

The Ecologist

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- Climatic Disruption
- Ranching & Forest Loss
- Multi-nationals in Amazonia
- Forest Peoples' Movements
- Indigenous Land Use Practices
- Militarization & Indian Rights



Amazonia: The Future in the Balance

Special Issue with Friends of the Earth UK

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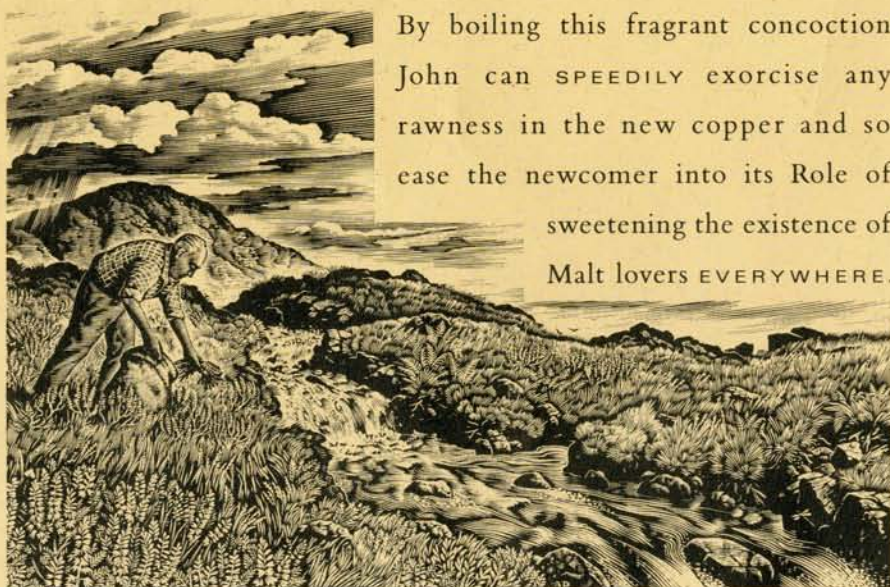
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¹HANDCRAFTED by the SIXTEEN MEN of TAIN.

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Amazonia: The Future in the Balance

The 1989 burning season in Amazonia is now over. Mercifully, initial reports suggest that, in Brazilian Amazonia at least, the extent of clearance has been less than in 1988 or 1987, which between them saw the loss of some 100,000 square kilometres of primary forest. But any sense of relief must be short-lived. For this year's assault on the forests would undoubtedly have been as extensive as ever had it not been for the early onset of the rainy season. The vagaries of the climate, rather than changes in policy, were primarily responsible for the lull in the relentless process of destruction.

An Ecological and Social Holocaust

At least 10 per cent of Brazilian Amazonia has already been laid waste (the World Bank estimates the figure at 12 per cent) and levels of destruction elsewhere in the region are no less alarming. Indeed, if the destruction continues at its current rate, little will be left of the forests within fifteen years.

The consequences will be devastating. Already the region is experiencing a loss of biodiversity on a scale as yet unimagined, with at least one species being condemned to extinction every day. In addition, the cultures of thousands of forest-based communities are daily being undermined, if not actively destroyed, with a resulting increase in disease, alienation and social misery. Erosion, floods and land degradation are now widespread, and essential ecological cycles are being stretched beyond recovery (see C. Uhl et al., this issue). Indeed, Harald Sioli of the Max Planck Institute has warned that if the destruction continues: "There is a danger that the region may develop into a new dust-bowl."

Nor will the impact of forest loss be limited to the Amazon region alone. As Luiz Molion (*this issue*) points out, the most recent climate models indicate that a possible global consequence of widespread deforestation over the Amazon Basin is that less latent heat would be transported to regions outside the tropics, which therefore would become cooler. In addition, deforestation is adding appreciably to the greenhouse effect, with global consequences that are likely to be both socially and economically devastating. Indeed, the increase in forest clearance in Amazonia has led some climatologists to suggest that Brazil *alone* could be releasing 1 billion tonnes of carbon dioxide a year, twice the figure previously estimated for the total *worldwide* contribution of deforestation to the global CO₂ budget. Other greenhouse gases — notably methane and nitrous oxide — are also being released in large quantities, principally as a result of biomass burning, increased cattle ranching, and the use of artificial fertilizers.

Increasing Poverty

At the local and regional level, the destruction of Amazonia can only increase local poverty, malnutrition, alienation and unrest. The vast majority of the populations of the region depend directly upon the soil — and hence those ecological processes that maintain its fertility — for their livelihood. Whilst the countries of the temperate North have destroyed their forests with relative ecological impunity, the same is not true for the countries of the tropical South. In the Tropics, climatic conditions — in particular, the hot dry summers and the winter rains — ensure that defores-

tation is quickly translated into severe ecological degradation, which in turn is translated into growing impoverishment for the local population.

As a direct result of deforestation, millions of people are thus being condemned to a degraded and impoverished existence, with very little prospect of ever improving their lot. Their lives are daily affected by increased erosion, local climatic change and the disruption of drought-flood cycles. In effect, deforestation robs them of the very means of livelihood. Where those involved come from tribal groups, the impact of deforestation extends beyond the ecological devastation caused by the loss of their forests to the loss of their culture.

The social impact of soil erosion and land degradation is severe. Colonists who have moved into the forests are forced to move on at least every other year to find new forest land to cultivate. Many of those who move into the forests are already "development refugees", whose own land has been taken over for plantations, dams, mining projects and other development schemes. In Brazil, for example, the bulk of those peasants moving into Rondonia and Acre under the Polonoroeste colonization scheme have come from the fertile states of Parana, Santa Catarina and Rio Grande do Sul, where their lands have been taken over to grow cash crops, primarily soybeans for feeding to cattle in the EEC. The psychological effects of such enforced nomadism on people whose aspirations centre on a permanent home in which to bring up their children should not be underestimated.

Where the land eventually becomes too degraded to farm, the social effects of soil erosion go beyond enforced migration and translate into malnutrition and starvation. But, whilst the poor bear the full force of the ecological and social costs of deforestation, the financial rewards have been accrued by a small minority of the world's population, principally the urban and rural élites and consumers in the northern industrialized countries. In effect, far from relieving poverty, current development policies are creating it on a continental scale — and a major cause of that poverty is increased environmental degradation.

No Changes in Policy

The causes of the holocaust being unleashed on Amazonia have been thoroughly documented by *The Ecologist* and are detailed in the articles by Fearnside, Thomson and Dudley, Hecht and Treece in this issue: they include highways, dams, plantations, pasture-led deforestation, industry, mining — in effect, those projects which are intended to open up the region to resource intensive, export-led development.

Yet, with the exception of Colombia, which alone among the countries of the Amazon is taking far-reaching steps to protect its forests and their peoples (of which more later), the majority of governments in the region are firmly committed to the further industrialization of Amazonia. In Brazil, for example, the Grande Carajas programme is intended to open up eastern Amazonia to industry and industrialized agriculture. One-sixth of the whole of Brazilian Amazonia will be affected. All told the project occupies 900,000 sq. kms, or an area the size of France and Britain combined. Meanwhile, in the north-west, the Yanomami and other tribal groups are being systematically deprived of their lands under the Calha Norte Programme, the aim being "to ensure

unrestricted access to the mineral reserves located on tribal territories, and to incorporate the Indians into the colonization and development programmes planned for the region" (see D. Treece, this issue).

Although the rhetoric is now of "greening" development policies, little or nothing has changed on the ground. Repeatedly, we find environmental "safeguards" being flouted, "guidelines" being ignored and environmental protection being relegated to mere window dressing (see K. Thomson and N. Dudley, this issue). Indeed, in Brazil's case, the government's "Our Nature" programme (superficially intended to protect Amazonia) is being cynically exploited to short-circuit the territorial rights of indigenous groups in order to enable the government to permit mining, logging and other 'development' projects on Indian lands. Thus, "environmental protection" has been invoked to justify more than 50 per cent of the Yanomami's traditional territory being designated as "National Park" or "Forest Reserve", categories that deny the Indians their rights over the land and which specifically allow for its economic development.

Better Management: No Solution in Itself

But it would be wrong to blame the failure of national governments to stem the tide of deforestation on political cynicism alone. The truth is that the policies inherent in current development strategies are beyond "greening", *for it is the policies themselves — rather than simply their implementation — that are at fault.*

First, the very nature of many of the technologies and processes involved make large-scale environmental destruction inevitable. In the case of large dams, for example, the technology *dictates* that large areas of forest will be flooded. Thus, the 68 dams which the Brazilian Government is seeking to build in Amazonia will at the minimum inundate an area the size of Wales. No mitigatory measures can prevent such flooding. Nor can better planning and management 'undo' the damage done to the traditional cultures uprooted as a result of dam projects or 'mitigate' for the loss of tropical forest, where a single hectare may contain up to 400 trees, every other one a different species — diversity which can never be reconstituted by a reforestation programme. Similarly, no measures can 'safeguard' against the inevitable invasion of waterborne diseases following the filling of a dam's reservoir or the downstream effects on aquatic life.

Second, by their very nature, measures intended to mitigate the effects of development are "band aid" solutions. They do not, and are not intended to, challenge or remedy the underlying social, political and economic dynamics of deforestation, let alone the nature of the development process itself. Their role is to soften the impact of a given project not to prevent that impact from occurring in the first place: not surprisingly, their implementation is considered secondary to ensuring that the project proceeds. Indeed, they are the first budget items to be cut should the project run into financial difficulties.

Third, the belief that better management will avert ecological disaster in Amazonia (or indeed elsewhere) assumes that the root cause of the destruction lies in poor management. Yet, in most instances, this is only partially true. In the case of pasture-led deforestation, for example, the driving force behind further clearance lies not in any economic gains to be made from rearing cattle but from land speculation. As Susanna Hecht (*this issue*) points out: "The fact that the ancillary benefits of ranching are not linked to production, and will accrue under good or bad management (indeed, in the short-term, bad management brings higher returns) means that technological solutions are likely to have little impact on deforestation patterns."

Finally, the philosophy underlying the notion of "mitigatory measures" is based on the premise that there are "acceptable" levels of environmental damage and social disruption which can "traded-off" against future economic benefits. But even if those

benefits were realizable, it is often forgotten that the damage incurred with each trade-off is incremental. Taken on a project-by-project basis, the damage incurred by the development process might (for the sake of argument) be considered "acceptable"; but, when the sum total of the destruction caused is totted up, the overall impact is intolerable. A forest flooded by a dam here, a river polluted there, a hillside torn apart for minerals there — and sooner rather than later, the capacity of the biosphere to withstand the assault on its vital life support system is overwhelmed.

False Solutions

Given their commitment to maintaining the *status quo*, it is not surprising that both national governments and the international development community have ignored or played down the fundamental role of current development policies in causing the destruction. As a consequence, the official solutions to the crisis are as ecologically and socially bankrupt as the policies driving deforestation are suicidal. Indeed, far from stemming the tide of deforestation, the proposed "solutions" will effectively seal the fate of the forests and the peoples who depend upon them for their livelihoods.

The Tropical Forestry Action Plan:

A case in point is the Tropical Forestry Action Plan (TFAP), now being promoted by the World Bank, the UN Food and Agriculture Organization and the UN Development Programme. The Plan trivializes the pre-eminent role played by dams, plantations and other development practices in the destruction of forests, and instead blames the victims of the development process — landless peasants, for example — for causing deforestation. Inevitably, no measures are put forward to curtail, let alone halt, such projects, despite their having been responsible for most of the deforestation that has occurred over the last 40 years. Having failed to address the primary causes, the TFAP thus effectively ensures that the destruction can only continue.

Moreover, despite an avowed commitment to ecological restoration, only 10 per cent of TFAP's proposed budget is allocated for the protection of forest ecosystems. The regional plan for Latin America, for example, envisages only 1.5 per cent of the planned expenditure being spent on conservation. Indeed, the Plan is less concerned with the preservation of forests than with the setting up of commercial plantations of fast growing species, such as eucalyptus, which not only have a serious adverse effect on the environment, but which also do little to benefit the poor. Thus in Latin America as a whole, it is intended to invest between \$2 billion and \$2.8 billion a year for the next decade in the *industrial development* of the region's forests. Control over the forests would be taken away from local forest-based communities and instead vested in external agencies, whose prime concern is the rate of return on their investment. If implemented, the TFAP would therefore result in the large-scale transformation of natural forests — as well as prime agricultural land — into industrialized plantations producing "commercial" timber for sale.

The International Biodiversity Plan:

Alongside the Tropical Forest Action Plan, the World Bank is actively pursuing the goal of a global 'Biodiversity Action Plan'.

Stemming the continuing loss of biological diversity worldwide is undoubtedly an urgent priority. Genetic erosion is leading both to the extinction of life forms which have a value in themselves and to increased ecological vulnerability. However, the World Bank's proposed programme, like those proposed by other

official agencies, fails utterly to address the issue — and like its sister plan, the *Tropical Forest Action Plan*, could well exacerbate the problem.

Genetic erosion in the Third World has primarily resulted from development policies which have replaced indigenous agricultural and forestry practices, which rely on exploiting a wide variety of species (and thus encouraging maximum genetic diversity), with monocultures which result in genetic uniformity. Yet, the continued spread of genetic uniformity is perversely viewed as a means of ensuring "biodiversity conservation." For example, the World Bank has recommended the intensification of monoculture practices in forestry in order to "preserve biological diversity".

Instead of ensuring biodiversity by incorporating the principles of conservation into agricultural and industrial processes, the 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.

One problem is that no-one knows how large individual reserves would have to be in order to survive in the long-term. It is becoming clear, for example, that the integrity of the primary rainforest may require that very large areas are left intact. Judy Rankin, a botanist working in the Amazon, has found that isolated patches of primary forest of 10, 100 or even 1,000 hectares cannot sustain themselves. Within a couple of years of the forest being cleared, the remaining patches show distinct signs of degradation, particularly at the edges of the plots where trees are uprooted because of the penetrating winds. 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.

The promotion of biotechnology as a solution to the problem of genetic erosion is also a major cause for concern. Corporate interests view patent protection as a prerequisite for innovations in biotechnologies. One fear is that 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 — thus ushering in a new era of "bio-imperialism".

Already major pharmaceutical companies are screening and collecting natural plants through contracted third parties, often "sneaking" plants out of Third World countries rather than negotiate payment through the proper channels. The National Cancer Institute of the United States has sponsored the 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 give of this knowledge are unlikely ever to share in the profits from the development of new drugs or other products.

A Radical Alternative

The flaws in the TFAP and the Biodiversity Plan point the way to the political and economic changes that are most urgently required if the forests of Amazonia are to be saved. The broad outline of those changes has been sketched in a 'Manifesto' recently drawn up by the World Rainforest Movement and submitted to the United Nations as part of a wider campaign (initiated by *The Ecologist*) to pressure the United Nations to hold an Emergency Meeting on Deforestation (see page 210 this issue and *The Ecologist*, Vol. 19, No.5). The three most important immediate steps proposed are as follows:

- **To call a halt to all those practices and projects which would contribute either directly or indirectly to further forest loss;**
- **To revise radically the policies of those agencies that currently finance the projects and practices causing**

deforestation. Funding for such projects should be ceased and instead directed towards projects that promote the protection and regeneration of forests;

- **To empower forest peoples and those who depend directly upon the forests for their livelihoods with the responsibility for safeguarding the forests and ensuring their regeneration.** This will require not only the granting of land rights but also ensuring that forest peoples have the right to a decisive voice in formulating policies for their areas.

Wider Changes

But, as the WRM Manifesto recognizes, the future of the forests cannot be ensured if the problem of deforestation is tackled in isolation. It will require wider changes in both the regional and global political economy. Within the Amazon countries, for example, the underlying social, political and economic forces that are driving landless peasants into Amazonia must be addressed. Here the solutions must centre on relieving the pressure of the international debt burden and on land reform. In Brazil, where 42 per cent of the country's cultivated land is owned by just one per cent of the population, half of the population are landless. Rural violence, rocketing rents and the encroachment of the big estates lead to daily dispossession among the rural poor. Yet there is no shortage of fertile soil: indeed, were land reform to be carried out effectively, there would be enough land for everyone without having to cultivate a single hectare of Amazonia. Yet the best land — in the south of the country — is being used to grow cash crops for export.

Nor, without deeper changes in society and the economy, will empowering local forest peoples with the duty of safeguarding the forests *ipso facto* ensure their protection. Over millennia, forest peoples have developed sustainable methods of exploiting the forests without causing their destruction (see D. Posey this issue). But as Peter Bunyard, (*this issue*) points out: "The introduction of a consumer-oriented western model of development could destroy within a generation the adherence of Indians to their traditional production systems, especially by undermining the authority of the traditional leaders — the community 'captains' and shamans — whose role it is to oversee the activities of the entire community."

It is an appalling dilemma. On the one hand, there is scarcely an indigenous group in Amazonia which remains untouched by the market — indeed most now demand consumer goods — and on the other, there is the stark historical fact that the greatest threat to indigenous culture, apart from disease, has been the gradual encroachment of what is broadly termed the "consumer society". Addressing that problem will not be simple: yet, as Marcus Colchester (*this issue*) documents, successful examples do exist of Indian groups being able to enter the market without jeopardizing their culture or their environment. Much depends on the Indians having the time to gain experience in handling, and making decisions to control, social change. From this point of view, the two greatest menaces to the Indians are imposed development and the loss of their lands.

Beyond Tinkering with the System

Underlying the destruction of Amazonia (and indeed the general degradation of the biosphere as a whole) is an economic system which sees "wealth" merely in terms of capital accumulation, primarily through the production of material goods. It is a system which demands the systematic transformation of the biosphere into commodities for sale: which places no value on the ecologi-

cal services performed by ecosystems or on the social and psychological security provided by vernacular human societies; and which, above all, is incompatible with ecological and social security.

There can be few better illustrations of the irrationality of the modern market system than the forces that drive pasture-led deforestation. It matters not a jot that cattle bring few direct profits, nor that the land is so severely degraded that eventually it must be abandoned, nor that the ecological degradation is eventually translated into direct economic costs — be it through climatic change, soil erosion or the disruption of hydrological cycles. For the system allows profits to be made regardless of this devastation — the profits coming through land speculation. Within that context, clearing land for pasture will always be the favoured "economic" option, regardless of the unassailable ecological and social arguments in favour of keeping the forests standing. Moreover, so long as the underlying political dynamic behind pasture led clearance remains unaddressed, the threat to the forests will remain.

The changes required will demand more than mere tinkering with the system. International trade, and the consumer society that feeds it, ensure that we are all parties to the destruction. The beef mountains of Europe have been fed on soyabean grown on land in the south of Brazil, from which peasants have been dispossessed and sent as colonists into the forests. Aluminium cans which end up on our rubbish dumps come from smelters fed with bauxite from Amazonia and powered by dams such as the Tucuruí, which flooded some 216,000 hectares of forest. And so on. In this respect, the saving of Amazonia relies as much on the international community adopting policies that reduce the ecological impact of their activities as on any measures that can be taken within the Amazonian nations themselves.

Signs of Hope

Given the enormity of the changes required — changes that will affect everything we do — it would be understandable if the determination to save the forests gave way to despair and resignation. But, despite the gloom, there is light at the end of the tunnel. The case for extractive reserves is now gaining ground. Recent research in Peruvian Amazonia has documented the tremendous economic value to be derived from exploiting the non-timber products of *intact* tropical forests. The research shows that the income per hectare from "minor" forest products (nuts, rubber and the like) is two times higher than from logging the land, and three times higher than that from conversion to pasture for cattle (though the effects of land speculations were not taken into account).

Even more encouraging, the Colombian Government has set a remarkable precedent for Amazonian countries by granting inalienable land rights to its indigenous forest peoples. Some 18 million hectares — two-thirds of Colombian Amazonia and an area equivalent to the size of Great Britain — have been handed over, or are in the process of being handed over. Moreover, it is a policy based not on political expediency but on the belief that the Indians are the best guardians of the forest (see P. Bunyard, this issue).

Finally, forest groups throughout Amazonia, from rubber-tappers to Indians, are successfully taking up the fight to preserve the forests and their ways of life. Theirs is a dangerous struggle: witness the murder of Chico Mendes (see book reviews, this issue). But, like antibodies in a diseased body, they signal hope for the future — and with it the possibility of regeneration.

In that respect, it is worth recalling the words of the anthropologist Margaret Mead: "Never doubt that a small group of thoughtful, committed citizens can change the world. Indeed, it is the only thing that ever has." Daunting as the task ahead might seem, individual actions — through lobbying, changing lifestyles, political action, boycotts and the like — can make a difference. But only if we are willing to act. And act now, before it is too late.

Nicholas Hildyard

What you can do:

- Support the World Rainforest Movement's Appeal to the United Nations for an Emergency Meeting on Deforestation (see this page)
- Write to President Virgilio Barco of Colombia (Palacio Presidencial, Carrera Otavo 7-26, Bogota, Colombia) expressing your support for their decision to hand over land to indigenous forest peoples.
- Support Friends of the Earth (26-28 Underwood Street, London N1) in its campaigns to save the tropical rainforests, and the Gaia Foundation (18 Well Walk, London, NW3) which is channelling funds directly to forest peoples' projects in Amazonia and S.E. Asia.

* The Manifesto, together with a 50-page briefing document on the causes and consequences of forest destruction are available from: *The Ecologist*, Station Road, Sturminster Newton, Dorset, DT10 1BB, UK. Price: £3.00 (plus 50 pence postage and packing).

Call for UN Emergency Session on Deforestation

Three Million Signatures Presented to UN

On September 19th, representatives of forest peoples from Brazil, The Philippines, India and other Third World countries presented 3 million signatures, collected from 23 countries, to Perez de Cuellar, Secretary-General of the United Nations, in support of a call for an emergency session of the UN to consider ways to put an end to global deforestation.

The petition, launched by *The Ecologist* in 1987, was presented in conjunction with a Manifesto, drawn up by the World Rainforest Movement, calling for an immediate halt to those projects which are causing the runaway destruction of tropical and temperate forests (see editorial).

At first Perez de Cuellar refused to receive the petitions, claiming to be too busy. The response was a sit-in in the main lobby of the UN building. After an hour, the Secretary-General agreed to receive a delegation from the organizers of the campaign and representatives from tribal groups.

The international organisers of the petition campaign — the World Rainforest Movement, based in Penang, Malaysia and Ecoropa, the European Ecological Action Group, based in Paris — plan to follow up the initiative with two further campaigns:

1. At the national level, groups which participated in the campaign are being urged to lobby their national governments to back the call for an emergency session of the UN;
2. At the international level, a working party has been set up to help co-ordinate a coherent grassroots response to the forest crisis and to draw up, through local forest peoples' groups, detailed regional proposals to combat deforestation. The aim is to put forward a "Peoples'" alternative to the Tropical Forestry Action Plan and other top-down "solutions" being imposed by the international development community.

Nicholas Hildyard

The Amazonian Forests and Climatic Stability

by
Luiz Carlos B. Molion

The forests of Amazonia play a critical role in regulating climate at both the regional and global levels. Massive quantities of carbon are locked up in the forest biomass, which, if released, would add considerably to global warming. Moreover, the forests act to pump heat into the atmosphere, cooling the tropics and distributing heat to temperate zones. At the local level deforestation may increase temperatures, decrease rainfall and disrupt hydrological cycles.

The Earth's climate depends on several 'climatic controls'. Thus, the global distribution of the energy received from the sun is controlled by orbital parameters, such as the angular velocity and inclination of the Earth's rotational axis, cloudiness and the chemical composition of the atmosphere. The distribution of continents and oceans with their contrasting albedos (surface reflectivities) also has a controlling influence.

The above controls, in turn, influence the mechanisms that move heat from the equator towards the poles — the general circulatory system of the atmosphere — which plays an important role in maintaining global climatic stability. At the regional level, a number of other factors are also operative, including, the nature of the surface cover; the hydrological cycle; the local topography; and the influence of oceanic currents on adjacent land.

Amazonia and Temperate Climates

The sun is the most important source of energy sustaining life. The bulk of the solar energy reaching the Earth's surface is spent in the evaporation of water (generating latent heat) and in heating the air (producing sensible heat). In Central Amazonia, research has shown that about 80 per cent of the available energy is used in evapotranspiration (evaporation plus plant transpiration), while the rest warms the air.¹ Over *terra firme* forest — that is the upland forest which is never flooded — the bulk of the water vapour in the air comes either from the transpiration of

plants (60 per cent) or from rainfall intercepted by the forest canopy and litter layer (40 per cent). Direct soil evaporation is negligible. The annual mean evaporation in Amazonia is about 50 per cent of the total rainfall, that is, half of the rainfall falling over Amazonia comes from local evaporation and the other half from the Atlantic Ocean.² By comparison, in temperate latitudes local evaporation contributes about 10 per cent of precipitation.

In the tropics, the evaporation process consumes about 2.44 joules per gram of water, an enormous amount of energy considering that, on average, the Earth receives 2.94 joules of energy per centimetre square per day. The humid and hot air is more buoyant and rises; when it rises, however, it cools, forming cumulonimbus clouds and rain, thus releasing to the atmosphere the latent heat that was used in the evaporation at the surface. As the cumulonimbus clouds grow, more vapour is converted into liquid water and the whole atmospheric column is heated.

The rising air is replaced at low altitudes by air coming from the oceans (convergence); at altitudes of around ten kilometres the air is transported away (divergence) from the continent and sinks over the subtropical oceans thus closing a circulation cell. *Figure 1* sketches this circulation cell.³ For demonstration purposes, the direct circulation is broken into two components: the east-west component, known as the Walker Circulation and the equator-tropics component, known as the Hadley Circulation. *Figure 2* shows schematically how these two circulation cells are major components of the general circulatory system of the atmosphere. Note that along the equatorial belt, there are three regions where there is ascending air motion (*figure 2a*): the 'Maritime Con-

tinent' (Indonesia and the North of Australia), the Congo River Basin and the Amazon River Basin.

A fourth heat source, of no less importance, is the Intertropical Convergence Zone (ITCZ) which is a region over the equatorial oceans where the Trade Winds of both hemispheres meet. In the ITCZ region, there is ascending air motion, formation of a deep cloud band and rainfall: consequently, large amounts of latent heat are released to the atmosphere. That released heat is transported away from the tropics by the general circulatory system of the atmosphere to temperate and polar regions, which would otherwise be colder because they receive less energy from the sun than they lose to outer space. Thus, the global climate remains stable with annual variations which may be due to fluctuations in these heat sources.

The Amazon is an important source of heat for the general circulatory system of the atmosphere. Large-scale deforestation may reduce the power of this source. As mentioned previously, about 50 per cent of Amazonian rainfall comes from water vapour which is evaporated locally. Deforestation reduces evapotranspiration, therefore reducing precipitation and the release of latent heat. Thus, as a result of large-scale deforestation in Amazonia, those regions outside the tropics may receive less heat and become cooler than they are today, everything else remaining constant. Cooling of higher latitudes would result in a reduction of the growing season, affecting food production.

Amazonia and the Chemical Composition of the Atmosphere

Amongst the gases which constitute the Earth's atmosphere are a group known as

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the greenhouse gases which allow solar energy to pass down through the atmosphere but absorb heat radiated from the Earth's surface. The main absorbers of this infrared radiation are water vapour, carbon dioxide (CO₂), ozone (O₃), methane (CH₄), nitrous oxide (N₂O) and the Chlorofluorocarbons (CFCs). While the role that the tropical forests play in the carbon cycle is well-known, and there can be no doubt that deforestation is contributing significantly to global warming, quantitative understanding of the full contribution of the tropical forests to the chemical composition of the atmosphere is limited.

Deforestation of Amazonia contributes to the enhancement of the greenhouse ef-

fect both by biomass burning and by destroying the trees which fix carbon through photosynthesis. The Amazon has a storage of biomass equivalent to 50 billion metric tonnes of carbon which, if burnt, would release about 11 billion tonnes of carbon and would increase the concentration of CO₂ in the atmosphere by 3-5 parts per million.⁴ The contribution that reforestation can make in limiting global warming is clear, as is the effect that deforestation has on the composition of the atmosphere.

Local Climatic Effects

Forested regions have a lower albedo than

regions with less vegetation, and therefore absorb more solar radiation and have more energy to be partitioned between latent and sensible heat. Deforestation modifies this energy partitioning with the general result that the amount of energy available for heating the air increases, and the amount that goes into evapotranspiration is reduced. This leads to an increase in the range of temperatures (temperature amplitude), with maximum temperatures increasing and minimum temperatures decreasing. A comparative study in Nigeria between a forest and an adjacent deforested area showed that over the deforested area the soil temperature amplitude at 1cm depth was 5°C higher than that of the forest soil. During the day, the mean air temperature, measured at 1m level, was 3°-6°C higher in the clearing than in the forest; at night, however, the forest air temperature was slightly higher than that over the clearing. The relative humidity also showed large contrasts between the forested and deforested areas. For a particular day, the observed minimum relative humidities were 87 per cent and 49 per cent for the forest and the clearing, respectively, the distance between the two measuring points being about 50 metres.⁵

A recent climatic model suggests that large-scale deforestation in Amazonia would result in soil surface temperatures increasing by 2°-5°C with air temperatures at 2m increasing by 1°-3°C. At the same time, there may be a reduction in evapotranspiration, with a consequent reduction of local precipitation. The same study indicated that, where rainfall is high, the evapotranspiration was reduced by up to 50 per cent and, in turn, the average precipitation in the Amazon basin as a whole was reduced by about 20 per cent. It was also suggested that large-scale deforestation might change both temporal and spatial rainfall distribution.⁶

Floods and Erosion

Another important factor in maintaining the local hydrological cycle is water runoff, which paradoxically may increase with the reduction in rainfall, showing higher flood peaks. An experiment in tropical Africa where natural forest was replaced by a 350 hectare tea plantation showed a two fold increase in moderate flooding and a four fold increase in more serious flooding.⁷ Snow has studied the effect of the change in land use in the Madden Dam watershed in the Panama Canal

Figure 1. Schematic diagram of a direct circulation cell resulting from differential heating between continents and adjacent oceans in the summer.

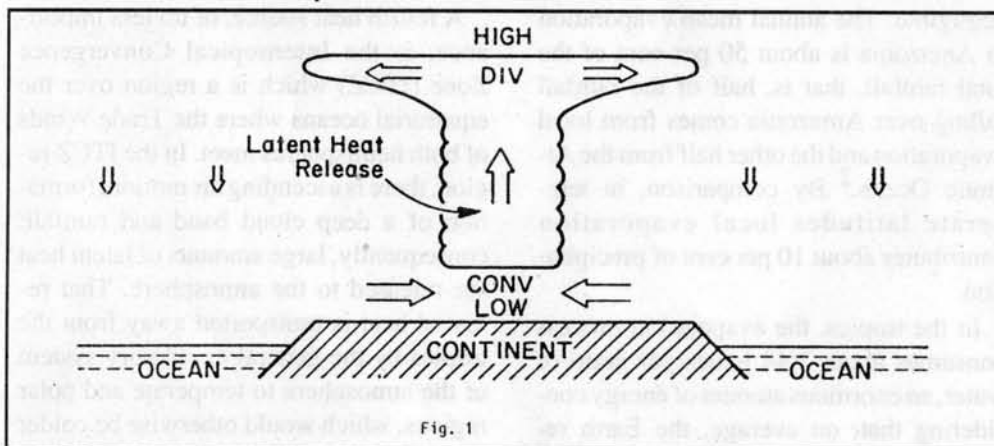
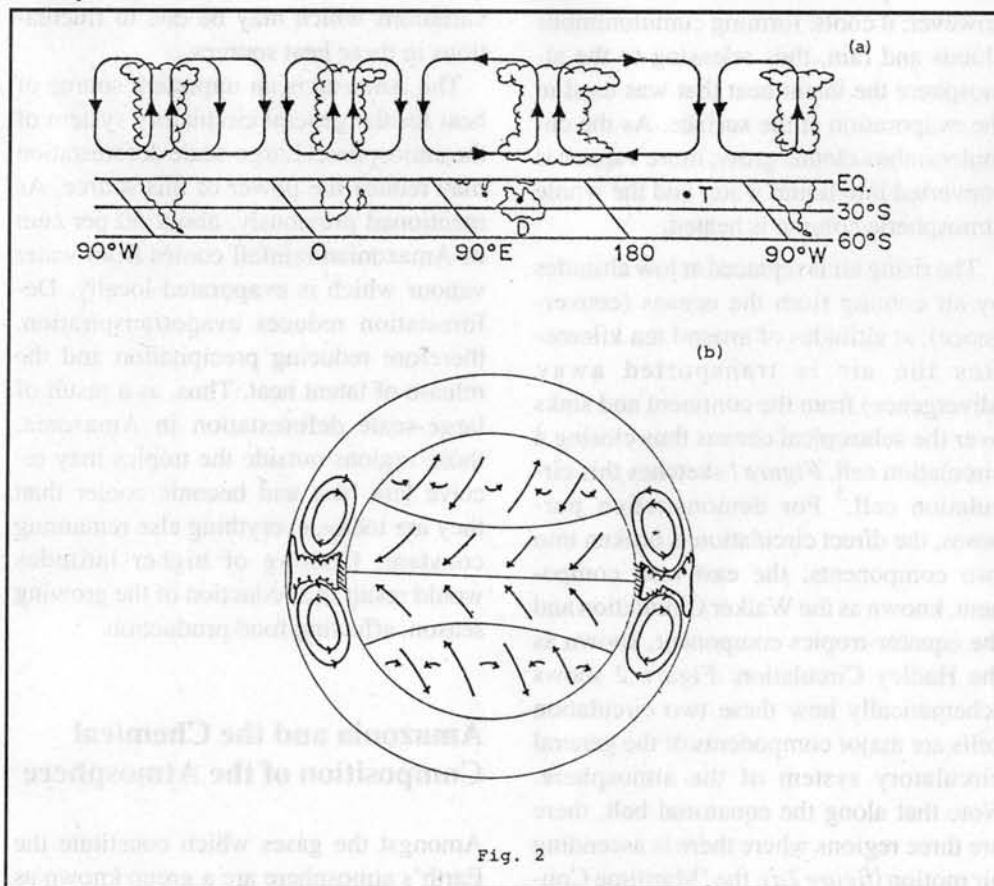


Figure 2. Schematic diagram of (a) the mean Walker Circulation cell and (b) the mean Hadley Circulation cell.



for agriculture.⁸ He concluded that the mean annual runoff of the cultivated and forested lands did not differ significantly, but the flood peaks increased during the rainy season. The change in land use affected the monthly distribution of surface runoff but not the annual mean. There are now problems with water shortages in the canal during the dry season.

The main causes of increased runoff after deforestation are soil compaction, which reduces infiltration, and the increased amount of rainfall that reaches the soil. Given that the Amazon forest canopy intercepts on average about 15 per cent of the rainfall, the removal of the forest cover in Central Amazonia would increase the volume of rainwater reaching the ground by 4000 cubic metres per hectare per year which, due to soil compaction by animals and machines, will runoff directly to river channels.

