

Feature

Environment

# The Operation of Sanitary Landfill Sites

by M N Islam

All landfill operations require careful planning in advance of the first deposit of waste; indeed, the main features of the proposed operations will have to be set out in the site operational plan which forms part of the working plan. How a landfill is operated determines to a large extent the environmental effects, and hence the public acceptability of the operation. One basic factor influencing the planning of site operations is the nature and quantity of incoming waste. The application of cover material during or at the end of the working day is an essential part of landfill practice. The various factors that are important to the efficient and responsible operation of a landfill are considered in the following sections:

Operational Factors

Following its collection, household waste will usually be taken directly to a landfill. However, in some cases pre-treatment has been found to be advantageous. The most commonly used pre-treatment methods for wastes in the UK and other developed countries are baling, wet pulverising and dry pulverising. The importance of maintaining a tidy site entrance is indeed such a requirement that is likely to be a condition of the disposal licence. Where the site entrance includes a reception area for waste brought by the public special care must be taken that this area does not become an eyesore. The types and quantity of all incoming waste should be recorded to provide data for a continuing assessment of waste inputs and with cover requirements as well as enabling predictions and future restoration. The control of traffic is very important, particularly on a large site where the working face may be some way from the site entrance. Good quality site roads are essential to ensure a

swift turn-round of vehicles in all weathers.

Three variations in landfilling techniques can be distinguished although in practice, depending on details of site operations and conditions, the distinctions between them may become blurred. The three main techniques are as follows: (a) Trench Method (b) Area Method (c) Cell Method.

Refuse Placement:

Where the base of the site cannot support the weight of vehicles, a preferred base will be required. The disposal of waste, other than inert materials, into standing water should not be permitted. Pushing waste over a vertical face is not acceptable. It should be deposited at the top or base of a shallow sloping working face. The angle of a working face should be shallow. Depositing waste in thin layers and using a compactor enables a high waste density to be achieved. Pulverised wastes can be landfilled in much the same manner as crude refuse. Rejects, which may comprise up to 50 per cent of the incoming waste, can be deposited first and then covered with the fine material. Baled waste can be transported to the working face on a trailer and should be deposited with the aid of a fork lift truck specifically designed for use over rough terrain. It is advisable for a baled waste-taking site that discrete cells are constructed and then filled with the bales. The size of these cells should be restricted to minimise leachate generation and fire risks. Compaction is essential for maintaining a well-run and visually acceptable site. A consequence of compacting waste to

a high density is that biodegradation may be slowed down due to decreased infiltration of water. Consequently, onset of production and the period of landfill gas and leachate generation may be extended.

Cover Materials

At most sites at the end of the working day, all exposed surfaces, including the flanks and working face, should be covered with a suitable inert material to a depth of not less than 0.15 m for the proper running of the site. Economically feasible and environmentally sound locally available cover materials should be used.

Whatever the cover material used, it will be necessary to estimate the quantity required each day. It is important that the surface of the waste is rendered smooth and any large protruding objects are removed.

Equipment, Manning and Safety

The plant most commonly used on landfill sites includes steel wheeled compactors, tracked dozers and loaders, rubber tyred wheel loaders, scrapers and hydraulic excavators. However, auxiliary equipment may also be required to carry out specific tasks such as spraying with water to reduce dust problems, the application of pesticides, roadsweeping and the like.

No one machine is capable of performing all the tasks required to operate a landfill. When selecting plant, consideration should be given to a variety of factors including site characteristics, site preparation, quantity of waste, type of waste, density of waste, cover requirements, back-up re-

quirements, operator comfort and safety. Machinery breakdown can be costly not only in terms of repairs and possible replacement machine hire charges but also the problems that will be caused due to poorly compacted waste and absence of cover. It is therefore considered prudent to encourage daily and weekly inspection of machinery and practice preventative maintenance.

Employment Levels

Employees should be competent, well trained and adequately supervised; training should include site safety and first aid.

The management and workforce should be made fully aware of the existence of site safety regulations and the need to observe them at all times.

Other Considerations

At some landfill sites a large number of bulky items may require disposal. Where it is economically viable, metal items such as refrigerators and cookers may be removed and sold for scrap. All other wastes should be placed, where possible, at the base of the working face after crushing.

The separation, and removal for subsequent sale, of items such as scrap metal is known as 'totting'. Totting should not be permitted at or near to an active working face but should be carried out only in specially designated areas away from the working face.

Environmental Control

Environmental control includes litter control, bird control, pest control, odours, fires, vandalism etc and should be practised carefully with the provision of the existing regulations.

