

Feature

# Climate Change and World Agriculture

**C**LIMATE change is expected to cause continental-scale disruptions in patterns of food production, and possibly of food prices as well. As temperatures rise and weather patterns alter, rainfall patterns will shift and many water supplies will diminish significantly. Some parts of the planet will become too hot or too dry to support crops, while others will experience large boosts in productive capacity.

Average annual rainfall is expected to increase globally as the planet warms, but this will not be the case for every region. In some parts of the world, rainfall could decrease by up to 20 per cent. Furthermore, it is thought that many regions which do receive more rain will find it arrives in heavier downpours which are spread over a shorter period during each year, reducing the length of the growing season and worsening problems of flooding and erosion.

Although there are still many uncertainties about the

regional impacts of climate change on agriculture, it appears likely that most of the world's breadbasket food producers will suffer significant reductions in yields. In Southern Europe, the United States, Central America, parts of South America, Africa and Southeast Asia, crop yields and livestock production may drop dramatically. In the humid tropics, where much of the world's rice harvest is produced, it is thought that the Southeast Asian monsoon may intensify, bringing more rain in summer and possibly less in winter.

Much depends on future rainfall in these regions, but research suggests that in mid-latitude, mid-continental parts of the world including the Great Plains, the North American Prairies and current grain-producing regions of Soviet Central Asia, there may be less

moisture available for plant growth. Research suggests that there is also a good chance that there will be significant reductions in crop yields in Western Australia, the Argentine pampas and Southern Africa, and in mountain regions of Southwest Asia, the Indian sub-continent and parts of mainland and insular Southeast Asia.

The loss of production in major food-producing countries would significantly reduce the quantities of food available for sale on the world markets, unless other regions can take over the role of producing food for global consumption. At present the world depends on three nations for 75 per cent of all cereal exports. All three — the United States, France and Canada — are expected to

experience marked reductions in food production as temperatures rise, rainfall diminished and the soil dries out. Shortfalls in food production could be balanced by production increases in higher latitudes, particularly in the Northern Hemisphere. Temperatures in higher latitudes will rise considerably more than the predicted global average. By the time the average global temperature has risen 1.5 degrees Celsius, higher latitudes could have warmed as much as 9 degrees Celsius, allowing land previously too cold for agriculture to be farmed.

Moreover, while rainfall is expected to decrease in many lower latitude regions, this is considered less likely in northern Europe, and possibly northern Asia as well. The resulting combination of

warmer temperatures and adequate rainfall would make it possible for agriculture to extend much further north in the future. However, it is by no means certain that increased production in the north will neatly coincide with production losses further south. Nor is it certain whether the quantities of increased production in higher latitudes will equal the loss of production in mid-latitude breadbasket regions.

Production losses could to some extent be reduced through the fertilizing effects of the extra carbon dioxide in the atmosphere. It is known that when there is more carbon dioxide in the air, plant growth rates increase. However, the latest research suggests that these yield increases may only last a few seasons.

After that plants tend to adjust to the extra carbon dioxide in the atmosphere, and their growth rates drop back to present-day rates.

In addition, warmer temperatures will mean an increase in the rate at which plants draw up moisture from the soil, which could substantially reduce the amount of soil moisture available for crops and vegetation. Higher evaporation rates and less soil moisture would dramatically affect global crop yields. It has been estimated that the combination of a 10 per cent drop in rainfall and a one degree Celsius rise in temperature would lead to a 50 per cent reduction in soil moisture available to plants.

Larger insect pest populations and increased plant diseases in a warmer world

will also contribute to drops in crop yields. Higher temperatures and humidity will enhance breeding conditions for pests and disease-bearing organisms, while warmer temperatures will also allow insect pests to move into regions at present too cold for them to survive.

As the climate changes, and with it patterns of agricultural production, farming techniques will have to become considerably more flexible. Farmers may have to become accustomed to changing their cropping and livestock management techniques every decade or so, and in many parts of the world they will also have to cope with increasingly frequent storms, floods and droughts.

New technological and management innovations will doubtless be developed. For farmers in the developed world, many of whom are already accustomed to changing their practices as better methods are developed, the transition could be relatively painless.

But for agriculturalists are in developing countries, particularly in those where agriculture is already marginal, adaptation and flexibility may not be as easy to achieve.

In these latter countries, even small changes in climate and rainfall can wipe out most of their crops. These countries are also the least able to make the necessary technological and management changes to allow them to continue to produce food in a changing climate. Considerable education and technical assistance will be needed to allow farmers in developing countries to change to different crops, or change their agricultural practices.