The moisture stored in the soil would be reduced drastically with deforestation. Schubart made measurements of soil permeability under the forest and in an adjacent five-year-old pasture field, both with the same type of soil.⁹ He observed that on average the absorption of water by the forest soil was about ten times greater

than that of the pasture. The soil under the forest has higher infiltration rates, recharges more uniformly and releases water more slowly than other types of land use.

Another problem linked to the variation of the climatic elements and the removal of forests is soil degradation and consequent erosion. Erosion of cultivated fields in the tropics may vary by 1.5-2500 times the erosion rates of forested areas, depending upon the slope of the terrain, soil texture, annual rainfall, nature and techniques of cultivation among others. Once the forest's protective cover is removed, the impact of large raindrops breaks up the soil, reducing even further its capacity to absorb water. At the same time, the rainfall which was previously intercepted by the canopy reaches the soil. The consequence is increased surface runoff and erosion with associated silting of rivers and reservoirs, changing of water quality and aquatic life.

If deforestation were to continue at exponential rates as has been predicted by Fearnside (see P. Fearnside, *this issue*), the entire Brazilian Amazon would be deforested in less than 15 years. The climatic consequences alone make it imperative that sustainable forms of land use are

found for the region which will allow the forest cover to remain intact.

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Deforestation in Brazilian Amazonia: The Rates and Causes of Forest Destruction

by
Philip M. Fearnside

While the proportion of Brazilian Amazonia which has been cleared is still small relative to the region's total area, if the explosive surge in the rate of clearing which has taken place in recent years is allowed to continue it will quickly lead to the disappearance of the entire forest. Lack of sufficient capital and labour can temporarily slow the rate of deforestation, but the deforestation process will run to completion unless fundamental changes are made in the structure of the legal and economic system underlying forest clearance.

The seemingly endless expanse of trees which covers most of Amazonia cannot delay the destruction of the forest by more than a brief moment in historical terms. It is of little importance whether 20 or 60 years pass before we come to the last tree. What is vital is whether or not future generations inherit a world with an Amazon forest.

Available figures indicate an apparently exponential rate of deforestation in the Brazilian states of Rondônia and Mato Grosso. In other states, the increase may not be exponential; it is nevertheless very rapid. The deforestation rate in Rondônia declined slightly after 1985, partly as a result of migrants moving on to more distant frontiers in Acre and Roraima, and partly from a decrease in the number of migrants entering Rondônia from Mato Grosso. The increasing movement of migrants from Rondônia to Roraima — one of the areas with no recent data available — means deforestation there has progressed further than previously thought.

Discrepancies Between Deforestation Estimates

A Brazilian National Institute for Space Studies (INPE) study of the areas burning in 1987 using data from a US National Oceanic and Atmospheric Administration (NOAA) satellite indicated that 204,000 square kilometres (20 million hectares) were burned in an area roughly corresponding to the Legal Amazon (see map 1), of which 80,000 square kilometres (8 million hectares) were in the portion of the area classified as dense forest,¹ the rest of the area being mostly cattle pasture, secondary forest and especially the *cerrado* (savanna) vegetation of Mato Grosso and Goiás. Our calculations, however, indicate that 35,000 square kilometres of dense forest were lost in 1987. The discrepancy between these and INPE's figures is probably in large part due to differences in assessing the degree to which the heat from the huge fires affected the sensitivity of the NOAA satellite.

A World Bank estimate of deforestation for 1988 concluded that 12 per cent of Brazilian Amazonia had been cleared by that year, a figure four per cent higher than my own estimate.² However, both the World Bank estimate and mine lead to the same

conclusion: the deforested area of Brazil's Legal Amazon is still relatively small, but it is expanding explosively.

The Motor of Deforestation

The process of deforestation in Amazonia is driven by both the expansion of already cleared areas and the appearance of new centres of deforestation. The formation of these new centres has been strongly influenced by governmental decisions over the past decades. The construction of the Belém-Brasília Highway (BR-010) in 1960, its improvement for year-round traffic in 1967, and its paving in 1974, were significant milestones in creating the largest nucleus of deforestation in Amazonia. Within this nucleus, the area deforested in southern Pará and northern Mato Grosso has enlarged significantly in recent years.

The construction of the Cuiabá-Porto Velho Highway (BR-364) in 1967 initiated another focus for deforestation, and its paving in 1984, with financing from the World Bank, has allowed a wave of colonization into western Amazonia. The paving of the BR-364 from Porto Velho (Rondônia) to Rio Branco (Acre) began in 1986, with financing from the Interamerican Development Bank. The disbursement of funds was suspended because of public concern in North America and Europe over the project's potential environmental impacts, but was resumed in October 1988 when the Brazilian Government announced its *Nossa Natureza* ('Our Nature') programme, which established a series of committees and suspended for ninety days the export of logs and the approval of new ranching incentives. Opening Acre to rapid settlement can be expected to play a key role in accelerating deforestation throughout Amazonia. Discovery of oil and gas fields in the Juruá and Urucú River valleys (see K. Thomson and N. Dudley, *this issue*) has added to the pressure for road construction in western Amazonas, which could become the next destination for the influx of migrants no longer finding land in Rondônia and Acre.

Internal Migration

Deforestation has been indirectly stimulated by the government through programmes to attract new migrants from other parts of

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the country, along with the establishment of settlements and the improvement of access roads. These programmes have multiplied as a result of the increase in administrative units in Amazonia and the elevation of 'territories' to the status of 'states.' The proliferation of new political units results from interior areas of the Amazon almost always lending their support to incumbent governments, making it advantageous for any party in power to increase the political representation of these areas. Because the principal criterion for creating new territories and states is an increase in population, local politicians have been keen to attract colonists. In the early 1980s, for example, the governor of Rondônia launched a national media campaign to promote the "fertile land" in the region (which, in reality, represents under ten per cent of the area, and is mostly already occupied). The campaign was strongest just before the territory of Rondônia became a state in 1982. In 1983, the Government of Roraima claimed in magazine advertisements that "thanks to its very rapid growth in the past four years, Roraima is almost ready to become the twenty-fourth state of Brazil . . . this dizzying expansion is due to the policy of attracting colonists. In four years — 1979 to today — the government of Roraima distributed no less than one million hectares of land to ten thousand families. With this, the population has more than doubled in this period".³ In recent years the press has reported various government plans to create new federal territories in the southern, central and western parts of Pará and in the southwestern and western portions of Amazonas.

Migration to the Amazon has caused a rate of population growth far above the national average. The population of Brazil's Northern Region grew at 4.9 per cent per year between 1970 and 1980, compared with 2.5 per cent per year in Brazil as

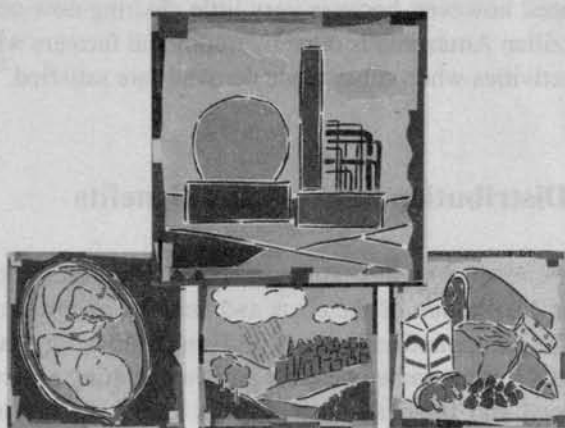
a whole and 14.9 per cent in Rondônia, where the deforested area increased at a rate of 37 per cent per year between 1975 and 1980, indicating that deforestation reached rates even higher than population growth. This suggests that the arrival of migrants explains only a part of the phenomenon of explosive deforestation.

Deforestation patterns in 100 hectare lots in the Ouro Preto Integrated Colonization Project (PIC) in Rondônia are being observed as part of the National Institute for Research in the Amazon (INPA)'s 'Carrying Capacity Estimation of Amazonian Agro-Ecosystems Project'. In 18 lots that had only one owner over a ten year period, the cumulative area deforested, on average, increased linearly until the sixth year of occupation, after which it increased much more slowly. The replacement of original colonists by new owners greatly increased the pace of deforestation. A comparison between 32 original colonists and 97 new colonists in the Ouro Preto PIC indicated that in the first four years after purchasing a lot, the new owner deforests, on the average, at an annual rate almost twice that of the original colonist. Therefore, the process of replacing original colonists with new owners, already common both in Rondônia and on the Transamazon Highway contributes to accelerating deforestation in these areas.

Land Use and Deforestation

Pasture plays a central role in accelerating deforestation, both for small colonists and for large land owners and speculators (*see S. Hecht, this issue*). Even in official settlement areas in Rondônia — where almost all of the government effort in agri-

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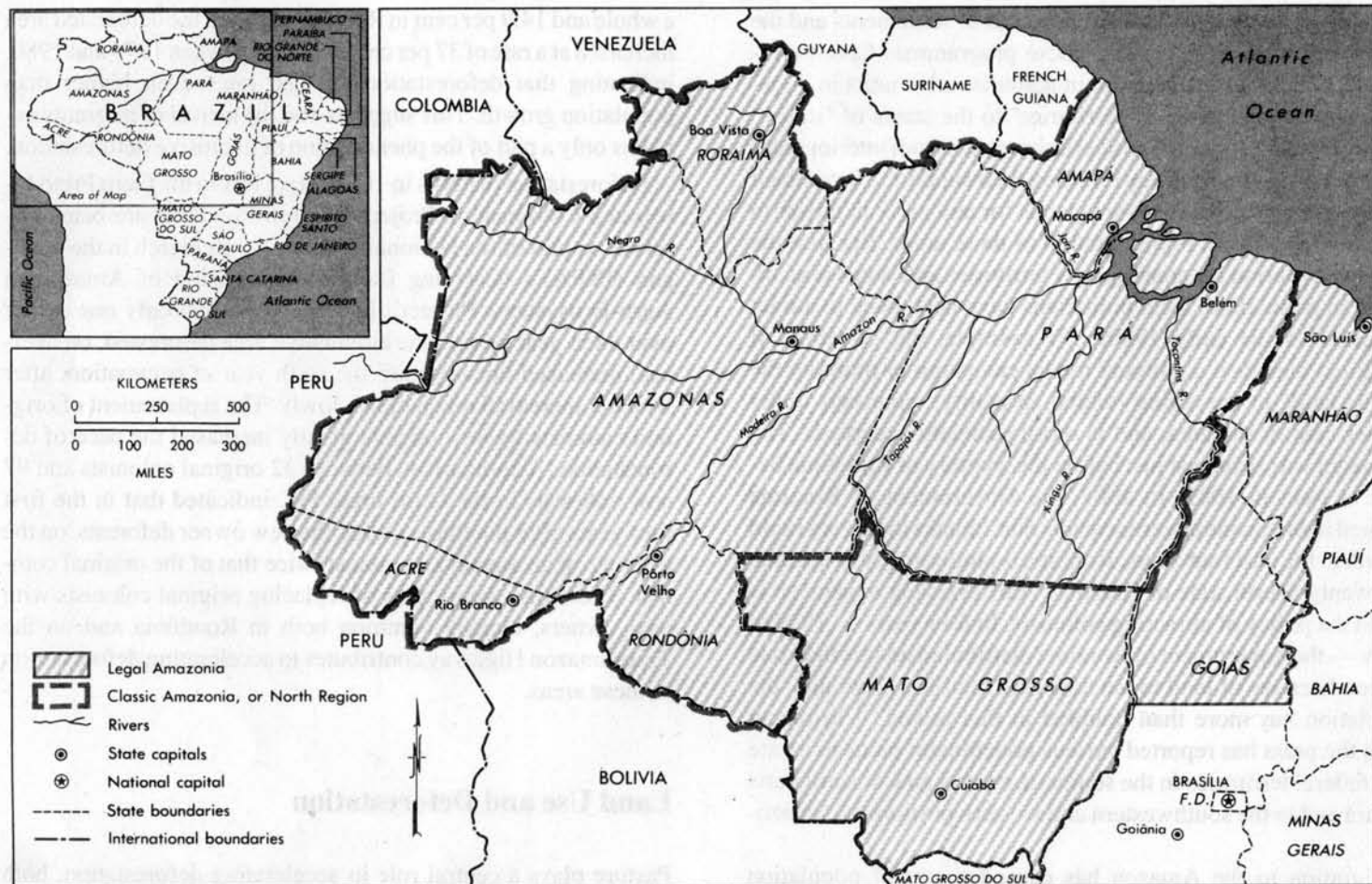
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Map 1. The Brazilian Amazon (World Bank)

cultural extension credit and advertising is focused on promoting perennial crops — it is pasture that occupies the greatest area.

Real estate speculation is a major force driving deforestation in the Brazilian Amazon and pasture has a central role in this system: besides increasing the value of legalized lots, deforestation followed by planting pasture is the method most often used both by small *posseiros* (squatters), not always thinking of speculation afterwards, and by large *grileiros* (land grabbers), attracted primarily by speculative opportunities. The granting of the right of possession to whoever deforests a piece of land is a centuries-old legal practice in the Brazilian Amazon.⁴ Such rights of possession are eventually transformed into full rights of ownership. Pasture represents the easiest way to occupy an extensive area, thus considerably increasing the impact of a small population on deforestation.

Financial incentives also continue to contribute to the deforestation, despite the myth that these incentives ceased to be important following the 1979 decision of the Superintendency for the Development of the Amazon (SUDAM) to stop approving incentives for new cattle projects in parts of the Amazon classified as 'dense forest'. New projects continue to be approved in the areas of 'transition forest', located between the Amazon forest and the *cerrado* (Central Brazilian savannah), contributing to intense deforestation in southern Pará and northern Mato Grosso. Old projects in dense forest continue to receive incentives for deforestation. The policy of denying new incentives to dense forest areas has not even always been followed: according to a member of the Consulting Council of SUDAM's Renewable Resources Department, a large cattle project was approved for Acre, completely within the supposedly-protected dense forest zone.⁵ The *Nossa Natureza* programme, does little to stem the flow of inducements: the programme only suspends new incentives for ranching, and this only for a period of ninety

days (later renewed for an additional ninety days). Generous governmental incentives make it possible for many projects to continue clearing pastures even after low beef production would have bankrupted any undertaking whose profits depended on agronomic results.

Deforestation for subsistence production is not a major cause of deforestation at present, but it may become more significant with increased population levels. Because settlement schemes are almost always unsustainable, more deforestation occurs as farmers and ranchers clear new areas when older clearings become exhausted. Increasing the output or the sustainability of agricultural systems would not necessarily decrease deforestation rates, however, because very little clearing now occurring in Brazilian Amazonia is done by traditional farmers who limit their activities when subsistence demands are satisfied.⁶

The Distribution of Costs and Benefits

An important factor preventing the control of deforestation is the current distribution of the costs and benefits of forest destruction. The groups and individuals profiting from deforestation are generally not the same ones that pay the resulting environmental, social and financial costs. Profits are often channelled to beneficiaries outside the Amazon region, and while the benefits are concentrated, the costs are widely distributed. Under these conditions, destruction continues to be completely rational in economic terms even if the total cost is much greater than the total benefits. On the other hand, some costs are concentrated, with the benefits accruing to larger, more influential groups, as in the case of land seized from indigenous tribes. Another important factor in the dynamic of deforestation is the monetary

nature of the benefits, while the costs, being environmental and human, are more difficult to quantify. The non-monetary costs, unfortunately, are no less real than the monetary ones.⁷

The fact that felling forest brings immediate profits — while many of the costs will only be paid by future generations — is one of the most fundamental aspects of the problem. In the middle of the economic crisis Brazil faced in July 1983, Rondônia, Mato Grosso and Roraima were the only federative units whose monthly income from the Tax on Circulation of Merchandise (ICM) grew more than inflation. It is probably not a coincidence that the ICM, considered one of the best indices of economic activity, has increased most where deforestation is most explosive. This encouraging picture of immediate profits, however, should be evaluated taking into account the heavy costs following massive deforestation.

The discount rate — the speed future profits and costs have their weights diminished in calculating the net present value of an activity — is a part of the structure of decision-making that renders unviable many potentially renewable systems of resource management.⁸ The discount rate is an index that depends on the income that can be potentially earned in alternative investments. No logical connection exists between the discount rate and the biological rates (such as the rate of growth of a tree in the forest) limiting the rate of return from sustained exploitation of biological resources.⁹ Rational use of the Amazon forest would generate only a slow return.

Population Growth in Amazonia

Human population growth in the Amazon region could also frustrate any policy designed to control deforestation. The flow of new migrants now greatly surpasses the impact of the reproduction rate on population, but in the long term both must reach an equilibrium. The capacity of Amazonia to absorb growing numbers of people is very limited: the social problems motivating the rush of migrants to the region must be solved in the source areas themselves.¹⁰

The expulsion of small agriculturalists by large landowners, both inside and outside Amazonia, together with the existence of a large landless rural population, makes finding a definitive solution to deforestation extremely difficult. The land tenure system in Amazonia, which is founded on deforestation, would have to be modified to make using the forest possible without clearing it. Since the tradition of legalizing land claims established by deforestation is an important factor in alleviating the impact of extreme social inequalities and the expulsion of rural populations, solutions for these problems would have to be implemented at the same time.

Future Pressures for Deforestation

Commercial logging, which until recently affected only a relatively small fraction of the region, is rapidly becoming a substantial source of disturbance.

At the moment, world markets for tropical hardwoods are being supplied principally by forest destruction in southeast Asia.¹¹ Due to their more homogeneous character, the Asian forests are better suited to industrial uses than is the Amazon forest; however, at the present pace of destruction, virtually all of Asia's tropical forests will be destroyed before the end of the



Road through forest in Brazil. Halting the building and improvement of roads in Amazonia would halt the vicious cycle of highway construction, colonization and deforestation. (Photo: WWF)

century, and, according to tropical wood merchants, commercial volumes of hardwood from Asia could be insignificant by the early 1990s. Large lumber firms are therefore likely to transfer their attention to Amazonia. Heavily logged forests have little chance of recuperation, even without having being clearcut or burnt (see C. Uhl et al, *this issue*). More advanced methods using a larger number of species to make fuelwood chips, pulp, plywood, particle board or other wood products are likely to increase the devastation caused by commercial logging.

Industry in the Amazon

Another potential cause of large-scale destruction is the making of charcoal.¹² Wood is now being collected from native forest to supply a pig iron industry in conjunction with the Grande Carajás Programme (see D. Treece, *this issue*). Recent statements by the Grande Carajás Interministerial Commission imply a charcoal demand which would consume 1000 square kilometres of surrounding forest per year. The Carajás iron deposit contains 18 billion tonnes of high grade ore — by far the world's largest and sufficient to sustain mining at current rates for at least 250 years.¹³ Only a tiny fraction is to be smelted in the area; the potential for expansion of smelting activity is limited only by the amount of available charcoal (that is by the amount of forest to be sacrificed). The first plant began operation on 8 January 1988. No environmental studies were done or impact statement prepared; it has not yet even been decided how much charcoal would be produced from plantations and how much harvested from native forest. Approval of the incentives, construction of the smelters and the beginning of operations all occurred after 23 January 1986, when environmental impact statements became a requirement in Brazil. The pig-iron programme also illustrates several ways potential environmental impacts of major development projects escape the environmental review processes of multilateral lending agencies such as the World Bank, which financed the Carajás railway and mine.¹⁴

Mining activities are probably set to increase considerably in the future. The invasion of Amerindian reserves spearheaded by freelance gold prospectors (*garimpeiros*) is already a major concern, the continuing officially-condoned assault on Yanomami tribal areas in Roraima being the best known case. Another growing cause of disruption is the construction of military bases

with roads and settlements, especially in the Calha Norte Programme.¹⁵ Yet another source of forest loss is hydroelectric development, plans for which imply flooding two per cent of Brazil's Legal Amazon.¹⁶

Addressing the Root Causes

It is clear the range of problems that need to be solved to slow deforestation in the Amazon is enormous. Brazil must face all of these problems both present and future if destruction of the Amazon forest is to be avoided. Root causes of deforestation must be addressed, rather than restricting action to the more superficial symptoms.

Very little now stands in the way of massive increases in deforestation. Limited amounts of capital, especially in Brazil's current economic crisis, can temporarily slow the rate at which deforesters are able to realize their plans, but the deforestation process will run to completion unless fundamental changes are made in the structure of the system underlying clearing.

Many events in the process of Amazonian deforestation are beyond government control. Decrees prohibiting deforestation, such as Law 7511 of 7 July 1986, have minimal effect on land clearing decisions made by farmers or ranchers living many kilometres from major roads and cities, and spread over a region as vast as Amazonia. Some key points in the system, however, are subject to government control. The granting of land titles, with its associated criteria of land 'improvement' through deforestation, is entirely a government activity. The government is also responsible for the programmes granting special loans and tax incentives for agriculture and cattle ranching activities. Above all, only the government builds highways. Were the government to build and improve fewer highways in Amazonia, the vicious cycle of highway construction, population immigration, and deforestation would be broken.

Current deforestation rates indicate that such changes must be made without delay. In the face of such a daunting array of problems, paralysis is frequent: either accepting destruction as inevitable, or considering as useless any action less extreme than a complete restructuring of society. Paralysis, whatever its rationalization, is the most certain path to a future without an Amazon forest.

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Transnationals and Oil in Amazonia

by
Koy Thomson and Nigel Dudley

Transnational corporations (TNCs) are active in agribusiness, mining, infrastructural development, banking, timber and almost every other major sector of the economies of the Amazonian countries. Whilst the impact of these activities has received wide coverage, less attention has been paid to the environmental and social destruction being caused by oil exploitation.

During the 1980s, oil concessions have been granted throughout Amazonia, setting in place a process of destruction beginning with exploration and ending in extraction. In September 1988, Occidental Petroleum Company reached an agreement with the Government of Peru to increase its production from rainforest areas by 20,000 barrels a day. It currently has at least 30 wells in the rainforests, and plans 24 more.¹ In Colombia, Amoco have agreed a three year technical evaluation programme with Ecopetrol for an area of 74 million acres of rainforest in the south-east of the country. Texaco have acquired rights in four areas of Colombian rainforest. In Ecuador, Texaco, Gulf, Conoco, Shell, British Petroleum and Esso Hispanol are all involved in exploration.²

Direct destruction is caused by numerous activities including clearance for seismic lines, access for exploration teams, helicopter landing areas, settlements for workers, drilling operations, drainage pits and roads.

The Impact on Tribal People

In 1982, the chief of the Amazonian Satere-Mawe group in Brazil wrote that exploration crews from the French transnational Elf Aquitaine "came into the reservation like an illness" after they had explored supposedly 'protected' tribal lands. He accused Elf employees of polluting waterways with refuse, thoughtless deforestation, landing their helicopter in the middle of a village, distributing alcohol and showing pornographic films to villagers.³

By May 1986, prospecting rights to a

third of the entire area of the 77 Indian Reserves in the greater Amazon basin had been requisitioned by mining companies — 17 million hectares out of a total of 52 million. Approximately 40 per cent of the companies involved are TNCs, including the Canadian TNC Brascan, British Petroleum, General Electric and Rhodia. If development goes ahead, both the native peoples and the environment will suffer irreversible damage.

Road Building

Oil companies build roads into oil sites primarily because it is cheaper than flying workers by plane or by helicopter, although it is sometimes claimed that governments insist on roads being built. Far more important than the actual area of forest cleared for the roads, is the role that roads play in allowing access to settlers and land speculators into previously impenetrable rainforest.

The impact of colonization is increased by the oil companies bringing workers into the drilling area, many of whom are on short term contracts. Workers are currently flooding into the oil drilling areas of the Carajás region of Brazil. When their contracts are finished, a proportion of the workers will stay to swell the ranks of the migrant farmers and miners. Oil workers also frequently hunt game in the forest, endangering birds and larger animals. Employees of oil exploration teams in Peru hunt illegally for meat and skins to sell in urban markets.⁴

The Contamination of Waterways

Oil spills and routine leakages pollute waterways and coastal areas whenever oil

is drilled in or near water, or is transported by ship. Damage to fish stocks from oil pollution is one of the problems identified by tribal groups living in drilling areas.

Much of the concern over water pollution has been focused on its impact on the vast Amazon basin river system. In June 1988, it was revealed that Texaco had discovered a potentially huge oil field on Marajo Island in the mouth of the Amazon River. Brazilian President José Sarney claimed that it was equivalent to a North Sea oil field, but experts believe the optimism to be premature.⁵ However, there have been some additional strikes off the coast of Brazil, and it is possible that a large strike will soon result.⁶

In the Oriente region of Ecuador, there have been at least 30 major oil spills from the Trans-Ecuadorean Pipeline, with an estimated loss of 16,000,000 gallons of petroleum. Two spills in 1987 and 1989 caused extensive damage to flora and fauna along hundreds of miles of river.⁷

Threats to Protected Areas

It is usual in most countries for oil drilling to take precedence over designated national parks or wildlife conservation areas. In Ecuador, the oil companies are drilling in the Cayambe Coca Ecological Reserve, in the north of the country near the Colombian border. The Manglares-Churute Ecological Reserve (Ecuadorian dry forest), in the west, is (or was) also in an area under consideration for oil drilling.⁸

The Yasuni National Park

A major controversy is presently centred on plans to construct a 175 kilometre, \$22 million road through the 680,000 hectare Yasuni National Park in Ecuador, one of

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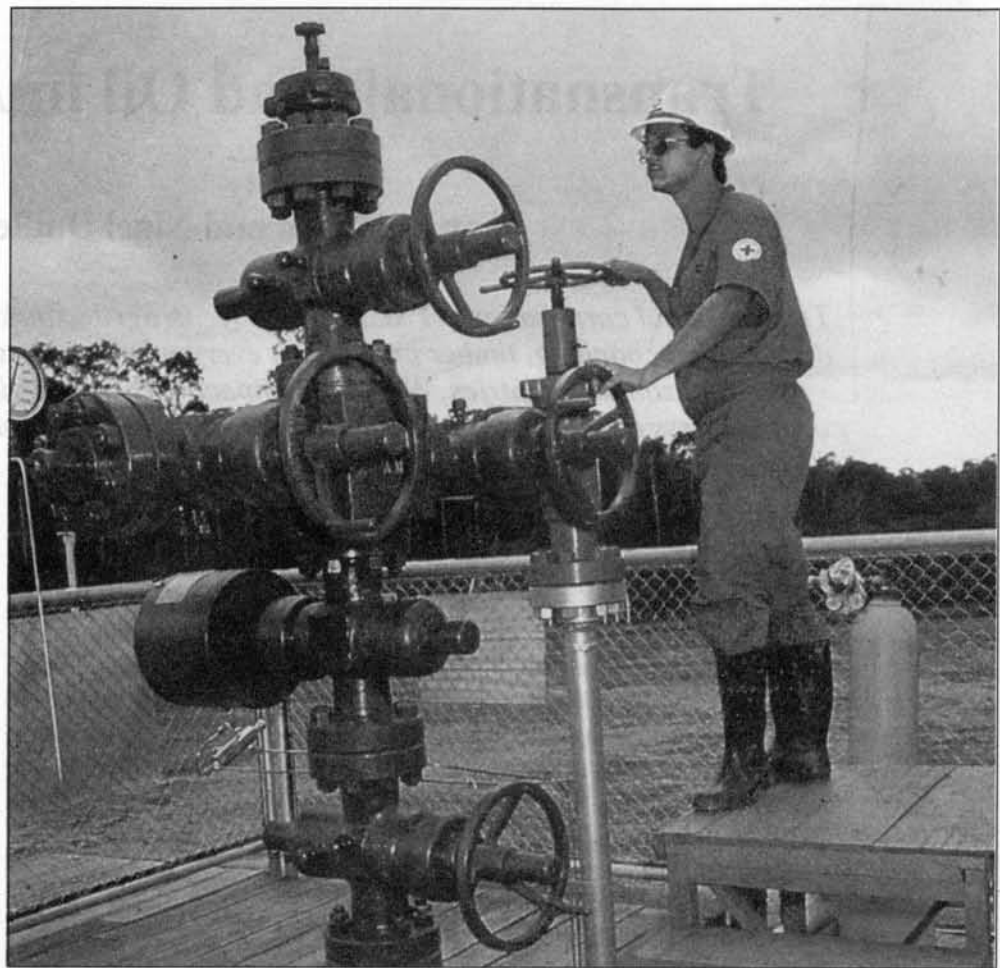
Oil exploration in the Brazilian Amazon. Exploration crews from the French transnational, Elf Aquitaine, have been accused of cutting trees and polluting rivers on 'protected' tribal lands, and distributing alcohol and pornographic videos to Indians. (Photo: Manchete)

the largest and most important reserves in the Amazon and home to the Waorani Indians, some of whom have never been contacted by outsiders.⁹ The Park is perhaps the richest area in the entire region, containing 50 species of fish, 500 bird species and over 100 mammal species, including jaguar, ocelot, giant otter, freshwater dolphins and at least ten species of primates. The Ecuadorian government has overturned its own legislation in giving permission (and encouragement) for the road to be built.

The Yasuni Park is especially vulnerable as it lies within the Oriente region, where Ecuador's best reserves of oil (the country's principal foreign exchange earner) are located. Occidental, the US transnational, started drilling near the boundary of the Park in mid-1987, and already exploration by Occidental and others in and around the Park has visibly reduced the number of large mammals in the area. Drilling is expected to damage irreversibly the area's river system.¹⁰ Several companies have been ceded blocks for exploration and exploitation within the park including Occidental, Consortium Elf Aquitaine of France, Petrobrás of Brazil, YPF of Argentina, Consortium Conoco Ecuador and British Petroleum.

The proposed road through Yasuni is supported by the Ecuadorian State Oil Corporation (CEPE), although its actual construction will be carried out by Conoco Ecuador Ltd (Conoco is a subsidiary of the chemical giant, Du Pont). CEPE will reimburse Conoco for the cost of the road once the Yasuni oilfield is commercially active, partly through a proposed \$80 million loan from the World Bank. The deal with CEPE is part of a standard service contract which permits oil companies to explore for oil, drill wells, bulldoze roads, create infrastructure for workers and subcontractors, and construct pipelines. Since April 1986, Conoco has invested approximately \$45 million in the exploration of the block containing the Yasuni national park.¹¹

Surveying for construction of the road is almost complete, and Conoco has already discovered oil in four of its wells, three of which are commercially productive. Construction of the Yasuni road could begin



any time between March and November 1989.

Colonization

Conoco claim that they will leave the area "in a condition comparable to that in which we found it", but this is extremely unlikely. There is already evidence from Ecuador of what happens after oil drilling roads are constructed. The construction of oil pipeline roads by CEPE in the Cuyabeno Wildlife Reserve, led to its colonization by more than a thousand people.¹² Although the Oriente region is being increasingly logged, timber exploitation is hampered to some extent by a lack of infrastructure.¹³ This may not be the case for much longer, however, and according to one environmentalist in Ecuador, "the pipelines (Quito to Esmeraldas) and their accompanying roads now criss cross the Oriente in a crazy mosaic of environmental and cultural destruction".¹⁴

It is almost inevitable that if the road is built there will be a massive colonization of the Yasuni National Park by farmers, ranchers, land speculators and timber cutters.

The struggle against this destruction is being led by the Indian Federations of Ecuador, who are pressing for an accord with the Ecuadorian government to pro-

tect Waorani territory. Fundación Natura, the Ecuadorian Foundation for Conservation has expressed grave concern about the future of all the 63,000 Indians thought to be living in the Ecuadorian rainforest.¹⁵ In July 1987, a bishop and a nun were speared to death after entering Waorani territory to establish peaceful contact and soften the impact between them and a consortium of oil exploration teams, including Petrobrás, Elf-Aquitaine and BP. In consequence, oil exploration temporarily stopped in that area, but has been resumed by Petrobrás this year.

Conoco's Environmental Promises

Conoco are extremely sensitive about their environmental image, and in a memorandum from senior management, dated March 1987, employees, contractors and visitors were given a series of "rules and courtesies which must be observed" in the Yasuni Park. They were instructed that:

"Conoco has a worldwide reputation as an environmentally concerned company and your co-operation in maintaining our record would be appreciated. Repeated violations of these instruc-

tions will be grounds for dismissal.

"Conoco's activities have an impact on the environment in which it operates - on the land, air, water, and the life forms found there. We will conduct all operations in a lawful and environmentally responsible manner. Specifically, Conoco will:

(1) Comply fully with all pertinent environmental laws and regulations".

In a letter to Friends of the Earth, in March 1989, they gave further assurances about their work in the Yasuni National Park:

"...To date, we have drilled seven wells, and each drill site covers no more than four acres. Equipment, materials and personnel for drilling have been airlifted by helicopter so no roads have been built into the drill sites...we have issued mandates to our employees and contractors not to hunt wildlife or disturb the flora and fauna of the Park...If the oil is to be produced, the construction of an access road would be necessary and would constitute the primary potential impact on the rainforest. This would come from the oil operations as much as from potential agricultural colonization and logging operations by local people who typically move in if unregulated..."¹⁶

At present, the Ecuadorian government is breaking its own laws, and Conoco is apparently only too happy to follow suit.

Exploration in National Parks

A key policy element for any environmentally responsible oil company must be to

refuse contracts which involve exploration in national parks. Conoco have not only refused to leave the Park, but have refused to take the second most preferable option, that of constructing the pipeline by air. Conoco admit that this is feasible, but reject it as too costly. James Nations, of the Centre for Human Ecology at the US Embassy in Guatemala, claims that:

"At a Yasuni Park planning workshop held in Quito during May, 1988, conservationists pointed out that when ecological and social costs are included in the oil companies calculations - rather than externalised as at present - a pipeline built by air would be cheaper than a pipeline built by road through the Yasuni National Park. While the Yasuni area is expected to produce petroleum for only 20 years, the park could last forever ... in the long term, income generated by tourism and germ plasm protection in the Yasuni National Park would be worth more to Ecuador than 20 years of oil production".¹⁷

Conoco officials say that the possibilities of not building the road are "slim-to-none".¹⁸ They claim that CEPE is responsible for the project, and as a service company, they only work for CEPE. But as Nations points out, "ultimately, it makes little difference how much money they spend on the Yasuni pipeline, because CEPE will reimburse the company's investment. CEPE in turn could use the World Bank loan to cover these costs".¹⁹ Nations suggests that the World Bank should request that the pipeline be built by air, citing "the World Bank's new policies on the protection of wildlands and biological diversity", as the reason why they should do so. In fact, if the World Bank stuck to its environmental policies, it

would not give the loan to CEPE in the first place. The \$800,000 being offered by the World Bank for conservation measures, is merely a gesture and is small recompense for the harm which will be caused by the larger loan.

Oil and Gas in the Brazilian Amazon

Exploration for oil and gas in the Brazilian Amazon has increased sharply over the last few years and the exploitation of fossil fuel reserves now threatens to open up even the most remote areas of the rainforest. There is no reason to believe that the effects of oil industry infrastructure development in previously remote regions will be any less destructive than those already seen elsewhere in the east.

