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GLM-[

Too much life on Earth?

Is the population explosion responsible for today's environmental ills? Some say yes. Others are just as sure that the blame lies elsewhere

Paul Harrison

JUST HOW far is the growing population to blame for the environmental problems we face today? A furious debate rages around this subject—and it is not just an academic sideshow. For it provides ammunition for and against the most contentious issue in development: family planning.

In one corner stand the neo-Malthusians, who blame most of the developing world's ills on population growth. They include groups such as the Population Crisis Committee in the US and individuals such as Prince Philip. The basic logic is simple and apparently convincing: more people consume more of every kind of resource, from energy to land to minerals, and produce more waste.

In the other corner: anti-Malthusians, such as the environmentalist Barry Commoner and Frances Moore Lappé, an American writer on agriculture. They blame, variously, inappropriate technologies; overconsumption by the affluent; inequality and exploitation, which squeeze poor farmers onto "marginal" land and "force" them to overexploit it. They blame everything, in fact, but population growth.

This highly polarised debate is not scientific, but ideological, fuelled by politics and religion. The Malthusian side provides support to those who favour drastic "population control" programmes—as in India in the mid-1970s, which after a period of enforced sterilisations alienated people from family planning. The anti-Malthusian arguments back up those who wish to deny women the right to a free choice of family planning and other improvements in their position.

Neither side can win the debate because both arguments are oversimplified. Both sides must accept that population is one, but only one, of the factors that lead to degradation of the environment.

There are three key factors. The first is the level of consumption, determined by lifestyles and incomes. Second, the technology needed to satisfy that consumption, and dispose of the waste generated. These two factors together decide how much environmental damage is done per person. Multiply by the third factor, population, and you arrive at the total level of damage.

Take carbon dioxide, the most important of the greenhouse gases. Worldwide emissions rose from 2349 million tonnes in 1950 to 6793 million tonnes around 1985, an increase of 3.1 per cent a year. Over the same period world population grew by 1.9 per cent a year. Emissions per person rose by 1.2 per cent as a result of changes in technology and higher consumption of goods that involve production of carbon dioxide.

Population growth thus accounts for almost two-thirds of the increase in carbon dioxide entering the atmosphere between 1950 and 1985. Increases in consumption and in technology together account for a

little over a third.

If present trends continue, the future impact of population growth on emissions of carbon dioxide looks alarming. If output per person in the Third World continues to grow at the same rate as over the past 40 years, the average person in the Third World will be producing 1.7 tonnes of carbon dioxide each year by 2025, more than double the current level of 0.8 tonnes. Meanwhile the number of people would have risen from 3680 million in 1985 to 7114 million. The population increase in the Third World alone would therefore produce an extra 5.75 billion tonnes of carbon dioxide—not too far short of the current world total of 6.8 billion tonnes.

In estimating the growth of the world's population, the United Nations has made several projections, giving a low, medium and high figure for the year 2025. According to the low projection, world population will reach 6331 million, 783 million less than the medium projection. It is quite possible to achieve this lower figure: it would not require a rapid decline in birth rate of the type seen in China, Thailand or Cuba, but would require the more modest reductions achieved by countries such as Tunisia or Jamaica. Such reductions require a wide choice of freely available family planning methods. Perhaps even more crucial are improvements in mother and child health, female education and women's status—all valuable measures in their own right.

Achieving the low population projection in developing countries would reduce annual carbon dioxide emissions in 2025 by 1330 million tonnes without reducing carbon dioxide output per person. This compares with some 1570 million tonnes currently produced each year as a result of tropical deforestation.

Slower population growth could make an even bigger contribution in the case of methane, another important greenhouse



A crowded world: but there's more to pollution than people

gas. About half of "man-made" methane emissions come from decomposition in irrigated fields and the guts of livestock. These are not examples of wasteful consumption that could be cut back. The area of irrigated land and the number of livestock have expanded to provide livelihoods for growing rural populations, and to meet the world's increasing demand for cereals and meat. Irrigated area has grown by about 1.9 per cent a year since 1970, about the same rate as the world's population. The number of cattle has grown only about half as fast, averaging 0.9 per cent a year.

Livestock and irrigation will both continue to expand in line with populations in developing countries. Slowing the growth of the population is the only feasible strategy for reducing the increase in methane emissions from these sources.

Emissions of greenhouse gas are examples of something added to the environment. Deciding what "blame" is due to population

KEY:

TTL - TITLE

THR - THREAT

EVN - EVALUATION

SGN - SUGGESTION

COL - CALL FOR COLLABORATION

GLM - GLIMPSE

TLI - TECHNICAL LEAD-IN

ONP - ONGOING PROJECT

SUM - SUMMARY

PRB - PROBLEM

SPC - SPECIFIC CLAIM

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becomes more complicated when the environmental problem involves taking something away. Deforestation, loss of species, loss of soil fertility and erosion all come into this category.

Forests and woodlands in developing countries shrank by 125 million hectares in the 15 years to 1986, according to the UN Food and Agriculture Organization. The anti-Malthusians blame logging and ranching. But ranching has played a minor role outside Latin America. The area given over to pasture in the Third World increased by only 7.9 million hectares over this period—equal to about 6 per cent of the loss of forests. Latin America accounted for the lion's share of this increase. In Asia the total area of pasture did not increase at all, and in Africa it shrank.

Increase in non-agricultural land, for dwellings, factories, offices, roads and so on, ate up some 58.7 million hectares over this same period—almost 600 square metres per person added to the population. As towns expand mainly in agricultural areas, not in forests or deserts, most of this increase will have been at the expense of agricultural land.

Despite this loss, the total area of farmland grew—by another 58.7 million hectares. This means that farmland must have expanded, in all, by well over 100 million hectares, half of that simply to compensate for losses to non-agricultural uses. Most of

this expansion will have been at the expense of forests and woodland. It probably accounts for more than 80 per cent of deforestation. The rest may be due to degradation through logging or overgrazing.

What share of the blame for the loss of forest to cropland is due to population growth? Between 1971 and 1986 cropland expanded by 0.51 per cent a year. Population grew by 2.2 per cent a year. Food consumption per person grew by 0.58 per cent a year. Technology change, in this case, improved yields so that the area of cropland needed per person decreased, by 2.3 per cent a year. So, of the two factors pushing for an expansion of cropland, population accounts for four-fifths of the effect, the increase in consumption accounts for only one-fifth. On this basis the rough calculation is that population growth was responsible for around two-thirds of deforestation in developing countries.

In recent years, the relative blame may have shifted in certain areas. In Southeast Asia, the pressure to earn foreign currency, and the lure to entrepreneurs of windfall profits from logging, carry much of the blame. Recent massive deforestation in Amazonia is more the result of government policies encouraging land clearance for ranching and farming, as an alternative to land reforms. But within the colonised areas, population growth will create pressures to clear more forest to provide

or infertile areas. Because these are more vulnerable to erosion, the total amount of erosion increases. Piers Blaikie, a sociologist at the University of East Anglia, believes that exploitation by national and international elites, rich landowners, large companies and so on, pushes the poor below subsistence level. They are then forced to mine the soil—extracting fertility without restoring it—simply to survive.

Yet in most of West and Central Africa and South Asia it is population growth that fills up existing cultivated areas and forces new families to move out to more marginal areas.

Physically, soil erosion is a function of several factors. The more torrential the rainfall, the greater the erosion. Erosion is also faster if, for example, it has less organic matter to clump soil particles together. Erosion is greater on steeper or longer slopes, and where vegetation cover is thinner.

Population growth affects several of these factors. As human numbers grow, the area of open fields expands. This increases the length of any particular slope. As dense fallow vegetation declines, the overall vegetation cover becomes thinner. Expanding livestock herds help to thin the vegetation by grazing. Because of this, the amount of organic matter in the soil also declines.

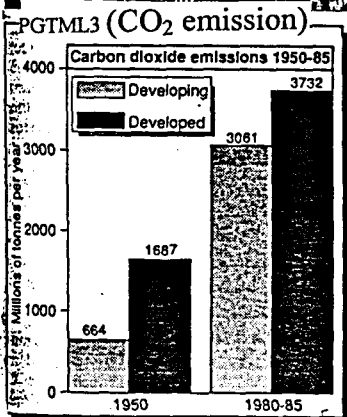
This effect of population on erosion assumes that technology does not change. Conservation techniques can reduce the damage: terracing or contour hedging can reduce the length and degree of slope. Adding compost and mulch can increase its organic content. Feeding livestock in stalls can reduce grazing pressure. But there are few places where conservation techniques have kept pace with population growth.

Poverty, exploitation, misguided government policies and so on are significant here. But they affect erosion mainly through the technology factor. Poverty, or low farm prices, for example, would starve farmers of funds, prevent investment and slow technological change. Inequality in land ownership artificially confines the poor to smaller or more marginal areas. Within those areas, higher population densities will lead to greater erosion unless technology keeps pace.

Population growth increases many types of damage to the environment. Slowing that growth reduces the damage. But it may be 20 years before there is any noticeable effect. In the shorter term, other measures will have a greater impact: reducing consumption, shifting to sustainable technologies, halting deforestation, attacking poverty and inequality, introducing land reform.

But in the medium to long term, reducing population growth can have a very significant impact. To achieve this, governments, development agencies and donors of aid must focus their attention on enhancing the rights, education and health of women and children. This will improve both the health of people and the environment. And precisely because it takes so long, action must start right now.

Paul Harrison is the author of *Inside the Third World* (Penguin, 1987) and helped to research *The State of World Population 1990*, published by the United Nations Population Fund on 15 May.



The Third World will soon be producing as much CO₂ as developed countries—mostly because of its increasing population

An awful lot of pollution in Brazil—but technology is only one of the culprits

land for the settlers' children.

The population of developing countries should reach a plateau at around 9.1 billion towards the end of the next century. (It is 4.1 billion today.) The extra 5 billion people will need roughly an extra 280 million hectares of land for non-agricultural needs. This will be taken mainly from prime agricultural areas. Compare this with the total agricultural land of developing countries in 1986 of 675 million hectares. If improvements to agriculture—"intensification"—do not keep pace, the amount of land given over to crops will have to increase to make good this loss, encroaching further on forest and pasture land. Slower population growth can make a sizeable contribution here too.

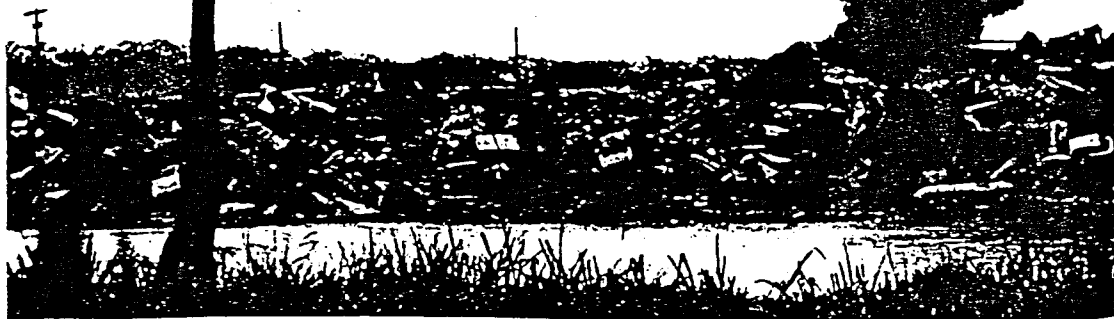
Soil erosion is a more contentious area. According to anti-Malthusians such as Lappé, inequality and cash cropping on large estates force the rural poor to farm dry, hilly

Population growth and overpopulation among the rich are creating a lethal situation for the entire world. It is the rich who dump most of the carbon dioxide and chlorofluorocarbons into the atmosphere. It is the rich who generate acid rain. And the rich are "strip-mining" the seas and pushing the world towards a gigantic fisheries collapse. The oil staining the shores of Prince William Sound was intended for the gas-guzzling cars of North America. The agricultural technology of the rich is destroying soils and draining supplies of underground water around the globe. And the rich are wood-chipping many tropical forests in order to make cardboard to wrap around their electronic products.

GLM-

PGRF1 (auto dump)

An auto and tire dump in Panama. Of the more than 400 million motor vehicles in the world in 1980, 150 million were in the United States, 36 million in Japan, 24 million in Germany, 1.7 million each in India and China, and 0.18 million in Nigeria.



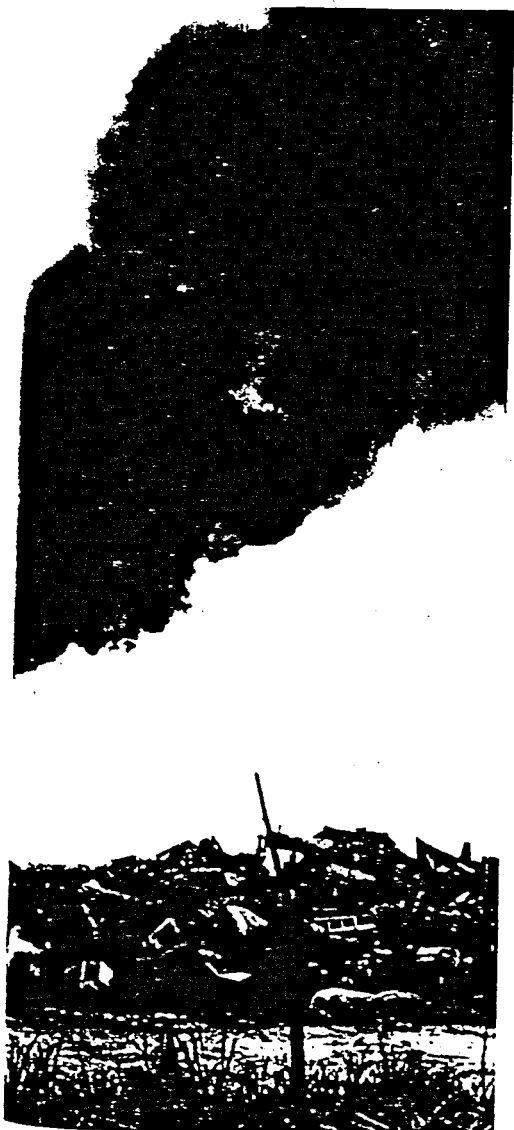
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TOO MANY RICH FOLKS

by Paul R. Ehrlich and Anne H. Ehrlich



UN/M. GUTHRIE

There is a widespread misapprehension that the population problem centres in the poor countries.¹ In the popular view, the "population problem" is being caused by Indian peasants, African herders, macho Latin American men, and the like. And a casual glance at demographic statistics might easily persuade the unsophisticated that this is correct. The population growth rate in Kenya is over 4 per cent, which if unchanged would double the population in only 17 years. The average growth rate for the less developed world (excluding China) is 2.4 per cent (doubling time 29 years), and travelers virtually anywhere in the developing world are greeted by huge numbers of children under the age of fifteen, who make up roughly 40 to 50 per cent of the population.

In contrast, rich nations have either very slow growth rates (well under 1 per cent), have reached zero population growth (ZPG), or in some cases such as West Germany and Hungary actually have shrinking populations. So, one might assume that, if Bangladeshis and Rwandans would just learn to use condoms, everything would be just fine.

Of course, nothing could be further from the truth. Rapid population growth, and overpopulation itself, do

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It is not crude numbers of people or population density *per se* that should concern us; it is *the impact* of people on the life support systems and resources of the planet. That impact can be conceived as the product of three factors: population size; some measure of affluence or consumption per capita; and an index of environmental damage done by the technologies used to supply each unit of affluence.

create serious problems for poor countries; indeed, they explain why most of them seem unable to escape poverty.

But population growth and overpopulation among the rich are creating a lethal situation for the entire world. It is the rich who dump most of the carbon dioxide and chlorofluorocarbons into the atmosphere. It is the rich who generate acid rain. And the rich are "strip-mining" the seas and pushing the world towards a gigantic fisheries collapse. The oil staining the shores of Prince William Sound was intended for the gas-guzzling cars of North America. The agricultural technology of the rich is destroying soils and draining supplies of underground water around the globe. And the rich are wood-chipping many tropical forests in order to make cardboard to wrap around their electronic products.

It is not crude numbers of people or population density *per se* that should concern us; it is the *impact* of people on the life support systems and resources of the planet. That impact can be conceived as the product of three factors: population size (P); some measure of affluence or consumption per capita (A); and an index of the environmental damage done by the technologies used to supply each unit of affluence (T). The entire population-resource-environment crisis can be encapsulated in the equation:

$$I = P \times A \times T \quad (I = PAT)$$

The $I = PAT$ equation explains (in very simplified terms) why the industrialized nations, regardless of comparative population size or density (people per square kilometre), must be considered to have much more severe population problems than any poor nation. [Unfortunately, nations do not even try to keep statistics on the average per capita environmental impact of their citizens; and it would be difficult to calculate precisely if they did.]

In order to make reasonable comparisons of affluence per person, we have chosen a surrogate statistic: per capita use of commercial energy. This is a rather reasonable surrogate, since much environmental damage is done in the processes of extracting and mobilizing energy, and even more is done by its use. Per capita commercial energy use oversimplifies by combining the A and T factors into a single unit of per capita impact, but that cannot be avoided. Generally, there is no convenient way to separate A and T using national statistics.

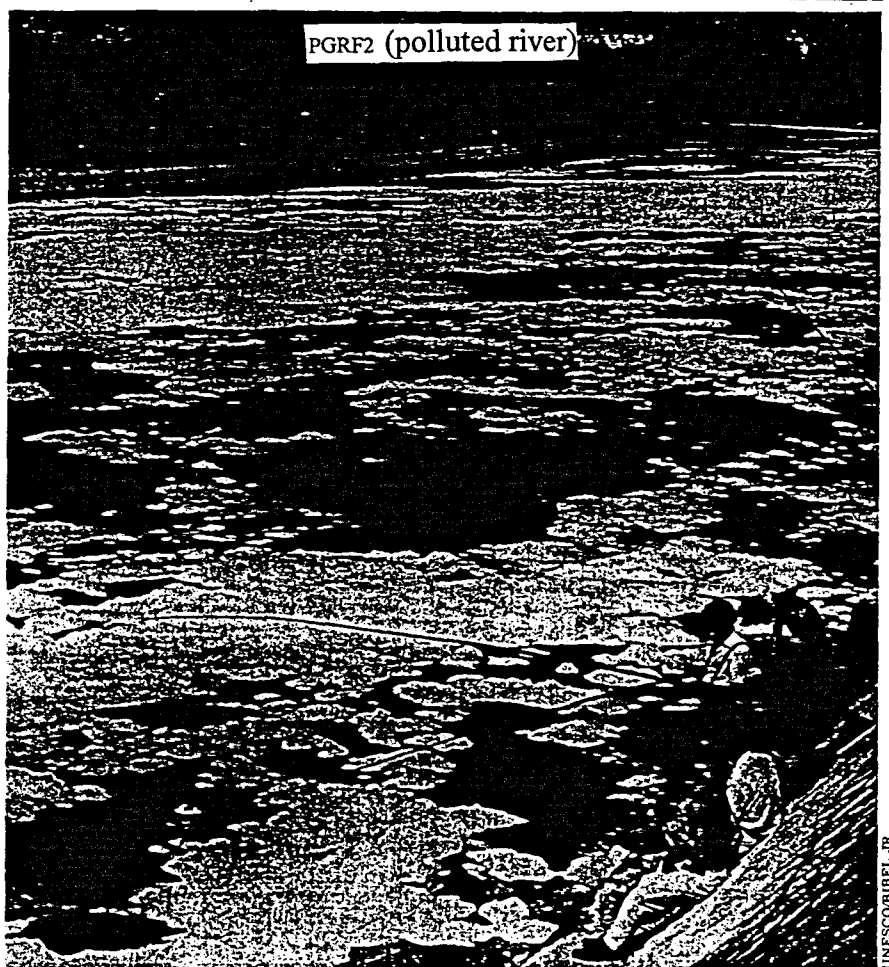
But the legitimacy of using the surrogate can be seen by considering how societies handle energy. Hundreds of thousands of birds and sea mammals killed at Prince William Sound in Alaska, the death of lakes and forests in eastern North America and northern Europe from acid precipitation, and roughly three-quarters of the contribution to

global warming that is due to carbon dioxide released in burning fossil fuels, all follow from the mobilization of energy to power overdeveloped societies. Global warming, entrained by huge releases of carbon dioxide, the acidification of ecosystems resulting from emissions of sulphur and nitrogen oxides from factories, power plants, and automobile exhausts, are examples of damage caused by energy use. That damage is no respecter of wealth or national boundaries; its consequences are visited on the poor as much as the rich who enjoy the benefits of using the energy.

Energy is also used in paving over natural ecosystems to create super-highways and parking lots to serve

automobiles; energy is required to produce the plastic and paper and aluminium cans that clog landfills and festoon highways and seashores; energy powers the boats that slaughter whales and deplete fisheries; energy is used to produce pesticides and cool the offices of Arizona developers as they plan the further unsustainable suburbanization of the American desert Southwest; energy warms the offices of oil company officials in Anchorage as they plan the "development" of the Alaskan National Wildlife Refuge.

Fishermen at their sport in a detergent-clogged Seine River in Paris.