**O**XOGEN booths have been put on the streets of Mexico City to protect people from "smog attacks." In March the capital spent three days under what the authorities called a second-stage smog alert.

People were urged not to leave their homes and limit use of their vehicles. It was only the second time this level of alert was necessary. Pollution levels had reached four times the World Health Organisation guidelines.

Hospitals have to cope with increasing numbers of people, especially children, with respiratory disease. The worst cases have to wear masks to help their breathing. The long-term effects are unknown and health statistics are inadequate. Death rates are five years out of date.

Mexico City's geography, economic plight and politics exacerbate the problem. Its 18 million people—exact numbers are uncertain—live in a mountain-ringed valley more than 2,000 metres above sea level. Migrants from the surrounding villages are attracted to the city because of employment, subsidised transport, housing, water and electricity. Ecological groups say the ruling Institutional Revolution-

## The City That Has to Struggle to Get Its Breath

The government of Mexico has launched an anti-pollution drive to reduce contamination caused in Mexico City by cars, oil refineries and industries. During the winter many factories, including an oil refinery, were ordered to shut. Now, reports Gemini News Service, millions of dollars are being earmarked to control the lethal concoction of gases from vehicles and industry. by Kulbir Natt

ary Party (PRI), which has governed Mexico throughout its independent history, has encouraged centralisation for political reasons. Mexico City generates one-third of the country's national income.

Estimates suggest that 2.5 million vehicles and 35,000 industries pump above five million tonnes of pollutants into the air annually. They include carbon monoxide, sulphur dioxide, benzene, nitrogen dioxide and assorted dust particles.

Mexico City's altitude compounds the problem. One-third less oxygen leads to slower fuel

combustion. This in turn raises the ozone level and results in the city being covered by a thick blanket of greyish brown smog for ten months of the year.

High ozone levels lead to eye irritation. In the long term it has more damaging consequences, like premature aging.

The basin in which Mexico rests means air circulation is inhibited and the blanket of smog is often slow to disperse. Air quality deteriorates in winter.

Emissions are trapped by layers of cold air descending from the mountains during the

night. The residents wake up to an unhealthy dose of sulphur dioxide.

Some environmental groups say the government is not doing enough, and that what is being done suffers from bureaucratic delay.

It is agreed that vehicle emissions cause about three-quarters of the smog. The current plan—the Integral Programme to Fight Atmospheric Pollution—has a \$2.5 billion budget and is being enforced this year.