Both Brazilian and foreign TNCs, including Petrobrás, Elf, Pecten (Shell US), BP and Idemitsu, have been involved in oil and gas exploration in the western Amazon since the late 1970s. The first major infrastructure project was not announced until 1983, when Brazil declared its intention to build a \$5 billion, 3,000 km, pipeline right across the Amazon from Caraurai in the northwest to Sao Paulo. The start of the pipeline is currently only accessible by boat or by air.

In January 1983, discussions started about the possibility of building another 3,000 km pipeline from the Juruá gasfield in western Amazonas to Sao Paulo.²⁰ Petrobrás had been drilling in Juruá for several years and estimated the gasfield to be some 300 miles long and 40 miles wide.

Limiting the Transnationals

During 1987, Brazil tried to stop foreign

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Brazilian TNC, Petrobrás, estimates that the Urucú oilfield in the state of Amazonas encompasses an area of rainforest three-and-a-half times the size of Switzerland.

TNCs from distributing petrol and oil products in Brazil. The plan collapsed after intense lobbying and a nationwide advertising campaign, only to be replaced by a new constitutional clause requiring all foreign mining and minerals exploration companies to hand over control and majority ownership to Brazilian nationals over a five year period.^{21,22} In addition, the constitutional assembly approved a clause halting the licensing of any new contracts for oil exploration by foreigners. From October 1988, oil-drilling, prospecting and minerals extraction were forbidden to companies not controlled by Brazilians.

One effect of the constitutional clause will be to make an already complex system of subsidiaries and 'paper' companies even more opaque, thus dimming the chain of ownership and therefore responsibility. For example, in 1987, BP in association with Brascan, had 197 separate companies in Brazil, 112 of which had requested concessions. The great majority of these companies had an insignificant capital, some as low as one cruzeiro and were, in effect, paper companies.²³

Some transnationals will no doubt find a way around the constitutional definition of "a Brazilian company of national capital", and maintain their control while ostensibly operating through legitimate Brazilian companies.

Brazilian TNC Exploration

Brazilian exploration, meanwhile, is accelerating and building on the first major oil discoveries within the Amazon basin itself in 1986.²⁴ In that year a well was discovered in the Urucú river basin, halfway between Manaus and the Peruvian border,

which produced 950 barrels per day. Extraction costs were estimated at \$3 a barrel, a quarter of those for offshore production. The strike was the largest so far made onshore in Brazil.²⁵ Subsequent strikes in the Urucú area, have led Petrobrás to estimate that the field encompasses an area of 150,000 square kilometres, three-and-a-half times the size of Switzerland.

According to Petrobrás a 'Master Plan for Managing the Amazon's Environment';

"is in the final development phase, and will guide Petrobrás operations in the region. The initiative is being undertaken for the first time in Brazil, and seeks to transform the company into an agent for promoting self-sustaining local development, assuring that industrial activity harmonizes with conservation of nature ... Petrobrás' guidelines for the Amazon also include environmental education: programmes will be prepared together with the company's and contracted firms' employees and with local communities to develop an environmental consciousness aiming at a nonpredatory use of natural resources".²⁶

It would take a heroic leap of the imagination to suppose that Petrobrás could meet these objectives in a single operation, let alone in an area of 150,000 square kilometres.

Mercifully, development of these fields has been slowed by financial constraints, but Petrobrás hopes to begin barging 5,000 barrels per day of Urucú oil to Manaus by late 1989.²⁷ The refinery at Manaus is expected to produce 20 percent of Brazil's national consumption. Proposals have re-

cently been made for an 800 km gas pipeline to supply the city of Manaus which might continue to Carajás, over 500 km further east.

British Petroleum's Environmental Record

In 1987, BP was exploring in eight tropical rainforest countries including Brazil, Columbia and Ecuador.

Their record in Brazil has come under scathing attack in the past, notably from Roberto Gama e Silva, a retired admiral who directed mining interests in Brazil during the last military government. In a book detailing the environmental and social impact of TNCs in the Amazon, he claimed that BP had built up a network of over 100 companies in collaboration with Brascan, and two Brazilian affiliates. Between them these companies owned over 6,000 prospecting licenses, covering 22 million hectares.²⁸

The latest attack has come from the London *Sunday Times*, which in April 1989 investigated the company's role in an open-caste cassiterite mine (used for tin manufacture) deep inside the Jamari National Forest in Rondônia. The mine is operated by the Companhia de Mineracao Jacunda which is jointly run by BP and Brascan.

Initially, BP claimed that 5,467 hectares of forest have so far been lost in the process, while the Brazilian forest service estimates that the true figure is nearer 97,208 hectares, some 40 per cent of the total 'protected' area. Following a full BP inquiry into the Jamari operation, BP admitted that the total forest cleared amounted to 5,720 hectares, 1,694 hectares of which was due to the mine itself, and 3,228 hectares due to a BP dam built to serve the mine.²⁹

According to the *Sunday Times*, despite BP's claims of sensitive road building, up to 200 metres of forest had been cleared on either side of the road serving the mine. Brazil nut trees, which are protected under Brazilian law, had been burned, and nearby rivers were clogged with silt. Almost 600 workers and their families have been moved into the area.³⁰ BP has now handed its shareholding over to RTZ.

BP Elsewhere in Amazonia.

BP ceased oil exploration in Brazil in 1988, but they are still involved in exploration in other areas of Amazonia.

BP claim to have a constantly-updated detailed set of environmental guidelines for oil exploration and drilling in tropical forests, complying with 21 principles of environmental protection. However in discussions with Friends of the Earth UK, the company was not prepared to release details of the 21 underlying principles, so it is impossible to judge how comprehensive the codes are in practice.³¹

Environmental Impact Assessments (EIAs) are theoretically carried out before starting any project, but it is known that this does not always occur in practice. Internal BP documents demonstrate a marked lack of attention to environmental procedure in rainforest areas compared with operations in developed countries. For example in 1987, in the UK, BP prepared 22 Environmental Impact Assessments, 40 Baseline Environmental Surveys and 18 Environmental Monitoring Surveys. In tropical areas, the record was dismal; only one preliminary EIA, one incomplete EIA, no Baseline Surveys, and no environmental monitoring.

Migration Along Seismic Lines

BP have stated that they take great care when undertaking seismic exploration. Guidelines limit the width of the path to two metres during exploration and BP claim that LANDSAT images and ground level exploration suggest that all signs of seismic lines have disappeared after ten to twenty years.

In Ecuador, this is clearly not the case. Mass migration up exploration routes and seismic lines is a serious problem, with seismic lines showing-up clearly as migration routes in LANDSAT imagery. This problem is now severe in Ecuador, despite official assurances from BP to Friends of the Earth that road building in the areas of oil exploration are strictly controlled and that settlements and subsidiary roads are not causing an environmental problem. Oil company maps obtained by Friends of the Earth show extensive development of side roads in some areas, and of settlements alongside the roads.

Observers who have travelled into BP blocks in the area south of Coco near the river Napo, in the central Ecuadorean Amazon, report seeing additional road building, subcontracted from BP which does not show-up on any maps. Settlements are springing up almost continuously along this stretch. These developments are directly related to oil exploration in the region.

"... in the absence of either an effective government, a vocal middle class, or active non-governmental organizations to scrutinise the activities of the TNCs, environmental and social guidelines are simply ignored."

Blocks held by Texaco and Conoco in Ecuador show similar problems with migration up seismic lines and paths to exploratory sites. The scale of the problem can be immense; Conoco alone has laid 2,307 kilometres of seismic lines.

Action by BP

BP is an active member, perhaps the most active member of the International Petroleum Environmental Conservation Association (IPIECA), a voluntary co-ordinating body for the petroleum industry set up with the United Nations Environment Programme (UNEP). BP has submitted its own environmental code to UNEP, through the IPIECA forum.

As a result of the *Sunday Times* exposé, BP have 'fast-tracked' their audit of tropical forest operations, which is now complete, and will be using the findings to produce a new set of operational guidelines, including a checklist (as produced for onshore operations in the UK), for use by field operators.³²

Shell in Latin America

Shell is involved in numerous operations in Latin America, and has been in long and delicate negotiations with the Government of Peru over a vast natural gas find in the southern Amazon region.

The company also has a number of oil exploration blocks in Peru in the Madre de Dios basin, in the southern forests, near other Shell exploration areas over the border in Bolivia.³³ If Shell finds large enough reserves, it aims to construct a trans-Andean pipeline from the rainforest to the southern coast at an estimated cost of \$700 million.³⁴ Shell is to put up about half the investment for the project, with the balance from the Inter-American De-

velopment Bank (IDB). So far, Shell has completed 3,400 kilometres of seismic lines and drilled six exploratory wells.³⁵

In Brazil, Shell is best known for its involvement in two bauxite projects, a 600 million tonne reserve by the Trombetas river jointly owned with the US Alcoa and a smelter on the island of Sao Luis, again with Alcoa, through Shell's sister company Billiton.³⁶

Local environmentalists claim that the aluminium smelter on Sao Luis has resulted in the loss of thousands of hectares of rainforest and mangrove swamp due to the construction of roads and settlements linked to the development.

Double Standards

Both Shell and BP have long maintained a high public profile on environmental issues in the UK. Both sponsor conservation awards, and both have high profile 'green' advertising campaigns.

The 1986 Shell Information Handbook highlights the company's projected attitudes towards the environment:

"...the potential environmental impacts of Shell products, processes and operations must be fully assessed and appropriate measures adopted to ensure environmental acceptability ... new processes are considered through the mechanism of an environmental impact assessment, so that environmental acceptability is built in from the beginning during the planning of major operations such as those connected with exploring for and producing oil and gas.

"...it is sometimes necessary to go beyond specific studies and consider general topics of overall relevance to Group activities. This special attention has been paid to such topics as acid rain, waste management, and oil pollution in the marine environment".

Exploration in tropical rainforests certainly qualifies as a case for special attention.

Shell UK Ltd, is now involved in prospecting for oil in rural Hampshire and Dorset in southern England. Facing protests from influential local authorities and the frequently well-off inhabitants of the area, Shell have mounted a large-scale public relations exercise and have published a 100 page report from Aberdeen University which shows that current controls over on-

shore drilling in countries like Britain, with a vociferous middle class to defend their rural homes, are already tight.³⁷ Shell and other oil companies are being forced to adopt extensive strategies for minimizing environmental damage, to the extent of choosing sub-optimal sites to preserve woods and hedges, carrying out complete rehabilitation of any natural areas and so on. The British government has pledged that onshore oil and gas developments will not go ahead unless they conform to strict environmental standards.³⁸

There is little evidence to suggest that Shell are as concerned about the infinitely richer and more biologically diverse forests of the tropics. Unlike BP, they have no comprehensive set of guidelines for operations in tropical rainforests.

Future Threats

In the wake of the Exxon-Valdez disaster, oil companies worried about expensive curbs on their activities in the rich nations are now increasingly looking to the Third World.

The magazine *Business Week* reported in May 1989 that:

"Left with scant funds and fewer prospects, the handful of drillers and service companies that can afford to are following the majors overseas to North Yemen, Colombia, Brazil, Malaysia, and India, where finding costs are lower and tax incentives are offered".

There are a number of important reasons why for example, BP, which has one of the best environmental divisions of any oil company, will continue to damage tropical forests in which they operate.

Firstly, there is neither the institutional will, structure, nor staffing to ensure that policy emanating from the London headquarters will be adopted and implemented by the 2,000 or so diverse subsidiaries overseas. This situation is made worse when BP is a minority partner. Effectively, although an environmental obligation clearly exists, the operations of these companies are beyond the control of the central group. Although sources within BP claim that when the environmental performance of partners has been poor, the company has withdrawn from partnerships, this is difficult to confirm.

Secondly, guidelines are still inadequate, particularly with regard to tribal peoples.

Thirdly, in the absence of either an effective government, a vocal middle class, or active non-governmental organizations to scrutinise the activities of the TNCs, environmental and social guidelines are simply ignored.

Conclusion

An ocean of green rhetorical froth has spewed forth from the oil transnationals, obscuring pipeline leakages and detracting from the tidal wave of social calamity and deforestation which is bearing down upon Amazonia. Genuine action though, is ankle deep, and even sincere attempts to minimize the impact of oil extraction can divert attention from more profound questions of equity and sustainability.

It may well be that Conoco deliberately minimizes the area of operations in the Yasuni National Park, and forbids hunting on pain of dismissal, but such gestures are a sham. Although National Parks workers in Ecuador favour foreign oil companies over Ecuador's CEPE, because of the foreigners' greater concern for environmental and human rights issues (CEPE have an appalling environmental record, including the direct discharge of oil into watercourses.)³⁹, a truly responsible oil company would refuse to explore in a national park in the first place.

BP, as has been shown, may have an excellent series of new and field-tested operational guidelines for rainforests, but creation of access is inherent in their present style of operations. It is the oil companies who are slicing Ecuador into bite-size chunks for the colonists. In other parts of Amazonia, drug smuggling and illegal mining operations are aided and facilitated by the construction of roads.

In Brazil, environmentalists face huge problems with their own transnational, Petrobrás, whose global reach extends through its subsidiary Brasoil, to the North Sea. It is highly unlikely that Petrobrás' operations in the Urucú river basin, covering an area of remote and delicate rainforest, three-and-a-half times the size of Switzerland, will be anything less than disastrous, despite the Green Master Plan.

Clearly, oil transnationals are a vital link in a chain of development, which is unplanned, unsupervised, unpoliced, and unsustainable. Their impact lends strength to an increasing call within Brazil to halt road building in Amazonia, close existing access roads and fell bridges, until such time as an effective institutional structure is in

place to deal with the problems of land tenure, corruption, and maldevelopment.

If the oil companies are to live up to their own green rhetoric, they face little choice but to pull out of rainforests altogether.

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The Militarization and Industrialization of Amazonia:

The Calha Norte and Grande Carajás Programmes

by
Dave Treece

It is the Brazilian Government's avowed aim to push back the frontiers of Amazonia. The goal is the industrialization of the region, and, in particular, the exploration of its undoubted mineral wealth. Two programmes — Calha Norte and Grande Carajás — epitomise the rush to destruction. The losers, as always, are the indigenous population and the environment.

Between 50,000 and 60,000 Indians, from 51 territories, will be directly affected by a major programme of military occupation, colonization and development of lands along Brazil's 6,500 kilometre frontier with Colombia, Venezuela, Guyana, Suriname and French Guyana. Representing 24 per cent of Legal Amazonia and 14 per cent of Brazil's entire territory, the Calha Norte programme embraces some of the country's largest tribal communities, many of which are already threatened by petroleum prospecting, mining activities and other developments. Among the tribal groups affected are the 3,000 Indians of the Javari valley and the 20,000 Tikuna of the Upper Solimões, the 18,000 Indians of the Upper Rio Negro and the 9,000 Yanomani of Roraima.

The project is the brain child of General Rubens Bayma Denys, secretary-general of the former National Security Council who, in a statement in June 1985, justified his proposals by arguing that the existence of a "demographic void" in the region, the "susceptibility of Guyana and Suriname to Marxist ideological influence", and the possibility of border conflicts between neighbouring countries, could render Brazil's national sovereignty vulnerable, and even "project East-West antagonisms onto the northern region of South America."

Not surprisingly, given the alarming

implications of the programme both for the Brazilian and Indian population of the region and for the neighbouring countries, General Bayma Denys recommended that the plans should not immediately be made public knowledge: "It should be observed that many of the themes dealt with, such as the reformulation of indigenist policies, the re-demarcation of frontiers or the localization of military installations, require secret handling, at least in the early stages of their analysis, by virtue of their high political sensitivity."

The military authorities have assumed a policy of economic integration for the tribal communities affected. For General Leônidas Pires Gonçalves, "there is not a Yanomani nation, there are 'Yanomani' tribes", and Calha Norte is a logical means of reconciling the development of the region with the integration of its population. Another army officer made even fewer concessions to the rights of the Indians: "The most important thing at the moment is to occupy the great empty spaces of the frontier region of the northern watershed of the Solimões, where there is a predominance of pockets characterized by a total absence of Brazilians, white men or *civilizados*. The presence of the Indian, alone, is insufficient to guarantee the defence of regions such as we have in Amazonas and Roraima."

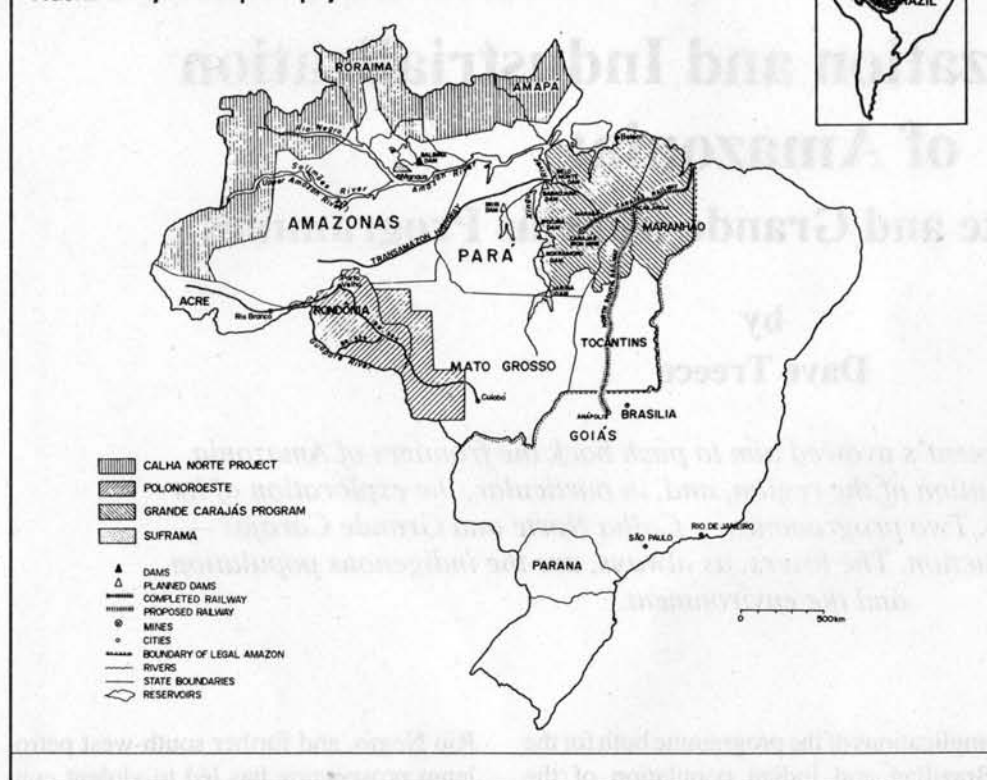
It is not coincidental that some of the largest tribal communities to be affected by the Calha Norte project inhabit lands containing valuable mineral and fossil fuel reserves. Gold is already being mined on Tukano and Baniwa lands on the Upper

Rio Negro, and further south-west petroleum prospecting has led to violent conflicts with the Korubo of the Javari valley. In a key area of northern Roraima, 27 concessions have been granted to companies including BP and Anglo-American for mining operations on Yanomani territory, which contain gold, diamonds and cassiterite. A further 363 applications have been lodged, representing a direct threat to one-third of the Indian's land.

The central objective of the indigenist policy for Calha Norte is to ensure unrestricted access to the mineral reserves located on tribal territories, and to incorporate the Indians into the colonization and development programmes planned for the region. It is stated policy that all indigenous communities inhabiting territories within 150 kilometres of the frontier are to be denied their constitutional right to legal and effective protection or demarcation of their lands. In their place, FUNAI, the Government Indian agency, is being allocated resources for the creation of "indigenous colonies" in which Indians are to participate in "Community Development Projects" and agricultural schemes. In addition, missionary and health workers fighting to provide medical protection for the Indians against introduced disease, and to monitor and publicize their plight, have been expelled on the orders of FUNAI and the National Security Council. In total, up to 60,000 Indians from 83 areas face the loss of their right to territorial security, the devastation of their forests and the shattering of their society and culture by the labour and commodity markets.

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FIGURE 1. Major development projects in Brazilian Amazonia.



Source: *Environment* Vol. 31, No.4, 1989.

The Assault on the Yanomani

The Yanomani, who for more than ten years have been campaigning for the creation of a park in northern Roraima, have been particularly brutally affected by such policies. The absence of effective legal protection for their lands has opened the door to successive invasions by freelance gold-diggers and commercial mining companies.

Announcements in 1987 and early 1988 of a demarcation decree for the territory were dramatically overtaken by one of the largest spontaneous movements of people to be witnessed in Amazonia. Within four months from the end of 1987, 20,000 gold-diggers had entered the Yanomani lands in the Couto de Magalhães area, arriving from all over the country at a rate of 100-200 every day, by river, on foot and in small planes which were able to take advantage of the new enlarged airstrip installed under the Calha Norte Project. Precipitated by the announcements of the area's demarcation, the gold rush had brought 40,000 miners into Roraima by the middle of 1988, in the knowledge that FUNAI had no adequate structure to deal with the invasion and that the efforts of the Federal and Military Police to stem the flood would be ineffective. Official estimates of the numbers occupying the Yanomani lands by the end of 1988 were of the order of 100,000.

The latest Government response to this critical situation, far from seeking to restore to the Indians their constitutional right to the exclusive occupation and use of their traditional lands, serves on the contrary to legalize the presence of the gold-diggers, to pave the way for the entry of large-scale commercial activities and to accelerate the physical, social and cultural disintegration of the Yanomani people.

Thus, two-thirds of the eight million acres to be set aside as "Yanomani Indian Land" are to be categorized as Forest or National Park and therefore subject to laws which do not take Indian land rights into consideration, allowing their economic development under the administration of FUNAI and the Brazilian Institute for Forest Development (IBDF). In effect, the Yanomani's territorial rights are to be limited to an archipelago of 19 separate zones hedged in by the areas of Forest and National Park and by areas designated for mineral prospecting, commercial mechanized mining and timber extraction.

The invasion of the Yanomani lands, effectively condoned and institutionalized by the Government, has already taken its toll on the tribal communities. By March 1988, more than 50 Indians had already died from influenza and malaria introduced by the miners; in just one area north of Paa-Piu, 280 out of 320 Indians had flu, 84 of them with pulmonary complications. Numerous violent confrontations have

been reported since the killing of four Indians and one miner in an incident in August 1987. The numbers killed by disease and violence during 1988 may be as many as 500. Only a serious operation to ensure the peaceful removal of the gold-diggers and the effective demarcation of the Yanomani's traditional lands as a continuous area, can prevent the tragedy which has already begun from engulfing an entire people.

Grande Carajás

Mining and industrial development projects are also causing ecological degradation and severe social impoverishment in the areas affected by the Grande Carajás project. All told, the project, which is intended to open up eastern Amazonia to industry and industrialized agriculture, is to occupy 900,000 km² — an area the size of France and Britain combined.

The centre piece of the project is the Serra dos Carajás open-cast iron ore mine. The Iron Ore Project, which consists of the mine itself, railway and port is being part funded by the World Bank and the European Commission. Other projects include a bauxite mine capable of producing 8 million tonnes of bauxite a year, and an aluminium smelter that will produce 800,000 tonnes of aluminium and 20,000 tonnes of aluminium oxide a year for sale to Japan. In addition, some 55,000 km² will be cleared to make way for export-oriented plantations and biomass fuel farms. A further 30,000 km² will be given over to ranches.

Approximately half of the Grande Carajás region, 450,000 km² or five per cent of the area of Brazil, is forest, ranging from true rainforest to seasonal evergreen forest and open savannah. The immediate threat is from the iron smelters and charcoal plants being set up along the railway from the Carajás mountains in Pará to the deep-sea port at São Luís, and from the mining operations in and around the main Carajás mineral province. Currently four smelters are in operation. Some 25 charcoal-based smelters have been planned for the area close to the railway.

The aim is to produce 2 million tonnes of pig iron per annum by 1991, rising to 16 million tonnes per annum by 2010. Charcoal production for pig iron smelting will destroy 3.1 cubic metres of wood for each tonne of pig iron produced. Annual production of 2.5 million tonnes of pig iron will therefore lead to 610,000 hectares of forest destruction a year — a figure which

would double current official figures of deforestation in Brazilian Amazonia.

In addition, a 3 million tonnes per annum steel plant is being considered near São Luis, at an estimated cost of US\$2-3 billion. For this, the Brazilian Government is negotiating to import coal by sea from Colombia. According to the National Steel Plan, some 8 million tonnes per annum of steel are to be produced in the Carajás region by the year 2010.

Since Brazilian companies are allowed to deduct 25 per cent from their annual taxes if this is invested in Amazonia, most of the furnaces are being built by subsidiaries of steel or mining companies from the central Brazilian state of Minas Gerais. Many are also being built with government loans from FINAM—the Fund for Investment in Amazonia. Once built, they are exempt from income tax for ten years.

The Responsibility of the World Bank and EC

While the pace of destructive development in the region has quickened, none of the institutions involved in funding the projects has taken any serious action to ensure that even minimum safeguards are employed in defence of the Indians and their environment. The European Community has failed to carry out any independent monitoring of the Iron Ore Project. Indeed, a meeting with the Community's Director of Credits and Investments revealed that the EC has relied upon the annual missions of the German banking consortium, KfW, which is entirely lacking in the technical competence necessary to assess environmental and social matters.

The construction of charcoal-fired pig iron furnaces along the Carajás railway continues apace, despite the warnings of the chief environmental officer for the state mining company, CVRD, about the disastrous environmental and economic consequences. CVRD, the World Bank and the EC still hold to the now rather hollow argument that no responsibility can be accepted for environmental or social problems outside the arbitrary 'area of influence' of the Iron Ore Project. This is despite the clear infrastructural role of the iron ore mine, railway and port (which comprise the Iron Ore Project) as an export corridor for the region, and despite admissions from within CVRD itself of its responsibility for the pig iron/charcoal projects given its monopoly on the supply of iron ore and rail transport (see B. Rich, 'The Greening of the Development

"It is the Indians' very integration into the world economy, rather than their marginalization, which explains the increasingly intolerable conditions of life they are forced to endure."

Banks', *The Ecologist* Vol. 19, No. 2, 1989).

As far as the tribal communities of the region are concerned, the same authorities claim great successes. But the extension of the official 'Support Programme' introduced in 1982, has done nothing to advance the situation of the 16 territories out of 27 (only 25 are included in the Programme) which still lack full legal and physical protection. Contrary to the claims of CVRD, the World Bank and others, figures from the Brazilian NGO, CEDI, indicate that the demarcation process has been completed for less than 37 per cent of the area traditionally occupied by Indian lands. Demarcation processes may have begun in many cases, and even been completed in some instances; however, the problem remains largely one of non-progress or of incorrect demarcation (too small, or non-traditional, useless areas), and of land invasions. The reassurances of World Bank and EC representatives about continued funding for the Amerindian Project ignore the central problem of FUNAI's institutional incompetence to administer such funding, as demonstrated not only by the experience in Carajás but also by the legal investigations into an ex-President of the agency's involvement in illicit timber contracts on Indian lands (see D. Posey, *this issue*).

CVRD has now declared that it has no intention of renewing funding for the Amerindian project after the present budget has run out. The 15,000 Indians of the region are therefore to receive no further support to withstand the continuing impact of a development programme that is expected to run for several centuries.

The Expropriation of Guajá Land

In perhaps the most urgent case, that of the 250 or so nomadic Guajá of Maranhão, two-thirds of the Indians' territory has been expropriated for cattle ranching.

On 6th May 1988, the Awá Indian Area was officially demarcated by FUNAI. This was to have been ratified by the Brazilian President. On 29th August 1988, however, the Minister of the Federal Resources Tribunal suspended the demarcation at the request of 36 cattle ranchers who have claims totalling 111,000 hectares in the Indian area. Granting this land to the ranchers will reduce the area of territory earlier declared for demarcation by 60 per cent, from 147,500 hectares to 65,700 hectares. A demarcation study and proposal made by the anthropologist Mércio Gomes (contracted by CVRD) in 1985 had recommended that 276,000 hectares be demarcated.

The dispossession of the Guajá not only leaves them exposed to the depredation of the cattle-ranchers, it also gives the green light to those seeking new sources of timber for the charcoal burning smelters rapidly being installed alongside the Carajás railway.

Alternatives to Charcoal?

Official policy is that charcoal from natural forests will be the principal energy source for at least the first eight years until charcoal from plantations becomes available. Since the charcoal will have to be supplied from ever-increasing distances, the financial viability of the projects is likely to be jeopardized. The experience of iron and steel production in the state of Minas Gerais, where over one-half of charcoal consumption is from natural forests, has been of widespread deforestation. Transport costs from sites up to 800km from the plants now amount to up to two-thirds of total delivery costs. Furthermore, given the low international prices of pig iron, production using charcoal from natural forests is only financially viable if the economic and environmental costs of deforestation are ignored.

In addition to objections from the local State Governments of Pará and Maranhão to the environmental consequences and the lack of economic benefit to the region itself, CVRD considers that charcoal is too valuable to be used for pig-iron production, and should be reserved for production of higher-value goods such as speciality steel. CVRD is collaborating with the São Paulo-based company Prometal in a project to set up a steel plant near the Carajás mine.

Meanwhile, CVRD's own environment department has expressed its clear opposition to the pursuit of the programme of

charcoal-powered iron smelters. In an internal document dated April 1987, CVRD's Superintendent for the Environment, F.F. de Assis Fonseca, has pointed out that, not only are the projects economically unviable unless native forests are used, but no measures are being taken, nor have they been contemplated, by the companies setting up the smelters to reforest the region. Even if they were, agroforestry knowledge is insufficient to start large-scale reafforestation in the short-term. At the same time, even the viability of projects using native timber is threatened by falling steel prices and rising charcoal prices. At present, it is only the fiscal incentives offered to the companies under the Grande Carajás Programme which make investment in these projects attractive. According to the viability study carried out for CVRD, optimistic predictions are that timber production capacity in the region will be exhausted within 20 years.

In September 1988, a number of Brazilian Non-Government Organizations (NGOs) brought a civil prosecution against the Brazilian Government and the companies responsible for the pig-iron smelters for violating environmental and forestry law, and for failing to observe the constitutional requirement to carry out environmental impact studies in advance of such projects. The NGOs are calling for a halt to iron smelting until thorough studies into alternative energy sources to charcoal have been completed and acted upon. Although presently frozen between the Federal and State courts, the case may already have succeeded in preventing the installation of the new pig-iron plants planned for the region. Meanwhile, for the past twelve months, the World Bank (with financial and technical support from the European Commission) has been ready with a proposed study into energy alternatives for Carajás. Only the intransigent opposition of the Brazilian Government has prevented the study from going ahead.

Social Impact

In the state of Maranhão alone, there are 450,000 landless families out of a total population of just over 4.5 million. The concentration of land ownership (26 million hectares out of the total 32 million hectares are big estates, but only 37 per cent of this area is actually occupied) is being intensified by charcoal production and other projects. As more forest is given over to charcoal, more peasant farmers will be thrown off their land. Those who

"Brazil's distorted structure of land ownership can only continue to exert pressure to 'open up' Amazonia for ranching and settlement; the burden of foreign debt and the irrational dynamic of the development process are accelerating the industrialization of the region at a dizzying pace."

are not, like the Indian communities of the region, will be pressured into selling their own timber and producing charcoal for the furnaces.

Pollution is a serious problem, given that the pig iron plants do not have pollution controls. Disease, too, is on the increase: tuberculosis is now amongst the chief diseases suffered by residents of Piquiá, Açailândia, which is surrounded by smoke from the charcoal furnaces. The full extent of associated respiratory problems will only become apparent after a number of years, but already those working in the furnaces themselves (the management of Vale do Pindaré Iron and Steelworks does not allow them to be photographed) are coughing up black bile. The majority of small farmers in the area are now employed by the new industrial firms, their land swallowed up by speculation.

Immigration into the region has also led to a severe reduction in the availability of fish on the island of São Luis, where in one locality production has dropped from 1,000 kilogrammes per week in 1986 to 600 kilogrammes in 1987 and 50 kilogrammes by this year. In Marabá, at the centre of the scheme, family incomes are calculated at five per cent of the amount necessary for the minimum requirements of food, health, transport and housing.

Responsibility for Destruction

Most important perhaps, for those campaigning on the issue, is the question of CVRD's responsibility for the environmental and social impact of developments in the region beyond its own Iron Ore Project, a responsibility which, along with the other funders of the Project, it has so far denied. However, as Fonseca puts it, "CVRD's responsibility is greatly in-

creased by the fact that it holds the monopoly on the mineral and on the rail transport. Any iron and steel project in the northern region can only exist with the support of CVRD." Under pressure from both the iron and steel lobby and from ecologists and the Forestry Institute, "It will be difficult for the company to defend itself from accusations of being the chief party responsible for the devastation." The same must apply to the EEC, the World Bank and the other financial institutions supporting the Iron Ore Project, yet which have attempted to disassociate themselves from the environmental and social disruption produced by the Project.

Conclusion

Today, the last isolated communities of Amazonian Indians are being swiftly and brutally taught the laws of world economics. The fragile boundaries of a world which seemed closed have been irrevocably opened up — a process that will continue regardless of what steps are now taken (and must be taken) to provide the Indians with the territorial security that can enable them to withstand and resist the onslaught on their ways of life. For it is their very integration into the world economy, rather than their marginalization, which explains the increasingly intolerable conditions of life they are forced to endure.

Whatever the individual victories of isolated communities (and they are few and far between), Brazil's distorted structure of land ownership can only continue to exert pressure to 'open up' Amazonia for ranching and settlement; the burden of foreign debt and the irrational dynamic of the development process are accelerating the industrialization of the region at a dizzying pace. Ultimately, therefore, any real advance in the control exerted by Indian groups over development on their lands will depend upon the balance of political forces in society at large.

The task ahead must be to build upon the incipient links being forged between various forest peoples' groups (*see Schwartz, this issue*) and those seeking to defend their environments and working and living conditions elsewhere in the country, in order to challenge those mining companies, government agencies and military forces which are violating the rights of tribal peoples. Only the advance of this movement can guarantee the Indians the possibility of genuine control over their lives.

The Sacred Cow in the Green Hell: Livestock and Forest Conversion in the Brazilian Amazon

by
Susanna B. Hecht

Thousands of hectares of forest are cleared each year in Amazonia to make way for cattle. Although misguided subsidies have played a role in the expansion of cattle ranching, they are not the root cause of the problem. Nor, in the case of the Amazon, is the "hamburger connection". Rather, the attraction of cattle lies in their ancilliary benefits: it is the things cattle do besides producing meat that make them so profitable. If the problem of pasture-led deforestation is to be countered, the solution lies in fundamental changes within the regional economy.

"These placid creatures which used to require so little food have now apparently developed a raging appetite and turned into man eaters. Fields, houses, forests, towns, everything goes down their throats."

Thomas More, *Utopia*

Thomas More was writing about the expansion of sheep herding in the 16th century, but this description of the displacement of forests and cultivated lands by livestock could have been written last week about the Amazon Basin. The majority of deforestation in the Amazon is caused by pasture development, and most cleared land will ultimately end up in pasture. The environment is not the only victim. Forest peoples routinely watch their lives, livelihoods and complex agricultural systems reduced to ashes by the burning of forest for pasture. Peasants are often directly displaced by cattle in bitter land disputes, or occupy land as part of a short-term cropping phase before the land is transformed to pasture. Their livelihoods are destroyed by this devastating process.