Monitoring

Monitoring is an essential part of landfill operation, not only during the operational life of the site but also throughout the aftercare period.

# Eaglet Raises Hopes for Wildlife

A Philippine eaglet named Pag-asa (Hope), the first to be successfully bred in captivity, is rekindling wildlife awareness in a country where conservationists are waging a losing battle to save vanishing species.

## The successful breeding in captivity of the rare Philippine eagle gives a boost to conservationists working to preserve endangered Philippine wildlife, reports Yasmin Arzuza.

Pag-asa emerged from its shell on Jan 16, a triumph for biologists who have been trying to breed the rare bird of prey since 1977. It became the 28th member of the dwindling Philippine eagle population. Weeks earlier, caretaker Domingo Tadena was guard-

ing a nest of quail's meat after it hatched. Pag-asa appears healthy, no mean feat considering the modest facilities of the breeding centre run by the PECPF. The centre is located in a village containing patches of old-growth forest in Davao City in southern Philippines island of Mindanao.

Pag-asa, the centre's 13th

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forests as each bird protects a territory of 60 to 100 sq kms. With Philippine forests disappearing at a rate of 119,000 hectares a year, the eagle's chances of survival in the wild are very slim. Less than 40 of the eagles, both in captivity and protected in the wild, are known to exist.

Loggers are partly responsible for the decline of the 'noble fliers', as aviator Charles Lindbergh once described the Philippine eagle. 'The eagles are bad for their business,' says Tadena, who recalls losing three nests found inside a logging concession.

From a sprawling forested camp in Mt. Apo, the Philippines' highest peak, the breeding centre was transferred to its smaller site in Malagos in 1988 when clashes between communist rebels and government forces threatened the lives of both eagles and caretakers.

Government funds were initially used for the eagles' upkeep, but environment officials cut off support in 1987 when the programme's managers at the time refused to be audited.

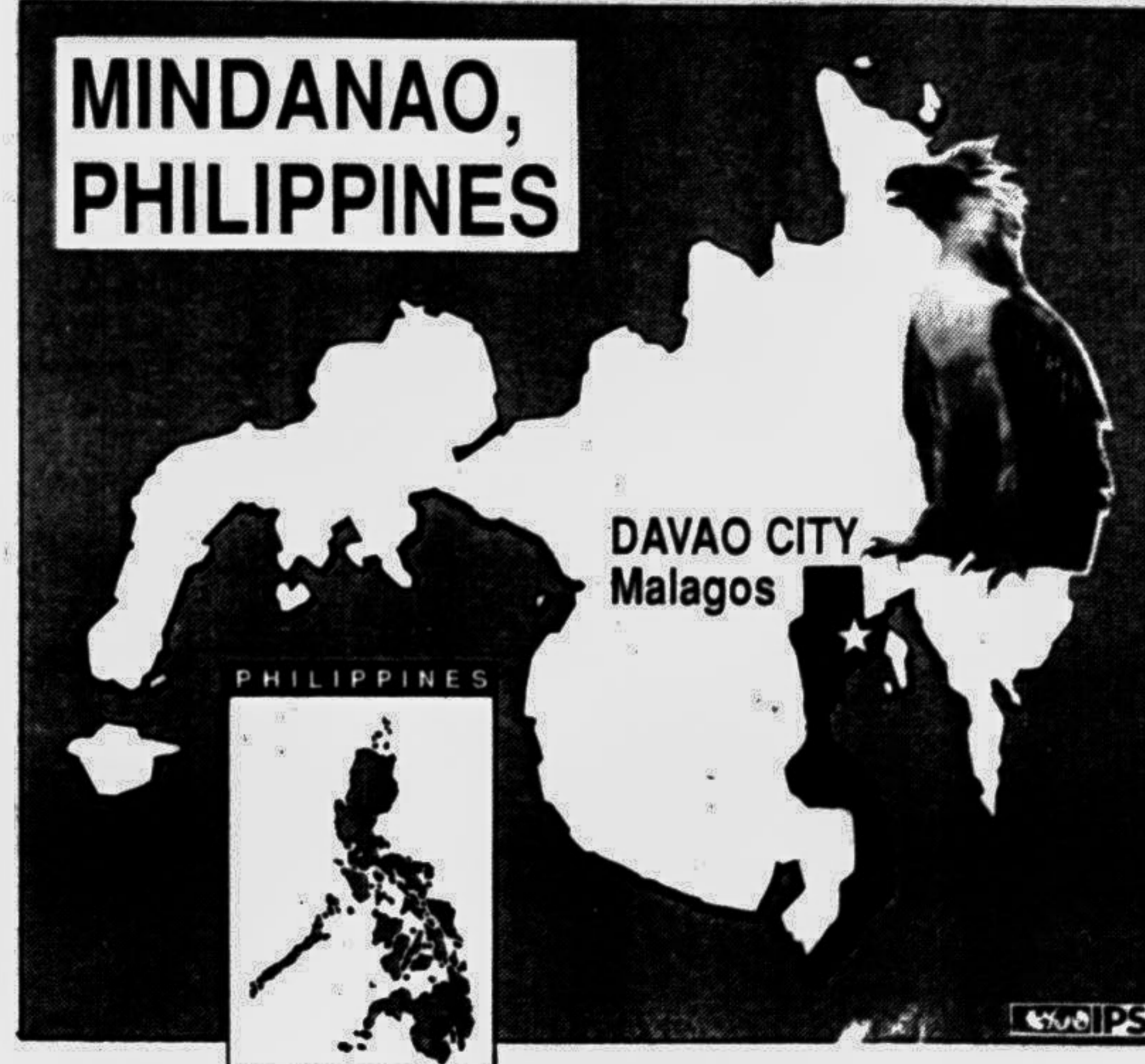
The programme spent US\$75,000 last year and will need a budget of US\$264,000 for 1992, says programme director Stephen Paspe. The centre survives on grants from agencies like the US-based Macarthur Foundation and Conservation International, corporate donations, and from visitors' fees.

