

Malaria runs riot on Brazil's wild frontier

The rapid loss of the rainforest is not the only problem facing the Amazon basin. Brazil is also suffering from a massive epidemic of malaria

Sharon Kingman

IN THE 1950s and 1960s, health officials in Brazil had brought malaria in their country under control. Transmission of the parasite that causes malaria had virtually stopped in the most densely populated central and coastal regions. Although malaria continued in the Amazon region, few people were exposed to it there, so it did not seem to pose a large threat.

Brazil controlled the disease by spraying the walls inside houses with insecticides to kill the mosquitoes that carry the malaria parasite. This strategy was particularly effective against the species of mosquito that prefer to stay inside buildings, rather than resting outdoors.

Similar public health programmes reduced the incidence of malaria in much of Venezuela, Guyana and Surinam (especially in the lowland coastal areas), as well as in Brazil. Unfortunately, this trend did not last. Over the past 10 years, the numbers of cases of malaria throughout the Amazon region, particularly in Brazil, has risen almost exponentially. In 1983, more than 297 000 cases of malaria were reported in Brazil, almost 287 000 of them from Amazonia. By 1988, those figures had risen to about 560 000 and almost 500 000 respectively.

To help Brazil to counter the epidemic, the World Bank has lent the country \$99 million (around £60 million). The money will partly help to develop the Brazilian agency in charge of controlling malaria, the Superintendency for Public Health Campaigns (SUCAM). It will also pay for Brazil to monitor how many people catch malaria, to treat patients, run education projects and improve drainage, including eliminating sites where mosquitoes can breed. Finally, it will allow SUCAM to buy materials and equipment for applying pesticides.

Malaria is one hardship that those desperate to benefit from the riches of the Amazon have to tolerate. One of the most obvious reasons for the sudden change in the statistics has been the huge influx of immigrants to the Amazon region, most of whom have no immunity to malaria. The populations of the Amazon states grew 5 per cent a year between 1970 and 1980; in most states, the population has doubled during the 1980s. In the state of Rondonia, which has attracted more immigrants than other areas, the population has increased by more than 1200 per cent between 1950 and 1980.

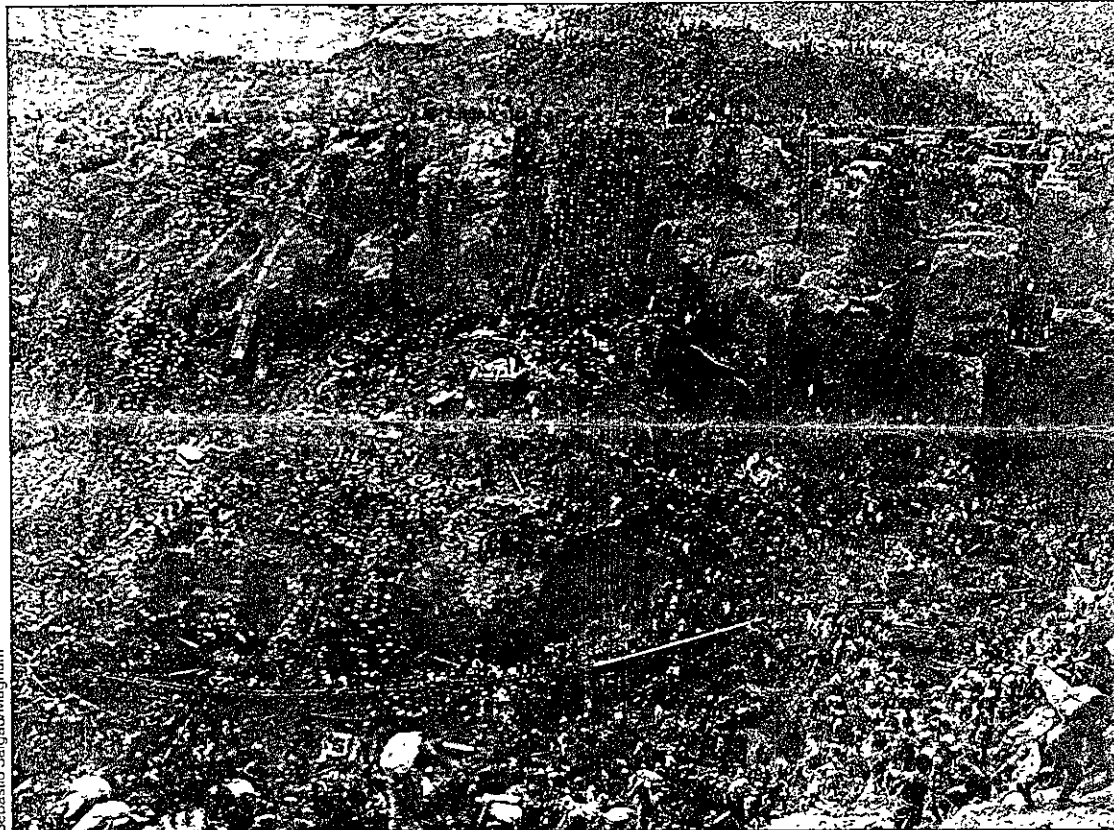
People have been attracted to the region