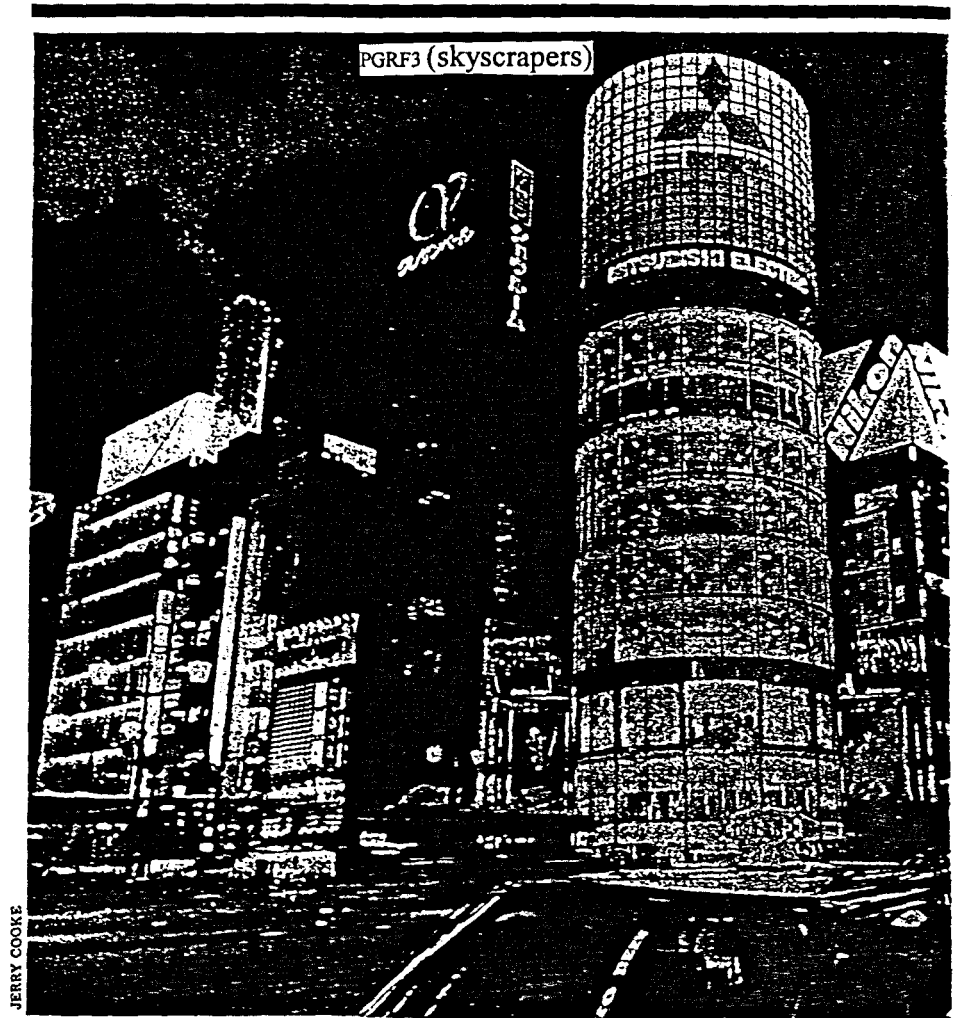
BRG

Energy is being used to pump aquifers dry around the world to support a temporary increase in grain production, and energy lets us fly in jet aircraft 30,000 feet above the circular irrigation patterns created by the pumping—energy that caused environmental damage when oil was pumped out of the ground and now is causing environmental damage as jet exhausts are spewed into the atmosphere. And, of course, energy damages when used to mine ores, win metals from those ores, and use those metals and other energy-intensive materials to manufacture automobiles, aircraft, TVs, refrigerators, and all the other paraphernalia of civilization.

BRG

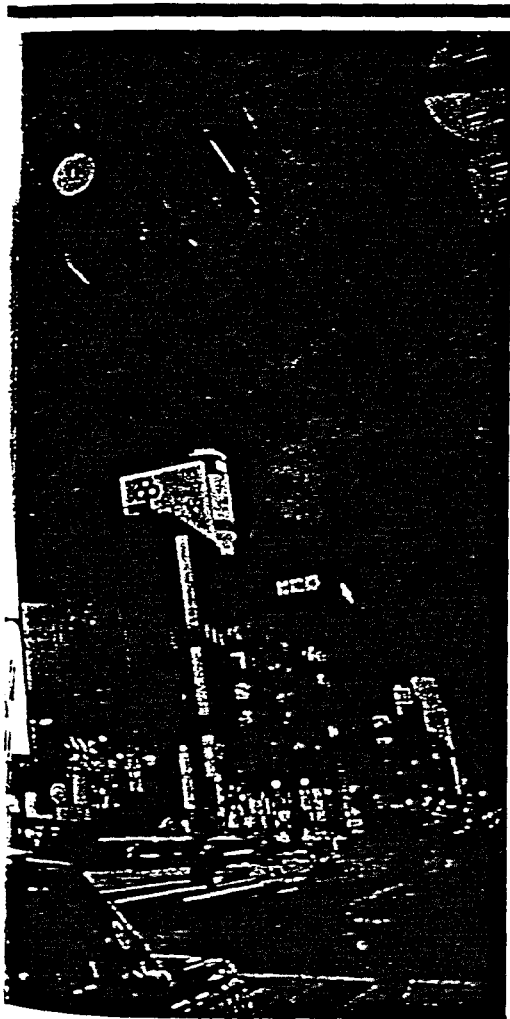
Poor people don't use much energy, so they don't contribute much to the damage caused by mobilizing it. The average Bangladeshi is not surrounded by plastic gadgets, the average Bolivian doesn't fly in jet aircraft, the average Kenyan farmer doesn't have a tractor or a pickup, the average Chinese does not have air-conditioning or central heating in his apartment. Of slightly over 400

Roughly three-quarters of the contribution to global warming that is due to carbon dioxide released in burning fossil fuels is caused by the mobilization of energy to power overdeveloped societies.



JERRY COOKE

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million motor vehicles in the world in 1980, 150 million were in the United States, 36 million in Japan, 24 million in Germany, 1.7 million each in India and China, and 0.18 million in Nigeria.

So statistics on per capita commercial energy use are a reasonable index of the responsibility for damage to the environment and the consumption of resources by an average citizen of a nation. By that measure, a baby born in the United States represents twice the disaster for Earth as one born in Sweden or the USSR, three times one born in Italy, 13 times one born in Brazil, 35 times one in India, 140 times one in Bangladesh or Kenya, and 280 times one in Chad, Rwanda, Haiti, or Nepal.

These numbers can be somewhat misleading in several respects. Both Sweden and the Soviet Union use about half as much energy per capita as Americans. But the Swedes use it much more efficiently to produce a roughly equal standard of living, whereas Soviet energy use is much less efficient, and their standard of living is considerably less than half that of the United States (and much more pollution is produced).

In most developing countries, including the last six named above, people overwhelmingly depend for energy on locally cut fuelwood, not commercially sold fossil fuels, hydropower, or charcoal, so their actual energy consumption is understated. The average Indian is certainly not eight times richer than a citizen of Chad or Haiti!

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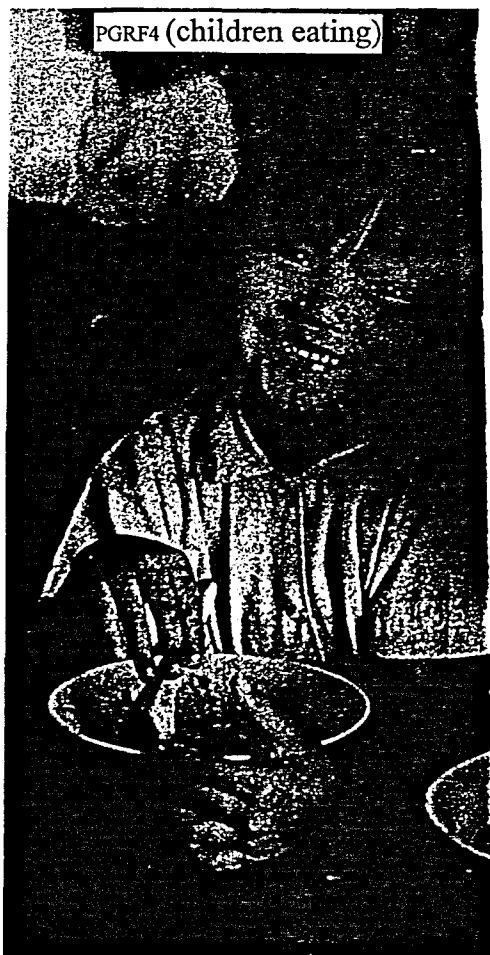
Nevertheless, as a rule of thumb, the concept is useful. There are more than three times as many Indians as Americans, so, as a rough estimate, the United States contributes about 10 times as much to the deterioration of Earth's life support systems as does India. By the same standard, the United States has 300 times the negative impact on the world's environment and resources as Bangladesh, and Sweden is 25 times more dangerous to our future than Kenya. These statistics should lay to rest once and for all the myth that population pressures are generated principally by rapid population growth in poor nations.

There is another way to look at the disproportionate negative impact of rich nations on civilization's future. The entire planet is now grossly overpopulated by a very simple standard. The present 5.3 billion people could not be supported if humanity were living on its income—primarily solar energy, whether captured by plants in the process of photosynthesis or by human-made devices such as solar heat collectors, solar electric cells, dams, or windmills.

Far from living on its income, however, civilization is increasingly dependent on its capital, a one-time bonanza of nonrenewable resources inherited from the planet. These resources include the fossil fuels, high-grade mineral ores, and most importantly, rich agricultural soils, underground stores of "ice-age" water, and biotic diversity—all the other species of plants, animals, and microorganisms—with which human beings share Earth.

In the process of depleting this capital,

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humanity is rapidly destroying the very systems that supply us with income. And people in industrial countries use a vastly disproportionate share of the capital. They are the principal depleters of fossil fuels and high-grade mineral ores. With less than a quarter of the world's population, citizens of rich nations control some four-fifths of its resources. They and the technologies they have spread around the world are responsible for more than their share of the depletion of soils and groundwater, and they have played a major role in causing the destruction of biodiversity, both within their national territories and elsewhere.

Overpopulation in industrial nations obviously represents a much greater

threat to the health of ecosystems than does population growth in developing nations. The 1.2 billion people in the developed world contribute disproportionately to global warming, being responsible for about four-fifths of the injection of carbon dioxide into the atmosphere caused by burning fossil fuels. Most of the responsibility for ozone depletion, acid precipitation, and oceanic pollution can be laid at the doorstep of industrial nations. So can the environmental consequences of much cash-crop agriculture, mining operations, and oil drilling and shipping worldwide. And industrialized nations share responsibility with developing countries for the roughly one-quarter of atmospheric CO₂ buildup caused by tropical deforestation.

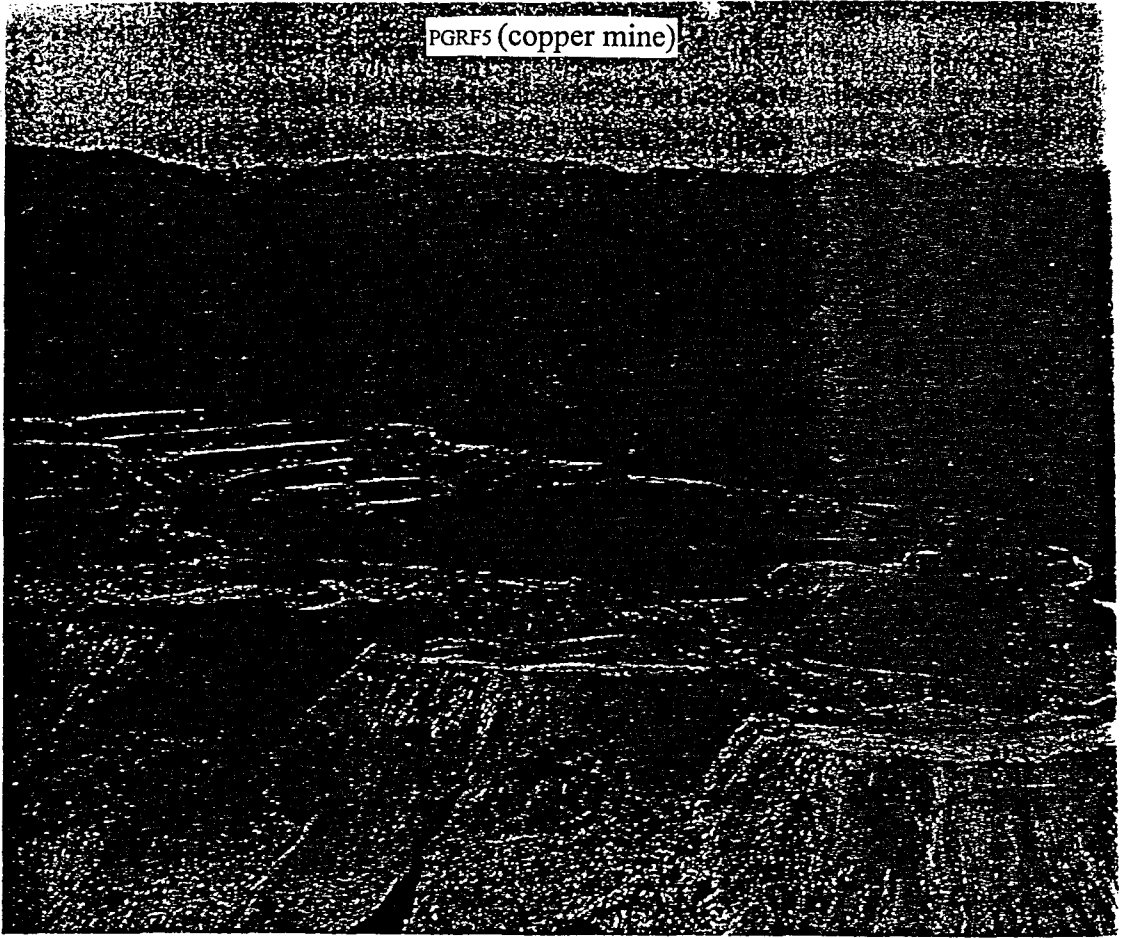
While people in rich nations must shoulder responsibility for civilization's resource depletion and environmental deterioration, they are also in a better position to lead the way in making the necessary changes to improve the human predicament. Still-growing populations, after decades of slackening growth, could soon achieve zero population growth and begin shrinking. Rather than lament the shift to an "older" population, people in developed countries could celebrate and encourage the trend. The smaller the population (P), if per-capita consumption or affluence (A) and technologies (T) remain the same, the less the environmental impact (I).

But the affluence and technology factors also can be more easily reduced in rich countries than in poor ones. Energy consumption could be substantially lowered through conservation in virtually all developed nations. Considerable progress in that direction was made in the United States, one of the world's more energy-wasteful nations, between 1977 and 1987, largely as a response to higher petroleum prices and growing dependency on imported oil. Unfortunately, the Reagan administration terminated or phased out most of the governmental incentives to conserve energy or develop alternative sources that had been put in place during the 1970s. By the late 1980s, Americans were reverting to their old bad habits, although the possibilities for energy con-



UNICEF/SEAN SPRAGUE

PGRF5 (copper mine)



SGN
servation had only begun to be tapped. Far from lowering the standard of living, the changes that were implemented, as well as those that remain possible, reduce energy costs to consumers and substantially lessen pollution.]]

Beyond conservation, many fairly painless changes could be made in the energy mix of most developed nations that would markedly reduce the release of CO₂ to the atmosphere. By substituting natural gas for coal, for instance, CO₂ emissions could be cut by about 50 per cent for the same energy benefit—and, again, less pollution. And renewable energy sources, especially solar-generated electricity, are increasingly practical substitutes for fossil fuels.

A copper mine. At 0.6 per cent "recovery" rate, a common grade of copper ore yields 12 pounds of red metal per ton extracted. The remaining 1,988 pounds of waste must be deposited of usually in massive, sometimes dangerous, and often polluting "trailing" piles near processing plants.

SGN
Apart from energy, most developed nations have ample room to shift to more environmentally benign technologies (thus reducing T). What is needed are economic incentives for manufacturers to take account of the costs of transport, distribution, use, and disposal of products, not just production costs, in making decisions.]] This could prove tricky, as corporations increasingly shift manufac-

If the habitability of Earth is to be preserved for all our descendants, we have no choice but to end and reverse population growth, limit our consumption of resources, replace damaging technologies with gentler ones, and attempt to design a better, more sustainable civilization.

SGN turing processes to poor countries to avoid higher labor costs and environmental restrictions in the home countries.]] As the global economy becomes more and more integrated, international standardization of environmental regulations may become necessary.

If the overdeveloped nations of the world fail to reduce their environmental impacts, working as far as possible on all three factors—population, consumption, and technology—they can hardly expect the developing world to do so. And without reductions in CO₂ and other greenhouse emissions by the rich, growing energy use by the poor nations will accelerate the greenhouse buildup. The sheer size and growth rates of populations in developing nations, along with their altogether reasonable aspirations and plans for development, virtually guarantee such an acceleration.

PRE To illustrate, suppose that China halted its population growth at about 1.2 billion (unlikely as that seems) and only doubled its per capita energy consumption, using its abundant supplies of coal. At that, its per capita consumption of energy would still be only 14 per cent of the average American's; yet that apparently modest increase would cancel the benefits of Americans giving up all use of coal (currently supplying about 20 per cent of US energy) and not replacing it with a carbon-based fuel. Similarly, if India achieved success in ending its population growth at 2 billion, and doubled its per capita energy use to about 7 per cent of present US consumption, it too would offset the foregoing of US coal. Unfortunately, Americans can

only give up coal-burning once.

So, while the rich nations today are the primary culprits in generating global warming (and numerous other environmental problems), an alarming potential for greatly increasing these problems resides in the poor countries, largely because the P factor is both so large and still growing so fast. If poor nations are to have any chance at all to end their population growth humanely and to develop their economies, the rich must scale back their assaults on the planet's life-support systems.

REC Viewed in this light, the situation clearly requires co-operation among all nations in implementing solutions to the human predicament. If the habitability of Earth is to be preserved for all our descendants, we have no choice but to end and reverse population growth, limit our consumption of resources, replace damaging technologies with gentler ones, and attempt to design a better, more sustainable civilization.

Having pioneered in today's destructive development, it seems only appropriate for the rich countries to lead in setting things right—by moving toward population shrinkage. □

NOTE

1. Based in part on material from P.R. Ehrlich and A.H. Ehrlich, *The Population Explosion*, to be published in February 1990 by Simon and Schuster, New York.



HUNGER VERSUS THE ENVIRONMENT: A RECIPE FOR GLOBAL SUICIDE

by NABIL MEGALLI

GLM- *The more humans there are to feed, the more we gnaw away at the the Earth's ability to feed us ...*



Have you eaten enough today? One-fifth of the world population is not so lucky. Furthermore, the odds are that your children will suffer, one way or another, from the fall-out from the rabid race between global hunger, rampant environmental degradation, and population growth gone berserk.

The picture of hunger in the last decade of the 20th century is frightening. Already, one billion people do not have the minimum to eat, and there will be one billion more mouths to feed by the year 2000. Agriculture is devouring its own base in three continents that cover two-thirds of the world's area and house four-fifths of its population. The world is galloping towards a situation where it will not be able to feed itself, no matter what it does.

In the United States, farmers are suffering from droughts at a frequency unprecedented in modern history. Global warming has already led to three severely drought-reduced harvests in the United States during the 1980s, even though droughts have, as a rule, occurred there once every 20 years.

There is evidence that a plateau has been reached in global efforts to increase the area under cultivation and enhance yields per hectare through agrochemicals. This desperate squeez-

'Food security must be the first priority of sustainable development.'

Dr Mostafa Tolba,
Executive Director, UNEP

ing of the land for more food is accelerating environmental degradation, which turns millions of hectares each year into wasteland. [According to UNEP's Global Assessment of Soil Degradation (GLASOD), there were 4700 million hectares of agricultural land in 1988, but 1230 million hectares—that is, about 25 percent—suffered from some degree of human-induced degradation.] In this hunger- and debt-driven hunt for food or profits, or both in the case of many small-scale developing world farmers, the search for new agricultural land is an irresistible cause of deforestation, overgrazing, overcropping and overfertilization. In turn, this causes desertification, salinization, pollution of water resources and erosion of valuable topsoil. It is often the cream of agricultural

land which is lost, while the new land is inevitably less suitable and less productive, and so more rapidly degraded.

[Current global topsoil losses are estimated to be 24 billion tonnes annually. In the US Corn Belt, studies show that each inch of topsoil lost reduces crops by 6 percent. In West Africa, topsoil loss has already reduced land productivity by 50 percent. Red Cross studies indicate that Ethiopia, which has only 6 percent of its forest cover left, is bleeding its topsoil into rivers at the rate of 2000 tonnes per square kilometre per year. Globally, per capita food production is retreating on another front, as population growth continues to defy all demographic predictions and birth control campaigns.] The world population currently stands at 5.5 billion and current estimates indicate it is likely to reach between 10.4 and 14 billion before it levels off.]

The world fish catch, estimated at 91 million tonnes in 1986, has probably already exceeded the maximum sustainable yield of 100 million tonnes. From that point on, the fish catch can only go on a downward spiral. [The UN Food and Agriculture Organization (FAO) says that overfishing and pollution have severely reduced the catch by small-scale fishermen, which is the main source of protein for their families and small local

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PGH2 (land salinity)



Salinization ruins a great deal of prime agricultural land, and is often caused by waterlogging due to excessive irrigation.

communities in many parts of the world. A lower fish catch means lower livestock production, since up to 45 percent of the catch is used as animal feed.]]