Wealth on the Hoof

It is important to understand that pasture-driven deforestation is not purely the outcome of international commodity markets — the so-called 'hamburger connection' — as has been argued for Central America and has been erroneously applied to the Amazon.¹ Nor does the expansion of

ranching only reflect the influence of misguided subsidies.² Were either of these interpretations the case, the solution — the substitution of other sources of beef or protein and the withdrawal of subsidies — would be relatively simple.

But the relentless expansion of ranching is more complex. Underlying the devastation is a combination of local processes, regional policies and national economics in which cattle and their pastures have a flexibility unmatched by other more ecologically appropriate land uses and an ability to serve a myriad of economic purposes. Attempts to control pasture-led deforestation and to promote more ecologically appropriate alternatives will be more difficult to achieve than simply through the manipulation of markets or policy.

Profit From Land and Resources

There are three basic ways of capturing value through land and natural resources. First there is *extraction*, which takes two basic forms: renewable and irrevocable extraction. Second there is, *production*, which involves more direct intervention in the manipulation of biological processes through the application of energy, labour, and capital. Capital here can include the standard economic uses of the term (machinery, money, etc.), but it also implies biological/environmental capital in the form of genetic resources or soil properties and human capital embodied in knowledge and individual skill. Production implies far more complex and organized forms of intervention in the natural world

than simple extraction, and incorporates the idea that energy and resources are applied to land to generate something of value not inherent in the land resource itself.

The third way to make money via land and natural resources is through their *ability to capture fiscal resources*, such as capital gains, through speculation; in effect, their usefulness as a *means of capturing institutional rents*, such as credits and subsidies, and as a *means for claiming other assets*. In this case, the value of the resource or land has little to do with its actual characteristics, or the labour and resources applied to it. The value of the resource/land is linked to its ability to generate returns through a variety of financial structures in the larger economy. Bhagwati has called these activities "Directly unproductive profit seeking activities", or DUPs.³ Value is determined less by inherent environmental characteristics (although these are not completely absent, as in the value of timber stocks), than by institutional factors such as validity of title, access to credits, or spatial characteristics, like proximity to roads. Land and resources become means of making a profit, but produce little in the way of goods and services through increased production.

Livestock and Profit

In Brazil, livestock have been extremely important as a means of claiming land and tax breaks and are vehicles to a variety of other forms of financial benefits such as subsidies and immense speculative gains.⁴

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I contend that the reason that livestock has played such a seminal role in the conversion of forest to pasture is that it is one of the best ways in which all three of the forms of capturing value described above (extractive, productive and DUP activities) can be achieved in the context of high environmental and economic risk. Both large and small landowners can benefit through the role of land in the Brazilian economy, and the specific features of the animals themselves. While the strategies for large and small producers will differ, they are based on similar principles:

- The importance of land as a means of gaining access to financial benefits inherent in specific polities (credit) or those characteristic of the wider economy (speculative gains);
- The importance of land as an asset;
- The usefulness of land and animals as a hedge against inflation;
- The biological flexibility of the animal which both reduces risk and permits the owner to decide the moment of sale;
- The ability of livestock to occupy large areas with little labour;
- The low risk of producing animals or pasture;
- Historic factors.

In the humid tropics, all these combine to produce the explosive expansion of a land use that produces minimal calories, proteins and direct monetary returns and maximum environmental degradation.

The Logic of Livestock: Large Owners

Most of the literature on cattle production in Amazonia focuses on the eastern Amazon and has concentrated on the dynamics of huge, subsidized, corporate ranches.⁵ This is because the logistics of obtaining such information are relatively easy, and because the documentation of these enterprises can be tracked through public materials held in SUDAM, the Superintendency of Amazonia. The studies that were produced from SUDAM information thus gave the impression that only highly subsidized livestock operations were involved in the tremendous transformation of forests to grasslands in Amazonia.

There is no question that the SUDAM ranches have been important in the deforestation dynamic since they formally control some 8,763 km² of Amazonia. In areas where they dominate, such as southern Pará and northern Mato Grosso, SUDAM have been responsible for 30 per cent of the



Massive ranches — encouraged by state subsidies — have been responsible for 30 per cent of the deforestation in areas such as southern Pará and northern Mato Grosso. But the focus on a few hundred mega-ranches has obscured the fact that there are more than 50,000 livestock operations in Amazonia. Clearing forest for pasture is clearly economically attractive even without subsidies. One reason lies in the profits that can be made from land speculation. (Photo: N. Hildyard).

clearing, according to figures from INPE, the Brazilian Institute for Space Studies.⁶

SUDAM ranches have been highly subsidized in several ways. These include:

- **Fiscal incentives.** SUDAM ranches received grants of up to 75 per cent of the ranch development costs in order to encourage corporate groups to invest in the region. These incentives have totalled close to \$600 million;
- **Tax holidays.** Up to 100 per cent of a corporation's tax bill would be forgiven if these monies were invested in holdings in the Amazon region or the dry Northeast. The net effect of these tax holidays was to permit corporations to use their monies as though they were venture capital, or simply to divert them into other more lucrative activities;
- **No import taxes.** Imported equipment used on these ranches were exempt from import duty;
- **Subsidized credits.** Such credits were widely available at essentially negative interest rates. Thus, while inflation leaped to well over 50 per cent during the 1970s, the credits were granted at 8-12 per cent. Because these credit lines were largely granted by public banks and were initially designed to favour small farmers, the loans for land development (*investimento*) — unlike those for short term

costs (*custieo*) or marketing — often had 6-8 year grace periods under a 12-15 year amortization period. Many of the contracts signed in the early 1970s were not adjusted when policies shifted, resulting in a 'founders rent' for early borrowers. Under the prevailing inflation rates, such funds were often diverted into the short-term financial markets ('overnights') or other kinds of investments with a rapid and high return;

- **Land Concessions.** Free concessions were provided in many areas or, alternatively, lands were provided at nominal cost. Indeed, in its economic analyses of ranching, EMBRAPA (the Brazilian Ministry of Agriculture) generally does not even incorporate a land price.

The above package of benefits — all directly tied to the clearing of forest, ostensibly for cattle ranching, — made ranching enormously attractive. Dynamic entrepreneurs from southern Brazil were given extraordinary favours, in part because they helped draw up the terms of the incentives, and also because they were to take on the *mission civilizatrice* of taming the Amazon. As Mahar has suggested in his studies of Amazonian frontier policy, livestock became a vehicle for capturing both these extraordinary financial benefits and untaxed capital gains.⁷ Whether ranching was sustainable, economic or appropriate made very little difference in this context.

The recent data on clearing, however, suggest new trends. The explosive deforestation in Rondônia, Mato Grosso and Pará indicate that large ranches are not the only cause of the problem. Areas dominated by middle size holdings, with few SUDAM holdings, such as those in Paragominas, Pará, are currently experiencing deforestation rates greater than 1.5 per cent per year.⁸

Land Ownership

The SUDAM-sponsored deforestation could probably be explained on the basis of subsidies and tax holidays alone, but the focus on a few hundred mega-ranches has obscured the fact that there are more than 50,000 livestock operations in Amazonia at all scales of production. Clearing forest for pasture is clearly economically attractive even without the luxurious benefits of SUDAM affiliation. To explain this pattern of livestock expansion it is necessary to look at the role of real estate in the context of regional development strategies, subsidized credits, inflationary pressures in the Brazilian economy, the potential revenues from timber and the possibility of gold strikes — all of which contribute to the speculative value of lands.

A whole industry — the *indústria de posse* — has developed around clearing land for pasture, selling that land as quickly as possible, pocketing the gains and then moving on into new forest zones. Indeed, more than 20 million hectares of the Amazon have shifted from public to private lands in the last decade — an enclosure movement unmatched in speed and size.⁹ As a result, pasture lands throughout Brazil have experienced immense rises in value, rises which also reflect large-scale infrastructure investment patterns — the development of extensive highway systems, and the clear commitment by the Brazilian government to sustain investment in Amazonia through such mega-projects as Grande Carajás, and the Tucuruí dam. The value of land as a commodity itself, rather than as an input into production, has helped fuel the murderous land conflicts that now characterize the Brazilian Amazon as speculators pit themselves against peasants and petty extractors.

Land ownership in Amazonia has been characterized by extensive fraud, overlapping and competing claims, and a chaotic, often corrupt process of determining definitive title.¹⁰ Since those who clear land have a stronger legal claim to a parcel than

"Cattle claim what is under their feet. A recognized land claim brings royalty rights on subsurface minerals. Thus, areas adjacent to gold strikes frequently experience vigorous clearing."

those who do not, there is ample incentive to clear as much land as possible. Moreover, under the laws of INCRA (the Institute of Agrarian Reform), an area six times the size of the actual land cleared can be claimed. Thus, should there be valuable timber or potential mineral finds on adjacent sites, these can be secured through clearing. There are also obvious economies of scale associated with large clearings. Finally, under the terms of the new 1988 constitution, land in 'effective use' (that is, cleared) cannot be expropriated for the purpose of agrarian reform.

Production

In a study carried out by the Brazilian Institute of Economic Analysis (IPEA) on SUDAM ranches, it was shown that even on large operations running at capacity, the actual production and sale of livestock was about 15 per cent of projected productivity, while those ranches that were still developing generated a mere eight per cent of estimated production, based on the general stocking rate of one animal unit per hectare. Take-off rates (that is, the percentage of animals regularly harvested) have hovered at about 10 per cent, one of the lowest rates in the world. The formation and management of pastures is quite expensive, pastures are not usually sustainable, and the value of the final animal product often does not repay the investment costs. Browder has suggested that cattle only repay about 25 per cent of their production costs, based on a 15 per cent take off rate and fully realized herds.¹¹

A study of the economics of livestock rearing under various price regimes — with and without subsidies and speculation, and with different types of technologies — has shown that taking the economic returns to cattle production alone (without credits, no overgrazing, and no land appreciation), ranching was only economically viable under very specific conditions.¹² Overgrazing improved the economic scenario somewhat, but the major gains to the

enterprise were realized through capital gains linked to the rise in land values and the subsidies. The critical issue to note is that the returns on cattle production are overshadowed by the spectacular returns available from land speculation, and the rents associated with subsidies. This is not to say that the revenue derived from the sale of cattle is unimportant, only to point out that most of the revenue associated with livestock will not be generated by production but rather through financial or DUP activities as described above.

Extraction

Irreversible extraction can have a role in livestock expansion in two ways. The first, mentioned above, involves using livestock as a way to claim lands. A recognized land claim permits the holder to assert royalty rights on subsurface minerals which are technically owned by the Brazilian state. Thus, areas adjacent to gold strikes frequently experience vigorous clearing. Cattle claim what is under their feet. The other main way in which extraction is linked to pasture expansion is through the use of valuable timber to subsidize pasture development costs. This is a more recent phenomenon due to improved infrastructure, expanding timber markets, and relatively recent policy changes, and is more widely used by smaller ranching operations.¹³

Larger scale livestock operations appropriate value from natural resources through their ability to capture financial resources and to claim extractive ones. They can generate revenue as producers of beef, but this rarely covers the costs of production. The fusion of all three forms of profit-making or accumulation through a given land use is not limited to cattle ranching. Nonetheless, ranching has a special appeal due to the low cost of pasture compared to agriculture or perennial crops like cocoa, the low labour demands and most importantly, the rapidity with which cattle occupy large areas of land, thus providing economies of scale for these activities.

The Logic of Livestock for Peasants

Although the discussion of large-scale livestock operations has dominated the analysis of cattle and deforestation, the highest rates of deforestation in Amazonia currently occur in the state of Rondônia,

where it is colonists and small producers who are mainly behind the expansion of livestock. The increase in Rondônia's herd was more than 3000 per cent in the period between 1970 and 1988, and it has come to dominate the cleared areas.

There are several reasons why livestock figure so prominently in the strategy of small farmers. Cattle, and livestock more generally, are one means of reducing the risks in agriculture. They provide a supplement to household income in the form of milk or calves, and if there are agricultural disasters, as is often the case in the Brazilian Amazon, they provide a large 'lump' of income when sold. The ability of animals to move between use and exchange values is also important for small-holders, as is the ready local market for animal products where beef fetches the highest price of any source of protein, and the highest per kilo value of any basic food commodity.

Cattle provide these market benefits with less labour cost than rice, beans, maize (corn) or manioc or tree crops, and, unlike crops, animals are capable of transporting themselves. The timing of animal harvest is determined by household need or market opportunity, and not by the biological demands of crop production which often work against small farmers since all bring their main crops to market simultaneously.

Cattle production also extends the economic life of a cleared area. Sites that have been planted with crops usually go out of production within three years and are then planted with grass. This land is grazed until it becomes choked with weeds or so degraded that no forage will grow. While the productivity of these pastures is extremely low, they provide a marginal return on a piece of land that would otherwise be generating nothing for the colonist household. This may be a minor gain, but for poor households its importance should not be dismissed, especially since the labour costs are relatively low.

In highly inflationary economies, such as those of most Amazon countries, investing in animals is a way for peasants to protect their savings. For people who may not be comfortable with banks, and where interest rates do not accompany inflation, such a strategy is completely reasonable. This advantage is enhanced by credit. Colonization projects have frequently enabled small-scale ranchers to gain access to credit (although the lion's share of these credits went to larger holdings). The benefit of buying a valuable asset with borrowed money whose value is evaporating, while that of the animal is maintaining

"Pastures in the Amazon do not remain productive for long: frequently they are abandoned within ten years. Heavily degraded lands are exceedingly difficult to recuperate; in fact, more than half of the areas cleared have subsequently been abandoned."

if not exceeding that of inflation, is quite clear.

Throughout the Amazon, pasture is the cheapest and easiest way to claim occupation rights for both large- and small-scale producers. If, as often happens, peasant households inhabit a parcel of questionable title, and this land is adjudicated, the larger the cleared area the greater the indemnification if they are expropriated. As areas that have been cleared for pasture have a value that is about one-third greater than that of forest, their ability to speculate with these lands is also enhanced. Among colonists, land speculation and indemnification by the state or larger landowners occurs with some frequency. Finally, a lucky mineral strike or generous profits from coca production may produce immense surpluses for a rural household. In this case, one of the few local investment opportunities in the regional economy involves investing in land with cattle.

Much is made of the symbolism of cattle as items of prestige in Luso-Brazilian culture, and there certainly is an element of pride in emulating the rich land owners with their huge herds. However, the diversity of economic ends that can be served by cattle make them a compelling investment for colonists with or without the symbolic overlay.

Cattle must be seen in the context of the numerous roles they fill in these very uncertain rural economies. For both large and small operators, their advantages are inescapable. Unfortunately, these private benefits have quite disastrous public costs in terms of their environmental effect and their implications for the regional economy.

Unto Dust: The Ecological Effects of Pastures

Pastures in the Amazon do not remain productive for long, and frequently are abandoned within ten years. The rainforest

survives on very poor acid soils and most of the ecosystem nutrients are held in the biomass itself, not in the soil. When forests are cleared for pasture, there is a nutrient flush as elements held in the biomass are released to soils. However, with leaching, runoff and uptake by the pasture plants, soil nutrients decline rapidly to levels below those necessary for maintaining pasture production. Cleaning the pastures by chopping down the bush, burning, and fertilizing, can give pastures a new, albeit short, lease on life, although the economics of maintaining pastures versus clearing new ones works against managing existing cleared land.¹⁴

Heavily degraded lands are exceedingly difficult to recuperate (see C. Uhl et al., *this issue*). Thus the clearing for pasture ultimately often condemns land to waste; in fact, more than half of the areas cleared in the Amazon have subsequently been abandoned.

In terms of regional economies, cattle generate very little employment except for that required during the clearing phase and for brush management. This is a private advantage for both peasants and large landowners, but for the regional economy it is a disaster. The standard *fazenda* uses about one cowboy for every 1500 hectares cleared. The linkages to other parts of the regional economy are fairly weak. Implements, seed, wire, animal supplements and veterinary products all come from southern Brazil, so the major gains from these transactions accrue to merchants and transporters and the southern Brazilian industrial sector. Although Amazonian beef is consumed in local urban centres, and some employment is generated in the small slaughterhouses and butcher shops, the bulk of the labour linked to pasture development is in the clearing stage, with little permanent employment. Tax revenues generated from livestock sales are low. The SUDAM ranches have produced in taxes only about two per cent of the value of incentive money they received.¹⁵

What are the Real Solutions?

One of the current solutions to pasture-led deforestation being proposed in international circles is the idea that by reducing cattle subsidies, livestock would lose its attractiveness as an investment. This view constitutes the major analytic contribution of the World Resources Institute¹⁶ and the World Bank.¹⁷ This perspective views development processes as largely mechanistic, and ignores the fact that these proc-



*In the case of Amazonia, the classic 'hamburger connection' and the influence of international beef markets simply do not operate. Amazonian beef is rife with *aftosa* and is prohibited from entry into US markets. Moreover, the Amazon is a net beef importer. (Photo: WWF International)*

esses take on a life of their own and interact with a number of dynamics within the local and national economy. The irony is of course that deforestation rates have increased as subsidies to the sector have declined.¹⁸

One of the central problems with those who see the solution in terms of lifting subsidies has been the excessive focus on super subsidies to a relatively small set of producers and the extrapolation of this view to all cattle operations in the Amazon. Even amongst those who received SUDAM subsidies, between 60-70 per cent of the total fiscal incentive resources were concentrated in 35 large corporate groups who often had more than one SUDAM project.¹⁹

While these ranches were important in initiating a regional clearing dynamic, the withdrawal of subsidies now comes too late. The regional economy responds synergistically to a number of factors that are beyond the control of one set of policies. What drives land speculation now are high inflation rates, the relatively low entry costs for acquiring land in Amazonia, the clear commitment to infrastructural development by the Brazilian Government, colonization programmes, the threat of expropriation of uncleared land, and the concerted promulgation of doctrines of national security, national integration and national destiny which justify continued infrastructure expansion.

As the rest of the Brazilian economy goes into a tailspin, the "Amazon Card" is seen as an important means of resolving internal social tensions and assuring con-

tinued wealth accumulation for entrepreneurs who have difficulty in participating in urban investments. Given the recent triumph of the UDR (Rural Democratic Union, a right wing landowners organization that has organized against agrarian reform) in the constitutional congress, there is a large, and politically powerful constituency that will support and encourage the continued occupation of the Amazon, no matter what the environmental or social cost.

Technological Fixes

A popular line of argument suggests that environmental problems in Amazonia could be substantially mitigated if better pasture and livestock practices were implemented. If each area cleared stayed in production, then the need for increased clearance would diminish. Research institutes throughout the Amazon engage in careful field testing, fertilizer trials and germplasm selection in order to find the combination that permits sustainable pasture production. While certainly a laudable goal, it assumes that destructive pasture management is largely the outcome of poor technologies.²⁰

Although better management could make a difference, I have argued throughout this article that production itself is of little interest in much of the regional livestock economy. It is the other things that cattle do besides grow meat that make them so profitable. Moreover, our own studies make it clear that improved tech-

nologies do not yet yield returns that can compete with overgrazing.²¹ The fact that the ancillary benefits of ranching are not linked to production, and will accrue under good or bad management (indeed, in the short-term, bad management brings higher returns) means that technological solutions are likely to have little impact on deforestation patterns in the short-term.

In the case of Paragominas, Pará, where extensive research has been under way for more than a decade, and where the best pasture technology systems are tested and subsidized, the adoption of more appropriate technology is minimal, and deforestation rates have increased above the prevailing rates of the 1970s.²² If improved technologies were to make a difference, they would do so here, because of the relative proximity of ranches to the large Belém market, and because of the enormous effort in research and extension on pasture management focused there. Good management is clearly of secondary importance for many, if not most, landowners with pasture.

Social Movements

Rainforests will ultimately survive because those who make their living from them have organized to protect them from destruction. Tropical forests are not empty. They are and have been home to millions of people in the Amazon, from indigenous peoples to petty extractors of all kinds. Based on systems of renewable extraction and some small scale agriculture, informed by complex systems of local environmental knowledge, these populations have been able to generate large revenues that, in some cases, have maintained the Amazonian élites — notably the rubber barons — in fine style. Now, threatened by livestock enterprises and government infrastructure development, their resistance has become more politicized and is centering increasingly on environmental issues.

The forest peoples' movements are frail, but they have nonetheless been able to stop deforestation. The Rubber Tapper Council and Rural Unions of Acre, for example, claims that 1.2 million hectares of forests have been saved by their direct actions. In southern Pará, where goldmining, logging and ranching have obliterated one of the richest forests and its fauna, the only areas that have not been routinely ravaged have been within the Kayapó and Xingú Indian reserves.

While there is often a romantic *frisson*

associated with the emergence of resistance movements, it is worth mentioning that the history of Amazonia has been written in crushed aspirations. Nonetheless such movements, beleaguered though they may be, have managed to form alliances to bring pressure to bear at many levels. In the end, however, the development of non-violent *empates* (the technique of forming human chains to prevent their trees from being cut down) may be more effective at stopping forest destruction. Such direct action is not without consequences, however, as the recent murder of rubber tapper leader Chico Mendes, and the continuing threats against other rural leaders, make clear.

Conclusions

In this article, I have tried to show how value can be obtained from natural resources via extractive, productive and DUP economies. This has been framed within an analysis of the logics of livestock for both large and small scale producers. By concentrating on strategies and rationales, I have placed less emphasis than is usual on demography and the workings of the commodity markets as causes of deforestation. In the case of Brazil, at least, the demographic model of deforestation is not valid because more than half the population is urban. The classic 'hamburger connection' and the influence of international beef markets simply do not operate in the current Amazonian context. Amazonian beef is rife with aftosa and is prohibited from entry into US markets. Moreover, the Amazon is a net beef importer. The current emphasis on policy and subsidy distortions is important, but does not deal with the root causes of the problem.

Models that focus on beef as a commodity cannot capture the broader dynamics of livestock-stimulated deforestation throughout the humid Latin American tropics. Land markets, the value of ancillaries, the larger macro-economic context and individual economic strategies must also be included. The biological, market, and ancillary features of livestock make cattle quite unlike other commodities like coffee or rice.

Ultimately, control over the processes of deforestation will be resolved at the national and not the international level. This view is not popular with those who place the blame for deforestation on the vast tentacles of international capitalism, but I believe it is important to understand that the Amazon Basin is not a First World

colony, and that the destiny of the region will be shaped through national politics to a greater degree than international pressure.

This does not mean that one needs to throw up one's hands in frustration, but rather to realize that the logic behind livestock has a momentum that is immensely compelling, and likely to become more so, particularly since the alternatives — forestry, agriculture, and agroforestry — lack the variety of mechanisms inherent in livestock through which value can be captured. Policy changes and improved technologies have important roles to play in providing the context for reducing deforestation. But, in the end, grass-roots politics and the recognition that deforestation is a symptom of a profound social, as well as environmental, crisis will be central to turning the tide.

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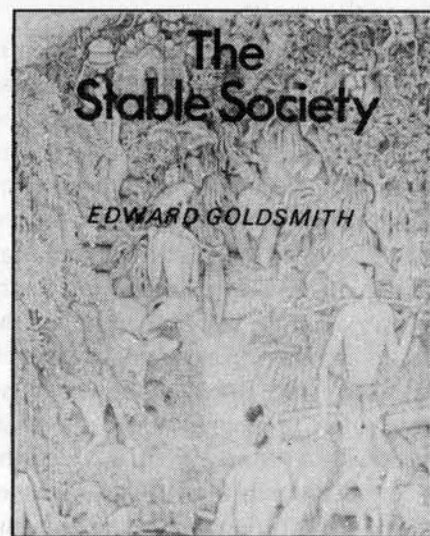
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The Stable Society Edward Goldsmith

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Disturbance and Regeneration in Amazonia: Lessons for Sustainable Land-Use

by

Christopher Uhl, Daniel Nepstad, Robert Buschbacher, Kathleen Clark, Boone Kauffman and Scott Subler

Throughout history, the forests of Amazonia have been subject to disruptions — from tree-falls to natural forest fires. Indeed, the forest is — and always has been — in a constant state of decay and regeneration. But whilst the forest can easily recover from isolated and infrequent disturbances, its capacity to regenerate is in danger of being overwhelmed. It is vital to understand the mechanisms of regeneration in order to assess what forms of land use are sustainable and, equally important, how damaged ecosystems might be restored.

Those concerned with the fate of the Amazon rainforest often appear to believe that it has existed in a pristine state for tens of thousands — or even millions — of years, and that it is only now being disturbed by 'development'. However, natural perturbations (for example floods, wind storms, fires, etc.) have always had an important influence upon Amazonian ecosystems. The study of ecosystem disturbances, both past and present, is relevant to considerations of Amazon land use because almost all land-use schemes result in disturbance.

Natural perturbations range from frequent small-scale (0.01–10 hectare) disturbances, such as treefalls, that have occurred for millennia in Amazonian forests, to infrequent, but nonetheless significant, large-scale (1–100,000 km²) disturbances, such as floods or fires, that have occurred throughout Amazon history at intervals of hundreds or perhaps thousands of years. Similarly, anthropogenic disturbances range from small-scale clearings, such as

those which have been created by slash-and-burn agriculture ever since humans entered the Amazon several thousand years ago, to huge (1–100 km²) disturbances, such as those now being caused by the conversion of forest tracts to pasture.

The scale, duration, and frequency of natural forest disturbance will change as climate changes. For example, during the last ice age, when the Amazonian climate was drier, savanna vegetation occupied large expanses of what is now forest.¹ This drier climate probably led to a disturbance regime characterized by frequent fires and severe droughts. When conditions turned wet again, flooding and wind storms may have taken over from fire and drought as the most important causes of forest disturbance. In the more recent past, humans have brought about a wholly new range of disturbances, through selective logging, agriculture and cattle ranching.

A distinguishing characteristic of these anthropogenic disturbances is their abruptness. In the past, changes in disturbance regimes were probably more gradual, allowing opportunities for species to adapt to changing conditions; now, whole communities of flora and fauna can be imperilled within a few decades, a time period shorter than the life-span of many of the resident organisms. A second hallmark of anthropogenic disturbances is their long duration relative to natural disturbances, thus allowing time for nutrient loss and erosion to occur. We are therefore now witnessing a grand experiment in Amazonia, forcing us to ask how much disruption

can Amazonian ecosystems withstand before they are irreparably damaged?

Regeneration Following Natural Disturbances

Over the last decade, research has shown that small-scale natural disturbances are common in tropical forests.^{2,3} Studies that we have carried out near San Carlos de Rio Negro in the Venezuelan Amazon show that most tree deaths result in the formation of small (50–100 m²) canopy gaps.⁴ Approximately 4–6 per cent of the forest area is usually in this 'gapped' condition at any one time. Recently formed light gaps are dominated by tree and liana seedlings, and older gap patches by pole-sized trees. The patch reaches a mature phase when it contains a mix of large trees, poles, and seedlings. It is possible to walk through the Amazon rainforest and detect these young, middle-aged, and mature-phase patches — testimony to past disturbances and to the dynamic nature of tropical forest ecosystems.

Because treefalls have undoubtedly been the most common type of disturbance throughout the history of the Amazonian forest, they have much to teach us about how the forest ecosystem responds to disturbance. The plants that grow up in treefall gaps or in any other disturbance come from four possible sources:

- *Advance regeneration.* The seedlings and saplings present in the forest understorey can, if rela-

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tively undamaged, quickly gain control of site resources. In Amazonia, one square metre of forest floor often supports about 10-20 seedlings and small saplings (less than 2m tall).⁵ These seedlings and saplings can persist in the understory for years in a state of arrested development, and then grow rapidly when sunlight becomes available;

- *Sprouting.* The capacity to produce sprouts from stem bases or roots following destruction of their main stem is common among Amazonian tree species;
- *Germination of seeds buried in the soil.* Anywhere from 200 to 1000 seeds may lie dormant in each square metre of soil in the Amazon forest. Almost all of these seeds are from pioneer tree species, that is, fast-growing, light-demanding species that specialize in taking over disturbed areas.⁶
- *The arrival of seeds from outside.* Seeds of surrounding trees can simply fall into the disturbed area. The seeds of more distant trees can be dispersed by wind, birds, bats, rodents, and other mammals.

Long-term studies of five treefall gaps at San Carlos, Venezuela, reveal that the advance regeneration pathway plays the dominant role in succession. Four years after gap formation, advance regeneration accounted for more than 95 per cent of all trees one metre tall or more. Almost all trees were of primary forest species; pioneer trees comprised only a small fraction of the regrowth. Advance regeneration was also abundant in two other upland forest stands surveyed in the Brazilian Amazon.⁷ These results indicate that many Amazonian tree species have a remarkable ability to persist in a semi-arrested state of development, their growth rates improving dramatically when treefalls occur.⁸

Importance of Plant Nutrients

The speed of recovery following a treefall or any other disturbance will depend not only on the presence of colonizing vegetation, but also on the availability of the resources (that is, light, water, and nutrients) necessary for plant growth. In the highly weathered soils of Amazonia, nutrient availability is usually the most important factor limiting plant growth.



Planners had hoped that Amazon pastures would give sustained yields, but generally these cleared lands have been productive for only four to eight years before they have had to be abandoned. There are now millions of hectares of abandoned pastures in Amazonia (Photo: N.Hildyard).

Treefalls supply roughly 1-2 per cent of total nutrient stocks reaching the forest floor each year. The nutrients released as the treefall debris decomposes, however, are not lost but are quickly taken up by the extant vegetation.^{9,10} Treefall gaps are thus a *rejuvenating disturbance* because the light and nutrients critical for plant growth become available through the fall and decomposition of the gap-making trees. A good stock of advance regeneration seeds and saplings quickly shoots up and plants arising as sprouts, from seed-bank seeds, or from dispersed seeds fill in any open places. The result is a quick return to forest with very little nutrient loss.

Fire Disturbance

By contrast to the frequent and non-disruptive nature of natural small-scale disturbances, natural large-scale disturbances are infrequent and potentially very destructive. For example, extensive landslides in mountainous areas of Central America expose the subsoil, resulting in the loss of all local sources of colonizing plants and substantial nutrient export from the ecosystem. Not surprisingly, recovery proceeds slowly. Hurricanes may also destroy large expanses of tropical forest (for example, in the Caribbean), but in contrast to landslides, the destroyed vegetation rebounds quickly because of abundant regenerating material and because nutrients are available. In Amazonia, fire has probably been the most important cause of natural, large-scale disturbance over the last several thousand years.

The evidence for past fires comes from

the abundance of charcoal in Amazonian soils. In the Upper Rio Negro region of the Venezuelan Amazon, charcoal is frequently found in the soils and radiocarbon dating of charcoal from different depths within any one soil profile usually shows that several fires have occurred at that spot during the past 8,000 years.¹¹ Indeed, the radiocarbon dates correspond roughly with what are believed to have been dry periods during recent Amazonian history.¹² Amazon researchers from the *Empresa Brasileira de Pesquisa Agropecuária* (EMBRAPA) and the *Instituto Nacional de Pesquisas de Amazonia* (INPA) in Brazil, concur that charcoal is common in the soils of the central and eastern Amazon.¹³ Indeed, in much of Amazonia, it is difficult to find soils that are not studded with charcoal.

In the decades ahead, human disturbances will dramatically increase the likelihood of fire in Amazonia through four interrelated phenomena:

1. Human activity generally involves fire in one way or another and thus the potential for forest fires increases;¹⁴
2. Forest cutting — for any purpose — leaves debris on the ground and thus increases the amount of readily combustible material;¹⁵
3. Opening of the forest canopy, by increasing the amount of solar radiation reaching the forest floor and decreasing relative humidity, allows branches and other debris to dry to point where they ignite easily;¹⁶
4. Deforestation, at the basin-wide level, changes overall climatic patterns — decreasing evapotranspiration, total precipitation and mean rela-

tive humidity — and thereby increases the likelihood of fires.¹⁷

Regeneration Pathways

Fires usually kill all the saplings and seedlings that are so important to advance regeneration in treefall gap succession, but other avenues of regeneration are possible. For example, in studies of forest succession following the cutting and burning of 0.5-1.0 hectare plots at San Carlos, it was found that vegetation regrowth was vigorous on lightly burned sites, with 10 tonnes per hectare per year of biomass accumulating during the early years of recovery.¹⁸ The regrowth was composed of plants that arose from seeds in the seed bank (the usual case), or as vegetative sprouts (also common), or from seeds dispersed to the site after the fire (occasionally).

More severe fires would result in greater mortality of live trees and seed-bank seeds, however, and, as a result, forest regeneration would be slower and less predictable. Indeed, the possibility of severe fires may already exist in Amazonia. For example, in Pará, Brazil, surface fires, associated with selective logging, leave a high volume of dead trunks still standing and these could subsequently promote more severe fires capable of killing the remaining large canopy trees.¹⁹ Even in the absence of an initial surface fire, we have observed that selective logging encourages the growth of vines. These vines, by providing a route for flames to reach the canopy, may, likewise, create conditions favourable for more severe forest fires.

Because of its long history of occurrence, fire should not necessarily be viewed as a dangerous and destructive force. When fires are of low severity they can act as stimulants as both nutrients and plant colonists are readily available and regrowth is vigorous.

Lessons from Natural Disturbances

Treefalls and fires are part of the natural disturbance regime of Amazonia and, probably for this reason, vegetation quickly recovers after such disturbances. To the extent that disturbances provoked by forest exploitation mimic these natural disturbances in size, duration, and frequency, the functional integrity of the ecosystem should be protected. In many respects timber management via selective logging creates disturbances akin to natu-

ral treefalls — canopy openings that stimulate the growth of advance regeneration. Foresters recognize the importance of advance regeneration in treefall gap succession and have developed systems of forest management, such as the tropical shelterwood system, explicitly to stimulate the growth of this pool of saplings and seedlings.²⁰

These systems of natural forest management have not, however, often been successful. Failures result from a combination

of factors. First, while advance regeneration seedlings and saplings may be abundant, desirable species may not predominate. Second, unless great care is exercised in harvesting, damage to the advance regeneration stock and to the residual canopy trees can be considerable.