About 40,000 people, mostly students, visited the eagles' camp last year. Tadena says donations increased along with environmental awareness when the breeding centre was opened to visitors.

To protect the eagles' habitat, the programme has an adopt-a-nest project which grants US\$112 to a family that offers to protect a nest found in the wild until the eaglet fledges.

Out of 26 nests found, only four remain, says Tadena.

Field workers from the centre also teach nearby communities the value of conserving wildlife and offer them livelihood projects like tree planting, farming, and setting up of seedling banks to ease population pressures in known Philippine eagle habitats.



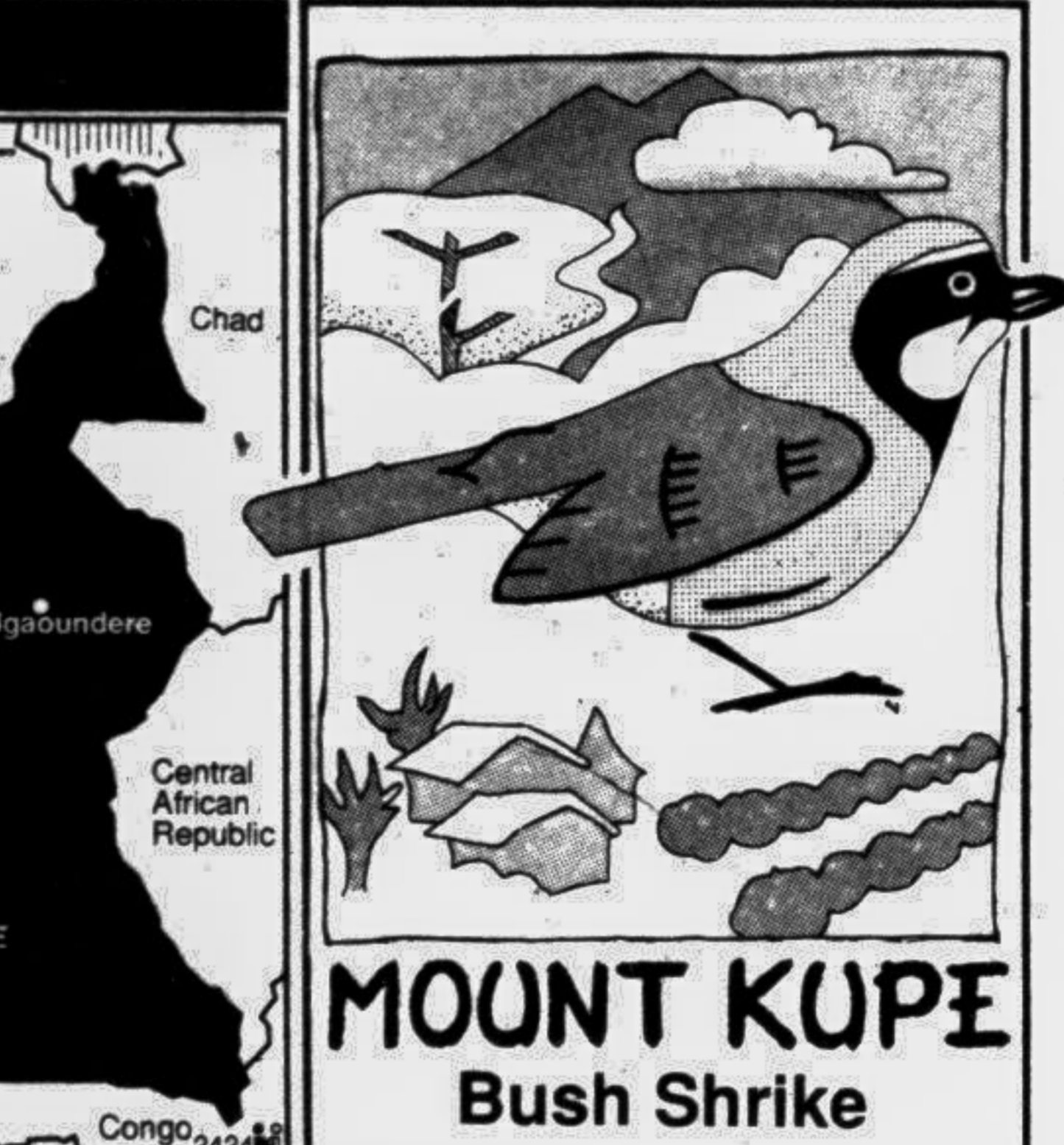
PHILIPPINES

# Bizarre Tourists Offer Mountain a New Future

by Mark R Richardson from Cameroon

Cameroon's Mount Kupe is the site of a tiny segment of rain forest that is home to a vastly diverse population of animals and birds. Like much of Africa, it is under threat from people wanting to plant farmland and hunt to extinction. Gemini News Service reports that, while the threat is still very real, a strange form of tourism offers the mountain some hope for protection.

The road to Nyasoso is one of the least driveable in this West African country. Over-loaded Land Rovers with shredding tyres and determined drivers are used for buses along the 10 miles of mud between the town and the paved road, and passengers often must get out and walk. Yet locals want tourists to come and spend money at Nyasoso, a settlement of a few thousand people isolated from



the main road by 2,000 metre high Mount Kupe. Now, thanks to that isolation and the work of a young British couple, visitors are beginning to brave the waist-deep mud ruts and collapsed bridges to reach the town.

The Bowdens arrived looking for a way to persuade the town not to destroy its forest. They found it with the Mont Kupe Bush Shrike.

It's actually quite surprising that something nobody has seen is so important to them, says Chris Bowden, describing the vicious predatory bird that only he and a dozen others have ever documented seeing.

"People ask 'Shouldn't we put it in a cage?' because they don't understand why someone should want to see it in the wild in the forest. But they do understand that it is unique, it's theirs, and that if they chop down the trees it will die."