Attempting to play down the effects of pollution and global warming is as futile as the belief that some regions can continue playing the role of global breadbaskets, at a high cost to themselves and to the rest of the world. It is estimated that the industrial giants in the 25-nation Organization for Economic Cooperation and Development (OECD) spend more than US\$150

billion annually in direct and indirect agricultural subsidies to keep potentially low-cost farmers in the developing nations from entering the market. The result is agricultural ruin on both sides of the artificial North-South divide. Agricultural subsidies eat up to three-quarters of the European Community's budget, and the cost of storing and destroying surplus EC foods has been estimated at US\$225 million per week. [In the United States, the Comptroller General has reported that governmental water subsidies often surpass the value of crops produced in arid and semi-arid areas. In these regions, wasteful irrigation consumes up to 80 percent of valuable water resources.]]

[[According to UNEP's *The World Environment 1972-1992*, the estimated annual costs of combating desertification globally stand at between US\$10 billion and US\$22 billion, while economic losses due to desertification are about US\$42 billion.]] The longer the delay in confronting this accelerating degradation, the more costly an exercise it becomes.]] In 1980, the estimated cost of a 20-year programme to combat desertification was US\$90 billion. In 1990-91, the estimated cost of a 20-year programme had risen threefold to US\$270 billion, because the area affected and the costs of land reclamation are increasing.

Desertification affects 3.6 billion hectares or 70 percent of the world's potentially productive drylands, that is, nearly 25 percent of the total land area of the world. These figures exclude naturally occurring hyper-arid deserts.

PGH3 (fishermen)



Overfishing and pollution has severely reduced the catch by small-scale fishermen, with serious consequences for the local community.

The implications are made worse by the industrialized countries' use of up to three-quarters of global agrochemical supply on their limited territory, in order to fuel their agricultural 'miracle'. Traces, albeit minute in some cases, of carcinogenic pesticides have turned up in all groundwater reservoirs tested in the United States. In Europe, which uses 50 times as much fertilizer as Africa, nitrate concentrations in some major rivers have been increasing at an annual rate of 0.15 milligrams per litre since 1960 and have in some cases already surpassed the World Health Organization's acceptable limit of 11.3 milligrams per litre. Thus, the agricultural earnings of the industrialized world are dished back in the form of mushrooming health care costs and a lower quality of life for every citizen.

Studies have shown that one-sixth of North America's inhabitants in the Great Lakes area are exposed to the highly toxic substance dioxin. Many

Fighting land degradation

The UN Conference on Environment and Development (UNCED) in Rio de Janeiro in June 1992 called for an international convention aimed at controlling desertification. As this issue went to press, the UN General Assembly was deciding how to begin drawing up this convention and what it would cover.

Desertification is the process of land degradation whereby productive land becomes degraded through overgrazing, overcropping, salinization and erosion by wind and water. Many of these processes

also involve deforestation. Desertification does not refer to the expansion of existing naturally occurring deserts, except where the expansion is a result of one of these processes.

Desertification affects more than 100 countries, including not only the Sudan-Saharan countries of Africa, but also Australia, the United States, some southern European nations and some of the territory of the former Soviet Union.

In 1977, at the United Nations Conference on Desertification, a Plan of

Action to Combat Desertification (PACD) was adopted. Despite the limited success of PACD, many actions to combat land degradation have been undertaken by the UN system, governments and other organizations, and of course, by individuals. Trees have been planted as protective belts and as fuelwood sources, agroforestry (mixing farming and forestry) has become more widespread and large areas of shifting sands have been stabilized, particularly in China.

Protecting the planet's forests

Forests play a vital role in protecting soils, watersheds and climate stability. They are also a rich source of products—ranging from fruits, pharmaceuticals and latex to timber—and are home to a vast range of different plant and animal species. In the lead up to the UN Conference on Environment and Development in Rio de Janeiro in June 1992, UNEP brokered the drawing up of a convention to protect biological diversity. This was signed by 156 nations in Rio.

There are a wide variety of initiatives being taken to protect the planet's forests, from local programmes to national and international programmes, such as the listing of national parks and debt-for-nature swaps, whereby donors repay national debt. This latter mechanism allows the debtor nation to use its money to protect its environment rather than pay foreign banks.

UNEP has been involved in forest protection through its contribution to the agreement reached at UNCED. This was a statement of the principles for the conser-

vation and sustainable development of all types of forests. It is a non-binding agreement which will be reviewed after three years to see if countries want a convention to conserve forests.

UNEP also contributed to Target 2000, drawn up by the International Tropical Timber Organization (ITTO). Target 2000 is a commitment by a country to have all timber traded within its borders sourced from sustainably grown forests by the year 2000. The agreement was endorsed at UNCED in Rio. Signatory nations present annual reports on their progress towards the target. The most recent meeting was held in Yokohama, Japan, in November 1992.

UNEP, together with the United Nations Development Programme (UNDP) and the World Bank, administers the Global Environment Facility (GEF), a three-year US\$3 billion pilot programme aimed at funding programmes that deal with specified global environmental problems, such as the loss of biological diversity from rich

habitats, including tropical forests. All funds under the pilot programme have now been spent, but as this issue went to press, a meeting was to be held in Côte d'Ivoire in December 1992 to consider the future direction and scope of GEF.

UNEP also has a number of specific programmes aiming to help protect forests. For example, UNEP has had a methodology devised to assess 'the environmental, social, and economic impacts of plantations'. Possible sites for evaluating the methodology are currently being considered. There are likely to be three sites, one in Africa, one in Asia and one in Latin America. UNEP is also focusing attention on the relationship of forests to environmental change, and a workshop on this subject is scheduled to be held at UNEP headquarters in Nairobi in December 1992.

water wells in the eastern United States have been abandoned because of toxicity levels. Excessive pumping of ground water for agriculture has caused subsidence. The ground in some areas of California's San Joaquin Valley is already 30 feet below its level 50 years ago. [Such stratification is a factor not fully taken into consideration when assessing the flooding potential of global warming. This has particularly ominous implications for regions which rely almost exclusively on ground water supplies, such as some small island states and the coastal regions where, incidentally, 50 percent of the world's inhabitants live. The problem of sinking ground level is compounded by the extraction of other minerals, particularly petroleum deposits in coastal states. Meanwhile, water pollution is threatening expensive coastal water desalination and power plants in regions which have invested heavily in this field.]

On the so-called Southern side of the planet, peasants, who form the majority of populations in many developing countries, have slipped from subsistence to near-starvation. Here, the status of the average farmer is the exact

opposite of his counterpart in the North. Because of agricultural protection, farmers are effectively insulated from any beneficial price increases that may occur on the international agricultural



Some 47 percent of the world's population will be living in cities by the year 2000, and there will be megacities of up to 20 million inhabitants.

bazaar. Governments keep prices artificially low to maintain 'social peace' in the overcrowded urban areas. The net result is a fall in returns to farmers, followed by a fall in food production, growing potential for civil strife and social decay in the countryside.

Some 47 percent of the world's population will be living in cities by the year 2000, in comparison with 10 percent in 1980 and 1 percent in 1940. There will be megacities of up to 20 million inhabitants (see page 13), and social friction and crime of unprecedented dimensions. About 90 percent of the projected population increase will take place in developing countries, and two-thirds of that increase will be in cities.

Mounting foreign debt payments also drive governments into encouraging export cash crops based on monocultures, at the expense of the vast genetic diversity of natural environments. More forest has to be axed, while, all too often, soils are driven to exhaustion by incessant cropping and reduced fallow periods. The result is that hunger feeds on itself in a vicious cycle of environmental degradation and expanding famines.

PGH5 (deforested land)

Balstad/Panos Pictures



The deforestation in Somalia is devastatingly clear, as refugees cut the sparse vegetation for fuel.

Three-quarters of the inhabitants in Africa work in the agricultural sector, and the continent was a net exporter of food 20 years ago. Today, as Somalia's devastation all too clearly attests, Africa is the leading example of food insecurity in the world, not only because of warfare, but also because of massive deforestation. Around the growing number of refugee camps in Ethiopia, Somalia and Sudan, the deforestation is frighteningly clear, as the refugees cut the sparse vegetation for fuel.

By the year 2000, there are likely to be up to 130 million hungry people in the Sahel countries of Africa as a result of drought and desertification. Whereas Asia has the largest number of hungry people, Africa stands out in terms of the percentage of people affected—25 percent of the population. Africa has one-quarter of the international refugee community, even though it contains only one-tenth of world population. The World Bank warns that 'Africa's food situation is not only serious, it is deteriorating'.

Worldwide, per capita food production rose by one-third in the period 1950–84, but it has declined by 7 percent in the 1984–89 period and is expected to fall by another 7 percent by the year 2000. In Africa, per capita food production has plummeted 20 percent from its peak in 1967. Extrapolation of present trends by World Bank analysts yields a 'nightmare scenario' for the entire continent.

In Latin America, the same phenomenon has been in evidence since 1981. Brazil, which at the time had the ninth

largest gross national product in the world, in 1987 approached the World Food Programme for emergency aid to feed 2.5 million peasants in its north-eastern region. They had swollen the state capital of Ceará Mirim by nearly one million during the mid-1980s. This is attributable in part to unprecedented drought and changing rain patterns linked to the surface temperatures of the El Niño currents in the Pacific. But equal blame falls on rapid deforestation, a fall of up to 75 percent in food crops matched by similar increases in export crops, and the contraction of the role of small farmers, while less than 8 percent of the population are garnering 80 percent of the land.

The downward agricultural spiral in developing countries has reversed only in cases where the average peasant has been allowed to add his input to the land he had jealously nurtured for millennia as his one and only source of sustainable livelihood. Cooperatives and non-governmental organizations play an indispensable part in this process. Improving the status of women and recognizing their key role in agricultural communities has been an important factor where agricultural output has increased.

Without improving the human side of the agricultural equation, there is little hope for added productivity through technical input or putting more area under cultivation. Response to fertilizers is levelling off after a 3 percent

PGH6 (African women)



It is vital to improve the status of women and to recognize that wherever women play a key role in agriculture, output invariably increases.

Air pollution cuts food production

It is not just what happens on the ground that threatens food production. Substances such as chlorofluorocarbons and other halons destroy stratospheric ozone. For each 1 percent decrease in stratospheric ozone, there is a corresponding increase of about 2 percent in UV-B radiation and a 1 percent loss in key crops such as soya beans. Exposure to increased UV-B also reduces the effectiveness of the body's immune system, increasing the incidence of disease, eye cataracts and skin cancer. Meanwhile, studies in the United States indicate that air pollution has already reduced crops by 5 percent and that ozone at ground level, caused by the action of sunlight on smog from the burning of fossil fuels, is costing US agriculture US\$5 billion annually in crop losses.

annual increase between 1950 and 1984 which boosted output 2.6 times. Meanwhile, there is a steady loss of irrigated areas, which provide one-third of the world's crops from only 18 percent of its agricultural territory. Irrigated areas grew from 232 million acres in 1950 to 615 million acres in 1980, but these areas are now being lost, largely because of increased salinity and a steady fall in the water table. According to UNEP's *The World Environment 1972–1992*, 43 million hectares of irrigated land (30 percent of all irrigated dryland) show evidence of degradation, mainly waterlogging and its resultant salinization and/or alkalization. In the United States, groundwater levels beneath much of the irrigated land are falling between 0.15 metres and 1.3 metres a year, and even greater drops have been recorded in China. Any further increases in agricultural lands will be in marginal and high-cost areas, or through deforestation, which will add further to the ruin.

If humanity is to feed itself, this environmental degradation has to stop—and stop soon.

BY ROBERT S. MCNAMARA

PGPI (crowd)

TTL

The Population Explosion

GLM

HIGH POPULATION GROWTH IS MAKING POOR
PEOPLE POORER, THE HUNGRY HUNGRIER, AND AN
ALREADY-FRAGILE ENVIRONMENT TOO WEAK TO
SUPPORT ITS PROLIFERATING INHABITANTS.

For thousands of years, the world's human population grew at a snail's pace. It took over a million years to reach 1 billion people at the beginning of the last century. But then the pace quickened. The second billion was added in 130 years, the third in 30, and the fourth in 15. The current total is some 5.4 billion people.

Although population growth rates are declining, they are still extraordinarily high. During this decade, about 100 million people per year will be added to the planet. Over 90% of this growth is taking place in the developing world. Where will it end?

The World Bank's latest projection indicates that the plateau level will not be less than 12.4 billion. And Nafis Sadik, director of the United Nations Population Fund, has stated that "the world could be headed toward an eventual total of 14 billion."

What would such population levels mean in terms of alleviating poverty, improving the status of women and chil-

PHOTO: JOHNS HOPKINS UNIVERSITY

THE FUTURIST November-December 1992 9

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PRB
BRC
EVN
dren, and attaining sustainable economic development? To what degree are we consuming today the very capital required to achieve decent standards of living for future generations?

More People, Consuming More

To determine whether the world—or a particular country—is on a path of sustainable development, one must relate future population levels and future consumption patterns to their impact on the environment.

Put very simply, environmental stress is a function of three factors: increases in population, increases in consumption per capita, and changes in technology that may tend to reduce environmental stress per unit of consumption.

Were population to rise to the figure referred to by Sadik—14 billion—there would be a 2.6-fold increase in world population. If consumption per capita were to increase at 2% per annum—about two-thirds the rate realized during the past 25 years—it would double in 35 years and quadruple in 70 years. By the end of the next century, consumption per capita would be eight times greater than it is today.

Some may say it is unreasonable to consider such a large increase in the per capita incomes of the peoples in the developing countries. But per capita income in the United States rose at least that much in this century, starting from a much higher base. And today, billions of human beings across the globe are now living in intolerable conditions that can only be relieved by increases in consumption.

A 2.6-fold increase in world population and an eightfold increase in consumption per capita by 2100 would cause the globe's production output to be 20 times greater than today. Likewise, the impact on non-renewable and renewable resources would be 20 times greater, assuming no change in environmental stress per unit of production.

On the assumptions I have made, the question becomes: Can a 20-fold increase in the consumption of phys-



ical resources be sustained? The answer is almost certainly "No." If not, can substantial reductions in environmental stress—environmental damage—per unit of production be achieved? Here, the answer is clearly "Yes."

Reducing Environmental Damage

Environmental damage per unit of production can—and will—be cut drastically. There is much evidence that the environment is being stressed today. But there are equally strong indications that we can drastically reduce the resources consumed and waste generated per unit of "human advance."

With each passing year, we are learning more about the environmental damage that is caused by

Large expected increases in population and consumption may spell trouble for many ecosystems, such as the tropical forests of Brazil.

present population levels and present consumption patterns. The superficial signs are clearly visible. Our water and air are being polluted, whether we live in Los Angeles, Mexico City, or Lagos. Disposal of both toxic and nontoxic wastes is a worldwide problem. And the ozone layer, which protects us all against skin cancer, is being destroyed by the concentration of chlorofluorocarbons in the upper atmosphere.

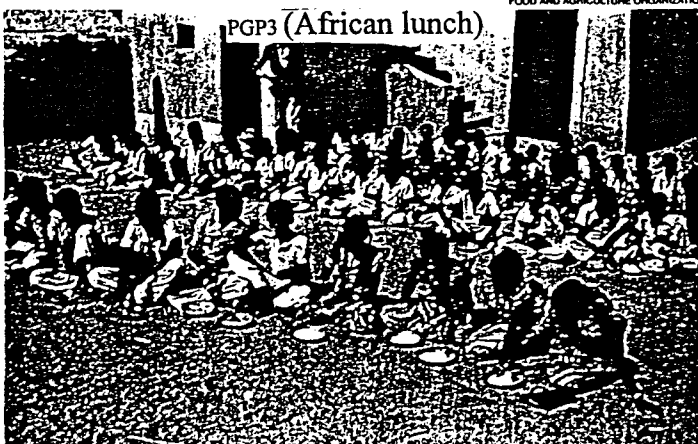
But for each of these problems, there are known remedies—at least for today's population levels and current consumption patterns. The

"MORE AND MORE BIOLOGISTS ARE WARNING THAT THERE ARE INDEED BIOLOGICAL LIMITS TO THE NUMBER OF PEOPLE THAT THE GLOBE CAN SUPPORT AT ACCEPTABLE STANDARDS OF LIVING."

remedies are costly, politically difficult to implement, and require years to become effective, but they can be put in place.

The impact, however, of huge increases in population and consumption on such basic resources and ecosystems as land and water, forests, photosynthesis, and climate is far more difficult to appraise. Changes in complex systems such as these are what the scientists describe as nonlinear and subject to discontinuities. Therefore, they are very difficult to predict.

Lunch at Nigerian school. Per capita food production in sub-Saharan Africa has been declining for the past decade due to high population growth rates, says author McNamara.



A Hungrier Planet?

Let's examine the effect of population growth on natural resources in terms of agriculture. Can the world's land and water resources produce the food required to feed 14 billion people at acceptable nutritional levels? To do so would require a four-fold increase in food output.

Modern agricultural techniques have greatly increased crop yields per unit of land and have kept food production ahead of population growth for several decades. But the costs are proving to be high: widespread acceleration of erosion and nutrient depletion of soils, pollution of surface waters, overuse and contamination of groundwater resources, and desertification of overcultivated or overgrazed lands.

The early gains of the Green Revolution have nearly run their course. Since the mid-1980s, increases in worldwide food production have lagged behind population growth. In sub-Saharan Africa and Latin America, per capita food production has been declining for a decade or more.

What, then, of the future? Some authorities are pessimistic, arguing that maximum global food output will support no more than 7.5 billion people. Others are somewhat more optimistic. They conclude that if a variety of actions were taken, beginning with a substantial increase in agricultural research, the world's

agricultural system could meet food requirements for at least the next 40-50 years.

However, it seems clear that the actions required to realize that capacity are not now being taken. As a result, there will be severe regional shortfalls (e.g., in sub-Saharan Africa), and as world population continues to increase, the likelihood of meeting global food requirements will become ever more doubtful.

Similar comments could be made in regard to other natural resources and ecosystems. More and more biologists are warning that there are indeed biological limits to the number of people that the globe can support at acceptable standards of living. They say, in effect, "We don't know where those limits are, but they clearly exist."

Sustainability Limits

How much might population grow and production increase without going beyond sustainable levels—levels that are compatible with the globe's capacity for waste disposal and that do not deplete essential resources?

Jim MacNeil, Peter Winsemaus, and Taizo Yakushiji have tried to answer that question in *Beyond Interdependence*, a study prepared recently for the Trilateral Commission. They begin by stating: "Even at present levels of economic activity, there is growing evidence that certain critical global thresholds are being approached, perhaps even passed."

They then estimate that, if "human numbers double, a five- to ten-fold increase in economic activity would be required to enable them to meet [even] their basic needs and minimal aspirations." They ask, "Is there, in fact, any way to multiply economic activity a further five to ten times, without it undermining itself and compromising the future completely?" They clearly believe that the answer is "No."

Similar questions and doubts exist in the minds of many other experts in the field. In July 1991, Nobel laureate and Cal Tech physicist Murray Gell-Mann and his associates initi-

ated a multiyear project to try to understand how "humanity can make the shift to sustainability." They point out that "such a change, if it could be achieved, would require a series of transitions in fields ranging from technology to social and economic organization and ideology."

The implication of their statement is not that we should assume the outlook for sustainable development is hopeless, but rather that each nation individually, and all nations collectively, should begin now to identify and introduce the changes necessary to achieve it if we are to avoid costly—and possibly coercive—action in the future.

One change that would enhance the prospects for sustainable development across the globe would be a reduction in population growth rates.

Population and Poverty

The developing world has made enormous economic progress over the past three decades. But at the same time, the number of human beings living in "absolute poverty" has risen sharply.

When I coined the term "absolute poverty" in the late 1960s, I did so to distinguish a particular segment of the poor in the developing world from the billions of others who would be classified as poor in Western terms. The "absolute poor" are those living, literally, on the margin of life. Their lives are so characterized by malnutrition, illiteracy, and disease as to be beneath any reasonable definition of human dignity.

Today, their number approaches 1 billion. And the World Bank estimates that it is likely to increase further—by nearly 100 million—in this decade.

A major concern raised by poverty of this magnitude lies in the possibility of so many children's physical and intellectual impairment. Surveys have shown that millions of children in low-income families receive insufficient protein and calories to permit optimal development of their brains, thereby limiting their capacity to learn and to lead fully productive lives. Additional millions die each



year, before the age of five, from debilitating disease caused by nutritional deficiencies.

High population growth is not the only factor contributing to these problems; political organization, macroeconomic policies, institutional structures, and economic growth in the industrial nations all affect economic and social advance in developing countries. But intuitively we recognize that the immediate effects of high population growth are adverse.

Our intuition is supported by facts: In Latin America during the 1970s, when the school-age population expanded dramatically, public spending per primary-school student fell by 45% in real terms. In Mexico, life expectancy for the poorest 10% of the population is 20 years less than for the richest 10%.

Based on such analyses, the World Bank has stated: "The evidence points overwhelmingly to the conclusion that population growth at the rates common in most of the developing world slows development. . . . Policies to reduce population growth can make an important contribution to [social advance]."

A Lower Plateau for World Population?

Any one of the adverse consequences of the high population growth rates—environmentally un-

Nearly 1 billion people today live in "absolute poverty" (on the very margin of life), according to author McNamara. Their number is likely to rise by some 100 million during the 1990s.

sustainable development, the worsening of poverty, and the negative impact on the status and welfare of women and children—would be reason enough for developing nations across the globe to move more quickly to reduce fertility rates. Taken together, they make an overwhelming case.