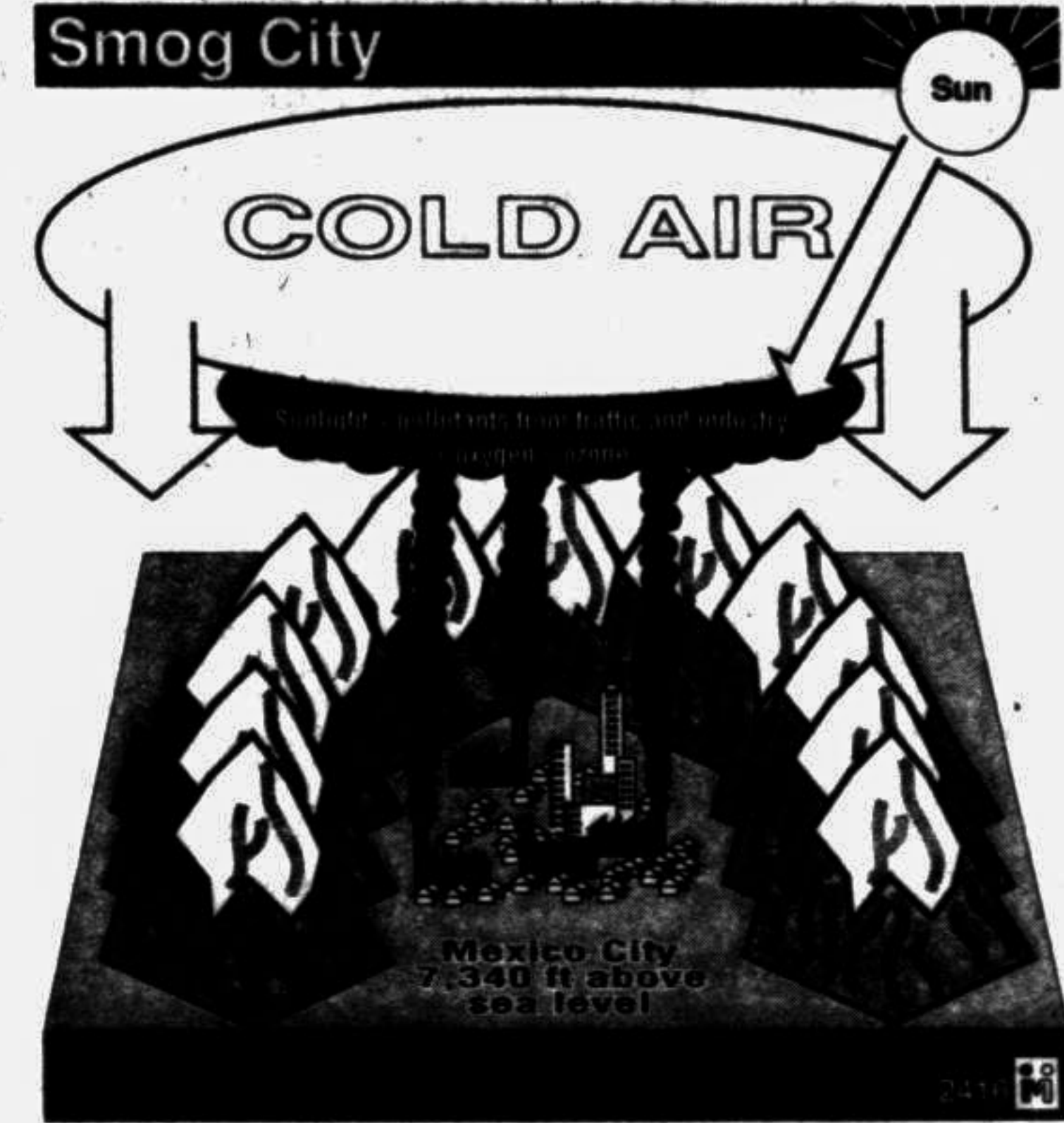
This is the largest sum set aside by any country to contain pollution. About \$1.3 billion has been earmarked to put controls on 40,000 taxis,

15,000 vans and an undetermined number of buses over the next two years.

On the industrial front some heavily polluting industries have been ordered to close. Others are being told to cut production and being installed with pollution control devices.

The government has offered tax incentives to persuade industries to relocate outside Mexico City. Few have done so. They complain of lack of infrastructure.

Most significant single development was closure of the "18 de Marzo" oil refinery. Environmental groups had campaigned for 10 years to



close the plant, which emitted 100,000 tonnes of nitrogen oxide and hydrocarbons into the air each year.

President Carlos Salinas announced the closure on the 53rd anniversary of its opening. It will cost about \$500 million dollars and represents a loss of 100,000 barrels of crude oil a day. They space will be turned into a public park.

Luis Manuel Guerra, President of the Autonomous Institute for Ecological Investigation, called the closure "one of the most transcendent events Mexico City has witnessed in the fight against pollution."

Pressure from environmentalists in having its effects. In 1987, the government announced what it called "one

hundred necessary actions." Many remain unenforced.

In 1989 a punitive "no driving today" programme was launched. It aimed to ban drivers from using their cars on one day of the week.

A legal loophole allowed wealthy Mexicans to use newly bought cars on the day of the ban. The sale of 200,000 above the norm since last year means the programme has had limited success.

A more radical, somewhat eccentric and unimplemented plan sought to cut deep passes through the mountains surrounding Mexico City to let the polluted air escape.

The current programme is greeted with more optimism. The target is to reduce pollution by almost 40 per cent in four years.

The optimism is backed up by Salinas' efforts to give environment a higher profile nationally and internationally. This year Mexico signed a debt-for-nature deal with an American developmental bank.

The bank bought \$100 million of Mexico's debt on condition that the country spent the money saved from the debt in reforestation. And in March Mexico staged a United Nations meeting to map out South American strategy for the UN World conference on environment in Brazil next year. — GEMINI NEWS

## Turning the Tide for Sri Lanka's Sea Turtles

Indian Ocean sea turtles, recently on the brink of extinction, appear to be making a comeback. The turtles' eggs had become a popular delicacy, and as a result numbers of the giant creature severely decreased. A Gemini News Service correspondent reports on his experience with the turtles and the simple but innovative plan which has their numbers increasing. by Sanjiva Wijesinha

**I**T was a cool, clear night at the end of Sri Lanka's southwest monsoon season. We stood expectantly on the soft, sandy beach at Bentota, a little west coast village some 30 miles south of Colombo. The sea was dark and warm, with gentle waves lapping the shore, just as they have for the past few million years.