For example, in a preliminary study of seven hectares of selectively logged forest in the Eastern Amazon, we found that, although only three per cent of the trees greater than 10cm diameter were har-

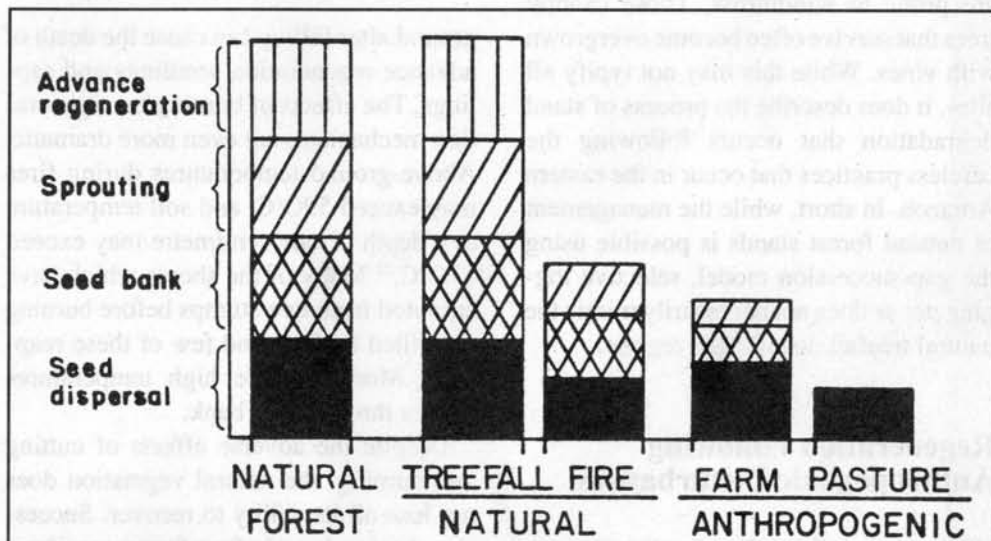
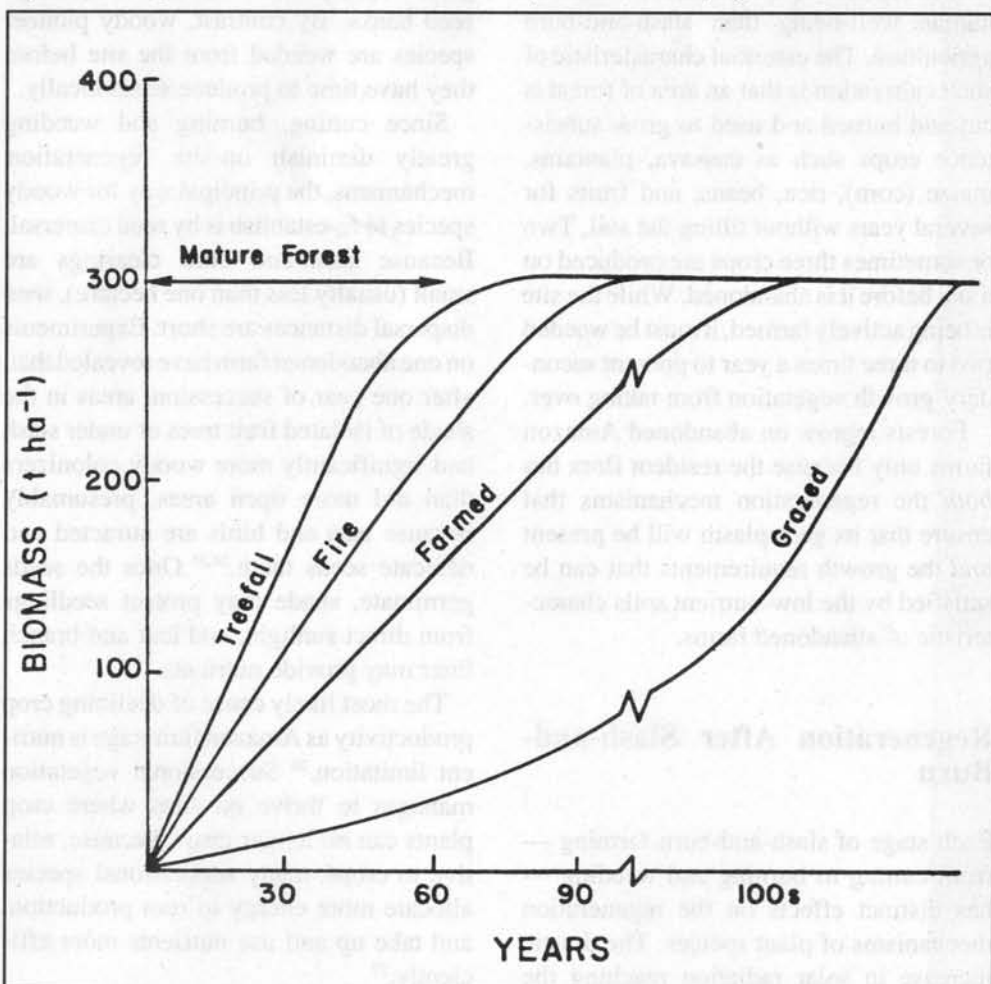


Figure 1 (above): As disturbances increase in size and/or intensity, the mechanisms of natural regeneration are gradually lost. In the most severe case, the only hope for re-establishing trees is by long distance dispersal of seeds.

Figure 2 (below): Both the availability of nutrients and regeneration mechanisms influence the speed of forest regeneration after disturbed sites are abandoned. Recovery is relatively rapid following natural disturbances when compared to anthropogenic disturbances.



vested, 23 per cent were uprooted by bulldozers (in the establishment of logging roads and trails), 24 per cent were crushed by the fall of harvested trees, and seven per cent suffered extensive bark removal.²¹ Additional harmful effects may not become apparent until several years after logging — as the forest structure begins to deteriorate. Trees that are scraped and wounded during logging sometimes succumb to pathogen attack. Other trees that no longer have neighbours to shelter them are prone to windthrow. Those canopy trees that survive often become overgrown with vines. While this may not typify all sites, it does describe the process of stand degradation that occurs following the careless practices that occur in the eastern Amazon. In short, while the management of natural forest stands is possible using the gap-succession model, selective logging *per se* does not necessarily mimic the natural treefall disturbance regime.

Regeneration Following Anthropogenic Disturbances

Humans cause small-scale disturbances by either cutting individual trees for fiber needs or cutting and burning small patches of forest to make farm clearings. Up to now, no human activity has affected more land in Amazonia or been more critical to human well-being than slash-and-burn agriculture. The essential characteristic of such cultivation is that an area of forest is cut and burned and used to grow subsistence crops such as cassava, plantains, maize (corn), rice, beans, and fruits for several years without tilling the soil. Two or sometimes three crops are produced on a site before it is abandoned. While the site is being actively farmed, it must be weeded two to three times a year to prevent secondary-growth vegetation from taking over.

Forests regrow on abandoned Amazon farms only because the resident flora has *both* the regeneration mechanisms that ensure that its germplasm will be present *and* the growth requirements that can be satisfied by the low-nutrient soils characteristic of abandoned farms.

Regeneration After Slash-and-Burn

Each stage of slash-and-burn farming — from cutting to burning and weeding — has distinct effects on the regeneration mechanisms of plant species. The drastic increase in solar radiation reaching the

"Sustainable systems of production are quite possible within the forest domain — but only if they do not stretch the natural capacity of the forests to regenerate. The future of Amazonia depends critically on how far we learn the lessons of natural forest regeneration."

ground after felling can cause the death of advance regeneration seedlings and saplings. The effects of burning on regeneration mechanisms are even more dramatic. Above-ground temperatures during fires may exceed 590°C, and soil temperature at a depth of one centimetre may exceed 170°C.²² Many of the shoots which have sprouted from tree stumps before burning are killed by fires and few of these reappear. Moreover, the high temperatures reduce the soil seed bank.

Despite the adverse effects of cutting and burning, the natural vegetation does not lose all its ability to recover. Succession begins long before farms are abandoned but is curtailed through farm-plot weeding, which causes striking shifts in the composition of the regrowth.²³ In the interval between weedings, herbs and grasses prosper and can build-up large seed banks. By contrast, woody pioneer species are weeded from the site before they have time to produce seeds locally.

Since cutting, burning and weeding greatly diminish on-site regeneration mechanisms, the principal way for woody species to re-establish is by seed dispersal. Because slash-and burn clearings are small (usually less than one hectare), seed dispersal distances are short. Experiments on one abandoned farm have revealed that, after one year of succession, areas in the shade of isolated fruit trees or under slash had significantly more woody colonizers than did more open areas, presumably because bats and birds are attracted and defecate seeds there.^{24,25} Once the seeds germinate, shade may protect seedlings from direct sunlight, and leaf and branch litter may provide nutrients.

The most likely cause of declining crop productivity as Amazon farms age is nutrient limitation.²⁶ Successional vegetation manages to thrive on sites where crop plants can no longer grow, because, relative to crops, many successional species allocate more energy to root production, and take up and use nutrients more efficiently.²⁷

From Farm to Forest

Surveys of abandoned farm sites of different ages in the Upper Rio Negro region are enabling us to put together a picture of the entire succession from farm to forest. When farm sites are abandoned, they are first dominated by grasses and herbs, but within a year trees become common. Almost all the trees present on recently abandoned farm sites are pioneer species. These trees begin to die after about ten years and are gradually replaced by a somewhat slower growing, more long-lived grouping of tree species. This second cohort of species lives for about 50-100 years, gradually yielding to the final residents, a group of shade-tolerant, slow-growing species. Saldarriaga has estimated that 200 or more years are required for a farm site to pass through these successional stages and be considered as full-grown, mature forest.²⁸

While slash-and-burn agriculture does dramatically alter site structure, the functioning of the ecosystem does not appear to be severely disrupted during the recovery phase. Above-ground production on regenerating farms, at least during the early years of succession, is equal to or somewhat greater than that in mature forests.²⁹

Although the sustainability of indigenous farming systems in the Amazon is now well documented (*see* P. Bunyard, and D. Posey, *this issue*), less well known are the farming practices based on natural successional processes which have been adopted by Japanese settlers in the Amazon (*see box*). Such practices give hope for the future in that they show that even recent settlers can learn to farm in harmony with the forest.

Regeneration After Pasture

During the last century, and particularly within the last twenty years, large areas of the Amazon Basin have been converted to pasture (*see* S. Hecht, *this issue*). Toledo and Serrao have estimated that about six million hectares of Amazonia are in pasture, and that by the close of the 1980s this figure could easily exceed ten million hectares.³⁰ Planners had hoped that Amazon pastures would give sustained yields, but generally these cleared lands have been productive for only four to eight years before they have had to be abandoned. Hence, there are now millions of hectares of abandoned pastures in Amazonia.

The vegetation composition, structure,

and biomass accumulation on 13 forest sites that had been cut and burned, used as pasture, and then abandoned in the Brazilian state of Pará have been studied by us to determine whether forest species regrow on abandoned Amazon pastures and, if so, at what rate.³¹ Our findings were as follows:

- *Abandoned pastures subjected to light use* (four study sites with poor grass establishment, light grazing, and short-use period, typical of perhaps 20 per cent of the region's pastures). These exhibited vigorous forest regeneration. Above-ground biomass accumulation averaged 10 tonnes per hectare per year or 80 tonnes per hectare after eight years (roughly one-third of mature forest biomass levels). The sites were rich in tree species with approximately 20 tree species present per 100 m², many individuals originating via sprouting.
- *Abandoned pastures subjected to moderate use* (six study sites with good grass establishment, regular grazing, frequent weeding and final abandonment after 8-10 years, typical of maybe 70 per cent of the region's pastures). These also showed signs of developing forest characteristics but biomass accumulation was only five tonnes per hectare per year. Individual trees arose via sprouting, from seed bank seeds, or dispersed seeds, but the number of tree species was also lower than on lightly-used sites and the number of forest trees was less.
- *Abandoned pastures subjected to heavy use* (three sites with good grass establishment, regular grazing, weed control through mowing and/or herbicides, and final abandonment after 12-20 years, typical of 10 per cent or less of the region's pastures). These had the least distinct patterns of succession. One eight-year-old site was dominated by grasses and herbs with fewer than one tree per 100m² and an above-ground biomass accumulation of 0.8 tonnes per hectare per year. Most colonizing plants had established themselves via dispersed seeds.

These results show that Amazon ecosystems generally can recover forest structure after large-scale pasture disturbances. Only in cases where the land has been severely misused for long periods is reforestation uncertain, but probably less

than 10 per cent of the pasture land in the eastern Amazon is currently degraded to this level. However, as pressure on Amazonian lands continues, non-regenerating sites are certain to become more common.

Encouraging Regeneration

Forest trees have difficulty establishing themselves in highly degraded pastures. One reason is that the grassland seed bank contains few forest species and, with few tree root systems from the forest remaining alive, the establishment of forest trees depends critically on seed being transported to the pasture from the forest. However, natural seed dispersal is discouraged by the lack of food and perches for such seed vectors as bats and birds. Moreover, where forest seeds do reach pasture land, they are subject to high predation by leaf-cutter ants and pasture rodents which prefer tree seedlings to grass-

land herbs and shrubs. Finally, many seedlings die due to competition with the existing herbaceous vegetation for light and water.

Overall, survival and growth is extremely low for small-seeded colonizing species — the group most readily dispersed to degraded pastures. These pioneer-type species lack the endosperm reserves to get their stems above the matrix of competing herbaceous vegetation and their roots below the drought-plagued surface soil. To ensure establishment, they must be protected from predators and pampered through their first year of life by providing shade and water and removing competitors. Other species require less vigilance. Tough-coated, large-seeded species sometimes establish because they are too big for seed predators to handle and because their ample endosperm gives them the reserves needed to compete with the existing vegetation.

Hence, the critical first step in forest

Farming Practices Based on Natural Regeneration: Japanese Colonists in the Amazon

Although they are the exception, some settler groups in Amazonia have managed to develop sustained-yield agroecosystems based on successional processes. One such system is practised by farmers of Japanese descent who have been slowly immigrating to Amazonia since the 1920s. (Brazil has one of the largest Japanese populations outside Japan). The first Japanese colonists were sponsored by a Japanese textile company interested in the settlement of the Amazon as a means of relieving population pressure in their home district in Japan. Over time they have developed from purely subsistence farmers into commercial agriculturalists fully integrated into local, national and world markets.

The present-day Japanese-settler agroecosystems are remarkably complex, incorporating annual crops, perennial tree crops, and perennial vine crops. The perennial and annual crops are planted together after forest clearing and gradually the farms develop into mixed-perennial polycultures. The overstories are dominated by rubber, mango, brazil nut, mahogany and other lesser-known species valued for their timber and/or fruit. The understories are composed of shade-tolerant trees such as coffee, cacao, guarana, and cupuacu. Vines of vanilla and other species move from understory to canopy adding still more complexity. These agroecosystems often incorporate fish culture and chicken and pig production. There is a high level of horizontal integration with waste or refuse from one operation forming a subsidy (fertilizer, mulch, food) for other operations and thus reducing many of the problems such as pests, weeds and loss of nutrients that plague annual cropping systems.

Tree crops protect the soil from degradation caused by leaching, erosion, and compaction, and they frequently have a higher tolerance to soil acidity and aluminum toxicity than annual crops. Tree crops also make relatively low demands on soil nutrients because of efficient nutrient recycling, and because the mass of harvested products is low. Indeed, critical to the success of these systems is their choice of products that have very high commercial value per unit of harvested mass. Finally, this approach is labour, rather than energy, intensive, an important consideration in a region scarce in economic resources, but rich in human resources.

The recognition that the natural process of plant succession can provide a model for the design of sustainable agricultural systems and that there are already working examples of such systems is encouraging.

restoration will be to foster the establishment of predator-resistant, stress-tolerant tree species. Deep-rooted species that are able to extract water and nutrients from the lower soil horizons would be particularly appropriate. Once a few scattered trees are present in these pastures, subsequent phases of forest development may occur naturally because isolated trees attract bird and bat seed vectors and provide 'islands' from which the forest can spread.

Strategies for accelerating forest regrowth should be designed to minimize the required inputs of capital and human labour and maximize the contribution of natural processes. Grasslands can be reforested cheaply if we learn how to catalyze forest regeneration processes. The initial goal of reforestation strategies should be the establishment of trees which attract diverse seed-carrying animals. As tree cover develops, more seed carriers will move between the forest and the grassland; grasses will eventually be shaded out, perhaps reducing populations of leaf-cutter ants and rodents. Shortages of water during the dry season and competition for soil nutrients should decrease as the dense root system of the grassland ecosystem is replaced by that of the new forest.

Restorers or Exploiters?

Amazonian ecosystems are not defenceless. The resident species have many responses to disturbance, so long as those disturbances are limited. As disturbances become larger and more prolonged, soil nutrient impoverishment occurs and the forests' regeneration strategies are slowly eliminated. Because natural disturbances are either small-scale or short-lived (or both), post-disturbance regeneration is rapid. However, recovery following anthropogenic disturbances tends to be slow (for example, after slash-and-burn agriculture) or in some cases uncertain (for

example, on abandoned pastures after heavy use).

Sustainable systems of production are quite possible within the forest domain — but only if they do not stretch the natural capacity of the forests to regenerate. The future of Amazonia thus depends critically on how far we learn the lessons of natural forest regeneration. Thus forestry operations should mimic natural disturbances in size duration, and frequency if they are not to disrupt the functional integrity of Amazon ecosystems. So too, agroforestry systems will need to be based on natural succession models that retain nutrients and protect fragile soils while providing steady yields. Finally, degraded lands can be revived with human assistance. But to be successful, we humans will have to change our ways — and become restorers rather than exploiters.

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Kayapó village on the Bacajá river, Pará state. All groups within the Kayapó nation refer to themselves as Mêbêngôkre or 'people of the water's source'. (Photo: William Fischer)

Alternatives To Forest Destruction: Lessons from the Mêbêngôkre Indians

by
Darrell A. Posey

*Ethnobiology, the study of indigenous peoples' knowledge of flora and fauna, is starting to reveal the complexity of the Amazon Indians' methods of sustainably managing their forest resources. Modern land use practices in Amazonia are inherently unsustainable, and in destroying Indian societies are destroying a vital source of information as to how people can live in and actually **enrich**, rather than destroy, the forest.*

Indians in Brazil have historically been considered, at best, as 'relatively incapable' human beings that must be 'protected' as wards of the Federal Government. The Brazilian Indian Foundation (Fundação Nacional do Índio — FUNAI) serves as the official organ responsible for Indian affairs. Under past national constitutions, FUNAI was considered the only legal institution that could represent or defend native peoples. Land demarcation, sales of mineral and timber rights, judicial proceedings, even labour

contracts and agricultural sales could only legally be conducted by FUNAI officials.

Claims of corruption within FUNAI have now swollen to a level equal to accusations against its predecessor, SPI (Sociedade para Proteção do Índio), which was disbanded due to its scandalous activities, in 1967. A former President of FUNAI, Romero Jucá Filho, has been charged with involvement in the illegal sale of gold and timber rights on Indian lands. This did not stop him, however, from being named Acting Governor of the Federal Territory of Roraima, where some of Brazil's richest mineral and natural reserves are located — mostly in indigenous reserves.¹

As Carneiro da Cunha points out, "the Indian question today is centred around disputes over mineral and natural resources on Indian soils and sub-soils". Native peoples, by virtue of their low numbers

(approximately one per cent of the Brazilian population) and cultural, social and political differences, are markedly disadvantaged in the battle against the powerful forces of international capitalism behind those who seek to exploit these resources.

Maintaining Stereotypes

Much of the general strategy of the exploiters of Indian lands depends upon the maintenance of traditional stereotypes of 'primitive' Indians. In a country where paternalism is as much a part of the national fabric as *carnaval*, it has been all too easy to mask attempts to thwart native independence movements with rhetoric about 'helping' Indians to make decisions about 'what is best for them'. Rarely have Indian leaders been heard, because, it is

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said, they could not possibly know enough about white man's society to make good judgements.

It is equally important for those who wish to exploit Indian lands — especially in Amazonia which is the refuge of over half of Brazil's remaining aborigines — to say that such lands are unproductive and/or unoccupied. The whole of the Amazon Basin is considered empty — one great frontier where only a few 'primitive' Indians and 'cultureless' *caboclos* (peasants) struggle to survive. As Carneiro da Cunha notes: "Indian lands are . . . treated as 'no-man-lands': always considered as the first option for mining, hydroelectric projects, land reform, and development projects in general." This strategy has been relatively easy to maintain over the years because of the inability of native peoples and *caboclos* to organize in a dominant society where minority rights have never been considered an issue.

The Human Tragedy

The destruction of Amazonia is a human as much as an ecological tragedy. *Caboclos*, with few exceptions, are ignored in Amazonian studies as though they were

devoid of any culture whatsoever. Expelled from their lands as squatters (*posseiros*), they are forced into poverty and dependency in sprawling slums (*favelas*) where they pay the price of 'development'.

Indians reflect clearly the tragic human costs of Amazonian development.² Brazilian Indian populations have declined from approximately 8,000,000, at the time of the first European contact, to less than 200,000 today. Eighty-seven Indian groups have become extinct during this century in Brazil alone.³ With the decimation of each indigenous group, the world loses thousands of years of accumulated knowledge of adaptation to tropical ecosystems. Such precious information is overlooked without the least consideration: the rapid pace of economic development cannot be halted even long enough to take note of what it is about to destroy.

Indian cultures offer a rich and untapped source of information on the natural resources of the Amazonian Basin.⁴ Recognition of the value of indigenous knowledge by our civilization would permit Indians to be seen as major intellectual contributors to humanity, rather than mere exotic footnotes to the pages of history books. This recognition could provide an 'ideological bridge' through which In-

dians can prosper with the dignity they need and the respect they deserve.

The Mëbêngôkre and the Kayapó Project

The Kayapó Indians once inhabited a territory the size of France between the Araguaia and Tocantins rivers in eastern Amazonia. Today they live on a five million acre proposed reserve that includes a variety of tropical ecosystems, ranging from high forests to vast grasslands. All groups within the Kayapó nation call themselves the Mëbêngôkre ('people of the water's source') and speak a language of the Je family of languages.

The knowledge of the Mëbêngôkre Indians is an integrated system of beliefs and practices. Much generally shared information is to be found in a Mëbêngôkre village, in addition to the specialized knowledge held by a few. There are specialists in soils, plants, animals, crops, medicines and rituals. Each and every Mëbêngôkre believes that he or she has the ability to survive alone in the forest for an indefinite time. Such a belief engenders a strong sense of personal security and is interwoven into daily life.

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Forest Islands

The creation of forest 'islands' (*apete*) in tropical savannas, demonstrates to what extent the Mêbêngôkre can alter and manage ecosystems to increase biological diversity. Such ecological engineering requires detailed knowledge of soil fertility, microclimatic variations and species' niches, as well as the inter-relationships among species which are introduced into these human-made communities. The successful *apete* results not only from knowledge of immediate soil and biological properties, but also from the long term relationships that develop as these 'forest islands' become established and increase in density and height. Because numerous plants are cultivated to attract game animals the *apete*, can be viewed as both agroforestry plots and hunting reserves.⁵

The Mêbêngôkre frequently speak of *ômbiqwa-ô-toro* plants, or those plants which are 'good friends' or 'good neighbours' to one another. The Indians are aware of some species combinations that develop more vigorously when planted together. Such synergistic groups often include dozens of plant species, require complex cultivation patterns, and are characterized in terms of 'plant energy'. Thus, a Mêbêngôkre garden is created by careful combinations of different 'plant energies', just as an artist blends colours to produce a work of art. Planting practices based on plant energies can be compared with ecological principles which allow us to understand, from the viewpoint of Western science, the underlying logic of Mêbêngôkre management.

Mêbêngôkre techniques of long-term management of forest savannas, with regard to both floral and faunal resources, represent an alternative to the destructive development models offered by timber extraction, agroforestry, agriculture and cattle ranching. Native animal and plant species can be utilized, while being conserved, if indigenous integrated management principles are adopted.⁵ Mêbêngôkre understanding of forest growth also holds useful lessons for those studying the restoration of degraded forest ecosystems.

Ethnopedology: Indian Understanding of Soils

The Mêbêngôkre have a sophisticated understanding of soils, which are classified according to horizontal and vertical dis-



Brazilian Indians are generally considered 'primitive' and 'incapable' by non-Indians. Decisions on how to use the resources on Indian lands have always been taken by outsiders despite the fact that the Indians have an unrivaled understanding of forest ecosystems. (Photo: Vincent Carelli)

tinctions based on texture, colour, drainage qualities, friability, and stratification. Soil qualities are frequently related to indicator plant species that allow Indians to predict the flora and fauna associated with specific soil types, each of which is managed differently according to its individual characteristics.

The Indians modify local soils by using different types of ground cover such as vegetation, logs, leaves, straw and bark to influence soil moisture, shading and temperature. Holes are sometimes filled with organic matter, refuse, and ash to produce highly concentrated pockets of rich soil. Old banana leaves, stalks, rice straw, and other organic matter are piled (and sometimes burned) in selected parts of fields to create additional local variations.

The Mêbêngôkre have dozens of types of plant ash, each of which is said to have certain qualities preferred by specific cultivars. Plant ash is an important component in all aspects of indigenous agriculture.

The well-known '*terra preta dos indios*', the soils formed through Indian occupation, are extremely rich and are distributed throughout Amazonia, but little is known of their formation as they

have been considered to be the results of historical practices that are no longer followed. There are, however, numerous Indian groups like the Mêbêngôkre that continue to manage soils to improve fertility and productivity.⁷

The study of indigenous uses of ground cover, mulch, organic matter and ash could lead to the development of modern agricultural systems in Amazonia that succeed in improving, rather than degrading, soils.⁸

Ethnozoology

Indians are astute observers of many aspects of animal behaviour: mating, nesting, feeding, hunting, predator-prey relationships, diurnal and nocturnal habits, etc. They teach these lessons to their children partly through the rearing of pets in the village, and also by encouraging children to learn the behaviour patterns and feeding habits of different animal species that are considered to have their own 'personalities'. Like other tribes, the Mêbêngôkre conscientiously study animal anatomy, giving special attention to the stomach contents of game animals.

A precise knowledge of insect behaviour is utilized by the Mêbêngôkre in the control of agricultural pests. For example, nests of ants of the genus *Azteca* are deliberately placed by the Indians in gardens and on fruit trees which are infested with leaf-cutter ants (*Atta* sp.). According to the Mêbêngôkre, the *Azteca* ants have an odour which repels the leaf-cutter ants. In the same manner, the Indians cultivate several plants which have extra-floral nectar glands, often on the leaves or stems, which attract predatory ants to serve as 'bodyguards', for the plant. Several species of predacious wasps nest preferentially under the leaves of banana trees which Indians plant to form a living wall around their fields. Thus, knowledge of insect behaviour is an important aspect in the manipulation of the natural biological control of agricultural pests.⁹

Ethnomedicine and Ethnopharmacology

One of the most productive areas of ethno-biological research is ethnopharmacology. Plants used medicinally by native peoples are a prime source of useful drugs for the pharmacological industry. Intensive study of indigenous plant and animal

preparations and their administration, can enrich conventional medical knowledge. Data on the parts of the plants which are used in medicines, the ecological preferences of these plants, the seasonal cycle of their flowering and fruiting, and the soils in which they grow are important since these factors influence the amounts of pharmacologically-active ingredients in the harvested plants.¹⁰

Not only can ethnopharmacological studies contribute to the discovery of unknown drugs, but also reveal new sources of known pharmaceuticals. This is especially important for countries like Brazil where imported medicines are exorbitant in cost.

Ethnopharmacology should be coupled with ethnomedicine to be truly effective. For example, Elisabetsky and Posey have suggested how research into two Mëbêngôkre folk disease categories can advance knowledge of symptoms that complicate diarrhoea and dysentery — the major killers in the humid tropics.¹¹ The Mëbêngôkre classify over 150 types of diarrhoea/dysentery, each of which is treated with specific medicines. Ethnopharmacologists and physicians frequently forget that disease categories are, like all phenomena, socially classified and not universal: folk categories, as in the Mëbêngôkre case, are often more elaborate and detailed than their Western counterparts.

Ethnoagriculture and Agroforestry

Research into indigenous agriculture has resulted in valuable information on pest control without costly chemical sprays and additives. The use of natural predators, insecticides and fertilizers, make indigenous agriculture both inexpensive and energy efficient. Intercropping of cultivars appears to be another key factor in natural control, as does the extensive use of 'trap crops' within and at the margins of plots. 'Natural corridors' maintained between Mëbêngôkre fields serve as biological reserves that maintain species diversity, while facilitating the re-establishment of plants and animals during forest regeneration.

When applying the restrictive term 'agriculture' to Mëbêngôkre management of domesticated and semi-domesticated plants, one must consider that indigenous agriculture begins with a forest opening into which useful species are introduced

and ends with a mature forest of concentrated resources, including game animals. The cycle is repeated when the old-field forests become too high and dense for efficient production and are cleared again.

The Mëbêngôkre also practice long-term management strategies to maximize firewood production using a number of techniques including seasonal cutting schedules, pruning, vertical extraction preferences, limb and trunk size choices, maturation decisions and drying capabilities.

There is an urgent need in Amazonia for the implementation of integrated agricultural and forest management, which would include both plant and animal resources and not be destructive to the local environment. Indigenous systems, like those of the Mëbêngôkre, have functioned successfully for millennia and offer many ideas for the successful implementation of diversified and sustainable agricultural and forestry practices.

Myths and Ecological Concepts

A knowledge of complex ecological interrelationships is sometimes expressed in the highly codified and symbolic forms of myth and ritual. These can only be understood when one lives and participates in an Indian society for some length of time.

The Mëbêngôkre recognize two mythological entities that illustrate how beliefs can function as ecological concepts. One is *Bepkororoti*, which is the spirit of an ancient shaman unjustly killed by fellow tribesmen while seeking his hereditary share of tapir meat after a hunt. His spirit now manifests itself in the form of rain, lightning, and dangerous storms, which can kill people or destroy crops. He becomes angry when people do not share, and fear of his vengeance compels the Mëbêngôkre to be generous. To placate *Bepkororoti*, Indians cater to his fondness for honey by leaving behind a portion of honey, pollen, and brood in raided hives. As a result, some species of stingless bees return to disturbed hives and re-establish colonies. The belief in *Bepkororoti* thus serves to preserve bee colonies and ensure continued honey production.

The *mry-kàák* is an entity that takes the form of an electric eel-like animal, twenty or more meters in length, that lives in deep pools of water. It is the most feared of all creatures, since it can kill with its powerful electric shock from a distance of 500 meters or more. It is thought to subsist on

minnows and, whenever the Mëbêngôkre see schools of spawning fish or minnows, they stay clear of the area for fear of the *mry-kàák*. This practice serves to protect the minnows, which are the basic element of the aquatic foodweb of the river.

An Ideological Bridge Between Peoples

Mëbêngôkre ecological adaptations and agricultural methods offer new models for resource management of the Amazon without incurring the wholesale destruction which characterizes present development policies. If indigenous experience were taken seriously and incorporated into research and development programmes, then the Indians would be recognized for what they truly are: a diligent, intelligent, and practical people who have adapted successfully to their Amazon environment over thousands of years. It is imperative that Indians and their respective systems of ecological management be protected so that they can develop according to their own social and cultural rules which we, in our ignorance, have only just begun to appreciate and understand.

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The Brazilian Forest Peoples' Movement

by
Tanya Schwartz

If the forests of Amazonia are to be saved, the responsibility for protecting them must rest in the hands of those people who depend upon them for their livelihoods. In Brazil, the rubber tappers, in trying to gain economic autonomy through cooperatively run 'extractive reserves', are defending the forests from destruction by loggers and ranchers. Similarly, attempts by Indians to gain self-determination over how they use the resources of their lands, and where possible to research methods of improving their age-old sustainable forest management techniques, offer the hope that keeping the forests standing may come to be seen as the only sensible economic future for the Amazon.

"Tell them in your country how beautiful the forest is here. Tell them how it is inhabited by people who don't want to watch its destruction. They want to care for it."

These were Chico Genu's parting words to me after I had spent four months in Acre, Brazil, living with the people of the rain-forest. Chico, a 26-year-old rubber tapper, is Vice-President of the *Conselho Nacional dos Seringueiros* (National Rubber Tappers' Council — CNS). He lives on the river Tejo, near the Peruvian border, a five day boat journey from the small town of Cruzeiro do Sul. A political activist for the last five years, his work with the rural workers' trade union has culminated in a project which offers hope for the survival of the Amazon rainforest and its people.

On the 12th June, 1989, the *Associação dos Seringueiros e Agricultores da Bacia do Rio Tejo* (River Tejo Association of Rubber Tappers and Farmers) was officially launched. In his pre-election speech before he became president of the association, Chico Genu told the 300 rubber tappers: "If we let them destroy the forest, where will we live? I have seen the *favelas* (slums) of Sao Paulo, if the sons of the *patraos* (land barons) go to school, why can't ours? Why do we pay rent to them? The forest is ours. We are the ones who care for it."

The fact that the elected management of the Tejo Association can barely read or write is compensated for by the help which they receive from two individuals: Antonio Macedo, a member of the *Conselho Nacional dos Seringueiros*, who has

helped many Indian communities in the area to set up cooperatives through the ProIndian Commission (CPI) in Acre, and Mauro Almeida, a Brazilian anthropologist and adviser to the CNS, who provides the link to the outside world.

The goal of the Association, as proposed by the CNS, is to set up an extractive reserve in the 2,400 square kilometre Tejo river region, with the aim of improving the quality of life of the 600 resident families and protecting the forest by putting it under the direct control of the local population.¹ The area designated is rich in extractive resources, has an annual production capacity of 600 tonnes of rubber and much potential for diversification.

The plans for the next two years are:

- To develop cooperatives and a transport network;
- to install processing units;
- to research systems of sustainable forest management;
- to set up health centres and schools.

The project is being monitored by the CNS. An essential element is the training of rubber tappers so that they can develop the necessary skills to run the reserve; manage cooperatives, staff schools, oversee health projects and carry out research. It is hoped that this extractive reserve will serve as a pilot and a precedent for the creation of similar reserves in other Amazon areas.

Five indigenous areas, which are now vulnerable to invasion by loggers, surround the area, which will be crossed by the BR 364 (the World Bank-funded Acre-Pacific road). This road will intensify the destructive pressures on the forest and its peoples. When the reserve is established, the indigenous areas will become part of a

protected forest of 4000 square kilometres.

Ending 'Rubber Baron' Exploitation

The movement to set up the reserve gathered momentum in October 1988, when 2000 rubber tappers attended a meeting in Cruzeiro do Sul. In fact, the creation of an extractive reserve was only of secondary consideration to the rubber tappers. More important, was how to end the exploitation by the land barons — an exploitation to which, along with the surviving Indian tribes, they have been subjected for over 100 years, since they were brought into the Acre region during the rubber boom as poor peasants from northeast Brazil.

The land barons have been forcing the tappers to pay an annual rent of 30-60 kilograms of rubber (roughly 10 per cent of their production). They buy the rubber at low prices and sell essential town produce such as gunpowder, knives, salt and cloth, at grossly inflated prices. The landowners fail to provide any services such as schools and health centres and are frequently involved in violence against the rubber tappers.

Following the Cruzeiro do Sul meeting, most of the tappers of the region stopped paying rent and, since May 1989, the tappers of the river Tejo have been running their own cooperatives, organized in 12 areas along the river. With \$70,000 from the National Bank of Social Development, they have acquired boats and an initial stock of essentials. The cooperatives have built sheds to house their stock and the 12 organizers have undergone a two-day training course.