Should not every developing country, therefore, formulate long-term population objectives—objectives that will maximize the welfare of both present and future generations? They should be constrained only by the maximum feasible rate at which the use of contraception could be increased in the particular nation.

If this were done, I estimate that country family-planning goals might lead to national population-stabilization levels that would total 9.7 billion people for the globe. That is an 80% increase over today's population, but it's also 4.3 billion fewer people than the 14 billion toward which we may be heading. At the consumption levels I have assumed, those additional 4.3 billion people could require a production output several times greater than the world's total output today.

"THE FUNDS REQUIRED ARE SO SMALL, AND THE BENEFITS . . . SO LARGE, THAT MONEY SHOULD NOT BE ALLOWED TO STAND IN THE WAY OF REDUCING FERTILITY RATES."

Reducing Fertility Rates

Assuming that nations wish to reduce fertility rates to replacement levels at the fastest possible pace, what should be done?

The Bucharest Population Conference in 1974 emphasized that high fertility is in part a function of slow economic and social development. Experience has indeed shown that as economic growth occurs, particularly when it is accompanied by broadly based social advance, birth rates do tend to decline. But it is also generally recognized today that not all economic growth leads to immediate fertility reductions, and in any event, fertility reduction can be ac-

Family-planning clinic in the Philippines. Author McNamara believes that industrialized nations should provide more financial support for family-planning programs in the Third World.

celerated by direct action to increase the use of contraceptives.

It follows, therefore, that any campaign to accelerate reductions in fertility should focus on two components: (1) increasing the pace of economic and social advance, with particular emphasis on enhancing the status of women and on reducing infant mortality, and (2) introducing or expanding comprehensive family-planning programs.

Much has been learned in recent years about how to raise rates of economic and social advance in developing countries. I won't try to summarize those lessons here. I do wish to emphasize, however, the magnitude of the increases required in family planning if individual countries are to hold population growth rates to levels that maximize economic and social advance.

The number of women of child-bearing age in developing countries is projected to increase by about 22% from 1990 to 2000. If contraception use were to increase from 50% in 1990 to 65% in 2000, the number of women using contraception must rise by over 200 million.

That appears to be an unattainable objective, considering that the number of women using contraception rose by only 175 million in the past two decades, but it is not. The task for certain countries and regions—for example, India, Pakistan, and al-

most all of sub-Saharan Africa—will indeed be difficult, but other nations have done as much or more. Thailand, Indonesia, Bangladesh, and Mexico all increased use of contraceptives at least as rapidly. The actions they took are known, and their experience can be exported. It is available to all who ask.

Financing Population Programs

A global family-planning program of the size I am proposing for 2000 would cost approximately \$8 billion, with \$3.5 billion coming from the developed nations (up from \$800 million spent in 1990). While the additional funding appears large, it is very, very small in relation to the gross national products and overseas development assistance projected for the industrialized countries.

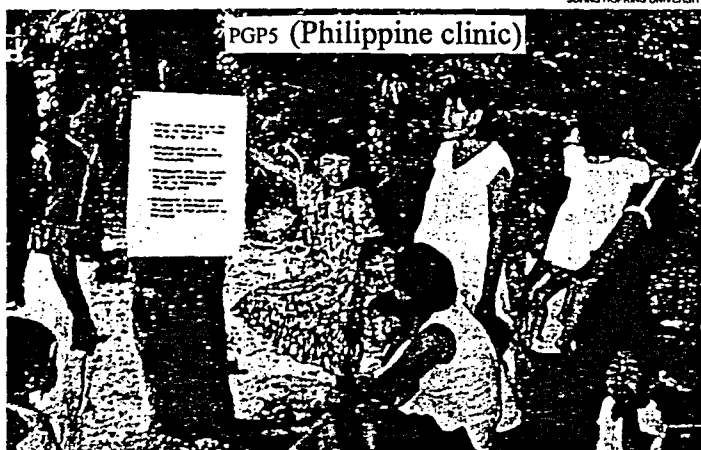
Clearly, it is within the capabilities of the industrialized nations and the multilateral financial institutions to help developing countries finance expanded family-planning programs. The World Bank has already started on such a path, doubling its financing of population projects in the current year. Others should follow its lead. The funds required are so small, and the benefits to both families and nations so large, that money should not be allowed to stand in the way of reducing fertility rates as rapidly as is desired by the developing countries.

The developed nations should also initiate a discussion of how their citizens, who consume seven times as much per capita as do those of the developing countries, may both adjust their consumption patterns and reduce the environmental impact of each unit of consumption. They can thereby help ensure a sustainable path of economic advance for all the inhabitants of our planet. □

PGP6 (McNamara)

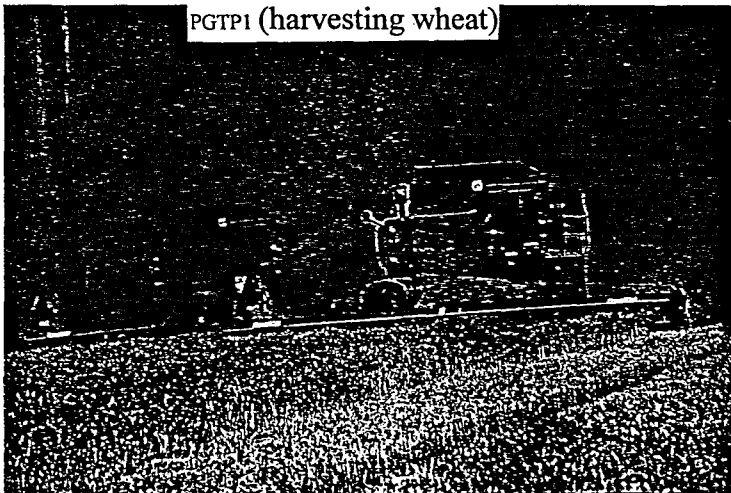


About the Author
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The Great Debate: 1

TTL [Must the poor



PGTP1 (harvesting wheat)

starve?

GLM [Our Great Debate on feeding 8 billion people by 2020 opens with a warning from David and Marcia Pimentel of the College of Agriculture and Life Sciences at Cornell University, that we may be facing the prospect of millions more malnourished people.

PGTP2 (David & Marcia)



10

PRB [As the human population continues to grow in a geometrical way, while food production grows arithmetically on our finite planet, it is becoming increasingly difficult to ensure that food production will meet escalating human needs. According to the World Bank and the United Nations more than one billion humans are now considered malnourished, indicating a combination of insufficient food and inadequate distribution. This is the largest number of hungry humans ever recorded in history. With the world population projected to double from about 6

PRE [billion to more than 12 billion in about 50 years, based on current rates of increase, many scientists believe the world food problem will become increasingly severe, conceivably with the numbers of malnourished reaching 3 to 4 billion.

BRG [Based on their evaluations of available natural resources, scientists of the Royal Society and the US National Academy of Sciences have issued a joint statement reinforcing the concern about the growing imbalance between human numbers and the resources that support them.

Reports from the Food and Agricultural Organization, numerous other international organizations and scientists confirm the existence of this serious food problem. For example, the per capita availability of world grains, that makes up 80 per cent of the world's food, has been declining for the past 14 years. Certainly with a quarter million people being added to the world population each day, the need for food increases.

SPC2 [BRG [More than 99 per cent of the world's food supply comes from the land, while less than 1 per cent is from oceans and other aquatic habitats. The continued production of an adequate food supply is directly dependent on an ample supply of fertile land, fresh water, energy (especially fossil energy), and the protection of biodiversity. As the human population grows, the requirements for these resources also grows. Even if the total resources are not depleted, resources on a per capita basis will decline as they are divided among more and more people.

SPC3 [BRG [Fertile cropland, is being lost at an alarming rate. For instance, as the World Resources Institute has pointed out, nearly one-third of the world's cropland (1.5 billion hectares) has been abandoned during the past 40 years as erosion has made it unproductive. Erosion is a long-term problem because it takes 500 years to form 2.5 cm of soil under agricultural condition.

Most replacement of eroded farm land comes from marginal land, generally cleared forests. Indeed, agriculture accounts for 80 per cent of the world's deforestation. Despite such land

MARK LINDHOLM/ISTOCK

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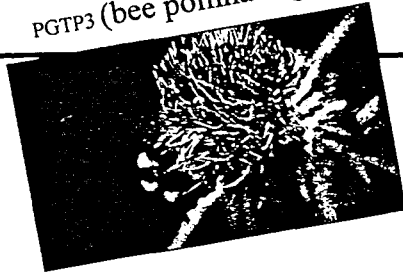
PRO - PROPHECY

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PGTP3 (bee pollinating)



Far left: Intensive farming, Perth, Australia. For every pound of bread produced in Australia seven pounds of topsoil are lost forever.

Left: Bee pollinating. No technology can substitute for this free service.

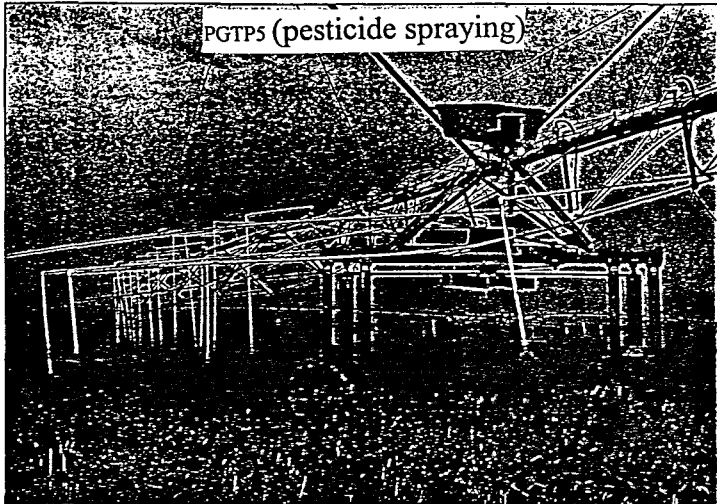
Below: Massive amounts of water are used to irrigate cropland in California.

replacement strategies, world cropland per capita has been declining and is now only 0.27 ha per capita. This is nearly one-half the 0.5 ha per capita, which is considered minimal for a diverse diet of animal and plant products. The shortage of productive cropland, plus decreasing land productivity is, in part, the cause of current food shortages and associated human malnutrition. Other factors, such as political unrest and unequal food distribution patterns also contribute to shortages.

All crops require and transpire massive amounts of water during the growing season. For example, a hectare of corn that produces about 7,000 kg of grain will transpire more than 4 million litres of water during the growing season. In total, agricultural production consumes more fresh water than any other human activity. Worldwide, about 87 per cent of the fresh water is consumed by agriculture and this is not recoverable. To supply this much water to a crop requires from 6 to 8 million litres of water per hectare.

A major threat to maintaining fresh water supplies is the continuing over-draft of our surface and ground water resources. Water resources, critical for irrigation, are under great stress as more populous cities, states and countries need and withdraw more water from rivers, lakes, and aquifers every year. At present, 40 per cent of the world's people live in regions that directly compete for water. A reflection of these water shortages is the per capita decline in irrigation used for food production in all regions of the world.

Nearly 80 per cent of the world's fossil energy is used by the developed countries to maintain their high standard of living. The intensive farming technologies of developed countries use massive amounts of fossil fuel for fertilizers, pesticides, irrigation, and machines as a substitute for human labour. In developing countries, by contrast, the use of energy has been primarily for fertilizers and irrigation to help prevent starvation rather than reduce labour inputs. However, fossil energy is a finite resource and its depletion is being speeded up as population



PGTP5 (pesticide spraying)

needs for food and services escalate.]

The United States is now importing 60 per cent of its oil and expects to exhaust all of its oil reserves in 15 to 20 years. Then oil imports will have to increase and the US trade imbalance will be further skewed. As supplies of fossil energy dwindle, the cost of fuel everywhere increases. This is already becoming a serious problem for developing countries, where the high price of imported oil making it less affordable for the poor farmers. Therefore, less will be available to power irrigation and provide for other agricultural needs in developing countries. Worldwide, per capita supplies of fossil energy already have started to decline.

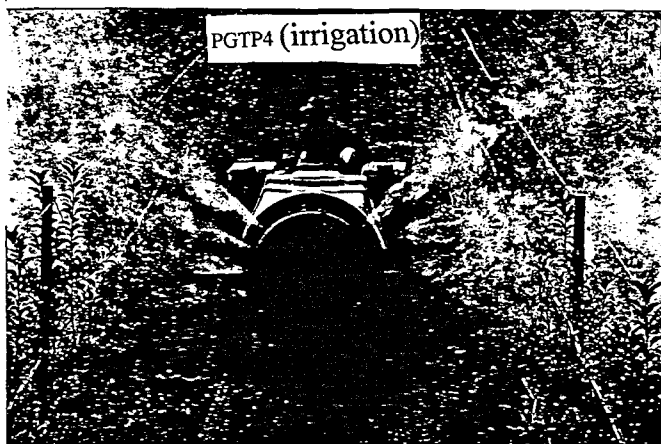
Economic analyses often overlook the biological and physical constraints imposed on food production. The assumption is that market mechanisms and international trade are effective insurances against future food shortages. A rich economy is expected to guarantee an adequate food supply to meet a country's demand despite existing local ecological constraints. However, when global biological and physical limits to domestic food production are reached, food importation is no longer a viable option for any

country. At that point, food importation for the rich can only be sustained by starvation of the powerless poor.

These concerns about the future are supported by two observations. First, most of the 183 nations of the world are now to some extent dependent on food imports. Most of these imports are cereal surpluses produced in only a few countries that have relatively low population densities and practice intensive agriculture. For instance, the United States, Canada, Australia, Oceania, and Argentina provide 81 per cent of net cereal exports on the world market.

If as projected, the United States population doubles in about 60 years, based on the current rate of increase of 1.1 per cent, the United States would cease to be a net food exporting country. Then all food resources would have to be used to feed the 520 million hungry Americans.

In the future, as exporting nations will need to keep surpluses at home, Egypt, Jordan as well as countless other countries in Africa and Asia will be without the food imports that now help them survive. China illustrates this problem. China now imports many tons of food, but if their population increases by 500 million, and soil erosion con-



MARK EDWARDS/STILL PICTURES

tinues unabated, by 2050 or so they may need to import 200-400 million tons of food, as Lester Brown of the Worldwatch Institute has recently pointed out. But by then, the food may not be available.]

Second, all developing countries are coming to rely more heavily on fossil energy, especially for fertilizers and irrigation, to sustain their food supply. The current decline in per capita use of fossil energy, caused by the decline in oil supplies and their relatively high prices is generating direct competition between energy use in developed and developing countries.

Certainly technology will assist in improved management and more effective use of various resources, but it cannot produce an unlimited flow of those vital natural resources that are the raw materials for sustained agricultural production. For instance, fertilizers can enhance soil fertility, but humans can not make topsoil. Indeed, fertilizers made from finite fossil fuels are being used to compensate for erosion. And although increasing the size and speed of fishing vessels has enabled us to overfish the oceans and lakes, it has not increased the per capita fish catch. Overfishing is so severe in regions like eastern Canada, that cod fishermen are now on shore and destitute.

Consider also the supplies of fresh water. Water withdrawn from the Colorado River by several states for irrigation and other purposes results in the river being nearly dry by the time it reaches Mexico. There is no technology available that will double the flow of the Colorado River. Similarly, shrinking ground water aquifers cannot be refilled by human technology.

In addition, agricultural production

Above: Spraying pesticides onto fruit trees in the Po Delta, Italy. Over seven tonnes of pesticides are washed into the Po every year.

depends on the integrity of biodiversity to maintain food production. In New York State on one bright, sunny day in July, the wild and other bees pollinate an estimated 1,000,000 million blossoms of essential fruits and vegetables. Humans have no technology to substitute for this vast task or the numerous other services provided by natural biodiversity.

Considered strategies for the future, must be based, first and foremost, on the conservation and careful management of land, water, energy, and biological resources for food production. Once these resources are exhausted they can not be remade by humans. In addition, more efficient and environmentally sound agricultural technologies must be developed and put into practice to support the continued productivity of agriculture.

Yet none of these measures will be sufficient to ensure adequate food supplies unless the growth in the human population is curtailed. Before we are confronted with more food shortages and resource crises, we need to change our stewardship of the world and balance human numbers with land, water, and other resources.

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Kill or cure? Remedies for the rainforest

There is more than one way to save a rainforest. But the many parties that claim to know which way is best are at odds with each other

Fred Pearce

FROM THE comfort of a four-storey house in Richmond, Surrey, Nick Hildyard is clear about why the world's tropical forests are disappearing. "Western development programmes in the Third World are to blame," he says. Hildyard and his mentor, Teddy Goldsmith, have spent the 1980s waging a campaign in their influential journal, *The Ecologist*, against the agencies that funnel Western cash into poor countries for dams, mines, power stations and other large development projects. Such projects, they claim, destroy the environment and the cultures of the people of the tropics. Ultimately, by undermining the planet's life-support systems, they threaten us all.

Goldsmith, the elder brother of financier Jimmy Goldsmith, founded *The Ecologist* in 1969 and masterminded *A Blueprint for Survival*, one of the first of the doomladen tracts on the future of the planet that were published in the 1970s. Since then, he has carved for himself an important role in the world of campaigners who spend their days trying to influence the decisions of governments, aid agencies and funding bodies such as the World Bank.

During that time, Goldsmith has been called a "green imperialist" and even a "green fascist" for his determined opposition to schemes to bring the poor world into the



mainstream of the world economic system. But this week he will lead into the UN offices in New York a delegation mostly made up of Third World environmentalists to present two documents. The first is a petition signed by more than three million people calling for an emergency debate of the UN General Assembly to rethink international strategies for saving the rainforests.

The second document is a radical manifesto agreed at a meeting in April of pressure groups from round the world under the umbrella title the World Rainforest Movement. The manifesto, "An emergency call to action for the forests, their peoples and life on Earth", threatens to split the international environment movement down the middle—at a time when the greens have won international acceptance for their case that tropical rainforests are a unique resource that must be saved. It calls for a ban on most large aid programmes, including those designed to save the rainforests, and a ban on trade in timber from virgin rainforests.

To many, this sounds like "green imperialists" trying to pull up the ladder of economic development before the nations of the tropics can clamber aboard. *The Ecologist* added ammunition to this claim when it argued that "Third World countries must only import those manufactured goods which they can pay for without selling off their forests..."

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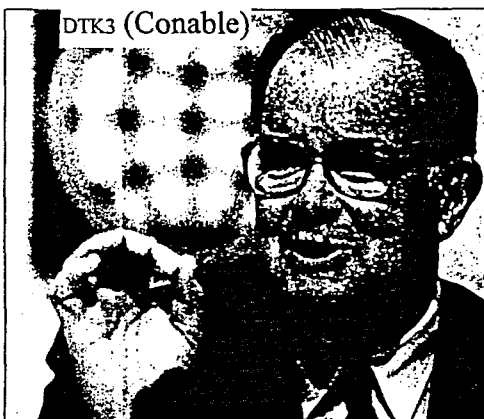
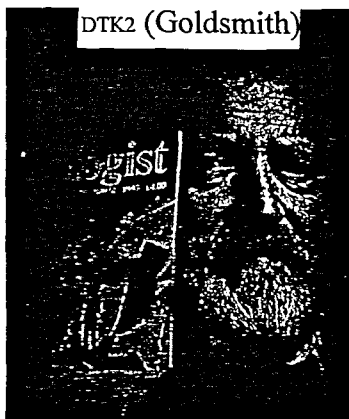
and that development banks and aid agencies should be "prevented, by law if needs be, from lending money to finance any non-essential imports and expenditure on infrastructure over and above that which Third World countries can really afford financially, socially and ecologically".

This is harsh medicine, almost green monetarism. Yet the message has the support of many important pressure groups in tropical nations such as Malaysia, Indonesia and the Philippines, as well as in Europe and Japan. More conservative environmental groups, particularly those in the US,

oppose it vehemently: most of them are committed instead to campaigning strategies to "green" the development process by changing the policies of the World Bank and other aid agencies. Despite the efforts of a few campaigners to bridge the gap, there is a wide gulf between these two views on how to save the forests and improve the lot of the poor in the Third World.

For Hildyard, the real imperialists are the aid agencies. "People in the tropics see very dramatically what in one generation development strategies have done to their countries," he says. "They see an immediate choice between the Western method of development or going their own way." He believes that the Western path leads to ecological and economic disaster.

There is common ground around the world that something must be done to save the rainforests. Under sustained assault from Goldsmith and many others, the World Bank, under its new director Barber Conable, has announced its own conversion to green issues. The bank has formed an environmental department to review the impact on the environment of all projects that it proposes to fund. The bank admits to many



Two views on saving the rainforests: Teddy Goldsmith (left) and Barber Conable of the World Bank

past sins. At a conference in London last November, one of its environment specialists, Roger Goodland, spoke of a vast project to mine iron ore in the Amazon basin in Brazil that had turned into a "potential disaster of gigantic proportions" when the government decided to smelt the ore in the forest, fuelling its smelters with local wood.

Harried by moderate pressure groups in Washington, such as the World Resources Institute and Environmental Protection Institute (which is now merged with Friends of the Earth US), the bank has produced a Tropical Forest Action Plan. This admits that "costly mistakes associated with past emphasis on massive development projects must be avoided", but insists that the answer to the problem is more aid for development. Conable wants from governments, aid agencies and industrialists "a greatly expanded and coordinated global effort to sustain tropical resources".