As we watched, from out of the watery darkness appeared a rounded shape which slowly dragged itself from the sea and up the beach. It was huge sea turtle, about six feet in length (1.83m) and weighing about 500 pounds (227kg).

Using her powerful flippers, the turtle dragged her enormous weight along the sand and up the sloping beach until she had passed the high water mark. Here she began to dig, her flippers scattering sand in all directions as she scooped out a hollow approximately two feet deep to accommodate her body. Then, having rested for a few minutes, she began using her hind flippers to scoop out a hole beneath her tail.

Once this digging was over, she rested again, and then set about the main purpose of her visit, egg laying. Initially the eggs, each about the size of a ping pong ball came out at intervals of about half a minute. Soon they started arriving two or three at a time. By the time she had finished, there must have been over a hundred eggs in the hole.

The giant turtle rested for a while and then started using her flippers to scoop sand back into the hollow she had created. She then turned her head towards the sea and slowly, deliberately, started her journey back. By morning

the incoming waves would have washed away all traces of her tracks.

Like the lapping of the waves, this ritual has been going on since the time of the dinosaurs.

The hundred or so eggs laid by each sea turtle would incubate in the warm sand for 48 to 60 days and from them would hatch baby turtles.

Unfortunately, many people consider sea turtle eggs to be a delicacy. So to a Sri Lankan villager, a female turtle's output of hundred eggs represents about 100 rupees (about US\$ 2.50) worth of an easily marketable commodity.

In a community where 100 rupees is a man's average daily wage, the fact that sea turtles are an endangered species facing worldwide extinction means little. So most of the eggs would once have been dug out of the sand, sold, and ended up as omelettes, scrambled eggs or bull's eyes.

Realising the futility of trying to uphold the law by patrolling the beaches, and protecting the eggs until they hatched, a group of pragmatic wild-life enthusiasts decided to collect the eggs from their natural "nests" and incubate them in specially protected sand pits. The most practical way of collecting eggs to stock the hatcheries, they decided, was to get potential poachers to harvest the eggs by paying them the current market price.

Thanks to these turtle hatcheries set up at places such as Bentota and Kosgoda the tide has turned for the turtles. Since their inception, these hatcheries have released

## Protective poaching



Max length: 3.6m Max weight: 680kg  
As the female Sea Turtle lays her eggs she cries salty tears to help get rid of extra salt from drinking sea water.

over half a million turtles into the sea.

The hatchery at Bentota is run by the Bentota Robinson Club — a tourist resort run by the German-based Robinson resort chain. The hatchery at Kosgoda, initiated by medical doctor Upen de Zylva, is financed by the Swedish camera company Hasselblad.

Once the eggs hatch, the baby turtles are put into large tanks of sea water for a couple of weeks. If released too early, they are easy prey to big fish such as sharks. The turtles are released into the sea only at dusk to minimise the threat from birds of prey that pounce on turtles swimming near the surface.

Even within the hatchery, the baby turtles have to be protected from polecats, mongooses, porcupines and the ever watchful sea gulls and hawks. The hatchery keeper at Kosgoda, who has been there since its inception, spends many sleepless nights chasing away these predators.

Tourists from abroad come in large numbers to see the baby turtles in their tanks,

and, if they are lucky, to see the mother turtles laying their eggs.

The hatcheries, it would appear, have turned the tide for Sri Lanka's turtles. They are thriving once more in the Indian Ocean.

— GEMINI NEWS

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during the breeding season and the familiar croak in rural areas had virtually ceased until this year.

Professor Kazi Zaker Husain, project advisor of a recent survey, reports that the frogs have returned but that mature frogs are still rare. He warns against lifting the ban until the species is safeguarded.

The frog population survey involved field studies in five plots in each of 46 selected villages. For two months investigators caught frogs at night and marked them to avoid double counting.

Most frogs weighed between 150 and 170 grams (about 4-5 ounces) indicating that they had been born in the last two years. Full grown frogs weigh 250 - 300 grams (7-8 ounces). /PANOS

## THE IVORY DEBATE

More than a year after the ivory trade ban was imposed, experts are still debating whether the survival of the African elephant might be better assured if the trade in ivory is allowed. Eddie Koch of IPS reports.