for many reasons. The building of the Transamazon highway, begun in the late 1960s, made it easier to enter the Amazon basin, allowing people to establish farms and settlements. Settlers in Rondonia founded more than 30 000 new farms within 10 years. People have also been drawn by the prospects of finding gold and by jobs in mining.

Many settlers have no immunity to malaria, probably because they come from

breed, on boats or even on rafts, if the operation involves dredging for minerals on the river bed.

The push into the Amazon jungle has created additional opportunities for mosquitoes to breed. *Anopheles darlingi*, the most important vector of malaria in the region, generally breeds in pools of stagnant water, as well as at the edges of streams and rivers protected from the current. And after a river has flooded, water remains trapped



Sebastião Salgado/Magnum

Mass movement: about 50 000 men work in the Serra Pelada mine, many of them with no immunity to malaria. Within two weeks of a cowhand discovering gold there in 1980, 10 000 gold-diggers arrived

areas where the disease has remained under control. The association with new settlers colonising the area has brought the nickname "frontier malaria".

The rising incidence of malaria also has a knock-on effect in Brazil outside the Amazon. People who go to Amazonia to work, and return home, infected with the parasite, to areas where malaria is absent, can spark off local epidemics. In 1987, SUCAM had to divert resources to silence 29 new outbreaks of malaria outside the Amazon region.

Settlers are vulnerable to being bitten by malarial mosquitoes because they live in makeshift shelters with no walls to stop the insects entering. Miners, particularly, wear minimal clothing and many live in camps beside streams where mosquitoes can

along the banks, providing ideal breeding grounds for mosquitoes.

New roads through the Amazon region create similar habitats: construction workers building roads dig channels on either side of the highway to raise it to a suitable level. When these flood, the mosquito moves in to lay eggs. Culverts dug beneath the road to drain water away become blocked, so flooding again results.

In areas where farmers have cleared forests to cultivate the land, the soil erodes and washes down into the main rivers. There, it silts up the banks, increasing their height and making it harder for water to drain away after flooding.

Mining itself can generate breeding sites for mosquitoes. Sites where there has been open-cast mining can fill with water, again

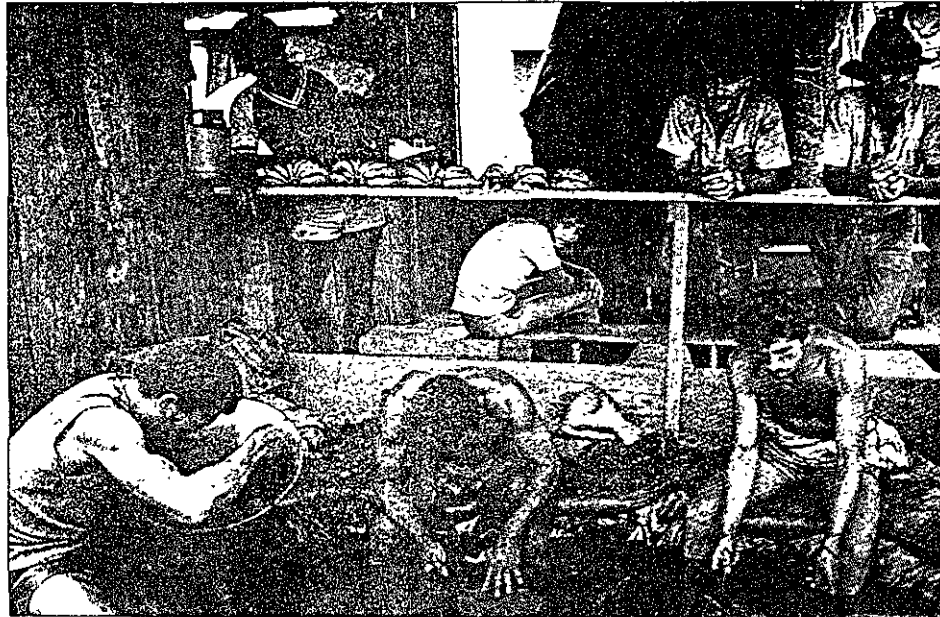
encouraging mosquitoes to breed.