Worldwide aid to preserve the forests should double to \$800 million a year. But the money will not be spent on protecting virgin forests from timber companies. It will be spent on forestry. "The traditional approach of protecting and conserving forests as natural resources independent of their

The Goldsmith connection: swapping debts for nature

THE WORLDS of Teddy Goldsmith and his financier brother, Jimmy, come together in the idea of "debt for nature" swaps. The intriguing idea has been promoted most assiduously by the World Wildlife Fund (WWF) in the US. It suggests that poor nations that are heavily in debt to the rich world's banks should be relieved of part of that debt in return for promoting conservation in their own countries.

So far, most of the deals have been small and ad hoc, struck often as a result of individual initiatives by people such as Thomas Lovejoy at the WWF. In May this year, for instance, Costa Rica agreed to spend \$17 million on its Guanacaste National Park, in return for being relieved of \$24 million of debt. But there is hope in the US that huge deals could be struck in future.

At Margaret Thatcher's heavily publicised meeting on climate change in April this year, Jimmy Goldsmith proposed the establishment of an international organisation (he called it Foresteo) that would systematically buy up debts and strike deals with debtor

nations in which they would pay the interest on the debt by "protecting their forests for the good of all".

Many in the poor world have reacted angrily to these ideas. Some governments, such as Brazil, see them as an attack on their national sovereignty—an attempt to annex the rainforests. Even pressure groups in the poor world, which are anxious to protect the rainforests, oppose the swaps. They say the debts were illegitimately incurred during the 1970s, when banks were desperate to lend their huge reserves of petrodollars. "Can't pay, won't pay" sums up their attitude.

This response has embarrassed Nick Hildyard and Teddy Goldsmith. In "Save the Forests: Save the Planet", published in a special issue of *The Ecologist* in 1987, they argued strongly for such swaps as the first stage of a "plan of action" for the forests. But they met a wall of opposition from their allies in the Third World. Last April's meeting of the World Rainforest Movement, which adopted most of *The Ecologist's* other ideas in its declaration, specifically opposed debt for nature swaps. That brought anger from other

quarters—such as Koy Thompson at Friends of the Earth UK, who tries to steer a course between the various factions in his rainforest campaigning. A revised version of the manifesto makes no mention of swaps at all.

Nonetheless, Hildyard still backs the idea. He is, he says, currently asking groups in countries such as Brazil and Thailand if there are any kinds of debt swaps that they would support. For Hildyard and Teddy Goldsmith, the key to successful swaps is that they should be "big and systematic": on the scale, in other words, of the debts that started the trouble. "The current problem with the swaps," he says, "is that because they are so small, they do not challenge the development process. They shore it up by rescuing Third World economies. Larger deals could alter the development process itself."

That may not be quite Jimmy Goldsmith's idea. He believes that the swaps will "help the economies of the host nations off the rocks and reintroduce them into the world economy", precisely what his brother does not want. □



DTK4 (forest products)

Trees yield fruit, nuts and medicines as well as timber

surroundings is no longer appropriate," says the plan. The bank and its allies among more conservative environmental groups believe that it is only by taking charge of the tropical forests, and by allowing companies to make money out of them, that the world can save the rainforests. With the exception of reserves set aside for their unique biological features, the forests must cease to be a common resource. They must be fenced, owned and managed for profit if they are to survive.

While Goldsmith and the radical environmentalists want a ban on all timber cutting in virgin rainforests, their opponents believe that this would be impossible to police and disastrous—a charter for the uncontrolled destruction of the forests by poor farmers, ranchers and loggers alike. Who is right?

The International Union for the Conservation of Nature and Natural Resources is the world's premier arena for scientific concern about the environment. The union's data-collecting offshoot, the World Conservation Monitoring Centre, operates from a Portakabin parked in a lane on the edge of Cambridge. There, Mark Collins is compiling a rainforest atlas of the world and probably knows more than anyone about the state of the rainforests. While the world throws up its hands in horror at the burning of the Amazon, he points to the uprooting of the trees of the Philippines. "It is in the most appalling state," he says, "disappearing at a fantastic rate. Virtually all of the pristine rainforest is gone." While almost 20 per cent of the country is technically forested, much of this land is seriously damaged. There is virtually no forest left on the central islands.

Collins is especially interested in national parks and other areas that are of scientific interest for their genetic diversity or uniqueness. He fears for the national park of Mount Apo in Mindanao, the main southern island. The park is the home of the country's national emblem, the Philippine eagle. It is now an isolated forest and people are moving into the national park. The loss of forests in the Philippines is being repeated in nearby Sarawak in Malaysia. And the logging companies,

determined to meet the needs of Japan, the world's largest market for tropical timber, have their eyes set next on Burma, Laos, New Guinea (almost 80 per cent of which is still forested) and the Amazon rainforest, which is currently being destroyed by farmers rather than loggers.

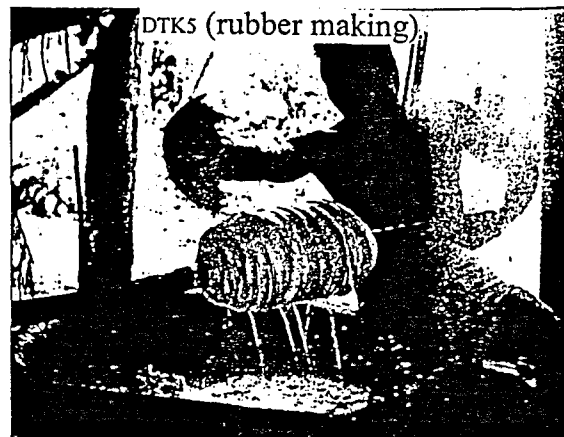
Collins and the IUCN support the World Bank's Tropical Forest Action Plan. "The forest must be managed," says Collins. Bans on logging are counterproductive. He points to an inventory of forest resources carried out last year by the Philippine government with German assistance. The inventory showed that on islands where logging is banned, such as Mindoro and Marinduque, rates of deforestation have been higher (average 3 to 5 per cent per year) than in areas that are managed (where the average is 0.5 to 2 per cent).

The goal of the Tropical Forest Action Plan is "sustainable forestry": livelihoods made out of the forest without the forest itself being destroyed. It sees managed, commercial forestry as the means to this end. For the World Bank's allies this is a hard but attainable objective. "Properly used and managed," says the plan, "the tropical forests constitute a massive potential source of energy, a powerful tool in the fight to end hunger, a strong basis for generating economic wealth and social development, and a storehouse of genetic resources to meet future needs." The idea of sustainable forestry is a myth, say the radicals. They point to a recent study for the International Tropical Timber Organisation, a body set up recently by governments to oversee the tropical timber business and improve its environmental record. It found that less than one per cent of all forest lands were "sustainably" managed—though the phrase remains notoriously undefined.

In practice, says *The Ecologist* in an editorial this month, sustainable logging is unattainable. "Any plan that seriously seeks to conserve biological diversity must exclude industrial logging from primary [that is, virgin] rainforests," it says. "Corruption, commercial pressures, the high rate of return expected on capital, the ravages of heavy machinery make [sustainable logging] a pipedream," says Hildyard.

For Collins, people like Goldsmith and Hildyard are doing the worst possible thing. He admits that he worries at the havoc caused by the commercialisation of the forests: "The thought of turning mangroves into bog paper fills me with horror." But the IUCN's primary aim, he says, is to prevent companies from clear felling (that is, ripping up) rainforests to make way for new plantations. It wants to encourage companies to adopt sustainable management of existing forests, harvesting and renewing them gradually as a long-term investment.

"If people like Goldsmith insist that sustainable development of natural forests is not possible, then economists will conclude that you cannot manage them and the companies will



DTK5 (rubber making)

Rubber is another natural resource of rainforests

clear the lot for plantations. It's a fatal argument," is Collins's view. This hardly does justice to *The Ecologist's* case, though. Hildyard and Goldsmith argue that, as sustainable logging is not possible in primary rainforest, eventually timber will have to come from areas planted for the purpose.

The tropical rainforests are undeniably at a dangerous crossroads. Their tragedy is that they are being managed neither in the traditional manner, by hunters and shifting cultivators making their livings from the forests without destroying them, nor by strong state forest agencies or commercial companies willing and able to adopt strategies for the long-term management of a sustainable resource.

Argument persists between the two camps of conservationists about who is to blame for the destruction of the rainforests. Commercial logging is directly responsible for only a fifth of the loss. But related activities, including road building and damage to other trees as logs are hauled through the forest, increase the toll. More critically for the political debate, the construction of roads in logging areas opens up huge tracts of forests to the landless poor of the tropics, who then move in to carry on a version of the traditional method of "shifting cultivation" that has characterised farming in the forests for thousands of years. Often these new shifting cultivators cannot leave the forest soil long enough for it to recover its fertility before returning to clear the trees and farm again. And many people, thrown off farm estates or fleeing from urban shanty towns, have neither the skills nor the determination to maintain the forest environment.

The analytical confusion created by loggers "opening up" forests for farmers has allowed two strands of argument to develop. Thus, Hildyard uses the data to argue that the timber industry is responsible for as much as half of the destruction of the rainforests; the Tropical Forest Action Plan, equally correctly, can claim that "nearly half the forests cleared in the tropics each year make way for shifting cultivation". Hildyard concludes that commercial development of the forests is at the root of their destruction, while the World Bank deduces that lack of commercial development, by creating armies of landless poor, is to blame.

Hildyard characterises the World Bank's position as tantamount to blaming the poor for the destruction of the forests. This, *The Ecologist* says, "is a gross and evil charge". But Collins argues that "countries are no longer big enough for shifting cultivation. We need gazetted, policed forests." Unless such action is accompanied by other measures, such as land reform to improve the lot of the landless poor, then the poor will pay the penalty for the commercial development of the forests.

In place of the chimera of sustainable logging, Hildyard offers a new future for economic development of the rainforests as "extractive reserves". The basis for this idea is the growing realisation that forests contain other economically valuable resources besides timber. When the UN's Food and Agriculture Organisation conducted a global study of forest resources in 1980, it considered only timber. Yet a recent study of a small patch of Amazon rainforest found that fruits and latex represented 90 per cent of the potential commercial value of the forest and wood just 10 per cent. Reporting the study in *Nature*, Charles Peters, of the New York Botanical Garden, pointed out that the most immediate and profitable way to combine use of the Amazon forests with their conservation was to exploit these other resources. The same is likely to be true for many other primary rainforests.

Why are such resources not being developed? Peters concluded that while tropical timber is a "highly visible export commodity controlled by the government... non-wood resources are sold in local markets by an innumerable number of subsistence farmers, forest collectors, middlemen and shop-owners". They are "extremely hard to monitor and easy to ignore in national accounting systems".

The finding is a ringing endorsement of both *The Ecologist's* ideas and those of Chico Mendes, the former leader of the



Chico Mendes: a catalyst for "extractive reserves"

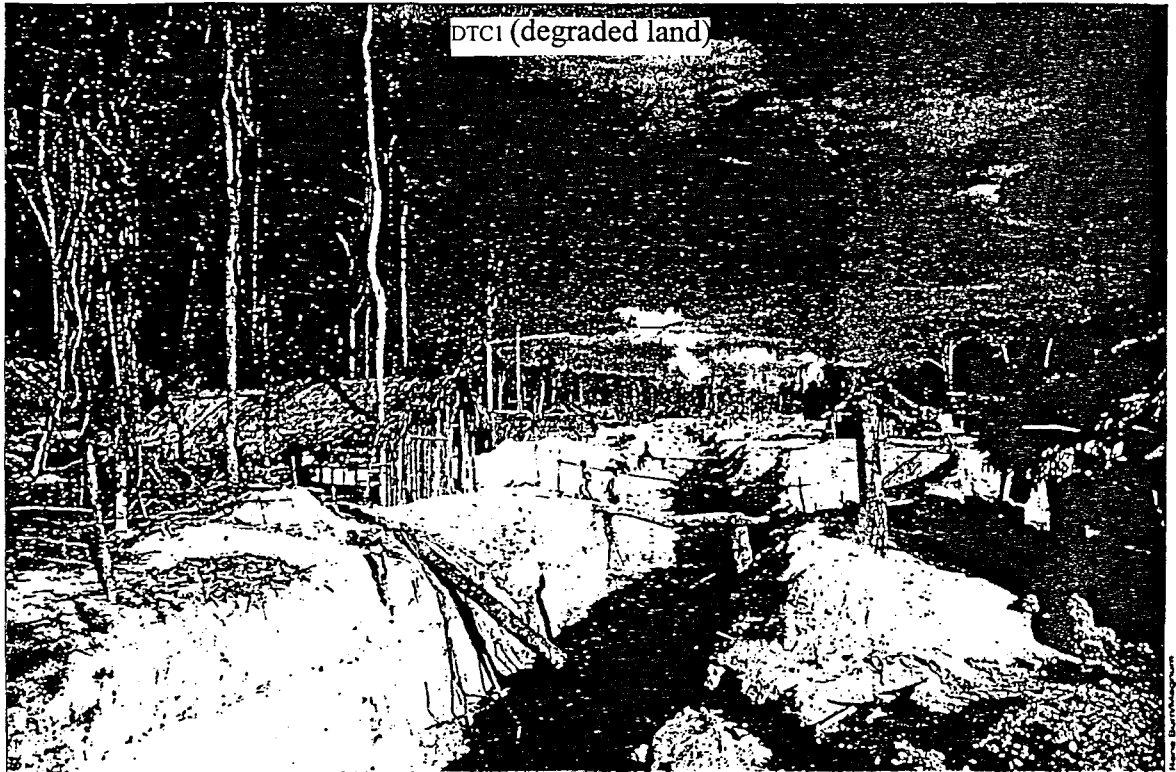
rubber tappers in the Brazilian forest province of Acre. Mendes was shot dead last December by commercial farmers who were angry about his campaigning for extractive reserves.

The highly publicised murder of Chico Mendes has acted as a catalyst for new calls for extractive reserves. The International Tropical Timber Organisation, with backing from the World Wildlife Fund in the US, has funded a development project in Acre that will try to balance sustainable commercial production of tropical timber with the needs of indigenous peoples and the activities of local communities that exploit other forest products, such as natural rubber and Brazil nuts. [It remains to be seen whether all these aims are compatible.]

The Ecologist points out that the tropical timber industry destroys other resources, including the trees that provide fruit, nuts, medicines and gums. [Even so, extractive reserves provide the greatest hope that the burning of the Amazon by poor farmers and cattle ranchers could be halted. They offer the prospect of commercial development of the rainforest, but a development attuned not to the short-term needs of remote governments and commercial conglomerates but to the long term needs of the forest dwellers.]

For that to happen, research is essential. In a lengthy interview just before his death, Mendes argued that: "There are an infinite number of natural resources in the forest... We want the government to encourage the industrialisation and marketing of forest products that it has always ignored in the past. The universities should spend some time researching the Amazon region. If this happened, and the government took it all seriously, then in 10 years the Amazon region would be very rich and have an important role in the national economy." It would also still have its trees. [

Fred Pearce is researching a book on the international environment movement. Further reading *In the Rainforest*, by Catherine Caulfield, Heinemann 1985. *Fight for the Forest: Chico Mendes in His Own Words*, Latin American Bureau, 1 Arnel Street, London EC1.



The tropical chainsaw massacre

TTL Environmental campaigners call for an end to logging in the rainforest; aid agencies counter with a call for "sustainable" management. But the buyers and sellers of tropical timber have the wherewithal both to slow the destruction of forests and to conserve species threatened with extinction

Sara Oldfield

WHEN Margaret Thatcher decided that Number 10 needed embellishing with a touch of Brazilian mahogany, she severely damaged her carefully cultivated image as a green-tinted Prime Minister. While protesting concern for the world's rainforests, she was contributing to their destruction. The contradiction highlights one of the biggest threats to the rainforests: the lack of clear and sensible policies on the import of tropical timber by the same governments that condemn the indiscriminate felling of the forests.

The destruction of tropical forests is one of the worst ecological disasters of the 20th century. It is the key to the most serious environmental problems: mass extinctions, global warming, shortages of natural resources, and the displacement and suffering of tribal people who live in the forest. Deforestation is about supplying basic human needs in the developing world and supplying cut-price timber and pulp to rich nations hungry for resources. Caught in the downward spiral of international debt, tropical countries have little choice but to make short-term profits from their forest lands. One way to a quick profit is to "mine" tropical hardwoods for the international timber market. With few exceptions, the exploitation of forests for tropical timber is poorly planned and badly managed. But in the long term, the countries with



rainforest will pay a high price for their quick profits: the trade-off is the loss of a biological resource that has the potential to offer more than a few species of trees (see "Kill or cure? Remedies for the rainforest", *New Scientist*, 16 September).

Logging is only one of many factors that lead to the loss of tropical forests. It is difficult to quantify the contribution commercial logging makes to the destruction of tropical forests. But in sparsely populated states such as Sarawak, in Malaysia, and parts of central Africa, commercial logging is clearly the driving force behind the clearance of forests. In itself logging does not lead to total deforestation, but falling timber usually brings down smaller trees around it and more trees topple as heavy machines drag the timber through the forest. Logging operations also open up the forests to other agents of change. Poor people, hungry for land, follow the access roads built by logging companies and clear themselves patches in the forest close to the roads. Government policies often encourage people to settle in logged areas, however inappropriate they are for growing crops.

Whatever the role of the timber companies in destroying tropical forest, the international trade in tropical timber has become the focus for environmental campaigns in consumer countries. These campaigns are beginning to have a significant

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Forest flooded: hardwood planks pile up in a timber yard in Sarawak

effect on the international market in tropical timber. In Britain, the Netherlands and West Germany, for example, environmental groups are calling for boycotts of goods made from tropical timber from forests that are not managed on a sustainable basis. The impact of environmental campaigns dominated discussions at the meeting of the International Tropical Timber Organisation (ITTO) held in Abidjan, in the Ivory Coast, earlier this year.

Chain stores against chainsaws

In Britain, Friends of the Earth has focused on timber products. About 200 retailers in Britain have stopped selling goods made from tropical wood that has not come from properly managed forest. Most of these are small companies, but two large chain stores, Laura Ashley and Habitat, also take this stand. More than 30 local authorities have placed conditions on the use of hardwoods, generally refusing to buy any that come from forests that are not managed sustainably. In West Germany, more than 150 towns and communities have officially banned the use of tropical hardwoods. A campaign launched in the Netherlands at the end of 1988 is beginning to have some effect: by February this year, 40 per cent of Dutch municipalities had decided to cut down on the use of tropical hardwoods.

The consumer campaigns have produced heated reactions in trade circles. Manufacturers and importers are generally defensive, emphasising how much damage boycotts could do to the economies of developing countries that rely on timber exports. They argue that if logging stops, the forests could suffer something much worse, such as total clearance to make way for plantations of cash crops. And, without revenue from timber, these countries cannot afford to make any attempt at conservation. The arguments certainly ring true, but they do not justify the current wasteful way in which tropical forests are exploited. According to Simon Counsell, a campaigner

with Friends of the Earth, the most encouraging result of FoE's campaign is that retailers are passing the message back to their suppliers that more and more people refuse to buy goods they see as damaging the rainforest. The suppliers, in turn, are sending the same signals to their importers.

Now there are signs that bad publicity is increasingly forcing furniture makers and builders to substitute temperate hardwoods for tropical woods. Some have begun to use plastic or aluminium covered by thin sheets of veneer where previously they used mahogany and teak.

The European Parliament recently agreed a series of measures to help to protect tropical forests through controls on the timber trade. It proposes to encourage and help to pay for all the timber-producing countries to prepare plans for managing and conserving their forests. Each country is allowed five years to prepare its plans and during this time the community will negotiate appropriate imports of timber from each country. After five years, all imports of tropical hardwoods into the Community would be controlled by a quota system. Imports of timber from tropical countries without a management and conservation plan would be phased out. Whether five years is long enough to sort out a rational and sustainable industry in tropical timber remains to be seen. The task is monumental: virtually all tropical wood entering the world market is extracted from natural forests. Less than 0.2 per cent of tropical forests are managed to produce a sustainable harvest of timber.

The ITTO has a central part to play in promoting management of natural forest in a way that will sustain an industry in tropical timber. The organisation operates the International Tropical Timber Agreement, adopted in 1984 by 36 countries that produce tropical timber and 33 that consume it. The agreement aims to encourage exporting countries to conserve tropical forests both to supply the timber trade and to maintain the genetic diversity and ecological balance in the region concerned (see "Spare the tree and spoil the forest", *New Scientist*, 26 November 1988). The ITTO works through its council and three permanent committees with a small secretariat based in Yokohama in Japan. Much of the organisation's work is tied to projects that are funded through the aid agencies of consumer nations. The project proposals are sometimes seen as the commodities being traded between the producer and consumer countries, in an attempt to secure more international funding for investment in tropical forestry.

Until recently the organisation has been limited in what it can do because it had little cash and few staff. But there are signs of growing support for ITTO, as the organisation defines its objectives and the governments of consumer nations are increasingly inclined to use it as a vehicle for conserving tropical forests. At the recent ITTO meeting in Abidjan, member countries agreed to pay more than \$8.9 million to the organisation. In the European Community, France, Italy and the Netherlands all agreed to contribute but so far the British government has not offered any funds. The international trade in tropical wood is worth more than \$6 billion a year: clearly there needs to be an international mechanism to channel funds back to conserve the resources the trade depends on.