**JOHANNESBURG** : Hunted to near extinction until the world slapped a ban on the trade in ivory last year, the African elephant now faces a new threat because of South Africa's plans to resume selling elephant tusks on the world market.

The ban, which came into force last January, dealt a death blow to ivory trading syndicates whose activities sustained the mass slaughter of elephants in African in the last decade, according to environmentalists here.

Prices are now at rock bottom, demand for ivory being effectively choked off and dealers in East Asia closing shop, said a representative from the environment monitoring group in Johannesburg.

"If we start to sell ivory again, it might just be the shot in the arm that producers of carved ivory in East Asia need to revive the trade," said the representative.

But an equally vociferous school of conservation argues that the very future of the African elephant depends on utilisation of the ivory trade rather than its suppression.

"Our elephants are not faced with a major threat," said Anthony Hall-Martin, chief conservation officer in the Kruger National Park, South Africa's biggest reserve.

"Our parks are well managed and we deal very effectively with poachers," said Hall-Martin.

"We used to make a lot of money by selling ivory from elephants in our parks," he said.

"Now we are unable to use this because of the ban. We are being discriminated against because states to the north of us have been unable to protect their elephants."

The first salvoes in the verbal battle were fired when Pretoria's environment minister, Louis Pienaar, announced recently that his government had taken the first steps to re-

sume the marketing of ivory and other elephant products.

The international moratorium on the sale of ivory was agreed at a conference of nations belonging to the Convention on International Trade in Endangered Species (Cites) in Lausanne in late 1989.

South Africa, together with Zimbabwe, Zambia and Botswana, opposed the ban.

But it agreed to participate voluntarily in the embargo for the whole of 1990 and extended this decision to cover this year.

Pienaar says South Africa has now asked Cites to remove South Africa's elephants from Appendix 1, the world body's list of endangered animals that may not be used for commercial purposes.

He wants them placed on Appendix 2 which covers animals that can be commercially utilised, subject to strict guidelines and international supervision.

If this proposal is accepted at the next conference of Cites parties, scheduled for Japan in March 1992, South Africa will again be able to market ivory and other elephant products internationally, says Pienaar.

The environment minister says a Cites team will be coming to South Africa to investigate the country's elephant management schemes ahead of the 1992 summit.

Pienaar is likely to use the arguments of an authoritative new book on the ivory trade by four researchers from the wildlife trade monitoring unit in Cambridge, England.

Authors Edward Barbier, Joanne Burgess, Timothy Swanson and David Pearce argue in their book, published by Earthscan and entitled 'Elephants, Ivory and Economics', that the African elephant faces a better chance of survival if conservationists make constructive use of the ivory trade instead of pushing it underground.

The team points to the communal area management programmes for indigenous resources (Campfire) projects in Zimbabwe as an example.

This provides revenue from sales of ivory for anti-poaching units and compensation for local communities whose agricultural schemes are sometimes damaged by elephants.

A number of other southern African states — including Botswana, Zambia, Namibia and the Kwangwe homeland for Swazi people in South Africa — have adopted similar projects to promote rural development and nature conservation at the same time.

Revenues from such schemes are shared with communities living on the borders of nature reserves.

The people receive tangible benefits and they act as the protectors of nature rather than the promoters of poaching.

The suppression of a community's rights to some exploitation of local wildlife, or to share in any proceeds resulting from wildlife utilisation, may actually encourage local people to hunt illegally or support outsiders engaged in these activities, the four authors contend.

They agree with other international experts that the ivory trade has declined because of the ban — especially due to the participation of Japan which once consumed some 40 per cent of the legal and illegal ivory on the world market.

But although prices have dropped by up to 40 per cent and ivory carving outfits in Japan and Hong Kong — the ivory capitals of the world — have been decimated, the authors warn that this is likely to give the elephant only a temporary respite.

New markets may open up in countries like South Korea, Taiwan and Saudi Arabia now that prices have slumped.

Export Ban Puts a Leap Into Frog Life

A two-year ban on frog exports has brought the sound of croaking back to Bangladesh — and may help cut pesticide imports writes Mostafa Kamal Majumder in Dhaka.

nearly US\$11 million in 1987/88, about eight per cent of frozen food exports.

The ban was imposed in 1989 after environmentalists complained that the loss of frogs was disturbing the ecological balance. Rice crops were particularly badly affected. Frogs are insect-eaters and, as exports rose, so did imports of insecticides.

Traders even caught frogs