Once bitten by a parasite-carrying mosquito, anyone who catches malaria in the Amazon region has few opportunities for treatment. Miners move around a great deal in search of work, and many mines are accessible only by air. Even in the most densely populated areas, there are few health centres.

The species of parasite which is the most common cause of malaria in the Amazon is *Plasmodium falciparum*. This is the most severe form of malaria. It is often fatal if not

and flies out again to lay its eggs.

No one knows why the mosquitoes behave differently. This species of mosquito may have originally lived outdoors and fed on animals in the forest, but then had to adapt to an indoor life, feeding on humans, when the forest and its animals disappeared. An alternative theory is that insecticides have put pressure on *A. darlingi* to evolve its outdoor habit. However, this hypothesis contradicts the observation that malaria is worse when people first colonise an area, when they tend to live outdoors.



Over-exposed: many miners, here shown panning for gold in soil brought from the mine, live in huts without walls, an easy target for the malarial mosquitoes. Many dwellings are near water in which the insects lay their eggs until it becomes too polluted



Tony Morrison

treated. In the Amazon, it is resistant to most antimalarial drugs, including chloroquine.

To complicate matters further, traditional methods of controlling malaria may not work well in the Amazon. The species of mosquito responsible for transmitting most cases of malaria in the Amazon forests looks exactly the same as the species that spreads malaria in the lowland areas of Venezuela and Guyana. Yet while the latter spent most of its time inside dwellings, where it was easy to spray it with insecticide, the Amazonian variety prefers to be outside. It enters shelters and buildings, feeds on its victim,

negative environmental impact." The amounts being used, says the newsletter, "will be minimal compared with those previously used in agricultural spraying". The loan includes allocations for training on safe techniques when spraying and for monitoring the use of the pesticide.

Albert Heier, a spokesman for the Environmental Protection Agency in Washington DC, says that the US banned DDT because of its persistence in the food chain, and because insects became resistant to it. Nevertheless, he believes that the benefits of DDT would outweigh its risks in a country with a huge outbreak of malaria.

DDT is not the only insecticide that the Brazilian authorities will employ. Even if the others, such as synthetic pyrethroids, have better reputations for their impact on the environment, it is still important to evaluate the effectiveness of spraying. Apart from the outdoor habit of *A. darlingi*, another difficulty is that there are no walls to spray in many dwellings. To counter this problem, officials in some places have adopted a policy of making curtains out of locally produced raffia to resemble walls, and spraying these. Evaluation of the impact of this strategy will be difficult, because scientists know very little about the habits of the mosquitoes of the forests.

Brazil's experience of malaria in the Amazon raises the issue of how little attention is generally paid to the impact of development projects on health. The World Bank, which provided loans for many of the projects in the Amazon basin, has recently set up an environment department. Visvanathan Rajagopalan, a vice-president of the World Bank, says the department's function is to examine ways of managing natural resources, improving conservation and the ecological impact of projects. "These things are receiving much greater attention than in the past," he says.

Bernhard Liese, also with the World Bank, points out that in Brazil no one understood the intricate factors contributing to the malaria epidemic in the Amazon until it had been going on for some time. Disorderly development, with many families moving in each day by any possible means of transport, made it difficult to evaluate what was going on. "Amazonia really is a wild west, a frontier," he says.

It took time for SUCAM to learn that frontier malaria was a completely new type of malaria, Liese adds. Although the disease concentrates in areas of settlements and gold mines, the epidemic dies down after three or four years, when water around the settlement becomes too polluted for the mosquitoes to lay their eggs in it.

The World Bank maintains that, even though it lays down strict rules about the ways in which countries can spend its loans, it cannot stipulate that they take measures to reduce adverse effects on health when carrying out projects. That is up to the country concerned, the bank believes.

Not everyone agrees. Bruce Rich, a senior attorney with the Environmental Defense Fund, an independent organisation based in Washington DC, which focuses on environment and development in the third world, and particularly the role of the World Bank, holds a different view. He says that the World Bank, which since the early 1980s has loaned hundreds of millions of dollars to Brazil for development of the Amazon region, "has a direct responsibility for this disaster". Of the latest loan, for the control of malaria in the Amazon, Rich says: "For a country like Brazil, that's a very expensive way of standing still." □

Further reading "Human migration and the spread of malaria in Brazil", A. Cruz Marques, *Parasitology Today*, 1987, vol 3, p 166.
Report on a Technical Consultation on Research in Support of Malaria Control in the Amazon Basin, available on request from the Tropical Disease Research Programme of the World Health Organization, 1211 Geneva 27, Switzerland.