The ITTO has commissioned studies on key issues in tropical forestry to guide it in its policymaking. One study on the status of natural forest management, for example, has already influenced the thinking of the ITTO's permanent committee on reforestation and forest management. The study, carried out by the International Institute for Environment and Development (IIED), showed that almost none of the countries with tropical forests manage them on a sustainable basis. The institute found successful examples only in Peninsular Malaysia and Trinidad and Tobago.

There are so few successful models of sustainable management, however, that the definition of "sustainable" is not clear and is open to interpretation. The ITTO now accepts that sustained yields are possible only if four basic conditions are

fulfilled: security for the forest in the long term; controls on logging operations; confidence in the market for tropical woods; and, finally, that those who have to make decisions have enough information on which to base them. Control of logging has the biggest impact on the state of an area of forest and its capacity to recover after logging. Clearly, the amount of timber felled should never exceed the reproductive capacity of a species in a given area, nor should it damage the ecological stability of the forest.

Various systems of managing tropical forests have been introduced in Africa and Southeast Asia, but too often these have been abused because of the pressure to make a quick profit. The reasons for failure are not usually technical but rather the result of a poor policy for land use and a lack of political will. If countries do not set aside permanent areas of forest and introduce national policies for forestry that take into account market forecasts and economic planning, sustainable management will remain an elusive goal. Natural moist forests that could have sustained a timber industry in the Ivory Coast, Nigeria and Thailand have already virtually disappeared.

Selection changes the shape of the forest

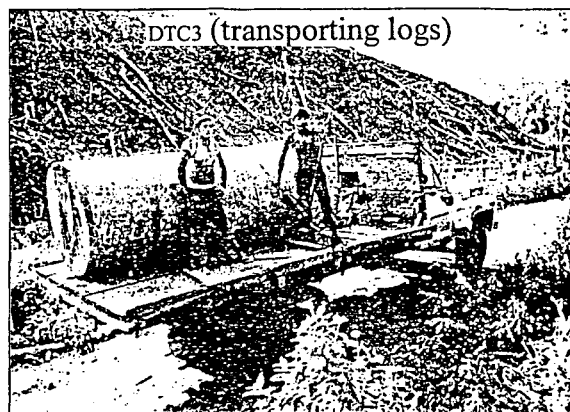
One of the most widely used systems for managing tropical forest is the selective management system. Countries in Africa and Asia have tried it with various modifications. This system is based on a "minimum girth", so that trees are felled only when they reach this size, and timber is extracted in a cycle of 30 years or so. According to Simon Reitbergen, a forester working for the IED, the limits are often so low that trees are cut before they reach their full economic potential. Logging too many trees too often not only damages the structure of the forest, by removing all the large trees, it also leads to genetic erosion of valuable species, by removing the best specimens from the gene pool.

Traditionally, loggers have concentrated on a small number of species of hardwood, generally those that are attractive to a conservative international market. Tropical countries that sell their timber are trying increasingly to promote less well-known species. Even so, of Amazonia's thousands of species of trees, only about 50 are exploited widely. African countries export fewer than 50 species of hardwood; and only 15 of those account for the bulk of the African trade. Commercial exploitation of the most popular tropical timbers over the past century threatens to destroy the trade in those woods. It also threatens some of the species with extinction in parts of their natural range.

Afromosia, *Pericopsis elata*, is one of the world's most valuable hardwoods. It is a good example of a tropical tree that is mined as a resource with little thought for its conservation in the long term. Afromosia grows mainly in pockets of the Ivory Coast, Ghana and countries of central Africa, and now faces extinction in the wild. Ten years ago, the National Academy of Sciences in the US drew attention to the plight of afromosia, calling for the establishment of reserves for the species. More recently, the United Nations Food and Agriculture Organization included the species in its data book on endangered trees and shrubs.

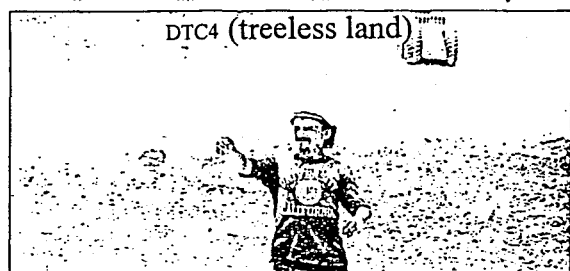
The timber, with its teak-like qualities, has been traded internationally for the past 40 years. The lucrative trade encouraged heavy logging of natural stands. Unfortunately, the species grows very slowly, so natural regeneration takes many years and foresters rarely bother to plant it. In relatively undisturbed areas of natural forest, loggers tend to take afromosia before any other timber. In eastern Cameroon, for example, it is one of the few species exploited in virgin forest. Now the stocks in the scarcely populated forests of northern Congo are beginning to attract the attention of logging companies.

Afromosia is only one of many tropical species that are threatened by logging. In the Ivory Coast alone, the International Union for Conservation of Nature and Natural



DTC3 (transporting logs)

Big is best? Loggers take the biggest and choicest trees first



DTC4 (treeless land)

Treeless Brazil: once a forest, now a runway

Resources (IUCN) classes some of the most valuable hardwoods as "vulnerable", meaning that the species could become extinct within the country unless action is taken very quickly. Species under threat include: acajou, *Khaya ivorensis*, traditionally the main timber export from the country; other mahogany-like redwoods such as *Khaya anthotheca* and *Khaya grandifoliola* (also called acajou in trade); sipo or utile, *Entandrophragma utile*; bosse, *Guarea cedrata*, and bahia, *Mitragyna ciliata*. Similar species are already endangered in Liberia, where loggers and shifting cultivators have felled huge numbers of trees. In Ghana, too, the so-called African mahoganies are threatened; stocks of iroko, *Chlorophora excelsa*, another choice timber, are expected to last only another 12 years at the present rate of felling. Ghana has banned the export of logs of afromosia, iroko, five species of *Khaya* and *Entandrophragma*, and 11 other species.

In Southeast Asia and Latin America, valuable timber trees also face intensive pressures from logging. Two species of *Intsia*, *Intsia bijuga* and *Intsia palembanica*, known as merbau, ipil or Borneo teak, provide one of the most valued timbers of Southeast Asia and the southwest Pacific. A decorative timber of high quality, *intsia* is popular for furniture, window frames and parquet floors. Most natural stands are almost worked out, except in parts of Indonesia and Papua New Guinea. Peninsular Malaysia is also running out of some types of trees: *Intsia palembanica* and other valuable timbers such as ramin, *Gonystylus bancanus*, and agathis or damar minyak. *Agathis borneensis*, are also in short supply. The country bans the export of logs of 16 species.

The archetypal tropical timber, Brazilian mahogany, *Swietenia macrophylla*, is widespread in South America. According to the IUCN, however, it is endangered in parts of its natural range. In the scramble to exploit the shrinking supplies of mahogany, loggers have felled them in nature reserves and in Indian reserves in the states of Rondonia and



Mark Edwards/Sill Pictures

Gaining entry: development follows in the path of commercial logging. Timber trails open up the heart of the forest

acre. Between 1985 and 1988 at least one-third of all mahogany logs were extracted illegally from Indian reserves. Armed guards now protect access roads to the forests and Brazil has introduced tighter controls on the exploitation of mahogany.

As yet there are no effective international measures to restrict or monitor trade in those species threatened by excessive exploitation. A handful of Central American species, including a mahogany (*Swietenia humilis*), are listed in the appendices of the Convention on International Trade in Endangered Species (CITES). The listing provides theoretical controls over trade. These species do not figure much in international trade, however, and there are proposals to remove most of the trees from the CITES lists at the meeting of the convention in Lausanne next month. The European Parliament recognises that CITES could help to strengthen protection for certain species of forest trees, and the government of Ghana is considering the addition of some species of African mahogany to the convention. How effective this move would be is open to question. The ability of CITES to control the trade in threatened species of tropical timber has scarcely been tested.

At the same time the ITTO is considering its role in conservation—as a protector of species as well as the protector of an industry. As a first step, the organisation has commissioned the World Conservation Monitoring Centre, based in Cambridge, to review the status of those species of tropical timbers being traded. This will pull together information from scattered sources into a central database. The review will consider the effectiveness of existing conservation measures and will look at the feasibility of monitoring the trade in rare species.

Any scheme to manage forests on a sustainable basis must consider individual species. "Sustainable" production must not mean that loggers are allowed to move from one area of forest to the next or switch trade from one species to another as

stocks run out. Cropping a wider range of species is less wasteful, but there are dangers in promoting trade in less well-known species without studying the distribution and abundance of those species. The International Institute for Environmental and Development has commissioned the International Institute for Environment and Development to explore the possibilities of trading in less popular species.

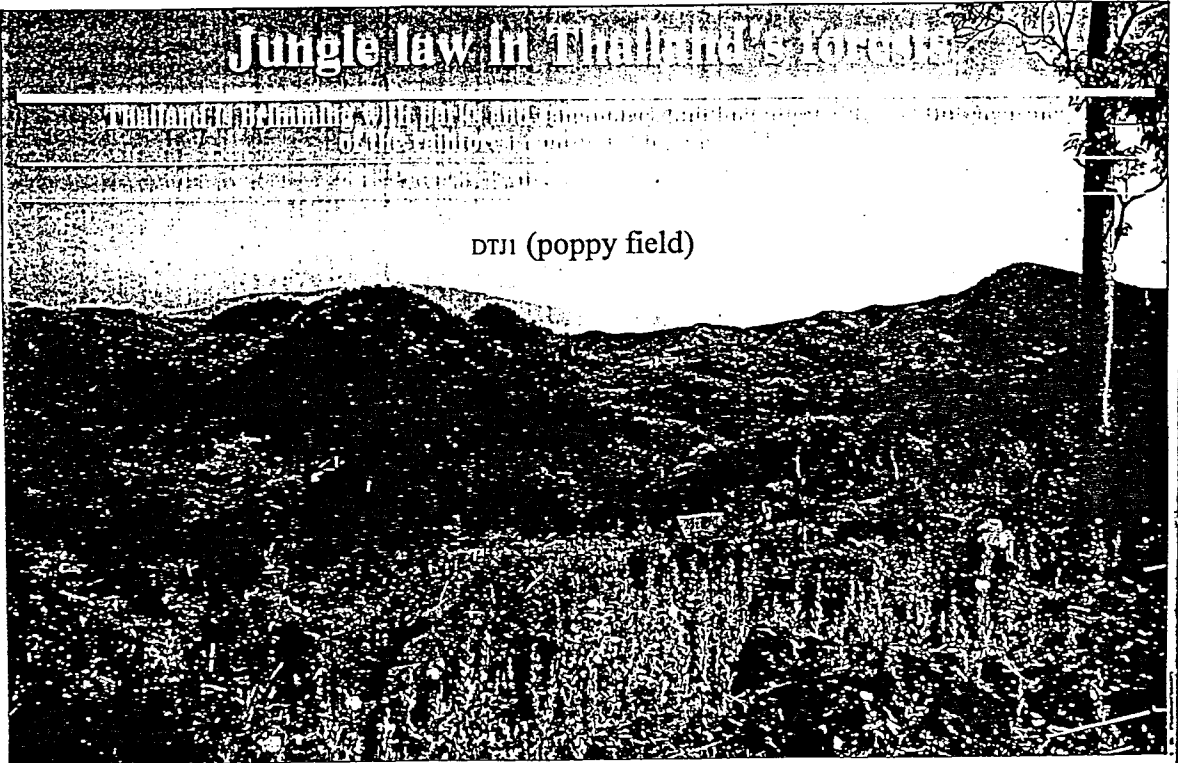
The timber industry itself is taking an increasingly positive attitude towards conservation. In February, the Federation of European Timber Trade Associations backed a proposal to create an ITTO fund for managing tropical forests, by imposing a levy on tropical imports to the European Community. The German Timber Importers Federation has introduced a code of conduct for German companies involved in logging in tropical forests or in trade in tropical species. Some environmental groups greeted the code with scepticism but admitted that it might be a small step in the right direction. In other countries, such as Denmark and the US, representatives of trade and environmental groups have met to try to work out common aims and accords. Even in Japan, the largest consumer of timber, the Japanese Lumber Imports Association, a voluntary association with more than 80 member companies, has established an environmental committee that will consider making contributions to ITTO and will discuss policy with environmental bodies.

Whatever the economic pressures consumers apply, governments in the producer countries have the final say. Thailand announced a complete ban on logging last year; and the Philippines has banned the export of raw timber. Clearly, some countries now realise that the environmental benefits from their remaining tropical forests are too valuable to sacrifice for quick profits. □

Sara Oldfield is a botanist working for the Wildlife Conservation Monitoring Centre in Cambridge. She is currently working on a study of the conservation status of tropical timbers in trade for the ITTO.

TTL

GLM



Illegal crop: opium poppies grow where virgin forest once stood

THAILAND is one of the wealthiest and most stable countries in Southeast Asia. Much of the wealth has come from the country's tropical forests. And much of what has not been logged for timber has been cleared to grow food for a rapidly expanding population. Today's population of 52 million looks likely to reach 75 million by the year 2000. In the past three decades, the Thai government has responded to the loss of its forests and other natural habitats by introducing a range of legislation to protect wildlife and by establishing a network of national parks and other reserves.

Thailand's forests are no longer extensive but its National Parks are. Since 1961, Thailand has created 52 parks, covering 4 per cent of the country. The parks aim to conserve natural resources and landscapes while allowing people to use the parks for recreation and research. A further 4 per cent of the country is covered by 28 wildlife sanctuaries, and 41 non-hunting areas (NHAs), mostly in wetlands, account for less than 2 per cent of the land.

With an arsenal of environmental legislation and nearly half of its virgin forests now in protected areas, Thailand looks a shining example of conservation in action. But it is not. The country has the mechanisms for preserving what is left of its forests—yet it is failing. Commitment to implement the impressive range of policies is lacking. And the parks and reserves do not have enough money and people to do their job properly. The government is faced with problems that it sees as much more serious than those of nature conservation: immigration, the opium trade and other political and economic pressures.

Yet the loss of the forest has brought huge problems on a par with these. Last year, Thailand suffered its worst natural disaster for many years. Flooding and landslides, directly



attributable to deforestation, killed hundreds of people. The disaster prodded the government into action. Almost immediately it banned all logging and revoked forestry concessions. The government declared 1989 the Year of Nature and Environmental Protection. But if the country is to avoid future disasters, the government will have to implement its own laws with more conviction than it has in the past.

Half a century ago tropical forests dominated the Thai landscape, much as they do in Burma today. Commercial logging, especially of teak, *Tectona grandis*, was a major industry, but timber is now in short supply. Many Thai sawmills have begun to process wood smuggled across the border from Burma. Satellite images show that by 1985 less than a third of Thailand remained forested; most of the forests are restricted to remote upland areas. There is even less virgin rainforest: satellite images do not distinguish between primary forest and degraded woodlands.

Pressure on the remaining forest comes from the growing population and from the government's inability to control the immigrant hill tribes and other groups such as the Khmer Rouge, around the border with Cambodia. All the fertile lowland regions are already cultivated intensively, for rice and vegetables, which is forcing farmers to spread uphill into uncultivated areas, including protected virgin forests. Higher in the hills, tribespeople from Burma, Laos, China and Cambodia are clearing the forest for subsistence farming and growing opium. These people do not acknowledge Thai law and their culture does not recognise the concept of land ownership (see Box 1).

In a densely populated country such as Thailand, there is a major conflict between development and protection of the environment (see "Kill or cure: remedies for the rainforest").

KEY:

TTL - TITLE

GLM - GLIMPSE

PRB - PROBLEM

SET - SETTING

PRO - PROPHECY

THR - THREAT

TLI - TECHNICAL LEAD-IN

SPC - SPECIFIC CLAIM

GCL - GENERAL CLAIM

BRG - BRIDGING

EVN - EVALUATION

ONP - ONGOING PROJECT

PRE - PREDICTION

CNS - CONCERNS

SLN - SOLUTION

SGN - SUGGESTION

SUM - SUMMARY

CON - CONCLUSION

ANX - ANXIETY

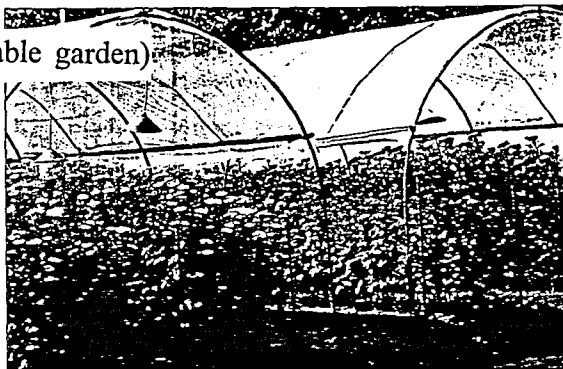
SPN - SPECULATION

COL - CALL FOR COLLABORATION

REC - RECOMMENDATION



DTJ2 (vegetable garden)



Legal crop: farmers clear the forest to grow cabbages, carnations and strawberries, with the blessing of the government

New Scientist, 16 September). The conflict is most intense in upland regions, where the remaining areas of forest are the only places where people can make a living by clearfelling and turning the land over to agriculture.

Doi Inthanon is a striking example of a national park that has gained little from its status as protected land. The highest peak in Thailand (2576 metres), Doi Inthanon lies 60 kilometres southwest of Chiang Mai, the northern capital. A wide range of types of forest cover the mountain slopes, from evergreen cloud forest with a spectacular sphagnum bog near its summit to deciduous dipterocarp forest at lower altitudes. Some species of plants and animals live only on this mountain. Recognising its value, the government created the Doi Inthanon National Park in 1972, designating an area of 482 square kilometres. But some hill people already lived there: in 1974, there were 490 Hmong and 1170 Karen in the park. Since then the population has more than doubled. By 1975, these people had cleared almost 15 per cent of the park to cultivate opium poppies and other crops. They had hunted and killed a large proportion of the large mammals in the park. These activities continue today.

Cabbages versus opium

According to the policy of the Royal Forest Department, the hill people should have been relocated outside the park, and no one should have been allowed to settle there. But virtually all lowland areas are already occupied, and, understandably, the hill tribes do not want to move. To make matters worse, rather than encouraging people to leave, the government set up a centre for agricultural development—despite objections from many conservation organisations in Thailand. The centre is part of the "Royal Project", launched by the King of Thailand in 1969 to wipe out the opium trade and encourage stable agriculture in the uplands. The reason

for such an illogical move at Doi Inthanon was that the government did not want to risk precipitating political instability by forcibly removing the people. In the past, the area has been used to cache arms and as a base for communist insurgents.

As a result of this encouragement, the most striking feature visitors to the park encounter is not wildlife, nor even recreational facilities, but a large and treeless valley cultivated with cabbages, carnations, peaches and strawberries. The development package includes a small power station, new four-wheel-drive trucks—and a monument to commemorate the King's 60th birthday. The monument cost 50 million baht (£1.1 million). The park's annual budget is 1.5 million baht.

According to the park's director, Pravat Woharndee, the agricultural project has not curtailed swiddening—the clearance and cultivation of forest land. Nor has it stopped hunting, illegal logging or opium growing. The park's low budget and a staff of 24 which shares 12 shotguns and three radios are not enough to deter hill tribes from their traditional activities. Intimidation is also a problem. A few years ago, poachers murdered two park guards who had caught and fined them. Pravat himself was shot by teak loggers while working in another park. But he remains committed to wildlife conservation and continues to press for more resources and better law enforcement.

A more insidious side of the agricultural development project lies downstream from the neat fields of fruit and vegetables. Few animals live in most of the watercourses. Ignoring instructions to the contrary, and despite a ban on the sales of pesticides in nearby towns, farmers apply heavy doses of DDT and other pesticides to their crops. One Hmong cabbage farmer in the park told *The Bangkok Post* that most fruit growers spray their crops every few days to guarantee unblemished produce. The hill people, he added, knew better

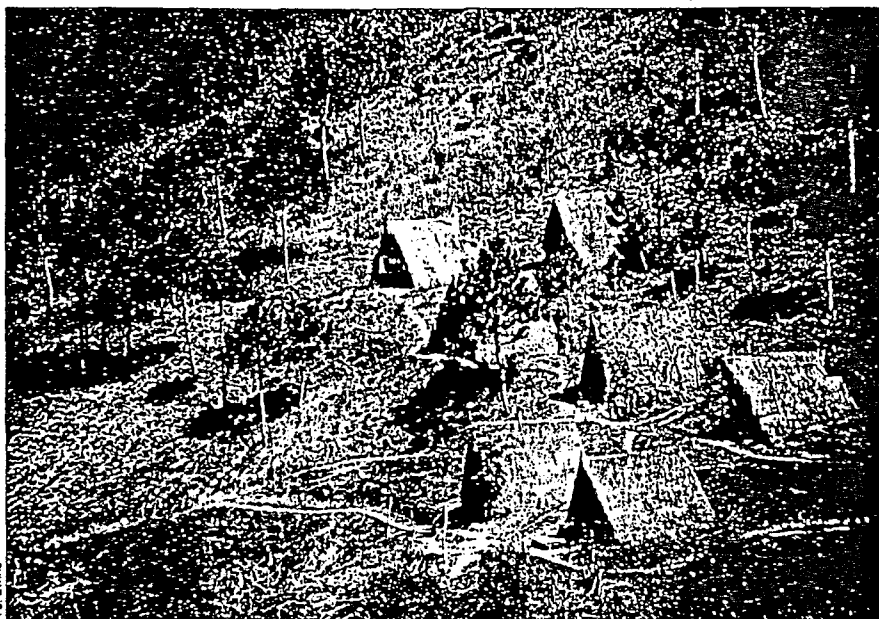
1: A clash between culture and conservation

THE HILL tribes of Thailand practise various forms of swidden culture. Swiddening involves clearing virgin forest, cultivating the land and then leaving it fallow for a period. The Karen and Hmong tribes account for two-thirds of the population of the uplands.