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Now, the mood along the river is jubilant. In June, 1989, the tappers were paying off their last debts to the land-owners. In July, the cooperative made its first sale of rubber. For the first time in 100 years, income from the sale of 6.5 tonnes of rubber went to the primary producers themselves. Town products were bought at normal prices. There is a good prospect that schools and health centres will soon be in place and that a local rubber factory will be bought. These initiatives await sufficient funding.

The spirit spreads. In July, 1989, on the neighbouring river of Cruzeiro do Vale, the tappers set up their own cooperative with minimal assistance. Along other rivers I travelled, the Tejo cooperative was the number one subject of conversation. I had entered the Tejo river region expecting to encounter battles for the forest, instead I witnessed a social revolution.

Sustainable Extraction

Except for Chico, and perhaps a few others, the rubber tappers have no conception of the imminent threat to their environment. When I described the skeleton fields of butchered rainforest which I witnessed only a few hundred kilometres away in the southern part of the state, they regarded me with bewilderment. These are people who have never seen a horizon unbounded by virgin forest, yet their battle for economic and social freedom is one of the keys to the preservation of the forest.

An extractive reserve is an area of public domain, occupied by social groups whose means of livelihood is the sustainable extraction of native forest products in accord with a pre-established management plan.² The aim of the plan is forest protection. The permission to utilize forest resources runs for 30 years. Should the tappers log and ranch to the detriment of the trees, they will lose control of the land.

An extractive reserve is not practicable if the tappers are subject to the land barons, who are only interested in the commercialization of rubber and, increasingly, in the timber trade with the expected arrival of the BR 364 which will open a route to the Pacific and thus the huge Japanese market for tropical timber.

The rubber tappers want to diversify their economy by selling the produce from small-scale horticulture, such as black beans and rice grown in small forest clearings or the fertile river banks during the summer season. They are also exploring ways of marketing the many edible and



Poster for the first national meeting of rubber tappers. The drawing is by a rubber tapper, Hélio Melo.

medicinal forest products. I asked Chico Genu what the spirit of the forest meant for him. He paused and answered:

"The spirit of the forest lies in its fertility. The forest bears many fruits, gums and medicine. Everything that the rubber tapper needs. When one tree falls — another is born."

Local Control of Land

However much international campaigning succeeds in changing Brazilian law in favour of forest protection and in influencing government policy, if the land and people stay under the control of the land barons, the forest is doomed. Local politicians are too corrupt and have too much to gain from deforestation to enforce forest protection laws. The Tejo river's local Senator, for example, has bought rubber estates along neighbouring rivers and has already sent in teams to select trees for logging once the BR 364 is asphalted.

The road is coming. If the tappers are not strong enough to defend their land, the virgin forest will disappear in the same way as in the neighbouring state of Rondônia (see P. Fearnside, *this issue*). The effect on the local population will be disastrous. Some will become wage labourers while others will be forced into the *favelas*.

The cooperatives unite the forest people. They unite the rubber tappers who lead an isolated life — their clusters of two

to four homesteads are often up to two hours march apart. And the cooperatives unite the rubber tappers and Indians who have been traditional enemies. The cooperatives give them economic independence from the land barons and thus the self confidence needed to oppose forest destruction. Already the first *empates* (non-violent resistance to forest clearers) have occurred in the area.

But the situation remains precarious. The land barons are mounting a strong counter-attack and are attempting to organize boycotts of the cooperatives' rubber. There are four court cases against Macedo, Mauro and Chico. The violence in the area is increasing: in July, Joao Fontinelli, a cooperative manager, narrowly escaped death from stabbing in his own home; Macedo receives continuous threats and has survived attacks on his life.

Despite the setbacks, the forest people are growing increasingly self-confident and cooperatives could be implanted everywhere in the Cruzeiro area if the seed money were to become available. If this does happen, and happen quickly, then the pattern of horror which accompanied the building of the BR 364 in Rondônia can be avoided. As Macedo explains:

"The forest people will preserve the forest and its rivers. But they need help to maintain this wealth; these riches. The BR 364 linking Brazil to the Pacific is on its way. Along with it will come 'wild' capitalism. Rubber estates have already been bought — ready to extract wood. We have seen helicopters above the Tejo river. They are marking suitable logging sites. They say that the road will bring progress. For us, it will bring devastation, pollution and destroy traditional ways of life. We need help to prepare the people here to resist the destruction."

The Indian Struggle for Self-Determination

Just as autonomy for the rubber tappers is essential in halting deforestation, the indigenous people of the Amazon must also be enabled to achieve control over their own future by being allowed to decide how the resources on their lands are utilized. Giving the Indians their rights on their own lands will not only protect the forest, but will enable the Indians to become more independent and therefore

less vulnerable to exploitation by outsiders.

The Indian Research Centre

The Centre for Indian Research and Training Resource Management is being set up this year at Goiania in central Brazil, by the Union of Indian Nations (UNI) with technical assistance from a number of bodies including the Ministry of Agriculture's Corporation for Agricultural Research, the Catholic University of Goiás, the Zoobotanical Foundation and the Gaia Foundation Brazil. As stated in their project report:

"In the last 10 years, the 180 Indian tribes in Brazil have begun a nationwide campaign for the demarcation of Indian peoples' territories and to halt the widespread destruction of our natural resources.

"Our lands have been damaged by the violent occupations of ranchers, timber companies, mining corporations, gold panners and so called 'development programmes' that include gigantic hydroelectric dams, agrobusinesses and other activities that threaten the fragile natural balance of the Amazon forest.

"In the last 20 years alone, more than 30 Indian tribes have been contacted for the first time. This contact with industrialized society has been so aggressive that, besides causing the decimation of our population, and jeopardizing our cultures and traditions, our peoples' eating and sanitary habits, architecture and art have been disturbed by the technoscientific practices imposed by western society."

Research Programme

The research programme at the Centre consists of:³

1. An integrated project on forest management and sustainable agriculture. Native fruits and perennial crops will be grown and sold to the domestic and international markets, and endangered species will be nurtured in captivity to increase their population and to provide for traditional livestock and controlled marketing.
2. An integrated project to make an inventory of the natural forest resources of different Indian reserves in order to

determine which management practices could prove sustainable in the future and to regenerate denuded lands.

3. Developing food processing and marketing centres to process and distribute the surplus produce from the Indian communities.

4. The development of pilot projects in Indian communities to increase their ability to be economically independent while maintaining their traditional relationship with the environment. The pilot projects will include urgently needed community health and community-run bilingual education services which the responsible government agency has never provided.

An Alternative Development Model

One of the students whom I met at the research centre was Paulo Pankararo, a 19-year-old from the Pankararo nation in northeast Brazil. With great fervour he explained the thinking behind the centre:

"In the Indian research centre, Indians have come together to study how to occupy our land using our traditional methods. How to formulate an alternative type of development than the one being currently proposed.

"We need to develop. Since the contact with white people my people have suffered. They remain dependant. Before, they did not use sugar. Today they need sugar which gives them toothache. Now they need western medicine. Before they did not use saucepans, now they need them.

"Before my people only produced or took from the forest what they needed for their own use. Now we need to produce a surplus for trading. Also, if we do not use this land fully, other people will. They will exploit it and destroy it.

"Today, we are fighting for the autonomy of the forest people. We need to be free politically and economically. We need to find a way to maintain an equal relationship with the capitalist system which otherwise will crush us.

"My people know how to maintain their ecological equilibrium. This knowledge is very important. It forms the base of our work here. But we do need to adapt. We must. We no longer live in vast

areas. The indigenous areas are limited.

"In the 1980s, much to our misfortune, many rural workers who had lost their land because of the building of the Taporique dam, entered our land of the Pankararo nation. Today 2,000 white people live in our area. They occupy nearly half our land. That area had many forest fruits and game. The whites destroyed it all. So now I want to learn here at the centre how to plant the forest fruit and how to breed forest animals.

"The Indians have always been described as negating progress. This is not so. It is a question of economic models. We need to show that the Atlantic forest is more important than sugar cane plantations. At the Research Centre we wish to develop a technology which is not aggressive but which is still productive. Instead of attacking nature, humans need to live in harmony with her. We are not anything superior and we are only children of nature, privileged children. When human beings realize that they form part of this cycle, when they begin to obey the natural laws, we will all be much happier. This destruction will cease."

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Protection of the environment and conservation of natural resources are factors which are playing an increasingly important role in development cooperation as in other fields. In this context, a central position is occupied by reafforestation and rational forest management. We are supporting the Republic of Algeria in its efforts to upgrade staff and planning methods so as to ensure a sustained management of forest resources in the Collo Region. For this project we are presently seeking a

Team Leader

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- Drafting of silvicultural guidelines for a sustained management of forest resources
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Indian Development in Amazonia: Risks and Strategies

by
Marcus Colchester

Few indigenous groups in Amazonia remain entirely outside the market — and most will go to considerable lengths to obtain consumer goods. But entry into the market is fraught with social and environmental problems. Many groups have suffered badly in the process: others have succeeded in maintaining their traditional way of life and preserving their environment despite the pressures. Success would appear to depend above all on the Indians having time to gain experience in handling, and making decisions to control, social change. From this point of view, the two greatest menaces to the Indians are imposed development and the loss of their lands.

The recent upsurge in public concern to 'save the rainforests' has led to numerous proposals to prevent their destruction by enhancing their economic value. By showing that standing forest can generate greater economic returns than cleared areas, the hope is that the policies leading to deforestation can be checked and reversed. Moreover, by increasing the economic productivity of forest-based societies, the goal is not only to save the forests but to achieve a future for the societies which live there and which have managed the forests sustainably for thousands of years. There is a fear, however, that this is a vain dream, a Faustian pact with the devil; that the commercialization of forest products will undermine and destroy the very societies it is intended to save. The history of Amazonia warns us that whenever there have been profits to be made from the forests, it is the Indians who have been the losers, because with their unequal access to power they have had to give way to the might of outsiders invading their lands. Yet, even where the Indians have managed to retain control of their lands there is a risk that the commercialization of their economies can fatally disrupt and destroy their societies. This article reviews some of the many studies of social change in Amazonia to provide a cautiously optimistic note. Economic transformations need not necessarily undermine the traditional social organi-

zations, so long as careful planning and indigenous controls are assured.

The Pressure for Change

Those who have studied development in Amazonia from an indigenous viewpoint have, for good reason, tended to describe the process from the perspective of the Indians facing the encroachment of the outside world.¹ But this emphasis on the damaging effects of progress on Indian societies can give the false impression that the Indians are opposed to economic development. The reality is, in fact, very different, and although a large number of Indian societies continue to suffer from, and to oppose, the intrusions of outsiders onto their lands, many, probably most, are simultaneously seeking their own means of development. Groups like the Waimiri-Atoari, who defend their traditional life with arrows² are the exception, and most Indian groups are inclined to welcome strangers because they bring their 'superior' technology with them.

The Indians' desire for western technology is not hard to explain. Shifting-agriculture in the Amazonian forests is about four times faster with an axe or a machete than with a stone chopper, and tasks like house construction, canoe building and wood-carving are made about ten times easier.³ Raiding and killing to acquire metal tools was common during the early phases of contact,⁴ but usually the Indians gain access to the goods they desire by

more pacific means — trading instead of raiding. Once trade links have been established by which the Indians can acquire machetes and axes, other industrial products quickly follow. Metal cooking pots, arrow points, shotguns, drills, needles, mirrors, scissors, beads, cloth, fish-hooks, nylon etc. all soon become integral parts of the Indian economy until suddenly the Indians find that they can no longer survive independently of the outside world. As the Indians' demand for modern industrial products grows, there grows a corresponding demand for them to produce some kind of saleable commodity to trade for the new essentials — and so the Indians, through their desire for easier, more efficient, more leisurely modes of production, become trapped in that spiral of mutually exacerbating variables that is called 'progress'.

In searching for viable means of production of goods to exchange for modern industrial products, we can note three different strategies that the Indians have been able to develop. They can either sell themselves, sell the surpluses of their traditional economy, or they can adopt new economic tactics to produce non-traditional products. In various parts of Amazonia different Indian groups have adopted all these alternatives and the consequences have been as diverse as the means chosen. Before we go on to examine in some detail the second and third strategies, it is instructive to look at some examples of the first to remind us of the driving interest that the Indians have in acquiring modern goods.

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Slaving, Prostitution and God

The Indians' adoption of metal goods dates back to the first voyage of Cristobal Colon, and it was not long before the free exchange of Indian labour for occidental goods gave way to a system whereby favoured Indians were rewarded with metal tools in exchange for captives who could be forced to work in the colonists' silver mines, pearl fisheries, sugar plantations and brasil-wood felling industries.⁵ While the slave trade has been well documented in the literature, it has often been overlooked that the Indians themselves were actively engaged in the slave-raiding expeditions, as this was the most effective means available to them for acquiring metal goods.

Although it may be presumed that slaving no longer exists in any part of Amazonia, there are many groups that have been so deprived of their traditional means of livelihood that they are forced to sell themselves in various ways to gain the goods that they now depend on. The example of the Izozeno-Chiriguano of Bolivia, who have to sell their labour as cane-cutters to make a living, reveals that the economic system of debt-peonage (once integral to the rubber-trade at the turn of the century) still persists.⁶ Another means of acquiring modern goods by selling oneself, prostitution, exists throughout Amazonia, often overriding traditional social institutions.^{7,8} For example, when I questioned the Sanema (Yamoama) men if they didn't get angry with their wives for having relations with the government hydrologists stationed in their Venezuelan territory, they replied:

"No, no, no. We just say 'Look girl!

Next time you go fucking with the foreigners, you make sure you bring me back a machete!"

The contrast that such a tolerant attitude makes to the vigour with which Sanema men usually defend their rights to women is hard to exaggerate.⁹

The fact that the initial attractiveness of the missionary to the Indians is his possession of modern goods is not denied even by the missionaries themselves. The missionaries survive and thrive amongst the Indians because they trade material benefits for the Indians' souls.^{10,11,12}

The Production of Surplus

Such means, as those noted above, by which Amazonian Indians acquire modern

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industrial products are widespread, but, at least in the relatively traditional areas, most goods are obtained through direct exchange, whereby surplus products are exchanged for the desired goods. What begins as a simple transaction, machetes in exchange for manioc, axes for artefacts, sets in motion a whole process of social and economic change in Indian societies. From being isolated, autonomous, self-sufficient peoples with subsistence economies, the Indians become dependent, accessible and manipulable and linked to the western market economy. Thus, the process by which tribespeople become peasants is initiated

The process of 'integration' into national economies can take a number of different paths. As the cases examined below illustrate, depending on which aspects of the economy are purposefully modified to produce a saleable surplus and, above all, on what modifications in the organization of production are undertaken to accommodate these economic changes, the pattern of change may not necessarily be disastrous.

Judging the success or otherwise of social change is fraught with difficulties since it must inevitably relate to a scale of values that are not necessarily shared. Here I shall be attempting to examine some examples of economic and social change using three general criteria in their evaluation:

- The economic viability of the changes in terms of cost-benefit (of both finance and labour);
- The environmental consequences of the same changes (success being judged in terms of avoiding environmental degradation);
- Their social consequences (success being judged in terms of minimal disruption of traditional social structures and beliefs).

It should be noted at the outset that such a scale of values may not necessarily cor-

respond to those of all the participant Indians.¹³

Change Among the Mundurucú

One of the earliest attempts to analyse systematically the process of economic and social change in Amazonia, is a study by Murphy and Steward of the (Ge-speaking) Mundurucú Indians of the Tapajos river of the Brazilian Upper Amazon.¹⁴

The Mundurucú began their trading relations with the neo-Brazilians by producing large surpluses of manioc (toasted cassava) which was processed by extended families and traded collectively with the newcomers. The trade relations were mediated through the Mundurucú's traditional chiefs, whose major functions were to be leaders in warfare (Mundurucú warriors also worked as mercenaries during the era of 'pacifications'). Murphy theorized that the process of manioc production by groups of related women acted to reduce male domination in the political realm and actually changed patterns of post-marital residence.¹⁵ The details of these transformations are in dispute,¹⁶ but one result has been a collapse of male authority and an increasing sexual equality: changes that are not unwelcome to the Mundurucú women.¹⁷

Much more destructive and obvious changes in Mundurucú society were caused by their involvement in the rubber trade. This trade commenced about 80 years after the beginning of the manioc trade and developed in a manner common throughout Amazonia.¹⁸ Neo-Brazilian traders would establish relations with Indian groups and provide them with tools and trade-goods on credit. In exchange for these goods, the Indians would be under an obligation to tap avenues of rubber trees and, after processing the latex, hand the rubber over to the trader as part payment of their debts. The trader would then make further loans and so establish permanent relations with the Indians, based on these debts — the system known as debt-peonage (or debt-slavery or debt-bondage).¹⁹

In the Mundurucú case these trade relations were first established through the same chiefs as had mediated the manioc trade and the mercenary ventures:²⁰ however there were strong pressures operating to fragment the society. In the first place, the rubber traders preferred to mediate through 'chiefs' chosen by them rather than by the Indians, and the Indians began, as a consequence, to lose confidence in their (new) leaders, since they did not

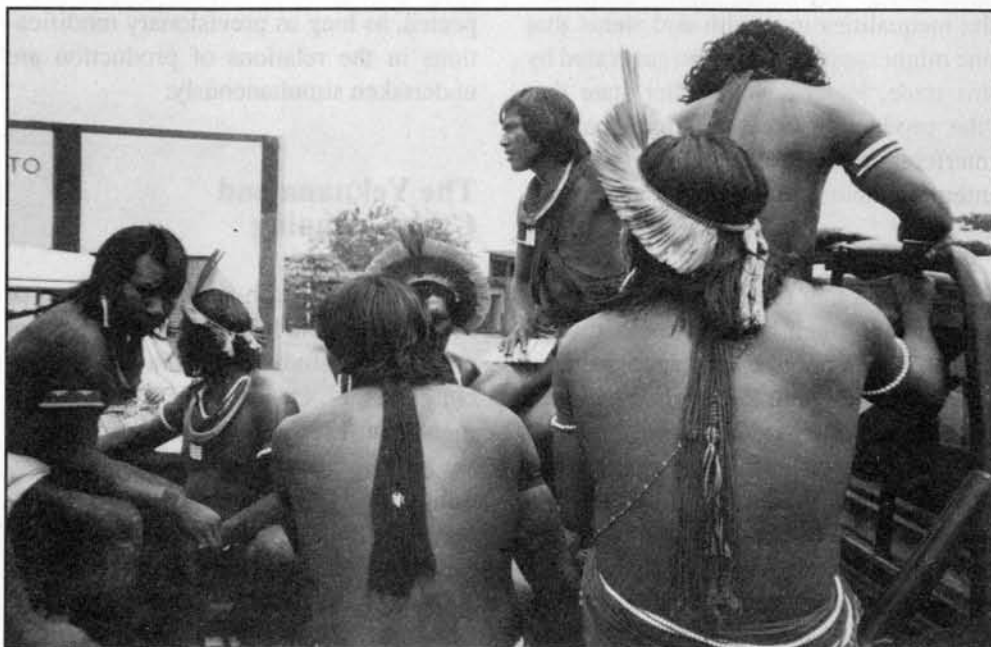
appear to represent their own interests. Secondly, the decline and eventual cessation of warfare reduced the need for chiefs in any case. Thirdly, the tapping and processing of the rubber could best be carried out individually and not collectively as had been the case with manioc production.²¹ The Mundurucú villages began to break up as families moved off independently to work the rubber avenues. Moreover, the Indians began increasingly to deal directly with the traders rather than through the 'chief'. For this reason, both the political and village structures were effectively shattered.²²

On the basis of this and other comparative material, Murphy and Steward conclude that:

"When the people of an unstratified native society barter wild products found in extensive distribution and obtained through individual effort, the structure of the native culture will be destroyed and the final culmination will be a culture type characterized by individual families having delimited rights to marketable resources and linked to the larger nation through trading centers."²³

The question though is whether this process is unmodifiable or whether changes in the social and political circumstances of the Indians cannot break them from their dependency and allow them to reassert their collective identity. Under certain circumstances it may be possible to break out of the system of debt-peonage by avoiding direct trading with the entrepreneur and by wholesaling directly to a rubber merchant. Survival International's aid project among the Andoke of Colombia was based on exactly this possibility.²⁴ It was hoped in this case that wholesaling, rather than individualist bartering with the entrepreneur, would lead to a reaffirming of community life and the freeing of the Indians from the disintegrating effects of the rubber trader's exploitation. In the event, the small injection of capital did successfully allow the Andoke to set up as a cooperative, and armed with a renewed sense of community they have reestablished control over their own affairs.

A more certain example of the beneficial effects of cooperative wholesaling for a community previously suffering the destructive effects of entrepreneurial dealing in extractive products is the case of the Gavioes. Initially shattered by the impacts of 'pacification', new diseases and relocation, the Gavioes were the objects of a number of investigative missions that followed the fall of the notorious Brazilian



Although a large number of Indian societies continue to suffer from, and to oppose, the intrusions of outsiders onto their lands, many, probably most, are simultaneously seeking their own means of development. The danger is that the commercialization of their economies can fatally disrupt and destroy their societies. (Photo: N. Hildyard)

governmental Indian agency, SPI and the setting up of FUNAI.²⁵ Between 1970 and 1975 the Gavioes (like the Mundurucú, a Ge-speaking group) were coaxed into a paternalistic trading relation with the FUNAI personnel not dissimilar from that with the rubber traders, except that money was used in the transactions. FUNAI were underpaying the Indians for their brazil nuts to the order of 80-90 per cent and exerted dictatorial control over the community's activities.²⁶ Nevertheless, the population began to build up again, from 76 in 1970 to 108 by 1976.²⁷ They acquired a (very small) reserve of 52,500 acres and then in 1975-6 embarked on a community development project, wholesaling direct to the market on their own account (and not via FUNAI's corrupt officials).^{28,29} According to Ramos, the case "is the most clear-cut instance of the economic integration of an Indian community without a loss of ethnic identity".³⁰

There are reasons for doubt as to whether this project was quite such a clear cut success as Ramos makes out. For example Bourne notes that the younger Gavioes are growing up ignorant of their mother tongue.³¹ Also, all the reports emphasize the poor quality of the Gavioes' nutrition and the falling returns of game.³² Nevertheless, what seems clear is that aid projects which aim at structural modifications that strengthen the traditional relations of production can counter the atomizing effects of individualist trading. The unifying effects of this cooperative venture have had a significant influence for the Indians in their subsequent dealings with Brazilian society. As Treece has docu-

mented in his study of the Grande Carajás Programme, the Gavioes have since fought a long and bitter struggle to hold onto their lands, to secure compensation for the crossing of their territory by a railway and by power lines, and to maintain control over their community development programme.³³ Their previous experience as a nut gathering collective provided a crucial preparation for this confrontation that would otherwise have most probably swept them into oblivion.

Self-Development Among the Panare

The case of the Panare documented by Henley and Muller is one where moderate self-development has proved equal to meeting (at least for a while) the Indians new, perceived needs, without either external advisers or formalized modifications of the productive organization, and also apparently without damaging the traditional social system.³⁴

The Panare, a Carib-speaking group of central Venezuela who have recently (though not *in toto*) descended into the savannahs of the vacant Orinoco lowlands from their traditional forested uplands, have recently adopted basket-weaving as a major trade-oriented activity. The trade is apparently carried out on an individual basis and no overt control is exercised over the manner in which money-earners dispose of their income. Young men tend to buy prestige goods and luxuries with their gains while elders spend their earnings on more 'useful' commodities.³⁵ In spite of

the inequalities in wealth and status that one might suppose would be generated by this trade, Henley and Muller state that "the production of commercial baskets interferes in no significant way with the internal economic relations of Panare society".³⁶

In evaluating this material it needs to be remembered that the Panare's recent development of their basketry trade, though a new phenomenon, is only a replacement of a prior trade with the *criollos* (creoles) based on tonka beans, the market for which collapsed in the 1960s.³⁷ Any changes due to individualist trading are thus liable to have occurred sometime in the past. Unfortunately the ethnographic material relating to the tonka bean era is not available, so it is hard to discern what effect the trade had on Panare society. Nevertheless, on comparative grounds we are justified in suspecting that the tonka bean trade may have been responsible for a weakening of the social structure — just as is occurring among the Warao and Yekuana Indians today, where individualist trading is eroding traditional patterns of authority. Perhaps this breakdown in authority structures explains the Panare's surprising lack of an oral literature.³⁸

The Panare material is important. Whatever we may choose to speculate concerning their past social organization and the effects of trading on it, the available evidence suggests that individualist trading may not, under certain circumstances, be very destructive to the social fabric. However it is clear that the modest income acquired by basket sales no longer satisfies the Panare's growing demands for industrial products.

Henley and Muller contrast the benign effects of basket trading in the western Panare area with the more pernicious effects of cash-cropping in the eastern populations.³⁹ In this eastern area, where the duration and proximity of contact with the *criollos* are both greater, a breakdown of food-sharing norms, marriage rules and even of the relationship terminology, are all apparent.⁴⁰ According to Henley and Muller, cash-cropping can be expected to increase in the future not only because of growing markets, but also because these markets are less liable to collapse or fluctuations than the market for 'primitive' artwork.⁴¹ Henley and Muller conclude that "cash-cropping is likely to have far-reaching social consequences for the Panare communities that practise it".⁴² The examples given below show, however, that these consequences need be neither so damaging nor so great as might be ex-

pected, as long as previsionary modifications in the relations of production are undertaken simultaneously.

The Yekuana and Cash-Cropping

The Yekuana (Carib-speaking) Indians of south Venezuela have been the objects of a number of studies on economic and social change. One project which commenced in 1958 and has been particularly well studied, centres on the community of Santa Maria del Erebató. It was established with the collaboration of a Catholic missionary organization, *Les Petits Frères Foucauld*. Initially an evangelical and economic aid project, the scheme gradually developed as a coffee-marketing cooperative and eventually became established as an 'Indigenous Enterprise' (*Empresa Indígena*), incorporating a number of separate communities, directed to the goals of self-development, self-determination and the preservation of Yekuana traditions. Correspondingly, the character of the missionary involvement has transformed from a paternalist one into a solely advisory function.⁴³

Founded on a long history of marketing traditional and extractive products (canoes, tonka beans, latex, basketry, cassava graters, cotton etc.) in exchange for industrial products,⁴⁴ the productive base of the *Empresa* changed little during the first ten years, except for a marked increase in trade in traditional artifacts. But, since the formal registration of the *Empresa* in 1975, there has been a steady expansion of cash crop production, both of coffee and manioc.

Accompanying these increases in exports, achieved with the help of financial loans from the government, has come the imposition of formal *Empresa* organization on the Yekuana cooperative, but in a manner adjusted to suit the traditional social organization. As among most Amazonian peoples, the traditional production unit is smaller than the village, in the Yekuana case being a family unit extended through marriage ties to include a man's sons-in-law and their children. Central to Yekuana society is the relationship of a father-in-law to his son-in-law, which is the only significantly hierarchical relationship defined by the relationship system. The *Empresa* organization relies on a General Assembly of all household leaders from all the six villages involved, which has the right to ratify and control the actions of an administrative committee in

turn responsible to an executive council. Election and decision making are all referable to the General Assembly, decisions being achieved on the basis of extended discussion and the reaching of a consensus of unanimity.⁴⁵

According to Dieter-Heinen "the traditional social structure has assimilated the new forms of economic organization without problems."⁴⁶ Indeed, the modifications have even "re-affirmed" traditional patterns of leadership.⁴⁷ More specifically, Dieter-Heinen has noted that the organization necessary for running the *Empresa* is only damaging insofar as the traditional authority structure, of fathers-in-law over sons-in-law is undermined by other external factors such as salaries/wages gained independently of the cooperative.⁴⁸ The Yekuana themselves are apparently aware of this problem.

Dieter-Heinen points out that the role of the *Empresa* organization is not only crucial in maintaining and controlling the units of production and consumption but also in regulating the "import mix".⁴⁹ To retain control over the expansion of the perceived needs of the indigenous communities, the *Empresa* plays the important role of assuming collective responsibility for both retail and purchase. Financial gains are thus used to pay off outstanding debts, cover overheads, fund new investments and buy essential commodities that fulfil communally perceived needs before being spent on luxury or prestige goods.⁵⁰ In this way, the atomizing effects of individualist trading are minimized.

Environmental Consequences of the Yekuana *Empresa*

Turning our attention from the success of the Yekuana *Empresa* at the financial and social levels to the environmental aspects, the picture is not a happy one. As early as 1968, only ten years after the founding of the large community at Santa Maria del Erebató, Coppens noted that it was "on the way to reaching the point of demographic-ecological saturation, beyond which the community must move again or divide into factions".⁵¹ Coppens made this observation not only prior to the settling at Sta. Maria of a second large Yekuana contingent but also before the establishment of three large Sanema (Yanoama) Indian villages in the immediate vicinity.^{52,53} The population, then numbering only 120, reached 654 by 1982.

Added to this, the cooperative's rate of forest clearance had begun to increase

almost exponentially with the expansion of coffee plantations and other cash-crops (mainly of cassava for sale as manioc). As early as 1968, gardens were being cut 20 kilometres downriver and up to five kilometres inland of the community.⁵⁴ The radius of activity has expanded accordingly in the years since.

The persistence of the community, in spite of these facts, should caution us against making too definite predictions concerning the way environmental constraints determine settlement size and movement. However the reality of the environmental impoverishment in the Sta. Maria area was not in dispute. Game could only to be found at great distances from the community and the level of protein consumption became a real concern to the visiting doctor:⁵⁵ for the local Sanema who have no outboard engines to expand the radius of exploitation the situation was even more serious.⁵⁶

Traditionally, the Indians would have relocated their villages when faced with resource depletion, but in this case infrastructural developments (standing fruit crops, airstrips, schools, dispensaries, clinics, crop-processing machinery and craftshops) tie them down. I have examined this process, by which the systems that traditionally balanced Indian economies against environmental damage become disrupted, in some detail in a separate publication.⁵⁷ The situation in Sta. Maria, as perceived by one of their leaders, was expressed to me thus:

"We are trying to establish a community here on the Erebató. That is what we need, a secure base . . . This year we are cutting 16 new gardens and making new coffee plantations. But this is no solution, for the plantations get further and further away. We need motors to reach them. But that is no solution, for then we have to buy gasoline and spares. Now we are making a small cattle farm at Cuchime and we are making a track to the Icutu 16 kilometres long, so we can take out the coffee that way . . . But we need gasoline and spares for the tractor. So that is no solution! Look at Caracas! Before only some people had a single car. Now everybody has a car. Some people have five cars! And there are underpasses, motorways and flyovers. But there are still always traffic jams! There is no solution!"⁵⁸

The complexity of these problems should not be underestimated. Economic changes imply changes in social organization and community dynamics which can have significant environmental conse-

quences (see Figures 1 and 2). The problems, though, may not be insuperable. At present the Yekuana of the Erebató are attempting once more to decentralize and disperse their communities, while retaining a coordinated development strategy, as a way of spreading their burden on the forest. A key to this process is the use of short-wave radio transmitters which allow the once more widely separated communities to share information and convene essential meetings. It remains to be seen whether this decentralization, even with the help of radios, is compatible both with effective coordination and grassroots democracy.

Conclusions

All this material makes it clear that every

case presents unique features that make direct comparisons hazardous. Nevertheless, it does not follow that the experiences of one indigenous group have no relevance for others. The examples make clear that engaging in economic change, without making modifications in the relations of production and consumption, can have serious consequences for these societies. Of the examples noted above, only the Panare seem to have emerged relatively unscathed by individualist trading, but the modest scale of their basketry trading is not likely to satisfy their new demands for long.

In the introductory section an attempt was made to distinguish between three strategies of exchange — selling oneself, selling traditional products and selling non-traditional products. The examples we have reviewed suggest that the second

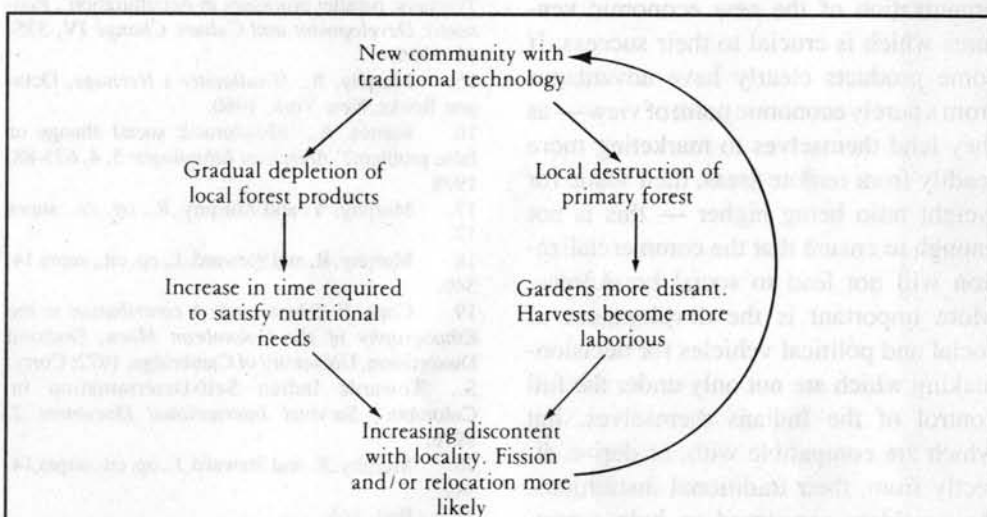


Figure 1: Traditional system of resource use. Negative feedback cycle prevents excessive long-term use of local environment.

