30.4-2.5.1991. Short synopsis of 300 words by 30th April 1990 please to: Conference Manager, The Institution of Water and Environmental Management, 15 John St. London WC1N 2EB. (Tel. 01 831 3110).

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#### A Selection of Papers

J SCHWARTZBROD, M T THEVENOT & J L STIEN (France), Helminth eggs in marine and river sediments.

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