The Karen are mainly subsistence farmers. They live in fairly permanent settlements, growing rice, beans and a wide range of other crops. They cultivate swiddens (cleared areas) on rotation every ten years or so. The forest has time to regrow to some extent between times, helping to maintain the fertility of the soil. Karen tribes supplement their income by selling crops and forest fruits and hunting forest birds and mammals.

Hmong tribes are more mobile, living on maize or rice, much of which they buy. Their main cash crop is opium. Hmong tribes live at higher altitudes than the Karen and cultivate their swiddens continuously, hoeing deeply to release as many nutrients as possible as fast as possible. After 12 to 15 years, they are forced to abandon their swiddens because they are exhausted of all their nutrients. The patches are overgrown by a coarse, fire-resistant grass, *Imperata cylindrica*, and trees are slow to return, making the soil extremely vulnerable to erosion.

In 1969, King Bhumibol Adulyadej Maharaja launched the Royal Hill Tribe



Hill people have settled at the heart of Doi Inthanon

Development Project, now called the Royal Project, under the aegis of the Highland Agricultural Project. This was largely a response to the population explosion in the uplands, the increasing trade in opium and the damage to the environment that threatened not only the country's resources in timber and wildlife, but also most of the country's watersheds. The project aims to eradicate opium growing and improve living conditions for the local people by

establishing settled agriculture in the hills. It has received substantial financial and scientific support, including international help and funds.

Most observers regard the project as a success. In 1989 alone, almost 3000 farmers received help with improving their crops of vegetables. As a result, many hill tribes are beginning to realise that there are financial benefits to be had from joining the scheme.

than to eat the fruit. Thailand is the largest importer of pesticides in Southeast Asia. *The Bangkok Post* also reported a survey which showed that, in 1985, 24 people died and 2400 fell ill after eating food contaminated with pesticides. Most ornithologists blame the high concentration of pesticides in the environment for the absence of scavenging birds such as kites and vultures.

[[Pavin Punsri, coordinator of the Royal Project based at the University in Chiang Mai, regards the centre as a success.]] Little wonder when a cabbage farmer can earn as much as 200 000 baht a year—more than 30 times the average subsistence income. Not all National Parks share the fate of Doi Inthanon. A three-hour drive northeast from Bangkok through monotonous agricultural plains brings tourists, both Thai and foreigners, to a spectacular range of forested hills. This is the Khao Yai National Park, an ASEAN (Association of Southeast Asian Nations) Heritage Park and Reserve, ranked among the world's top ten national parks. Of all Thailand's national parks, Khao Yai has received most attention, nationally and internationally, both in terms of wildlife conservation and scientific research. The international focus has been on its ecology. But the reason the park's budget has trebled in the past few years is not purely concern for conservation. Rather, the concern is to protect critical watersheds and the booming tourist industry. Half a million tourists flock to Khao Yai each year. About 95 per cent

of the visitors are Thai; most come to play golf or picnic in the recreational areas provided by the Tourism Authority of Thailand on sites of abandoned villages in the centre of the park. Making money is the name of the game: in 1983, entrance fees brought in 3 million baht, more than the whole of the budget for the national parks department for that year.

Balancing conservation and economics

Effective conservation of these forests depends on local communities using them sustainably, balancing conservation with social and economic development. The balancing act is most difficult in densely populated countries such as Thailand, simply because so many people want to make use of the forest's resources. In 1985, the Rural Development for Conservation project was begun in the village of Sap Tai at the edge of the park, funded largely by a German agricultural agency, Deutsche Welthungerhilfe. The aim of the project is to reduce the illegal exploitation of the park's resources by providing alternative sources of income (see Box 2). [[It seems to have been a success.]] Villagers now have no need to use the park illegally because they earn much more from other sources, such as guiding trekkers. Clearly there is a limit to the number of guides that a park can support, and it remains to be seen if the 100 or so other villages around the park can benefit in the same way.

Thailand's coastal ecosystems are probably as important

2: Learning to live with a national park

KHAO YAI became Thailand's first national park in 1962. It is a big park, covering 2169 square kilometres and forming one of the largest remaining tracts of tropical forest in mainland Asia. Twenty-five species of large mammals live in Khao Yai, including 250 elephants, 25 tigers and 10 000 gibbons. The park is also home to more than 300 species of birds and at least seven endemic species of plants.

Today, only rangers and other park staff live in the heart of the park. Sixty years ago, 30 families from a nearby province established a village in the mountains of Khao Yai. The villagers lived off produce from the forest and cleared some areas for cultivation. The village soon became a hideout for criminals and insurgents, but with the change from an absolute monarchy to a constitutional one in 1932, the new government dissolved the village and forced the inhabitants to move to lower ground.

The park is now encircled by small villages and farmland. Hundreds of villagers cultivate land just within the park

boundaries, some of them legally as they hold certificates of land tenure. The people have just about the lowest incomes in Thailand—about 15 baht (30 pence) a day. Not surprisingly, they supplement their meagre living by poaching animals and timber from the forest. The park is so big that the staff can supervise only a small area.

Although the rate at which the forest is cleared has slowed considerably, local villagers continue to log selectively around the edge of the park, and there are noticeably fewer tigers and elephants in areas well away from the park headquarters.

The National Parks Division confronted the problem of conservation by looking at the condition of people who were poaching in the park. With the Population and Community Development Association, and the support of the World Wildlife Fund and the International Union for Conservation of Nature, the division carried out a socio-economic study in 1984. The overwhelming conclusion was that the authorities must attack the problem on two fronts: increasing

the capacity to enforce the law in the park and at the same time improving conditions in the surrounding villages by some form of rural development.

In 1985 the Rural Development for Conservation project was begun in Sap Tai, a village surrounded on three sides by the park. The inhabitants of Sap Tai are subsistence farmers who have always supplemented their meagre incomes by stealing the park's natural resources. Two years after the project began, 319 of the 500 villagers had joined the Environment Protection Society: in exchange for a pledge not to poach from the park, members benefited from collective business enterprises and health and education centres. A credit cooperative allows members to borrow money to buy fertiliser, seeds and other material at a very low rate of interest.

One key project is the trekking business. A villager can earn 100 baht per day guiding wildlife treks in the park. The people of Sap Tai, at least, are beginning to realise the value of conserving wildlife. □

► internationally as its forests. Some of the best examples are found in 10 national parks. The Andaman Sea Islands are surrounded by rich coral reefs, and more than a third of the world's species of corals live around Phuket Island in the group. But as with forests, economics has taken precedence over conservation. There are many conflicting interests on Phuket: nature conservation, tourism, offshore tin mining, fishing and harvesting turtle eggs are not complementary



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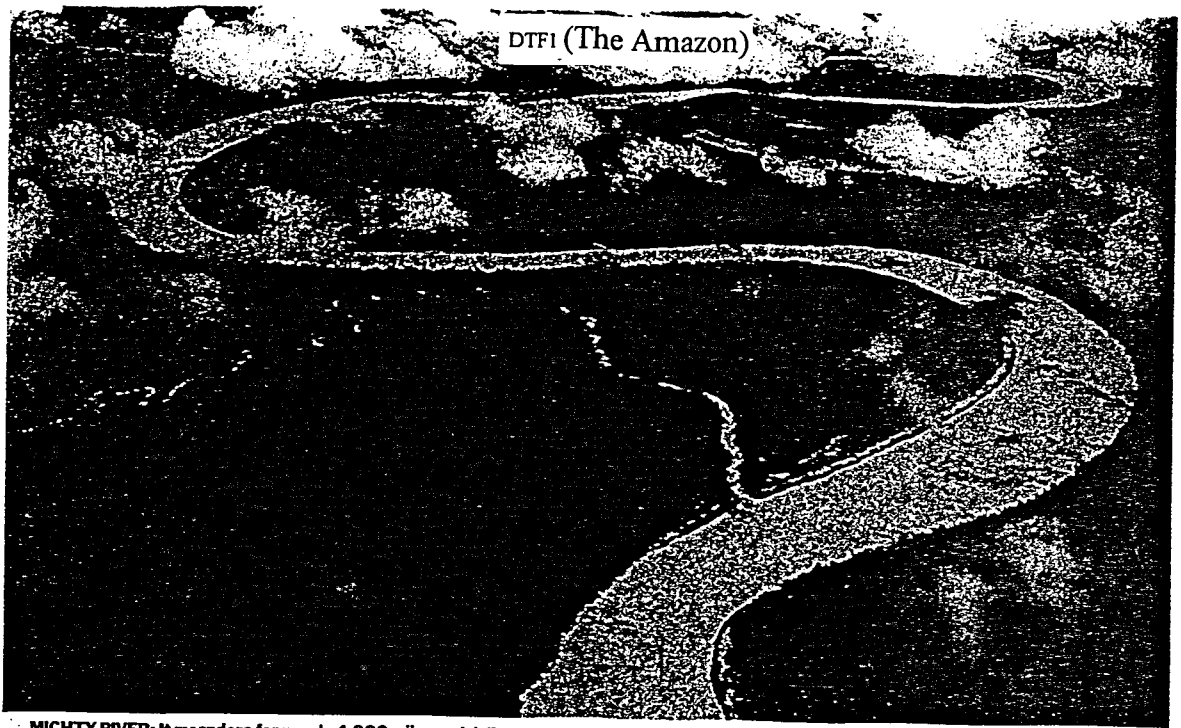
activities. In response to the conflicts, the National Environment Board, set up to advise the government, is looking at the best ways to make use of coastal resources. The indications so far are that neither development planning nor wildlife legislation figure prominently on Phuket. Most people ignore them, even in the national parks. It is probably time for the foreign tourist industry to speak out on behalf of the natural environment on which its success depends.

Wherever the environmental spotlight falls in Thailand, the image is one of degradation and poor use of natural resources. The fact that this is as true in national parks as elsewhere should set alarm bells ringing. But in a country that is growing increasingly crowded it is hard to set aside land purely for nature conservation. One problem is that despite the provision of wildlife departments and laws, they all remain under the control of the Royal Forest Department, one of whose jobs is to encourage forestry and logging. The International Union for Conservation of Nature (IUCN) suggests that the prospects for conservation will remain dim until the National Parks and Wildlife Conservation Departments are combined and made independent of the forest department, and given full departmental status—with a minister in the cabinet.

Almost a decade ago, the Thai government reviewed its policies and programmes for nature conservation. The review pointed out that many parks failed to live up to the IUCN criteria, yet it also emphasised that the parks could be protected effectively if existing laws were enforced. The government's response was to increase the budget of the parks department by 80 per cent between 1982 and 1986. These increases have now stopped, and the department is seriously lacking funds. Poachers and opium barons make fortunes and are better equipped and better armed than park guards. In the past 20 years around 40 park guards and officials have been killed on duty in parks and sanctuaries. Not surprisingly, many staff are discouraged from patrolling some areas.

Last year, Thailand learnt what some of the consequences of losing its forests are. As in many other countries, it took a disaster to stimulate some form of action to prevent more loss of life. But if the government is as ineffective in enforcing new laws as it is the old, Thailand's forests will continue to be killed and the rains will continue to wash away its soil.

Dr Peter Ewins is an ecologist working for the Nature Conservancy Council and has travelled widely in Asia. Dr Dawn Bazely is a biologist based at the department of zoology at the University of Oxford.



MIGHTY RIVER: It meanders for nearly 4,000 miles and delivers an average of 170 billion gal. of water an hour to the Atlantic

GOIN ETZ—STERN

Environment

• COVER STORY

TTL **Playing with Fire**

GLM *["Destruction of the Amazon is "one of the great tragedies of history"]*

BY EUGENE LINDEN

DTF2 (globe)



PRO

The skies over western Brazil will soon be dark both day and night. Dark from the smoke of thousands of fires, as farmers and cattle ranchers engage in their annual rite of destruction: clearing land for crops and livestock by burning the rain forests of the Amazon. Unusually heavy rains have slowed down the burning this year, but the dry season could come at any time, and then the fires will reach a peak. Last year the smoke grew so thick that Pôrto Velho, the capital of the state of Rondônia, was forced to close its airport for days at a time. An estimated 12,350 sq. mi. of Brazilian rain forest—an area larger than Belgium—

was reduced to ashes. Anticipating another conflagration this year, scientists, environmentalists and TV crews have journeyed to Pôrto Velho to marvel and despair at the immolation of these ancient forests.

After years of inattention, the whole world has awakened at last to how much is at stake in the Amazon. It has become the front line in the battle to rescue earth's endangered environment from humanity's destructive ways. "Save the rain forest," long a rallying cry for conservationists, is now being heard from politicians, pundits and rock stars. The movement has sparked a confrontation between rich industrial nations, which are fresh converts to the environmental cause, and the poorer nations of the Third World, which view outside interference as an assault on their sovereignty.

Some of the harshest criticism is aimed

at Brazil. The largest South American country embraces about half the Amazon basin and, in the eyes of critics, has shown a reckless penchant for squandering resources that matter to all mankind. Government leaders around the world are calling on Brazil to stop the burning. Two delegations from the U.S. Congress, which included Senators Al Gore of Tennessee and John Chafee of Rhode Island, traveled to the Amazon earlier this year to see the plight of the rain forest firsthand. Says Gore: "The devastation is just unbelievable. It's one of the great tragedies of all history."

The vast region of unbroken green that surrounds the Amazon River and its tributaries has been under assault by settlers and developers for 400 years. Time and again, the forest has defied predictions that

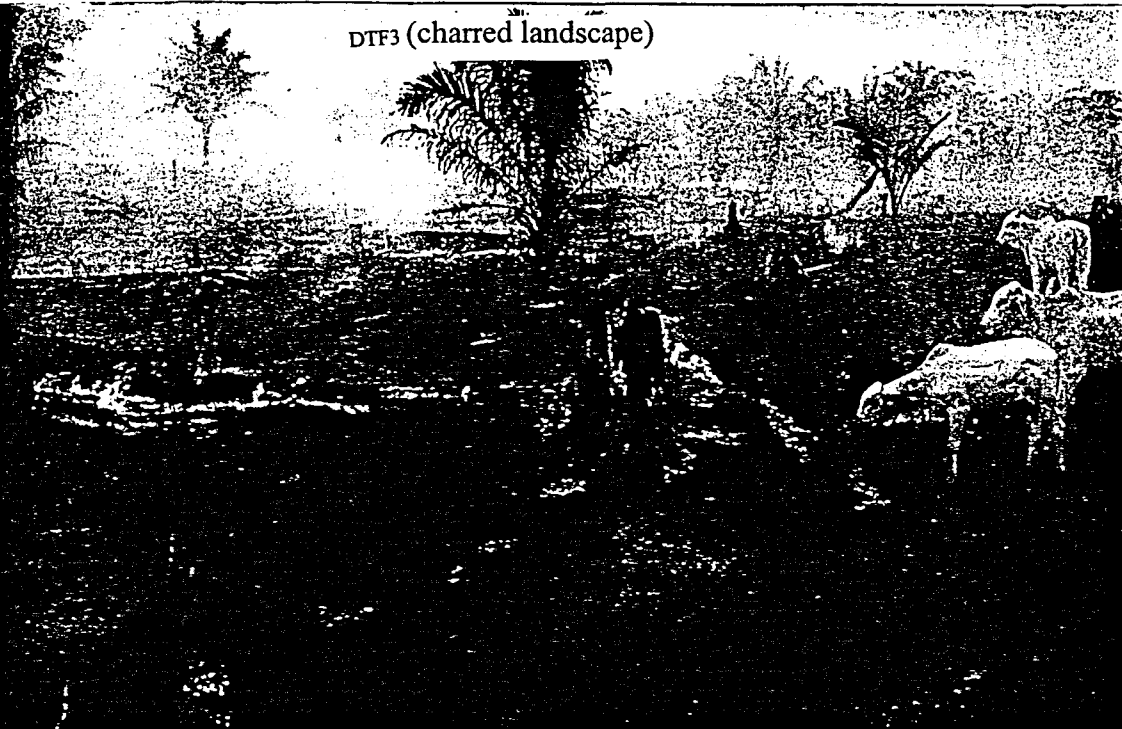
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TIME, SEPTEMBER 18, 1989

KEY:

TTL - TITLE	GLM - GLIMPSE	PRB - PROBLEM	SET - SETTING	PRO - PROPHECY
THR - THREAT	TLI - TECHNICAL LEAD-IN	SPC - SPECIFIC CLAIM	GCL - GENERAL CLAIM	BRG - BRIDGING
EVN - EVALUATION	ONP - ONGOING PROJECT	PRE - PREDICTION	CNS - CONCERNS	SLN - SOLUTION
SGN - SUGGESTION	SUM - SUMMARY	CON - CONCLUSION	ANX - ANXIETY	SPN - SPECULATION
COL - CALL FOR COLLABORATION		REC - RECOMMENDATION		

DTF3 (charred landscape)



CHARRED LANDSCAPE: Spurred by incentives, ranchers turn forests into pasture, but poor soil spoils the venture

NICHOLS—MAGNUM

It was doomed. But now the danger is more real and imminent than ever before as loggers level trees, dams flood vast tracts of land and gold miners poison rivers with mercury. In Peru the forests are being cleared to grow coca for cocaine production. "It's dangerous to say the forest will disappear by a particular year," says Philip Farnside of Brazil's National Institute for Research in the Amazon, "but unless things change, the forest will disappear."

That would be more than a South American disaster. It would be an incalculable catastrophe for the entire planet. Moist tropical forests are distinguished by their canopies of interlocking leaves and branches that shelter creatures below from sun and wind, and by their incredible variety of animal and plant life. If the forests vanish, so will more than 1 million species—a significant part of earth's biological diversity and genetic heritage. Moreover, the burning of the Amazon could have dramatic effects on global weather patterns—for example, heightening the warming trend that may result from the greenhouse effect. "The Amazon is a library for life sciences, the world's greatest pharmaceutical laboratory and a flywheel of climate," says Thomas Lovejoy of the Smithsonian Institution. "It's a matter of global destiny."

To Brazilians, such pressure amounts to unjustified foreign meddling and a blatant effort by the industrial nations to preserve their economic supremacy at the expense of the developing world. Brazilian

President José Sarney has denounced the criticism of his country as "unjust, defamatory, cruel and indecent." How can Brazil be expected to control its economic development, he asks, when it is staggering under a \$111 billion foreign-debt load? By what right does the U.S., which spews out more pollutants than any other nation, lecture poor countries like Brazil on their responsibilities to mankind?

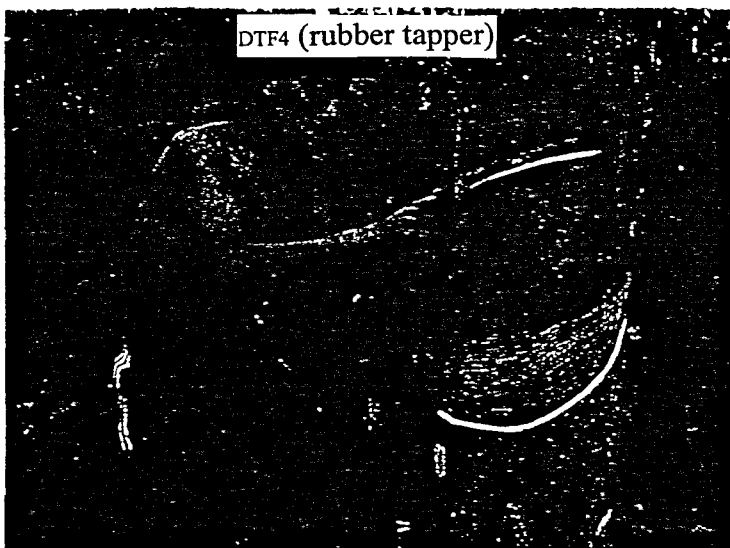
Yet Sarney is caught between conflicting, and sometimes violent, forces within his nation. On one side are the settlers and developers, often backed by corrupt politicians, who are razing the forests to lay claim to the land. On the other are hundreds of fledgling conservation groups, along with the Indian tribes and rubber tappers whose way of life will be destroyed if the forests disappear. The clash has already produced the world's most celebrated environmental martyr, Chico Mendes, a leader of the rubber tappers who was murdered for trying to stand in the way of ranchers.

The passions behind the fight are easy to understand for anyone who has seen the almost unimaginable sweep of the Amazon basin. The river and forest system covers 2.7 million sq. mi. (almost 90% of the area of the contiguous U.S.) and stretches into eight countries besides Brazil, including Venezuela to the north, Peru to the west and Bolivia to the south. An adventurous

monkey could climb into the jungle canopy in the foothills of the Andes and swing through 2,000 miles of continuous 200-ft.-high forest before reaching the Atlantic coast. The river itself, fed by more than 1,000 tributaries, meanders for 4,000 miles, a length second only to the Nile's 4,100 miles. No other river compares in volume: every hour the Amazon delivers an average of 170 billion gal. of water to the Atlantic—60 times the flow of the Nile. Even 1,000 miles upriver, it is often impossible to see from one side of the Amazon to the other.