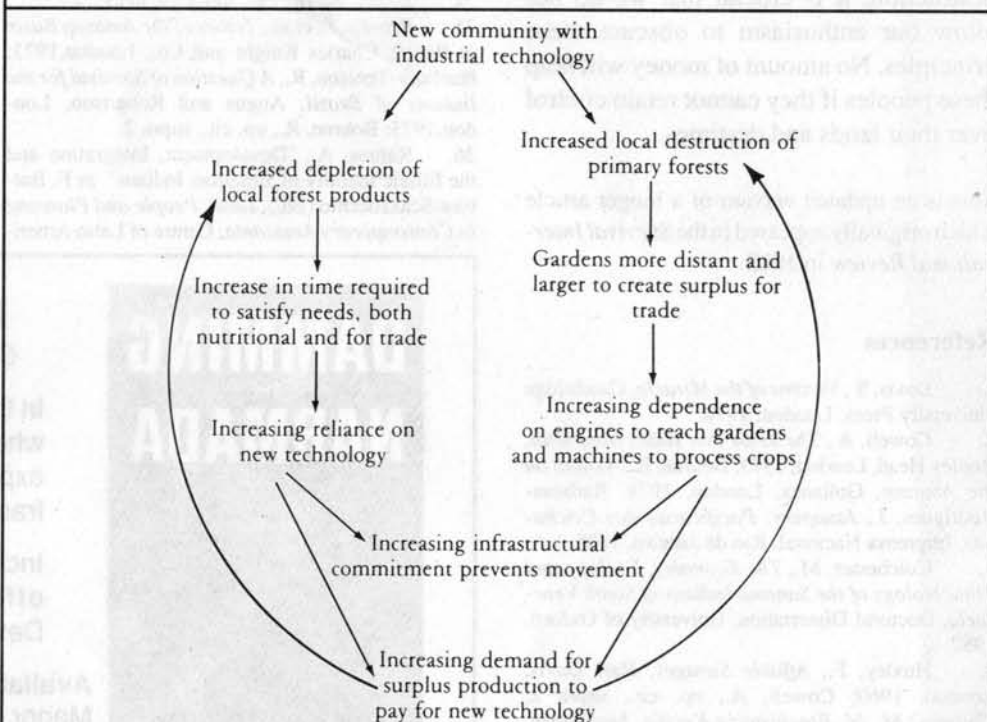


Figure 2: Modern system of resource use. Positive feedback cycle exaggerates speed of environmental destruction, leading to increasing dependence on outside society.

and third alternatives are not obviously distinguishable in terms of their social or environmental consequences, though experiments with new products can be financially risky. Although it might be supposed that the Indians' previous experiences in generating traditional products should make this, environmentally and socially, the least risky strategy, and that the need for external assistance in generating novel products might create socially damaging dependencies, in fact, there seems to be little to choose between the two strategies. The Indians can learn new production techniques very rapidly, accustomed as they are to being responsible for their own actions, but learning effective marketing techniques is as difficult with traditional as with non-traditional products. What all these examples show most clearly is that it is the social and political organization of the new economic ventures which is crucial to their success. If some products clearly have advantages from a purely economic point of view — as they lend themselves to marketing more readily from remote areas, their value for weight ratio being higher — this is not enough to ensure that the commercialization will not lead to social breakdown. More important is the development of social and political vehicles for decision-making which are not only under the full control of the Indians themselves, but which are compatible with, or derive directly from, their traditional institutions. As outsiders concerned to help forest-dwellers and to save their forests from destruction, it is crucial that we do not allow our enthusiasm to obscure these principles. No amount of money will help these peoples if they cannot retain control over their lands and destinies.

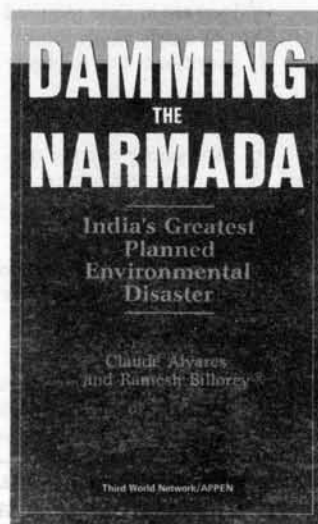
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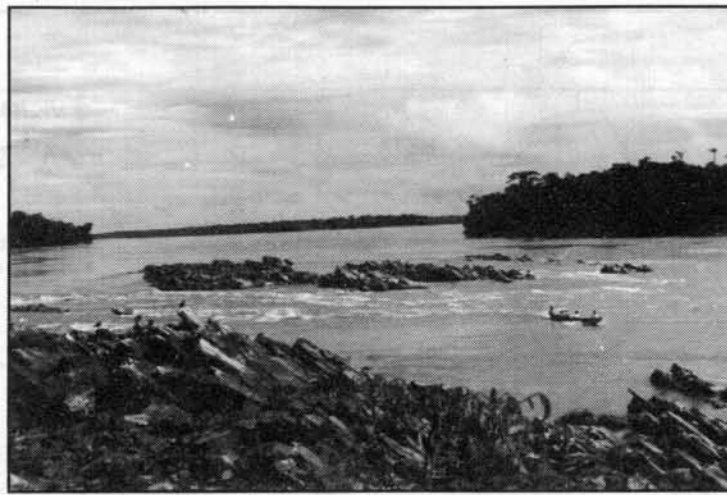
Damming the Narmada

Claude Alvares and Ramesh Billorey

In this comprehensive study, the authors, who had access to official documents, expose the large-scale manipulation and fraud that led to approval of the project.

Includes exclusive interviews with top officials of the Narmada Valley Development Authority.

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The Caqueta River. Part of the 12 million hectares of Colombian Amazonia that have been granted to the region's indigenous peoples. The transfer of another 6 million hectares is currently under way (Photo: P. Bunyard).

Guardians of the Forest: Indigenist Policies in the Colombian Amazon

by
Peter Bunyard

Over the past few years, the Colombian Government has set a remarkable precedent for Amazonian countries by granting inalienable land rights to its indigenous forest peoples. This policy reflects the Government's belief that the best guardians of the forest are its indigenous peoples.

The Colombian Amazon encompasses some 47 million hectares — approximately one quarter of the entire territory of Colombia and nearly double the size of Great Britain. Over the last 30 years, annual deforestation throughout Colombia has varied between 660,000 and 880,000 hectares. Such a rate, if continued, would see most of the country's forests vanish within 50 years. However, much of Colombia's Amazonian forest is still intact, a consequence in part of its isolation from the remainder of the country.

At present, 25 million hectares of the Colombian Amazon are utilized by Indians, but at a very low population density. The population of the entire region is some 550,000, the majority of whom are recent settlers who live at the margins of the rainforest, having cleared it. Some 38 million hectares were once covered in tropical moist forest, of which as much as 6 million hectares have been lost as the result of colonization, particularly following the 'Era of Violence' which began in the 1950s and led to an exodus of thousands of peasants from their traditional homes in the Andean Cordillera.

For the most part the colonization took place either in the Andean piedmont itself or just east of it in the Llanos (savannah plains lying between Colombia and Venezuela to the north of the Amazon rainforest). Such colonization and the resulting deforestation has had major environmental consequences, with massive erosion, landslides and the drying up of small rivers. As in other parts of Latin America, much of the forest is converted into pasture for extensive cattle raising. Particularly during the 1970s, both the Colombian Government and the World Bank gave support to the conversion of forest into pasture for cattle, despite the exceedingly poor returns and the ecological devastation. Such intervention has only aggravated the trend towards

large holdings at the expense of the poorer peasant who was yet again displaced to wreak more damage on the forest ecosystem. Support for cattle raising appears to have become institutionalized within government agencies such as INCORA - The Colombian Institute for Agrarian Reform - and the Caja Agraria - the Agrarian Bank.

The situation in the lower Amazon region of Colombia appears to be stable at present, with little pressure on the forests. Nonetheless, schemes exist for the exploitation of the Colombian Amazon, for its timber and its supposed agronomic resources. Undoubtedly, pressures for deforestation are currently worse in other parts of Colombia, in particular in the forests along the Pacific coast which are now being exploited by Japanese timber companies. With their extremely high rainfall — 10,000 mm per annum — these forests are some of the richest in ecological terms in the world. Their need for protection is a priority.

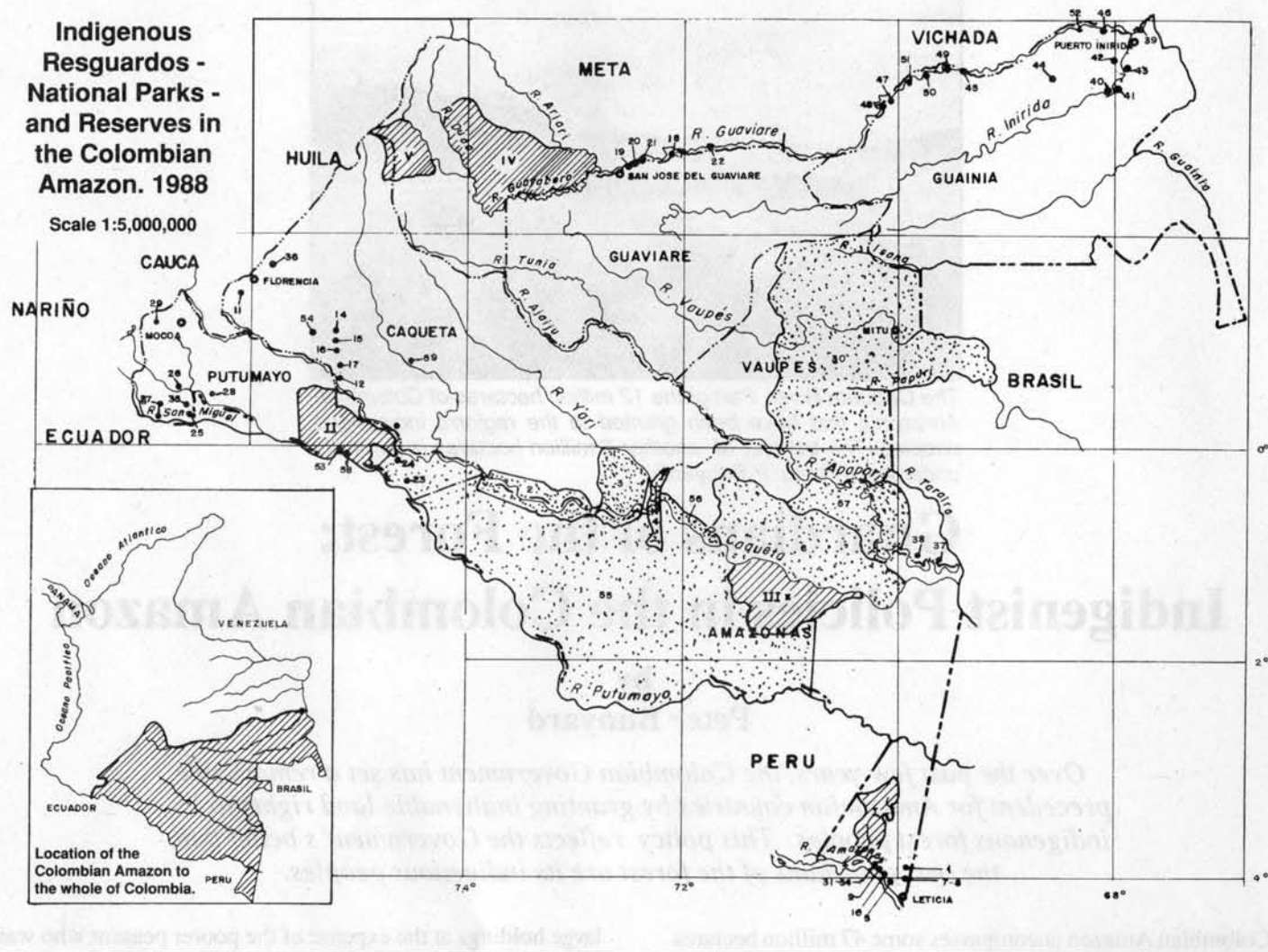
The eastern part of the Colombian Amazon, aside from the gold mining areas close to the border areas between Colombia and Brazil, and towns such as Leticia, La Pedrera and Mitú, has virtually no colonists. In fact, the population consists almost entirely of some 70,000 Indians organized into 50 different ethnic groups belonging to some 10 different linguistic families. Where the forest is still intact the indigenous peoples make up 95 per cent of the population.

Restoring the Forests to the Indians

The Colombian Government is now deeply concerned over the future of the Amazon Basin, not just those parts within its own territory, but also in the wider context of the effect of changes to

Indigenous Resguardos - National Parks - and Reserves in the Colombian Amazon. 1988

Scale 1:5,000,000



the Basin taking place in neighbouring countries, and especially in Brazil, which has far surpassed all the other countries of the Amazonian Treaty (Ecuador, Peru, Bolivia, Guyana, Surinam and Venezuela) in terms of the rate and extent of destruction. The Colombian Government has therefore been actively seeking ways in which it can implement policies that will protect the forest and safeguard it into the distant future. Its hope is that other countries of the Treaty will follow suit, as it is appreciated that destruction of the forest in one region may have repercussions on the well-being of the forest in others, especially as a result of climatic and hydrological changes.

Over the past 15 years the Colombian Government, under its various presidents, has been taking into consideration the rights of the indigenous population of its Amazonian territories. Negotiations between the various government agencies, including the Caja Agraria, the land reform agency (INCORA), the Institute for Natural Resources, Environment and National Parks (INDERENA) and the Division of Indigenous Affairs, came to fruition in April 1988, with the returning of the Predio Putumayo region into the hands of the Indians. Indeed, President Barco's government has now begun a massive programme of conferring land rights to all the many indigenous communities living in the country's Amazonian territories.

Over the past few years, more than 12 million hectares have been granted to the respective indigenous peoples, nearly half of which was handed over in April 1988. The Colombian word for these indigenous lands is *resguardo* and indicates the conferring of special rights that go beyond the notion of 'reserve' or 'reservation', insofar as the latter suggests a kind of bountiful 'set

aside' rather than an acceptance of prior rights. These rights, as enshrined in the laws concerning *resguardos* signify that the land is the collective property of the Indian communities and is inalienable. The land cannot therefore be sold or transferred to non-Indian hands. The legal character of the *resguardos* is guaranteed by the Government.

Discussion is now in progress over the granting of another six million hectares as *resguardos* in the northern part of the Colombian Amazon, in the State of Guainia, on the border between Colombia and Brazil. Should this land be granted as *resguardos*, some 200,000 indigenous people will have land rights over an area the size of Great Britain. Colombia has an estimated 450,000 indigenous peoples, approximately double the numbers officially recognized as being indigenous in neighbouring Brazil.

Indigenous Peoples: Guardians of the Forest

As a result of the indigenist policies being pursued by Colombia, numerous indigenous communities now have the right to an exclusive territory that will serve them as a base for the development and fulfilment of their productive activities. They have the right to their own forms of organization, to establish their own rules and to choose their own authorities. Moreover, they will be enabled to pursue a degree of autonomy in the management of their internal affairs and to enjoy the right to pursue development models that harmonize with their own needs. The hope is that, given the respect and recognition of the integrity of their territory, of their organization, customs and traditions, they will be

able to enjoy a peaceful and prosperous existence.

Acceptance of the prior rights of the Indians to the land is a major factor in the restoring of ownership, but equally significant is the Government's recognition that the Indians alone to date have achieved a mode of existence in the rainforest that enables sustainability without causing long term damage. They can therefore be considered its protectors: a role that the white colonizers have patently failed to fulfil.

Traditional indigenous peoples manage the forest in a fundamentally different way from that of the colonists. Nowhere is this more apparent than in their different approaches to farming the forest. For instance, the Indians avoid using the *vegas* — the fertile wetlands along the river — but create their '*chagras*' (or gardens) on firmer ground, one reason being their use of perennial rather than annual crops.

They also assiduously leave as much forest intact as possible since they see it as the fount of regeneration and of game and useful wild plants. Their forest economy is thus based on leaving a buffer zone a hundred or even a thousand times larger in area than that used around their communal houses for subsistence produce. Meanwhile, cattle have no meaning for them and, for the most part, they see little point in having them. To keep one cow necessitates the destruction of at least one hectare of forest.

In making their *chagras*, the Indians purposely do not burn the boundaries of the clearings nor cultivate them. In many of the *chagras*, they also plant various species of fruit trees and these form microhabitats which attract birds and bats and therefore accumulate their droppings which invariably contain the seeds of a number of species which in germinating also contribute to the swift process of regeneration. Usually, the Indians plant some 25 to 50 fruit trees per hectare.

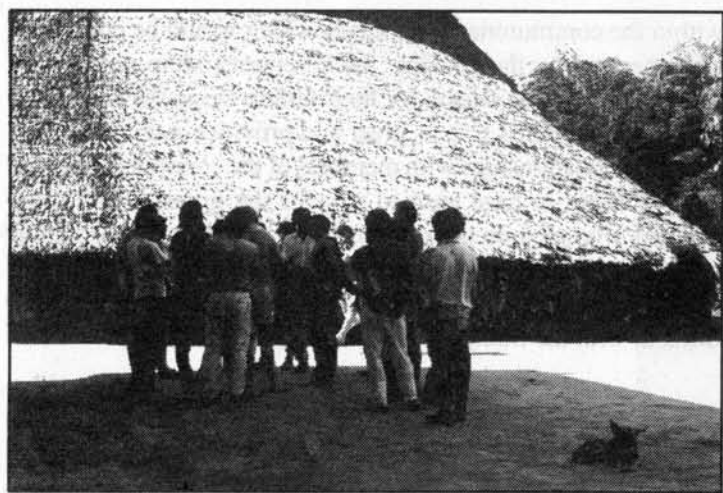
A *chagra* is chosen for the nature of its soil and vegetation. Primary forest is chosen in which there is little understorey and not too great a concentration of surface roots, especially root mats. When understorey is present that implies that the canopy is open and light is getting through, or that the soil is too wet, while root mats are difficult to burn and may need several burnings at intervals of one to two months. The soil must be between sand and clay, the former being good for *yuca* (cassava) and tuberous plants, while clay favours plantains, coca and other fruit bushes. The Indians avoid flooded areas, finding the right places as a result of their hunting operations through the forest.

The settlement in any one area is maintained until the resources, especially the *chagras* and orchard, begin to dwindle. In general, the community may stay in one place for some 25 years, during which time they may have moved their gardens some dozen times.

Surviving the Market

The Colombian Government has made it clear that the granting of indigenous rights over such extensive areas does not correspond exclusively to the needs of the Indian population but seeks the conservation of tropical rainforest ecosystems known to possess some of the greatest variety of fauna and flora of the entire Amazon region.

However, the fact that Indians are still living in the Colombian Amazon does not *ipso facto* guarantee the conservation of the forest. The introduction of a consumer-oriented western model of development into those areas could destroy within a generation the adherence of Indians to their own models, especially by undermining the authority of the traditional leaders — the



Indians outside a communal maloca (or meeting house) which they have restored. If the Indian communities are to survive, then it is vital that they retain their models of looking at the world and are not forced or persuaded to accept ours. (Photo: P. Bunyard).

community 'captains' and shamans — whose role it is to oversee the activities of the entire community. The indiscriminate killing of game during the time of the skin trade in the 1950s and 1960s, carried out primarily by Indians in the pay of white dealers, can certainly be attributed to the breakdown of traditions within the communities and the loss of respect for the traditional leaders.

At present the Indians have little to market. They produce some rubber but by the time they have got it to market using Japanese outboard motors and extravagant quantities of fuel, the profits are practically zero. The Indians are at the mercy of the dealers who come from Brazil and can keep the Indians waiting in town until they have no choice but to accept the low prices being offered. It would undoubtedly make all the difference to the communities if they could get a reasonable return on the rubber. Some leaders have suggested that if some of the profits on selling rubber were set aside, the accumulated funds could be used for such ventures as community schools.

Whatever activity is undertaken to get cash, the Indians are increasingly insistent that it should not interfere with the rituals and their underlying traditions of their society. Indeed, if all members of a community had conventional jobs, then the tribal structure would almost certainly break down. It is only through reinforcing ritual and tribal beliefs that authority is vested in the captains and shamans and a coherent community structure is maintained.

If the Indian communities are to survive, then it is vital that they retain their models of looking at the world and are not forced or persuaded to accept ours. Their most urgent challenge is to achieve a balance between the desire for certain manufactured goods and the desire to retain their cultures and the environment around them. The challenge is to achieve a useful and continuing dialogue between the Indians and both government and non-government agencies concerned with their welfare.

The task is formidable. Throughout the history of contact with Whites — a history of slavery, torture, massacre and disease — the most common method of getting the Indians wholly dependent has been to sell them goods, such as machetes and guns, and then keep them working until they have paid off their debts, which they never do, since the prices of the goods and the cost of labour are totally controlled by the white overlords, whether they be missionaries or dealers (see M. Colchester, *this issue*).

In an attempt to undermine this system of debt-peonage, and counteract its destructive cultural influence, the Division of Indigenous Affairs in the government tried to establish shops

within the communities themselves which would be controlled and operated by the Indians. Such ventures were not wholly successful, a prime reason for their failure being the contradiction in the captain's role as giver and provider in a complex of reciprocal relationships with members of the community and the need to bring in hard cash to pay for the goods. Thus some captains who took on the responsibility of running the community shops, finished up giving away the goods that they had had to procure through paying hard cash because the giving away fitted in with the traditional role of captain.

Resilience in the Face of Change

Yet, despite the pressures, the Indians express an extraordinary resilience in their ability to recreate their traditions and ways of life. In all probability, such resilience is a consequence of a way of life that necessitates shifting the entire community every few years to a new base in the forest. Reconstruction and recuperation are very much part of the Indians' vocabulary and they have seen enough of the misery and destruction following in the wake of white colonization and exploitation to be wary of the so-called benefits of development and progress. In effect, the regeneration of the forest itself following slash-and-burn gardening provides the Indians themselves with a model of the cycle of life and the natural forces of recuperation.

At this stage the indigenous communities require assistance in establishing a sound economic base which provides sufficient returns on their work so as to enable the acquisition of essential goods but does not undermine traditional and cultural activities. Help is also needed to overcome the health problems brought about largely through contact with colonizers and dealers. Again any assistance must be integrated with traditional methods of coping with disease. Finally, there is a need to provide education that is adapted to the cultural needs of the communities concerned. Here again, there must be subtle integration between the two cultures so as not to undermine the extant traditions.

Meanwhile the communities have a vital role to play in the

conservation and protection of the Amazon basin. The creation of national parks within the territories of the Indians should provide a unique opportunity for showing that indigenous cultures and environmental management are wholly interlocked.

A Model to Follow

The Colombian Government's open recognition of the close coupling between the traditions of the various communities and their management of the environment has clearly brought about a uniquely enlightened policy.

On April 23, 1988, Virgilio Barco, the President of Colombia, flew to La Chorrera in the Putumayo, and in the presence of the captains, leaders and governors of the various Indian communities, signed the handing over of the Predio Putumayo. He told the Indians:

"I bring you my greetings. I have come to give you some good news, a word of truth. At last your land is yours."

The Colombian Government has now given the world a model of how to deal with the vexed problems of environmental degradation and of indigenous peoples with intrinsic rights to land and their cultures. It is to be hoped that the other countries of the Amazon Treaty of Co-operation will look closely at the initiatives emerging from Colombia and will do their part in protecting this most diverse of terrestrial ecosystems.

At least in the Colombian Amazon, there is a good chance, given continuing support from outside including both government and non-government sources, that the indigenous communities and the important elements of their traditions will survive. That being so, the forest too will have a far better chance of surviving intact. As Barco pointed out at that historic meeting in La Chorrera, "Land and indigenous peoples belong to each other."

A full version of Peter Bunyard's report, *The Colombian Amazon: Policies for the Protection of its Indigenous Peoples and their Environment*, will shortly be available from The Ecologist, Worthyvale Manor, Camelford, Cornwall, UK.



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Books

Ecodevelopment and Wishful Thinking

SAVING THE TROPICAL FORESTS, by Judith Gradwohl and Russell Greenberg, Earthscan Publications, London, 1988, £6.95 (pb), 207pp.

BANKROLLING SUCCESSES: A Portfolio of Sustainable Development Projects, by Walter V. Reid, James N. Barnes, and Brent Blackwelder, The Environmental Policy Institute and the National Wildlife Federation, Washington, D.C., 1988, (booklet), 48pp.

Two publications have recently appeared with the purpose of injecting optimism into the depressing scenario of the destruction of the Third World's forests. *Saving the Tropical Forests* by Gradwohl and Greenberg and *Bankrolling Successes* by Reid, Barnes, and Blackwelder contain short descriptions of numerous small, environmentally-oriented 'development' projects being carried out around the world. They draw attention to the fact that there are people in the tropical outback attempting to restore the ecological balance of the planet by working directly with peasant and indigenous farmers. The authors are hopeful. "With cooperative efforts and individual commitment," write Reid, Barnes and Blackwelder, "sustainable development could occur everywhere. The groundwork has been laid and the goal is within our reach."

Saving the Tropical Forests grew out of a conference sponsored by the Smithsonian Institution and World Wildlife Fund in Washington, D.C., in 1985, during which a collection of groups discussed small-scale sustainable development projects and ecologically-oriented research in

which they were involved. Gradwohl and Greenberg, both professional biologists and the main organizers of the conference, took this as a point of departure and continued collecting information on other promising projects and research, and in the end managed to assemble 38 case studies from around the world.

Bankrolling Successes is best seen as a counterweight to an earlier publication entitled *Bankrolling Disasters*, in which the Sierra Club attacked the multilateral development banks for their role in financing a string of spectacular "international development debacles" such as the Polonoroeste project in Brazil and the Narmada Valley dam project in India.¹ Without contesting the claims made by the Sierra Club, *Bankrolling Successes* tries to move the discussion onto another track. Operating on the belief that "small development projects . . . tend to be more successful because they are flexible and have the potential for direct interaction with local conditions and people," they present 20 case studies of "successful" small-scale projects. Rather than bankrolling disasters, say the authors, the banks should consider bankrolling "the kinds of projects featured in the following pages."

Saving the Tropical Forests is a descriptive work with data from case studies, virtually no analysis of the data, and no concluding chapter outlining recommendations for future action. It is well written and makes enjoyable reading; the introductory chapter, in particular, is a useful summary of the problems of tropical deforestation. The language used is that of field biology and the people who appear are mostly scientists and technicians — local villagers and farmers tend to blend into the background foliage. *Bankrolling Successes*, by contrast, is not well written. The prose has a flat, split-pea soup consistency and is so laced with the passive voice that keeping track of who is doing what is a constant challenge to the reader. The primary objective of the book is to convince the large development banks that they should fund a series of small-scale ecodevelopment projects, which are put on display for interested buyers like items in a department store catalogue.

I am familiar with a number of the projects dealt with in the case studies of both books, and can say that while some of them are written up competently, others are sloppily pieced together and confused.

In fact, several of the case studies contain substantial errors. Throughout the two books there is a tendency to mix wishful thinking with strands of truth. Idealized conceptual models get confused with real life in some of the examples, and crucial details of a negative cast are simply kept out of the narrative.

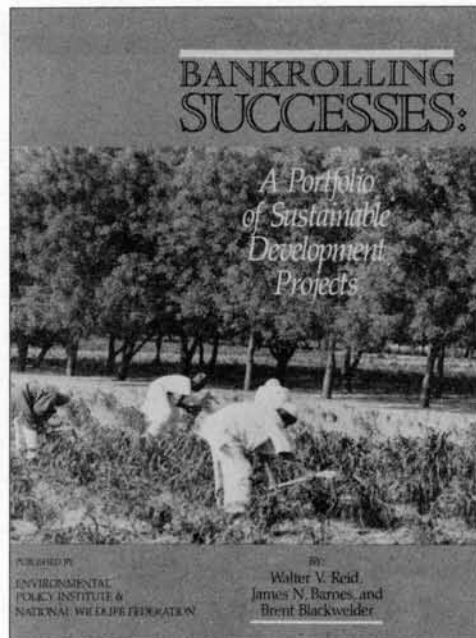
The Failure of Quintana Roo

Gradwohl and Greenberg describe a programme in Quintana Roo, Mexico, in which intensive vegetable gardening was promoted by the state government among 23 Mayan farming communities. "This project was so successful," they write, "that even after government subsidies were withdrawn most of the communities were able to maintain profitable production." In fact, such a programme was begun with state financing in 1983, but it was abandoned in confusion a short time later. The farmers involved were paid wages for their work, and from the beginning saw the enterprise as little more than a way to make money (in an area with scarce employment opportunities).

As soon as the project ended and the money stopped flowing, the farmers stopped work altogether. Marketing channels, managed by the government, never functioned and the "profitable" urban markets of Quintana Roo never materialized. Virtually all of the machinery brought in by the government broke down and rusted and was lost, and the cooperatives that had figured prominently in initial projections never formed. During a trip through the region in 1987, I was told by the two extension workers on this project that perhaps a couple of the local people were still planting some vegetables, but most had long since returned to what they did before: subsistence agriculture and wood cutting.

The Chinampas of Tabasco

The same book refers to research in the state of Tabasco, Mexico, that "has shown the efficiency of a modern chinampa system in maintaining high productivity of a diversity of crops, particularly when animals are integrated into the system."² Unfortunately, the transfer of chinampa agriculture from its original home in high-



"The objective of *Bankrolling Successes* is to convince the development banks to fund a series of small-scale ecodevelopment projects, which are put on display for interested buyers like items in a department store catalogue."

land Mexico to the swampy lowlands of Tabasco has not fared well. Today, according to one of Gradwohl and Greenberg's original sources for the case study, "after all the initial push to disseminate the knowledge of the chinampa farming system in Tabasco in the years 1975-80, not one functioning hand-made chinampa in Tabasco remains..."³ In fact, the "project" Gradwohl and Greenberg are referring to was taken from a description in a book called *To Feed the Earth: Agroecology for Sustainable Development*, which was in turn based on an article published in 1981, in the Dutch Journal *Agro Ecosystems*.^{4,5} The description in this latter article was essentially a composite of features from several sites, including experimental plots, that were interwoven with a series of imagined elements from an ideal system. In other words, not only have all attempts to transplant chinampas to lowland Mexico been unsuccessful; the "project" cited as evidence never existed.

The Sian Ka'an Biosphere Reserve

The case studies in *Bankrolling Successes* have a vague quality about them that makes them difficult to pin down. Even the careful reader will often have trouble figuring out what is going on and which group or institution is responsible for which programme. For example, in the description of the Sian Ka'an Biosphere

Reserve on the Yucatan peninsula of Mexico, the authors introduce two institutions: The Centro de Investigaciones de Quintana Roo (CIQRO), a government body, and the Amigos de Sian Ka'an, a private organization. They tell us that "nearly 95 per cent of CIQRO's research budget now goes to some 20 research projects conducted within the reserve." This may be the case, but they neglect to inform us that none of these 20 research projects has anything to do with 'sustainable development'. Then, without making clear who is responsible for what, they mention applied research efforts into lobster reproduction and disease among coconut palms, before they note that an intensive vegetable garden project has been set up by the Amigos de Sian Ka'an. In reality, the Amigos de Sian Ka'an, which is made up largely of dissatisfied CIQRO employees who defected, is managing all of these.⁶ Then, after a simple listing of this research agenda, and without any explanation of what the research findings were or what their effect has been, the authors proclaim that "Sian Ka'an has succeeded..." What does this mean? Who or what has succeeded? The park itself? The Amigos? Everybody? If the sustainable development projects are being tagged with success, this is simply not the case. From what I know of their programme, the people in Amigos are labouring hard to save the biosphere reserve, and are doing their best to involve local community members, but I think they would be the last ones to claim they have achieved "success" at this stage in their programme.

Desperation to Show "Success"

This is just a partial list of some of the problems in a few of the case studies. Did so many errors and confusions creep into the pages of these two books because the authors were in a hurry and became sloppy with their data, or were they misinformed by the string of people they interviewed? Were they so naive about Third World production systems and community development work in general that they were unable to distinguish between theoretical programme statements and on-the-ground reality? These explanations may have some validity, but it appears to me that the most important factor was the desperation of the authors to show "success" stories.

While both works contain statements to the effect that "success" is difficult to define (and indeed "success" is nowhere adequately defined in either book), and

today's successes may disintegrate into tomorrow's failures, the authors want to present us with a happy picture. They assure us that "successful development projects are extremely rare" (Reid *et al*) and that "success in conservation is an elusive property," (Gradwohl and Greenberg); but in the end the unsuccessful part of the equation is forgotten and the reader is given an uplifting (but misleading) view of technicians and peasants and indigenous farmers working together to improve the quality of life for local communities as well as the planet as a whole.

At least part of the reason for this attempt to maintain an up-beat perspective is explained by Gradwohl and Greenberg:

"...The small amount of hope inspired by local success might make the possibility of any global solution more tangible. All too often the bleak scenario presented about tropical forests makes the situation appear so hopeless that the only response can be apathy. If we turn our attention to possible answers to the problem, without forgetting the grim realities, it will keep us working toward better solutions."

On the surface this sounds reasonable. One might not entirely agree with the proposition that we have to buoy ourselves up with positive thinking, but that is all a matter of opinion. I am instead concerned because I have the strong sense that the conscious search after successful projects

"The language used in *Saving the Tropical Forests* is that of field biology... local villagers and farmers tend to blend into the background foliage."



caused the writers to adapt and shape their data so they would come up with rosy conclusions. Everything is working successfully and efficiently, and all of the concerned institutions and people are cheerily collaborating with each other. Inspirational perhaps, but it would seem to have little resemblance to the reality we have to contend with in the field.

Struggling Every Inch of the Way

This wishful thinking, however much we may enjoy it, often causes serious problems. First, an unalloyed string of happy little projects gives the impression that small-scale ecodevelopment projects with Third World farmers are easy. "The groundwork has been laid and the goal is within reach," say the authors of *Bankrolling Successes*. This is simply not the case. We are a good distance from reaching any sort of goal, and we are struggling every inch of the way. Coming up with alternative production systems that are simultaneously kind to the environment and attractive to peasant farmers is a very difficult enterprise, one that is seldom achieved in practice.

Second, once readers discover errors and misrepresentations in several of the case studies, the credibility of all of the projects they are unfamiliar with is necessarily thrown into doubt. From my experience, several of the projects profiled in the two books are good projects. The Panama iguana project described in *Saving the Tropical Forests* — although the programme staff has since moved to Costa Rica — is sensitive and shows considerable promise; it is scientifically rigorous and project managers have made every effort to work directly with local communities. This, however, does not warrant the comment that "the successful reintroduction and establishment of iguanas into depleted areas have been among the most important accomplishments." Reintroduction yes, but we will have to wait for a judgement on the establishment part, which is a long-term process. Also, the World Neighbours rural development programme in Honduras, included as a case study in *Bankrolling Successes*, is, in my opinion, a superlative effort; and to this might be added other World Neighbours "agricultural improvement" programmes around the world. More examples of effective projects no doubt exist among the cases discussed in the two books — al-

though I suggest we use the word "success" with extreme caution.

The fact of the matter is that the survival rate of small-scale "sustainable development" projects is extremely low. Some of those that might be considered successful in some sense are so small and limited in scope as to be almost insignificant. Most of the alternative technologies proposed for Third World farmers in Latin America (an area I know) have been met with apathy or outright rejection; the chinampas of Tabasco and the intensive vegetable gardening of Quintana Roo fell foul of a variety of social and economic factors, as well as technical problems. Again in Latin America, very few funding agencies have clear strategies for working with alternative, ecologically sound production systems among peasant or indigenous farmers, and there is virtually no communication among the technical groups attempting to push sustainable programmes. No one that I have talked to has come up with a useful methodology for measuring the effectiveness or the "sustainability" of any of these programmes.

Facing the Facts

Given this reality, there are several things we must do. First, we must take an honest and open look at what is out there, and face it squarely. In Latin America we have an extreme lack of balanced, straightforward case studies of ecodevelopment programmes and projects. As a consequence, we know very little about the dynamics of how they do or do not function, what their weak points are, which strategies succeed and which fail, why some things fall flat and others take off and soar, and a host of other questions that must be answered if we are to make any headway. One fundamental question is: if these alternative systems are so beneficial, then why have more of them not been adopted by small farmers? Despite the fact that 'sustainable development' has become a fashionable topic for articles, books, and conferences, we are virtually without any analytical literature on the matter. People in the field desperately need to know how to go about the task, yet at the moment there is nothing much to give them.

Clearly, we have to gain a much better understanding of what we are up against before we continue forward, and this can only be done by taking in the entire picture, covering the spectrum from unqualified success to flat-out fiasco. Things can be improved — considerably, I would

hope — but that will only occur when we honestly take stock of those flaws and breakdowns, and work to eliminate them. All of us are inspired by accounts of effective projects, and I personally would like to see more of them scattered about the landscape. However, we have to keep in mind that reality is one thing, and the way we might like it to be is something else.

Mac Chapin

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Notes and References

1. Schwartzman, S., *Bankrolling Disasters: International Development Banks and the Global Environment*, The Sierra Club, San Francisco, 1986.
2. Chinampa agriculture is a system of raised beds in shallow lakes used by the Aztecs at the time of the Spanish conquest. They are still used today in highland Mexico, where they are often referred to as "floating gardens" (although they do not actually float). See Chapin, M., 'The Seduction of Models: Chinampa Agriculture in Mexico', *Grassroots Development* 12, 1, 1988, Inter-American Foundation, Virginia; and Outerbridge, T., 'The Disappearing Chinampas of Xochimilco', *The Ecologist* 17, 2/3, 1987.
3. Gomez-Pompa, A., and Jimenez Osornio, J. J., 'Some Reflections on Intensive Traditional Agriculture', to be published in C. Gladwin and K. Truman (eds.), *Food and Farm: Current Debates and Policies*, Westview Press, Boulder.
4. Dover, M. and Talbot, L., *To Feed the Earth: Agro-Ecology for Sustainable Development*, World Resources Institute, Washington, D.C., 1987.
5. Gliessman, S. R., Garcia R., E. and Amador A., M., 'The Ecological Basis for the Application of Traditional Agricultural Technology in the Management of Tropical Agro-Ecosystems', *Agro-Ecosystems* 7, 1981.
6. Gradwohl and Greenberg, in a section dealing with the Sian Ka'an reserve (pp. 70-72), state that "the reserve involves a close working relationship between government and private groups." In truth, one of the problems in the reserve has been that CIQRO and the Amigos de Sian Ka'an have been at each other's throats.

Environmental Destruction and Political Myopia

THE FRAGILE ENVIRONMENT, edited by Laurie Friday and Ronald Laskey, Cambridge University Press, 1989, £12.95 (hb), 198pp.

This luxuriously produced book contains the text of the eight lectures that made up the 1987 Darwin College Lecture Series. It is a useful and well produced selection of articles that are likely to be of interest

to anyone concerned with the problems caused by the present rapid destruction of the global environment.

In the first chapter, Andrew Goudie provides a history of environmental destruction, starting off with that caused by our palaeolithic ancestors and proceeding to the present day. Much of the destruction is attributed to agriculture. I feel, however, that he should have made a clearer distinction between traditional agriculture, which was generally sustainable, and modern agriculture, which is incomparably more destructive.

The second chapter by Norman Myers on the future of the forests is superb, but then Norman Myers' knowledge of the subject is encyclopaedic. He is particularly interesting in the section devoted to the interrelationships between deforestation and global warming. As the most drastic change is likely to occur at high latitudes he considers that boreal forests are likely to decline from 23 per cent of the total forested area of our planet to a mere 1 per cent. Forests partly adapted to the warmer weather could 'migrate' to replace the boreal forests, but possibly not fast enough to prevent "a marked decline in carbon stocks held in plants and soil" which would of course release still more carbon into the atmosphere since boreal forests and their soils harbour 500 billion tons of carbon (25 per cent of the global total). It has been estimated that anywhere between 10 and 50 per cent of this carbon could be released into the atmosphere during the course of several decades, which means the release of somewhere between 3 and 10 billion tons of carbon a year as compared to a projected release of between 6.2 and 8.4 billion tons in the year 2000 from fossil fuels. This is indeed a terrifying thought.

The material gathered by Roger Whitehead on famine is of great interest. The author has conducted studies of chronic malnutrition and its causes in a number of villages in The Gambia. He notes the ineffectiveness of food aid, which is largely provided as a means of getting rid of surpluses in the West. Providing the starving with wheat flour is not much use as they are rarely "equipped with oven facilities for turning the flour into foods such as bread". Again, wheat 'soy blend', another surplus product, is difficult to use and it usually ends up being fed to rich men's chickens. Dried, skimmed milk, another surplus product, is usually simply "dumped at the frontier and can become as hard as concrete if left in the sun and rain". Often it is just used to fatten rich men's

pigs. Often the food is simply sold by government agents on the open market.

He is not particularly impressed by family planning schemes either, and rightly points out that effective stabilization of population size is a natural concomitant of a growing sense of general well-being "it is difficult to impose family-planning in the absence of this confidence for the future."

My only criticism of this chapter is that it does not go into the real causes of malnutrition and famine at a global level. He does not explain how Third World countries have been induced by Western policies, spearheaded by the World Bank, the UN Food and Agriculture Organization and other International Agencies, to use their best agricultural land for the export of food and non-food crops, using highly destructive methods of production that can only cause soil erosion, desertification and salinization. But then this is a large and extremely controversial subject, and it would need more than a chapter to go into it in the necessary depth.

The chapter on Changing Climates by Bert Bolin is a particularly good one. Bolin notes how already as far back as 1896 the Swedish chemist Svante Arrhenius showed how the accumulation of carbon dioxide in the atmosphere could cause a warmer climate. The fact that CO₂ was concentrating in the atmosphere was established by Callender in 1938. Since then the increase in the concentration of CO₂ has been continuously measured, in particular by C.D. Keeling. Unfortunately, governments and their scientific advisers have ignored all this. Bolin notes that the amount of carbon on living matter in land is only about 75 per cent of the amount found in the atmosphere. This is in stark contrast with the amount of carbon locked up in fossil fuels, which is 10-20 times larger. Bolin stresses the critical role of the oceans in the carbon cycle. They contain about 50 times more carbon than is at present in the atmosphere. According to Bolin about 50 per cent of the CO₂ taken up by the oceans is accounted for by photosynthesis. "If photosynthesis in the seas were to cease," he notes, "the concentration of CO₂ in the atmosphere would double". Bolin reviews other possible sinks for CO₂ and considers the effects of the different greenhouse gases on global warming. Nitrous oxides are likely to become a big problem. Increased emissions cannot easily be stopped "since the present larger amounts of nitrogen in soils and waters due to fertilization during past decades will decline only slowly and release this

excess of fixed nitrogen to the atmosphere for a long time to come." What is more, the residence of time of N₂O in the atmosphere is very long — about 150 years.

The residence time of CFCs is about 100 years. They decompose only very slowly. He considers that projected warming trends have probably been underestimated, perhaps by as much as 50-100 per cent because the warming must lead to an increase of water vapour in the atmosphere, which will in turn absorb more infra-red radiation and hence cause more warming.

Edward Goldsmith

Energy Efficiency and a New Ethic

TURNING UP THE HEAT: Our Perilous Future in the Global Greenhouse, by Fred Pearce, The Bodley Head, London, 1989, £12.95 (hb), 229pp. THE GREENHOUSE EFFECT: A Practical Guide to the World's Changing Climate, by Stewart Boyle and John Ardill, New English Library, London, 1989, £3.50 (pb), 298pp. SLOWING GLOBAL WARMING: A Worldwide Strategy, by Christopher Flavin, Worldwatch Paper 91, Worldwatch Institute, Washington, 1989, \$4/£2.50, 94pp, available from Worthyvale Manor, Camelford, Cornwall, PL32 9TT, England.

NASA climatologist James Hansen's statement in front of a US Senate hearing during the US drought in 1988, that "it is time to stop waffling so much and say that the evidence is pretty strong that the greenhouse effect is here", has resulted in a plethora of global warming-related books, policy statements, reports and political concern. Unfortunately the threat is so apocalyptic, and the action needed to avert it so drastic, that even environmentalists find it hard to admit the full scale of the social and political changes which are necessary if we are to escape the horrors of the 'heat trap'.

Fred Pearce's contribution to the burgeoning literature on global change is an excellent piece of popular scientific writing. Pearce places the scientific understanding of the greenhouse effect within the wider context of atmospheric and climatic history, our limited understanding

of what causes ice ages, the mechanisms of the carbon and sulphur cycles and the thinning ozone layer. His account is very much influenced by the Gaia theory and its implications for our 'experiment' with the biosphere. Pearce stresses the interconnectedness of the components of the biosphere and shows how many feedback mechanisms could (or may already have) come into play as global warming takes hold. An example is the link between ozone destruction and global warming. As the greenhouse gases trap heat in the troposphere (lower atmosphere), less heat passes out into the stratosphere which therefore cools. Ozone destruction on the scale which creates the polar ozone 'holes' can only take place at very low temperatures. As stratospheric ozone is destroyed, the stratosphere absorbs less heat in the form of ultra-violet light and thus cools further. Meanwhile, more UV reaches the troposphere which gets warmer and so the cycle reinforces itself.

A recurring theme of *Turning Up the Heat* is the inability of even the most advanced climate models to predict accurately the consequences of greenhouse gas pollution. "... the greenhouse age may turn out very different from that predicted by the climate modellers. Change may come suddenly, rather than slowly over decades. There may be unexpected developments, such as the opening of the ozone hole." Pearce quotes from an editorial in the journal *Climate Change*: "The very large uncertainty that seems endemic in the carbon dioxide problem means that the probability of significantly larger and significantly earlier impacts than predicted by the best estimate is by no means negligible, and it is precisely those events that could result in major disruptions to economic and social systems". Pearce adds, "Gaia, should she exist, could be overwhelmed."

The Greenhouse Effect is less 'scientific' than *Turning Up the Heat* and is meant as a "practical guide for the non-expert" to the "most serious environmental problem we have ever faced".

Ardill and Boyle give "Action Check Lists" of measures which need to be taken on an individual, local, regional, national and international level to control global warming.

This book contains an interesting account of the political awakening to the threat of global warming. When, in September 1988, Margaret Thatcher referred to "a massive experiment with the system of this planet itself", environmentalists and the media in Britain were so stunned

"... the threat is so apocalyptic, and the action needed to avert it so drastic, that even environmentalists find it hard to admit the full scale of the social and political changes necessary."

by her new-found environmental concern that they failed to take much note of a similarly remarkable speech to the General Assembly of the UN on the same day. In this speech, Soviet Foreign Minister Eduard Shevardnadze talked of "a global aggression against the very foundations of life on earth," and declared that the United Nations Environment Programme (UNEP), should be transformed into "an environmental council capable of taking effective decisions to ensure ecological security".

If Mrs. Thatcher's aim was to convince the British electorate that she was concerned about the environment, her comments have very much back-fired on her — the membership of environmental organisations (which are all extremely critical of her Government) and support for the Green Party have increased enormously since she made her 'green' speech. As the British Government's policies on major environmental issues have not changed even a fraction since this speech, the question arises as to why she voiced such uncharacteristic concerns. It has been suggested that the timing of Thatcher's speech hints that British intelligence may have known what Shevardnadze intended to say to the UN, and in an attempt to detract attention from what would no doubt reinforce Western public sympathy towards Gorbachev's regime, it was decided that Mrs. Thatcher should attempt to establish her 'green' credentials. Increased support for the Soviet Union in Western Europe would have made it even more difficult for Thatcher and Bush to persuade the West Germans to accept the already unpopular modernization of short-range nuclear missiles on German soil. Certainly other factors were involved in Thatcher's 'conversion', but given the lack of subsequent political action it seems certain that political expediency played a more important role than environmental concern.

In *Slowing Global Warming*, Christopher Flavin outlines the causes and possible consequences of global warming

and underlines the need for action. Flavin proposes a framework for a global policy of reducing greenhouse gas emissions, with the main burden on the biggest polluters such as the US and much less action needed by the Third World nations, most of which are responsible for a very small portion of global greenhouse gas emissions.

This Worldwatch Paper, like *The Greenhouse Effect*, concentrates on what can (and must) be done in the way of energy efficiency and switching to the use of renewables (both Flavin and Boyle are specialists in these fields), as well as the urgent need to phase out the use of CFCs and to end tropical deforestation and start massive reforestation.

Certainly all these measures are essential, and changing energy policies is the single most important factor in any global warming strategy (energy production and use is estimated to be responsible for 57 per cent of global warming), but I feel that these studies avoid the wider issues of the profound social, political and economic changes which will have to take place if humankind is to have a favourable climate over the next century and more.

According to the US Environment Protection Agency, stabilizing atmospheric concentrations of greenhouse gases at today's high levels will mean: reducing carbon dioxide emissions by 50-80 per cent; methane emissions by 10-20 per cent and nitrous oxide emissions by 80-85 per cent. Achieving these kind of reductions in a world with a rapidly rising population indicates that we have to think again the whole ethos of economic growth and realize that industrial society is not only *unsustainable* but is *undesirable*.

In the preface to *The Greenhouse Effect*, Mostafa Tolba, Executive Director of UNEP, declares that "no one should have any illusions about the difficulty of containing climate change. It will require little less than a new global ethic: economic growth which does not threaten nature." However, the "new global ethic" will need to be much more radical than just a new 'greener' economic growth. It will need to be an ethic which shuns growth through industrialism, which recognises true wealth as environmental, social and human health, and which leads us to reductions in production and consumption. Cleaner production and consumption will not be enough.

Patrick McCully



Chico Mendes, his wife, Ilzamar and son Sandino. Mendes was assassinated in the doorway of his home in Xapuri, Acre, on 22 December, 1988.

Chronicle of a Death Foretold

FIGHT FOR THE FOREST: Chico Mendes In His Own Words, Latin America Bureau, London, 1989, £2.95 (pb), 96pp. Available from Latin America Bureau, 1 Amwell Street, London EC1R 1UL. Include 75p for postage.

In December 1988, Chico Mendes, the leader of the Brazilian rubber tappers, was murdered in the Amazon. This short book explores his life and times, using translated extracts from his last interviews, which were recently published in Brazil. The book might have been titled, *Chronicle of a Death Foretold*, because Mendes did foretell his death, and his words on the subject are an eloquent testimony to the kind of man he was:

"My dream is to see this entire forest conserved because we know it can guarantee the future of all the people who live in it. Not only that, I believe that in a few years the Amazon can become an economically viable region not only for us, but for the nation, for all humanity, and for the whole planet... I don't want flowers at my funeral because I know they would be taken from the forest. I only want my assassination to serve to put an end to the immunity of the gunmen..."

Chico Mendes was an ordinary man who became extraordinary, partly because of the struggle he helped to wage on behalf of poor people who pitted their ingenuity against their environment *without destroying it*, and partly because (almost unwittingly) Mendes' struggle for a sustainable livelihood found an echo in urban Brazil and in the cities and suburbs of the developed countries. Mendes's words

continue to haunt long after the reader has put this book down.

What kind of world assassinates its best conservationists? Are we complicit in his assassination, through our consumption of forest products? This short, but vivid, study asks these questions, and seeks answers to them. The universe that Chico Mendes inhabited is isolated geographically, but in every other respect we inhabit *his universe*. Our banks (in the UK) have received 10 billion dollars from Brazil between 1983 and 1987, at a time when most poor Brazilian's living standards were declining. As this book makes clear, this money helped to make our personal current accounts more viable. And if we take the connections seriously, it is not difficult to appreciate that Chico Mendes' struggle for sustainability — initially for his family and community, later for the environment — needs to be linked to our own. The book has the merit of taking us through the specific struggle of the rubber tappers, the establishment of cooperatives, the opposition of the landlords to the recent agrarian reform proposals in Brazil, and making connections with the wider world in which our decisions influence what is produced, sold and stolen, from the Third World.

The book is enlivened by excellent drawings, some by rubber tappers themselves, and interesting archival photographs of Brazil's rubber industry. This is a book to show to your friends, to influence people with, and to campaign with. But above all this is a book to show to your children, as I did to mine. And the surprise is (should it be a surprise?) that they are likely to be even more concerned than their parents to honour Chico's death by *doing something* to halt social and environmental destruction in Latin America.

Michael Redclift

Michael Redclift is a reader in Rural Sociology at Wye College, University of London, Wye, Kent.

Sacramental Living

THE LIVING TREE: Art and the Sacred, by John Lane, Green Books, Bideford, Devon, 1988, £12.50.

This very attractive book is the testimony of a painter struggling with the artistic and spiritual disfigurement of modern society. It is an important work, located on the neglected interface of ecology and art. As Lane points out, an artist who has managed in this age not to betray the Muse is actually creating an ecology of mind and spirit. Chagall, Stanley Spencer and Van Gogh he sees as such artists. That it is a struggle to affirm in a society where the spiritual core has withered away, does not lessen the meaning and importance to us of art that goes on expressing the numinous, the transcendental, the sacramental.

Lane has realised that art is a highly sensitive indicator of the state of our society, and that too much twentieth century art has failed to transcend the evils of its time. Instead, it has merely corroborated a nihilistic status quo in the brutality of painting like that of Francis Bacon, or in the fatuous cynicism of Pop Art. Such work is consumed by the very horror of triviality that is its subject.

Like William Morris, Lane hopes for a better state of social and spiritual ecology; one in which the principles of aesthetic excellence in all work, love and the sacred are woven into the context of every social activity. To some degree, such social states have existed before, despite the cruelties and anomalies that existed alongside them in, say, the Later Middle Ages. Such eras have much to teach us in terms of social and spiritual ecology.

The Renaissance gave birth to humanism and the individual. These had an heroic and creative aspect in the arts of the post-Medieval world and in the establishing of important personal freedoms, but they had a negative correlative in the concept of economic individualism, social atomism and the de-sacralization of the universe. Lane rightly points out the catastrophic effects of such individualism, and feels that probably the individualist artist would be an irrelevancy in an ecologically sane society where art pervaded all social processes anyway.

I feel that the individual had to come into history, and that it would probably be a very bad thing to lose him or her (in his or her creative and idiosyncratic aspect)

altogether. The individual has much to offer, despite the destructiveness of economic individualism. Indeed, I see economic individualism (or capitalism) as actually destructive of the more meaningful aspects of the individual soul or psyche, the value of which has been one of the positive gains from a period of economic and ecological disaster.

But the individual has to be re-integrated; the poetry and freedoms left to flower, the venality, economic greed and myopia, somehow controlled. Lane hopes for a solution which has produced such profound and beautiful results in the past. I am sceptical of this: my heart is with the vision of William Morris, my head tells me that it is unlikely that the vast contemporary populations will re-enter the framework of aesthetic excellence that was the unselfconscious mode of the late Medieval or the Romanesque. Unprecedented factors are at work, namely, enormous human numbers and industrial technologies that are not going to be willingly relinquished by *homo sapiens*. Yet we all know that a synthesis of contemporary humanity with the wisdom of past traditions must come about if we are to survive. The form of that synthesis is an unknown, but its factors must include an intelligent marriage of the art and spirituality of more sacramental societies with some of the humanism of our now profane society.

Lane's paintings, sensitive icons of nature and the cosmos, conclude the book, tying his thought and achievement into an English metaphysical tradition in painting that includes Blake, Samuel Palmer, Spencer, Paul Nash and Cecil Collins; all artists pointing to ways out of the slough of materialism in which we are wallowing.

It is heartening that a working painter has spoken out against the stupidity and obscurantism that has disfigured much modernism in art, and that has become the most ironclad academic orthodoxy, corroborating a barren, anti-ecological vision which threatens the planet. Lane is telling us that art can still regenerate, can still lead us towards the sacred and the ineffable. The basis of his work is "to give praise". This life affirmation is long overdue, and we can only hope that many more artists will be touched by its insistence on the visionary and the meaningful.

Denys Trussell

Part one of Denys Trussell's article 'The Arts and Planetary Survival' was published in *The Ecologist*, Vol. 19, No. 5, 1989. Part two will be published in Vol. 20, No. 1, 1990.

BOOK DIGEST

Books which are covered in the digest may be given full-length reviews in forthcoming issues.

- **INTRODUCTION TO WORLD FORESTRY**, by Jack Westoby, Basil Blackwell, Oxford and New York, 1989, £10.95 (pb), 228pp.

A history of the forests of the world, a description of their present state and an assessment of their prospects in the future. Westoby criticizes current development policies for forests and proposes a programme that would take into account the scientific, cultural and economic needs of present and future generations.

- **THE PURPOSE OF FORESTS: *Follies of Development***, by Jack Westoby, Basil Blackwell, Oxford and New York, 1987 (reprinted in paperback 1989), £12.95, 343pp.

A collection of two decades of writings and speeches which show the evolution of Westoby's thinking on forestry, from his time as an officer of the Food and Agriculture Organization, to his later realization that conventional forestry was leading to the destruction of the forests and the impoverishment of the peoples who rely upon them.

- **THE ECONOMIC VALUE OF NON-TIMBER FOREST PRODUCTS IN SOUTHEAST ASIA: *with emphasis on Indonesia, Malaysia and Thailand***, by Jenne H. de Beer and Melanie J. McDermott, Netherlands Committee for IUCN, Amsterdam, 1989, 175pp. Available from Ministry for Development Cooperation, Section for Research and Technology, PO Box 20061, 2500 EB The Hague, Netherlands.

A report which attempts to show the value of the many secondary forest products which are ignored in the conventional economics of timber extraction. In contrast to logging, the harvesting of non-timber forest products is usually ecologically and socially sustainable.

- **GOVERNMENT POLICIES AND DEFORESTATION IN BRAZIL'S AMAZON REGION**, by Dennis J. Mahar, The World Bank, Washington, D.C., 1989, (booklet), 56pp.

A scathing indictment of the World Bank-sponsored Amazon development policies of the Brazilian Government written by an economic adviser to the Bank. A disclaimer states that: "the views and interpretations in this pamphlet do not necessarily represent the views and policies of the World Bank".

- **ACID EARTH: *The Global Threat of Acid Pollution***, by John McCormick, Earthscan, London, 1985 (new enlarged and revised edition 1989), £6.95 (pb), 225pp.

A comprehensive popular overview of the subject which explains the scientific, technical and political issues behind acid rain, the damage it is causing and the attempts to limit it.

- **GLOBAL ECOLOGY: *Towards a Science of the Biosphere***, edited by Mitchell B. Rambler, Lynn Margulis and René Fester, Academic Press, London and San Diego, 1989, 204pp.

Chapters on the Earth's feedback mechanisms, the components and interactions of ecosystems, and the importance of the atmosphere in environmental maintenance show that the boundaries of academic disciplines must be transcended if we are to understand how the biosphere works. An academic textbook which takes on board the implications of the Gaia hypothesis for the study of global ecology.

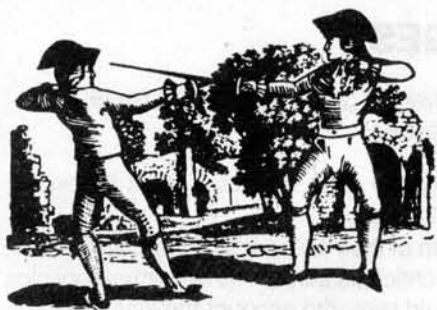
- **ECOLOGY: *and our Endangered Life-Support Systems***, by Eugene P. Odum, Sinauer Associates, Sunderland, Massachusetts, 1989, £10.95 (pb), 283pp.

A textbook for students of ecology and "a citizen's guide to the principles of ecology as they relate to today's threats to earth's life-support systems." Odum emphasises the basic causes of our environmental problems and their long-term solutions, rather than the 'quick-fix' of symptoms.

- **ECONOMICS AND THE CRISIS OF ECOLOGY**, by Narindar Singh, Bellew Publishing, London, 1976 (Third edition revised 1989), £7.95 (pb), 236pp.

The message of this pioneering work is even more vital today than when first published. Professor Singh shows that ecological destruction is the inevitable result of the military-industrial complex of both Eastern and Western powers, and that only an end to their domination can "so change the present that a future becomes possible".

Patrick McCully



Letters

Science Replies

Dear Sir,
I was surprised that the editor of *The Ecologist* would write an editorial such as 'Scandalous Science' (*The Ecologist*, Vol. 19, No. 4, July/August 1989). In particular, I would have expected you to appreciate that not everything printed within the covers of a journal will be equally well liked by all readers and that one of the functions of the responsible press is to air dissenting opinion and encourage discussion.

If I were to believe your editorial, I would assume you had not checked to find that *Science* had a functional letters page that expresses a wide range of viewpoints, many arguing against editorials, news stories, articles etc. In other sections not even a casual reader of *Science* could fail to observe the diversity of editorials, letters, news articles, and policy forums.

Dr Samuel Epstein's opinion is that only his letters to the editor or proposed editorials are appropriate responses to editorials or articles published in *Science*. If you refer to the letters and technical comments pages in the issues of 11 September and 18 September 1987 and 20 May and 5 August 1988, you will see ample discussion of the very points Dr Epstein accuses us of suppressing. It is true that we do not always publish Dr Epstein's manuscripts — but that is because his point of view was expressed in many cases more convincingly by others who did not resort to *ad hominem* attacks.

Science and this editor are strong advocates of measures to preserve the environment. The precise methods to achieve this preservation are subject to diverse viewpoints which we encourage. *The Ecologist* advocates a particular viewpoint and we would defend your right to do so. We, in turn, would defend the right to publish a variety of opinions, some of which may differ from yours.

Yours faithfully,
Daniel E. Koshland, Jr.
Editor
Science
1333 H. Street, N.W.
Washington
D.C. 20005
USA.

Stop Producing Toxic Wastes

Dear Sir,
Your editorial on Toxic Wastes (*The Ecologist*, Vol. 19, No. 4, July/August 1989) avoids what is, to me, the most important issue, namely that before deciding how and where to dispose of toxic wastes, all industries producing toxic waste should be reviewed to see if they are really necessary, and closed down or made to transfer to non-toxic methods if the goods they produce are not absolutely necessary.

We simply cannot go on filling up our planet with concentrations of toxic non-biodegradable materials which are usually produced with the primary aim of enriching the producer, and not for the greater benefit of mankind in general.

Yours faithfully,
Joan Costanzo
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I-95126 Catania
Sicily
Italy.

The Case for a European Community Trade Regulation on Tropical Timber

Dear Sir,
In the editorial of *The Ecologist* Vol. 19, No. 5, September/October 1989, Patrick Anderson from the Rainforest Information Centre in Australia argues for a ban on tropical timber imports. However, the question of how to achieve this ban is poorly treated, most notably with regard to the present debate over tropical timber in the European Community (EC). In fact, Anderson's discussion of this topic is a confusing mixture of mistaken information and questionable political judgements.

Everywhere in the world, NGOs and (sometimes) politicians are fighting for the conservation of tropical forests. They all work in different circumstances. Europe is not Australia, Africa or the USA. Consequently, in Europe one must take into account all kinds of specifically European political relationships, balances of power and public sensibilities. As long as the minimum acceptable options are clear worldwide, this should not be a problem. Banning the import of tropical timber from primary rainforests is one of these options. Banning the import of tropical timber from areas where logging causes conflicts with tribal peoples is another 'bottom line'.

Anderson attacks the European Commission, the administrative machinery of the EC, for having prepared a trade regulation to promote sustainable levels of logging through a system of quotas and management plans. The Commission

never wrote such a proposal. It was written by Hemmo Muntingh, member of the European Parliament (EP) who is known as the strongest advocate of tropical rainforest conservation in the EP. The trade regulation Muntingh has drafted is supported by a wide range of European NGOs, but Anderson concludes that: "the regulation will not be able to control the destructive practices in Sarawak and will, instead, frustrate further action on the issue by appearing to address the problem." Consequently, Anderson suggests that European NGOs are wrong in supporting this trade regulation. This is nonsense.

In July 1988, the EP adopted a resolution calling for a (temporary) ban on tropical timber imports from Sarawak. Anderson points out an apparent contradiction between this Sarawak resolution and the resolution on the trade regulation adopted by the EP in May 1989. In fact these resolutions were drafted in close co-operation between the respective rapporteurs and with the involvement of NGOs like Friends of the Earth. The intention was to generalize the scope of the Sarawak resolution by formulating a trade regulation applying to all EC imports of tropical timber. Consequently, close links can be seen between the resolutions. For example, the Sarawak resolution speaks about a bilateral timber agreement with the Malaysian Government on the basis of a management plan, exactly what is generalized in the proposal for a trade regulation.

Anderson believes that the trade regulation fails on three points. Firstly, there is the question of the rights of indigenous peoples. Anderson claims that they are insufficiently safeguarded by the text. The trade regulation is indeed meant to regulate EC imports of tropical timber, and not to regulate conflicts between logging and the land rights of indigenous peoples. It would be extremely complicated, if not impossible, to combine these two elements in an EC legislative text. The Treaty of Rome which established the EC does not offer a legal basis for a regulation incorporating the land rights of indigenous peoples in non-community countries.

Nevertheless, the intentions of the trade regulations are quite clear. The accompanying resolution, explanatory notes and preamble all refer to the position of indigenous peoples. It is stated that: "The present extensive deforestation in the tropical forests is a great danger for the interests and the way of life of numerous forest-peoples and even is a perilous threat to their very existence and survival". Such statements underline the fact that respecting the rights of indigenous peoples should be a primary condition for sustainable management.

Secondly, Anderson objects to the conceptual muddle surrounding sustainable timber production. The draft regulation states that "guidelines for the development of Forestry Management and Conservation Plans are set out in Annex IV". This annex will have to be drawn up by a panel of experts and it has never been the aim to explicitly deal with the concept of sustaina-

bility in the text of the regulation itself. "I am not an expert, I am a politician", Muntingh has declared. "We all know that sustainable timber production is a much disputed concept". But again the intentions are quite clear. For example, one of the objectives of the management and conservation plans to be drawn up between the EC and timber producing countries is "to avoid destructive over-exploitation and loss of biological diversity" (Article 3, Point 2). It is doubtful if the Malaysian authorities will be able to meet these demands. If they cannot, Article 6 of the regulation might become relevant: "The importation into the Community of tropical hardwood products originating in Third World countries not Parties to a Forestry Management and Conservation Plan is prohibited" (Article 6).

The third criticism that Anderson raises concerns the time-scale involved in the regulation. He claims that: "The regulation allows producer countries five years to prepare management plans, ignoring the fact that many of the countries presently exporting timber will have all but logged out their rainforests by the time the regulation can be implemented". This may be true, but cannot be used to criticize the drafting of the trade regulation. An immediate implementation of the regulation would be preferable, but looking at political reality an immediate introduction would surely be technically impossible for the European Commission, the EC Council of Ministers and (last but not least) the producer countries. It is also impossible to change overnight present destructive logging practices to sustainable management systems.

One cannot deny the enormous political obstacles lying ahead in the implementation of a trade regulation to (at least) restrict EC tropical timber imports. So far we have tackled the first obstacle (the EP) and found it to be our ally, although both producer countries and European timber traders have already expressed their disapproval. Unfortunately, the EP lacks the powers of European national parliaments. Therefore the ball now lies in the court of the European Commission which will have to decide whether or not to adopt the proposal for a trade regulation, as adopted by the EP. The EP cannot force the Commission to do so and at this stage it does not look as if the Commission will adopt the regulation.

On 1 August, the Commission published a 'communication' entitled *The conservation of tropical forests: the role of the Community*. The document does not make a single reference to resolutions on tropical forests adopted by the EP. No priorities are mentioned, no time schedules given and no proposals for legal action made. The document only identifies "possible areas for action", trade in timber being one of them, but again no reference to restrictions or import bans are made. Last September, the document was on the agenda of the Council of Ministers who decided to postpone decisions to their next meeting at the end of November. The role of the Council as a decision making body is conclusive. The ministers from EC member states will

all try and defend their own national interests, like the protection of their national timber industries. This means that there will be a lengthy process of negotiation with a weak conclusion.

These remarks are meant to underline that the discussion is not, should we, but how can we convince the EC institutions to take radical measures. One weapon NGOs in Europe have is the consumer campaign. Anderson is right to be enthusiastic about their success. The public image of tropical timber is quickly worsening with consequent reductions in demand. In the Netherlands, we expect to have almost 90 per cent of municipalities committed to reducing their consumption of tropical timber at the end of this year. But even if Dutch imports of tropical timber are reduced to zero, it would save only approximately 63,000 hectares of rainforest a year. Local and consumer campaign results will remain limited unless they are backed up by (inter)national legislation. Therefore the main purpose of boycott campaigns is at least as much in the political pressure they express as in the actual decrease in tropical timber consumption and deforestation.

This is also where the trade regulation comes in. A wide gap exists between public opinion which is increasingly rejecting tropical timber, and (inter)national policy institutions which are failing to take the radical measures we need. The trade regulation has a role to play in narrowing the gap. The proposal may not be ideal, but at least it is more radical than any other proposal for legislation so far tabled on the political agenda of Northern countries. Therefore we will continue to fight for the trade regulation and recommend that NGOs in countries like the USA, Australia and Japan also try and work with the proposal. The least they could do is to write to the European Commission to urge them to formally draft a proposal for a trade regulation.

Yours faithfully,

Herman Verhagen (Vereniging Milieu-defensie/Friends of the Earth The Netherlands)

Bram van de Lek (Rapporteur of the Sarawak resolution in the European Parliament)

Damrak 26
1012 LJ Amsterdam
The Netherlands.

Self-Reliance and Self-Determination

Dear Sir,
Paul Ekins' right-thinking article on the importance of self-reliance for achieving ecological stability, autonomy and self-determination (*The Ecologist*, Vol. 19, No. 5, September/October 1989) contains a worrying inconsistency.

Ekins correctly notes that Third World economies are largely controlled by "small,

wealthy elites that, for the most part, dominate even the poorest countries". Yet he concludes by urging "national governments" to establish trading strategies which promote self-reliance at local, national and regional levels. Isn't this a pious hope?

As Ekins also notes, it is the unequal distribution of power which obstructs just development. How did this come about? During the colonial era, the imperialists soon learned that it was impossible to rely on external military power alone to maintain their advantage. As Ronald Robinson put it, "domination is only practicable in so far as alien power is translated into terms of indigenous political economy . . . the financial sinew, the military and administrative muscle of imperialism was drawn through the indigenous elites of the invaded countries themselves."

The colonial authorities coopted and controlled the elites of the Third World, in exchange granting them local power and privilege, while they, in turn, no longer dependent on their own peoples to validate their authority, were freed to pursue their own interests in opposition to the very peoples they were supposed to represent.

In the post-colonial era, these same elites have maintained their hold on power; their interests, their investments, even their life-styles, are almost entirely dependent on overseas links. Indeed, the process of cooption and control of local leadership has, in most Third World countries, been drastically deepened, denying even the rudiments of autonomy to rural communities. National self-reliance, far from securing the advantage of these elites, will make them once more dependent on and responsible to their own peoples, a desirable goal, certainly, but hardly an option they are likely to adopt voluntarily. The re-establishment of effective self-reliance needs to start right from the grass-roots. Any other form of self-determination is liable to be illusory — a reshuffling of the pack while the same people still hold trumps.

Yours faithfully,

Marcus Colchester

Cob Cottage
Chadlington
Oxfordshire
England.

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