The jungle is so dense and teeming that all the biologists on earth could not fully describe its life forms. A 1982 U.S. National Academy of Sciences report estimated that a typical 4-sq.-mi. patch of rain forest may contain 750 species of trees, 125 kinds of mammals, 400 types of birds, 100 of reptiles and 60 of amphibians. Each type of tree may support more than 400 insect species. In many cases the plants and animals assume Amazonian proportions: lily pads that are 3 ft. or more across, butterflies with 8-in. wingspans and a fish called the pirarucu, which can grow to more than 7 ft. long. Amid the vast assortment of jungle life, creatures command every trick in nature's book to fool or repel predators, attract mates and grab food. Caterpillars masquerade as snakes, plants exude the smell of rotting meat to attract flies as pollinators, and trees rely on fish to distribute their seeds when the rivers flood.

But the diversity of the Amazon is



DTF4 (rubber tapper)



DTF5 (forest burning)

JUNGLE RICHES: An Indian can harvest rubber without destroying its source

ROAD TO RUIN: A highway through Rondônia has le

more than just good material for TV specials. The rain forest is a virtually untapped storehouse of evolutionary achievement that will prove increasingly valuable to mankind as it yields its secrets. Agronomists see the forest as a cornucopia of undiscovered food sources, and chemists scour the flora and fauna for compounds with seemingly magical properties. For instance, the piquia tree produces a compound that appears to be toxic to leaf-cutter ants, which cause millions of dollars of damage each year to South American agriculture. Such chemicals promise attractive alternatives to dangerous synthetic pesticides. Other jungle chemicals have already led to new treatments for hypertension and some forms of cancer. The lessons encoded in the genes of the Amazon's plants and animals may ultimately hold the key to solving a wide range of human problems.

Scientists are concerned that the destruction of the Amazon could lead to climatic chaos. Because of the huge volume of clouds it generates, the Amazon system plays a major role in the way the sun's heat is distributed around the globe. Any disturbance of this process could produce far-reaching, unpredictable effects. Moreover, the Amazon region stores at least 75 billion tons of carbon in its trees, which when burned spew carbon dioxide into the atmosphere. Since the air is already dangerously overburdened by carbon dioxide from the cars and factories of industrial nations, the torching of the Amazon could magnify the greenhouse effect—the trapping of heat by atmospheric CO₂. No one knows just what impact the buildup of CO₂ will have, but some scientists fear that the globe will begin to warm up, bringing on wrenching climatic changes.

As the potential consequences of rain-forest destruction became more widely

known, saving the Amazon became the cause of 1989. In New York City, Madonna helped organize a benefit concert called "Don't Bungle the Jungle," which also featured the B-52s and the Grateful Dead's Bob Weir. Xapuri, the remote town where Mendes lived and died, has been besieged by journalists, agents and pilgrims. Robert Redford, David Puttnam and other prominent moviemakers have sought the rights to film the Mendes story.

In the face of pressure from abroad and complaints from environmentalists at home, Brazil has grudgingly begun to respond. In April, only a few months after denouncing the environmental movement as a foreign plot to seize the forests, the Sarney administration announced a hastily patched-together conservation package dubbed Our Nature. Much of the language was ambiguous, but the program contained promising provisions, such as the temporary suspension of tax incentives that spur the most wasteful forest exploitation. Says Celio Valle, director of ecosystems at the government's newly created environmental agency: "Before, we used to consider Brazilian environmental groups as the enemy, but now we consider them allies." Amazonian development may become a significant issue in this year's presidential campaign. Fernando Collor de Mello, a member of the conservative National Reconstruction Party and a leading candidate to succeed Sarney, has said he believes in preserving the forests, though critics doubt his sincerity.

Many Brazilians still believe the Amazon is indestructible—a green monster so huge and vital that it could not possibly disappear. Asked about a controversial hydroelectric project that might flood an

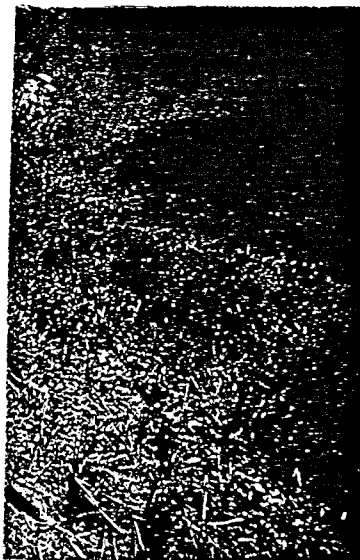
area as large as Britain, a Brazilian engineering consultant said, "Yes, that's a big area, but in terms of the Amazon it's small." Maintained Sarney recently: "It's not easy to destroy a rain forest. There are recuperative powers at work."

Yet the rain forest is deceptively fragile. Left to itself, it is an almost self-sustaining ecosystem that thrives indefinitely. But it does not adapt well to human invasions and resists being turned into farm- or ranchland. Most settlers find that the lush promise of the Amazon is an illusion that vanishes when grasped.

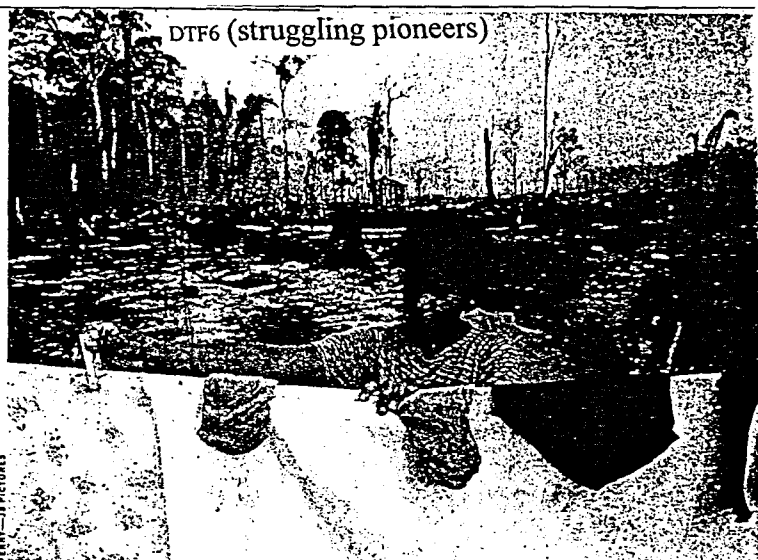
The forest functions like a delicately balanced organism that recycles most of its nutrients and much of its moisture. Wisps of steam float from the top of the endless palette of green as water evaporates off the upper leaves, cooling the trees as they collect the intense sunlight. Air currents over the forest gather this evaporation into clouds, which return the moisture to the system in torrential rains. Dead animals and vegetation decompose quickly, and the resulting nutrients move rapidly from the soil back to growing plants. The forest is such an efficient recycler that virtually no decaying matter seeps into the region's rivers.

But when stripped of its trees, the land becomes inhospitable. Most of the Amazon's soil is nutrient poor and ill suited to agriculture. The rain forest has an uncanny capacity to flourish in soils that elsewhere would not even support weeds.

Throughout history, would-be pioneers and developers have discovered just how unreciprocative the Amazon can be. Henry Ford tried twice to carve rubber empires out of the rain forest in the 1920s and '30s. But when the protective canopy was cut down, the rubber trees withered under the assault of sun, rain and pests. In



Indiscriminate burning and deforestation



STRUGGLING PIONEERS: Faced with meager earnings and malaria, most settlers give up

1967 Daniel Ludwig, an American billionaire, launched a rashly ambitious project to clear 2.5 million acres of forest and plant Gmelina trees for their timber. He figured that the imported species would not be susceptible to Brazil's pests. Ludwig was wrong, and as his trees died off, he bailed out of the project in 1982.

The Brazilian government, meanwhile, came up with development schemes of its own. In the early 1970s the country built the Trans-Amazon Highway, a system of roads that run west from the coastal city of Recife toward the Peruvian border. The idea was to prompt a land rush similar to the pioneering of the

American West. To encourage settlers to brave the jungle, the government offered transportation and other incentives, allowing them to claim land that they had "improved" by cutting down the trees.

But for most of the roughly 8,000 families that heeded the government's call between 1970 and 1974, the dream turned into a bitter disappointment. The soil, unlike the rich sod in the Western U.S., was so poor that crop yields began to deteriorate badly after three or four years. Most settlers eventually gave up and left.

Yet the failed dreams of yesterday have not discouraged Brazil from conjuring up more grand visions for today. The

country has continued to build roads, dams and settlements, often with funding and technical advice from the World Bank, the European Community and Japan. Two of the largest—and, to the rain forest, most threatening—projects are Grande Carajás, a giant development program that includes a major mining complex, and Polonoroeste, a highway-and-settlement scheme.

The \$3.5 billion, 324,000-sq.-mi. Grande Carajás Program, located in the eastern Amazon, seeks to exploit Brazil's mineral deposits, perhaps the world's largest, which include iron ore, manganese, bauxite, copper and nickel. The





DISASTROUS DEVELOPMENT: Dams supply little electricity, flood huge areas and provide breeding grounds for mosquitoes

Environment

principal iron-ore mine began production in 1985, and its operation has little impact on the forest. The problem, however, is the smelters that convert the ore into pig iron. They are powered by charcoal, and the cheapest way to obtain it is by chopping down the surrounding forests and burning the trees. Environmentalists fear that Grande Carajás will repeat the dismal experience of the state of Minas Gerais in southeastern Brazil, where pig-iron production consumed nearly two-thirds of the state's forests.

In the other huge project, Polonoroeste, the government is trying to develop the sprawling western state of Rondônia. The program, backed by subsidies and built around a highway through the state called BR-364, was designed to relieve population pressures in southern Brazil. But Polonoroeste has made Rondônia the area where rain-forest destruction is most rapid, and the focal point of the fight to save the Amazon.

The results of the development have been chaotic and in some cases tragic. Machadinho, for instance, was supposed to be a model settlement village with gravel roads, schools and health clinics. But when a surge of migrants traveled down BR-364 to Machadinho in 1985, orderly development became a pell-mell land grab. Settlers encountered the familiar scourges of the rain forest: poor soil and inescapable mosquito-borne disease. Decio Fujizaki, a settler who came west four years ago, has just contracted malaria for the umpteenth time. Says he: "I always wanted my own plot of land. If only it wasn't for this wretched disease."

Instead of model settlements, the Polonoroeste project has produced impover-

ished itinerants. Settlers grow rice, corn, coffee and manioc for a few years until the meager soil is exhausted, then move deeper into the forest to clear new land. The farming and burning thus become a perpetual cycle of depredation. Thousands of pioneers give up on farming altogether and migrate to the Amazon's new cities to find work. For many the net effect of the attempt to colonize Rondônia has been a shift from urban slums to Amazonian slums. Says Donald Sawyer, a demographer from the University of Minas Gerais: "The word is out that living on a 125-acre plot in the jungle is not that good."

The abandoned fields wind up in the hands of ranchers and speculators who have access to capital. Thanks to tax breaks and subsidies, these groups can often profit from the land even when their operations lose money. According to Roberto Alusio Paranhos do Rio Branco, president of the Business Association of the Amazon, nobody would farm Rondônia without government incentives and price supports for cocoa and other crops.

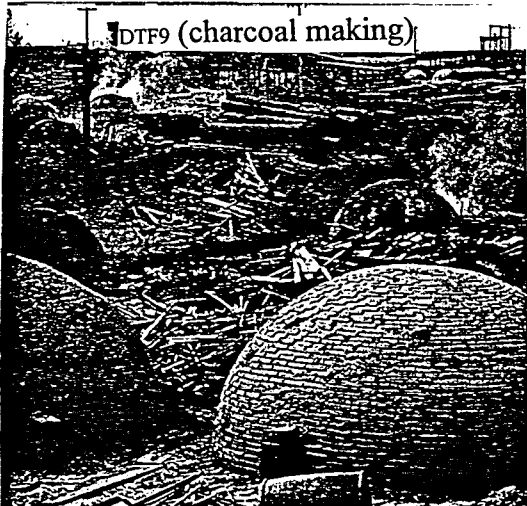
Rondônia's native Indians have fared worse than the settlers. Swept over by the land rush, one tribe, the Nambiquara, lost half its population to violent clashes with the immigrants and newly introduced diseases like measles. Jason Clay, director of research for Cultural Survival, an advocacy organization for the Indians, says that when the Nambiquara were relocated as part of Polonoroeste, the move severed an intimate connection, forged over generations, to the foods and medicines of their traditional lands. That deprived them of their livelihood and posterity of a wealth

of information about the riches of the forest. Says Clay: "Move a hunter-gatherer tribe 50 miles, and they'll starve to death."

Amid the suffering of natives and settlers, the one constant is that deforestation continues. Since 1980 the percentage of Rondônia covered by virgin forest has dropped from 97% to 80%. Says Jim LaFleur, an agricultural consultant with 13 years' experience working on colonization projects in Rondônia: "When I fly over the state, it's shocking. It's like watching a sheet of paper burn from the inside out."

A similar debacle could occur in the western state of Acre. It is still virtually pristine, having lost only 4% of its forests, but the rate of deforestation is increasing sharply as cattle ranchers expand their domain. Development in Acre has sparked a series of bloody confrontations between ranchers and rubber tappers, who want to preserve the forests so they can save their traditional livelihood of harvesting latex and Brazil nuts. It was this conflict that killed Mendes.

This courageous leader did not set out to save the Amazon but to improve the lot of rubber tappers, or seringueiros. He and his men would try to dissuade peasants from clearing land. The ranchers were eager to get rid of him, but he survived one assassination attempt after another. The conflict finally came to a head last year, when Mendes confronted a rancher named Darli Alves da Silva, who wanted to cross land claimed by rubber tappers to cut an adjacent 300-acre plot. After Mendes and a group of 200 seringueiros peacefully turned back the rancher and 40 peons, death threats against him grew more frequent. In December he was killed with a shotgun as he stepped out of his



WASTEFUL FUELS: Trees are burned to make charcoal to fire smelters



GOLD FEVER: Prospectors poison the land and water

Environment

doorway. Alves and two of his sons were convicted of the murder but have appealed the verdict.

Mendes became a hero to environmentalists not only because he fought and died to stop deforestation but also because of the way of life he was defending. The rubber tappers are living proof that poor Brazilians can profit from the forest without destroying it. According to Stephan Schwartzman of the Environmental Defense Fund, seringueiros achieve a higher standard of living by harvesting the forest's bounty than do farmers who cut the forest and plant crops.

One of Mendes' most important achievements was to help convince the Inter-American Development Bank to suspend funding temporarily for further paving of BR-364 between Rondônia and Acre. But the Brazilian government is again seeking the \$350 million needed to complete the road all the way to Peru, a prospect that alarms environmentalists. "One lesson we have learned in the Amazon is that when you improve a road, you unleash uncontrolled development on the rain forest," says John Browder, a specialist on Rondônia's deforestation from Virginia Polytechnic Institute.

Among other things, environmentalists fear that completion of the road will provide entrée for Japanese trading companies that covet the Amazon's vast timber resources. Acre's governor, however, argues that the road is needed to end the state's isolation and claims that the state will not repeat the mistakes of Rondônia.

The debate over the Acre road places environmentalists in an uncomfortable position, essentially telling Brazilians that they cannot be trusted with their own development. Raimundo Marques da Silva, a retired public servant who helped build Acre's original dirt highway, asks, "How would Americans feel if years ago we had told them they could not build a road from New York to California because it would destroy their forests?"

Still, some Brazilians do accept that the outside world has a legitimate interest in the Amazon. José Lutzenberger, an outspoken environmentalist, notes that the Brazilians trying to develop the rain forest are themselves outsiders to the area. "This talk of 'We can do with our land what we want' is not true," he says. "If you set your house on fire it will threaten the homes of your neighbors."

If the rain forest disappears, the

process will begin at its edges, in places such as Acre and Rondônia. While the Amazon forest as a whole generates roughly half of its own moisture, the percentage is much higher in these western states, far from the Atlantic. This means that deforestation is likely to have a more dramatic impact on the climate in the west than it would in the east. "Imagine the effects of a dry season extended by two months," says Fearnside. The process of deforestation could become self-perpetuating as heat, drying and wind cause the trees to die on their own.

This does not have to happen. A dramatic drop in Brazil's birth rate promises to reduce future pressures to cut the forests, and experts believe the country could halt much of the deforestation with a few actions. By removing the remaining subsidies and incentives for clearing land, Brazil could both save money and slow the speculation that destroys the forests. Many environmentalists prefer this approach to the enactment of new laws. Brazilians have developed a genius, which they call *jeito*, for getting around laws, and many sound environmental statutes on the books are ignored.

The government could also stop some of the more wasteful projects it is currently planning. Part of the problem in the Amazon has been ill-conceived plans for development that destroy forests and drive the country deeper into debt. Most hydroelectric dams, for example, have proved unsuitable in the region. The Balbina Dam, which was completed in 1987 and began operating early this year, flooded a huge area at great cost to



COURAGEOUS MARTYR: Chico Mendes, here with his children and wife Iizamar, was murdered for defending his way of life

Environment

produce relatively little power. It killed trees, poisoned fish and provided breeding grounds for billions of malarial mosquitoes. Despite this experience, the government plans to build scores of additional dams.

Fabio Feldmann, the leading environmentalist in the Brazilian congress, alleges that much of the momentum behind the dam projects and other large public works derives from an extremely lucrative relationship between the major contractors and politicians. A dam may not have to make all that much sense if it generates sufficient *comissão* (commissions) for the right people.

Perhaps the best hope for the forests' survival is the growing recognition that they are more valuable when left standing than when cut. Charles Peters of the Institute of Economic Botany at the New York Botanical Garden recently published the results of a three-year study that calculated the market value of rubber and exotic produce like the Aguaje palm fruit that can be harvested from the Amazonian jungle. The study, which appeared in the British journal *Nature*, asserts that over time selling these products could yield more than twice the income of either cattle ranching or lumbering.

But if the burning of the forests goes on much longer, the damage may become

irreversible. Long before the great rain forests are destroyed altogether, the impact of deforestation on climate could dramatically change the character of the area, lead to mass extinctions of plant and animal species, and leave Brazil's poor to endure even greater misery than they do now. The people of the rest of the world, no less than the Brazilians, need the Amazon as a functioning system, and in the end, this is more important than the issue of who owns the forest. The Amazon may run through South America, but the responsibility for saving the rain forests, as well as the reward for succeeding, belongs to everyone.

—Reported by Laura López/
Rio de Janeiro, John Maier/Pôrto Velho and
Dick Thompson/Washington

A Global Agenda for the Amazon

Alarm over the destruction of the Amazon has sparked a movement throughout the industrialized world to protect one of nature's greatest treasures. Rock performer Sting has pressed the issue in France; the cosmetics firm Body Shop is doing the same in Britain. Preservation of the rain forest is moving toward the top of the agenda of governments and development banks from Brussels to Tokyo. The worldwide pressure is particularly valuable since it is becoming clear that preserving the Amazon will require a worldwide commitment to creative economics and innovative diplomacy. If the complexities of this global emergency can be untangled, the solution might serve as a model for other cases of environmental mismanagement. That process will require several steps:

Diagnose the cause. Many of the world's worst environmental assaults are rooted in gross economic imbalances. The 1987 United Nations' World Commission on the Environment reported that the debt crisis is forcing Latin American nations to exploit their natural resources excessively to pay creditors. In Brazil the Amazon burns, says Peter Raven, director of the Missouri Botanical Gardens, as the "necessary consequence of the nation's extreme poverty." Means—and money—must be found to alleviate Brazil's foreign debt and to provide support for the country's sustained development. Says a West German Environment Ministry official: "You will be able to measure the concern of a nation for the preservation of the rain forest by the amount of money it is willing to contribute from its gross national product."

Expand the definition of sovereignty. The phrase environmental sovereignty is almost an oxymoron today: U.S. heavy industry exports acid rain to Canada; Japanese timber companies have ravaged the rain forests of Indonesia. As the U.N. environmental commission chaired by Norway's Labor Party Prime Minister Gro Harlem Brundtland observed,

"The traditional forms of national sovereignty are increasingly challenged by the realities of ecological and economic interdependence." Although Brazil rightly balks when U.S. politicians preach, as Senator Robert Kasten did, about the imperative of protecting "our Amazon," it is painfully clear that one nation often does have a legitimate interest in the environmental practices of another.

That recognition is leading to enterprising attempts to preserve the Amazon. In July, Britain and Brazil signed a memorandum of understanding that will provide valuable technical assistance to the South American country to help protect the rain forest. Under the roughly \$5 million plan, Britain has pledged its expertise for a variety of Amazon projects, including the study of sustainable forest management, the sustainable harvesting of rain forest products like rubber, and research into the relationship between the forest and the climate. Ghillelan France, director of the Royal Botanic Gardens, urges

that "developed countries are going to have to pool their resources to help."

Begin at home. The industrialized countries are on shaky moral ground when they lecture the developing world on the need to act responsibly toward the environment. Says Tomas Tarquinio, a Brazilian consultant to the Institute of European Environment Politics, a research organization in Paris: "The real answer is for the rich nations to alter and reduce their consumption and engage in environmentally responsible business practices. Until then, you cannot expect Brazilians to do so." The protection of the Amazon will be secured when antismog devices are attached to French automobiles, when gasoline surcharges are tacked onto the prices at American gasoline pumps and when Japan stops cleaning its computer memory chips in ozone-destroying chlorofluorocarbons.

—By Dick Thompson.
Reported by Bruce M. Crumley/Paris and Nancy Seufert/London



Sting with fellow campaigners on French television