Already the Bowdens have seen the effects of the disappearing forest in Cameroon's northern highlands, where eroded mountains can no longer provide either adequate farmland or timber for their dense local populations. It is essential, though, that Mount Kupe's residents want their mountain to be preserved for themselves, and not because they are told what is good for them.

"We're anxious the message is not coming from us, but from the people here," says Liz Bowden. "It would be ideal if local people can become involved in the management of all this."

"All this" is a small office in the town, under the same roof as the locally-run guesthouse, and a small nature club classroom at the high school. The Bowdens run educational programmes from each and will soon be travelling more frequently to the area's other villages in a truck donated by the World Wildlife Fund for Nature.

Some local people are hired as occasional guides, some as printers of the projects official T-shirt, and some as general help. Most people in town love the Bowdens. Most people still think bird-watching is weird. "It's a kind of collecting thing," Liz Bowden, a trained social worker, struggles to explain, "that takes a very particular mentality and is a bit of a fanatical little-boy thing."

She became a bird watcher herself after meeting her ornithologist future husband. Now that they have established a short nature trail at the base of the mountain and attracted a number of tour groups to the forest, local residents can appreciate the attraction of preserving their forest for the weird foreigners.

Mount Kupe has no legal protected status, so there is little to hunters from walking up its slopes and killing as many birds and animals as they wish. Guns have decimated the populations of most of the animals and the Bowdens have convinced some hunters that killing such rare creatures as monkeys and deer is not sustainable.

But they're up against hard economic reality: bush meat is greatly preferred to chicken or goat, and a chimpanzee carcass will sell for \$130.

"I don't think it's possible to kill all the animals," says Paul Mesumbe, a local hunter.

Mesumbe does not believe the warnings of the Bowdens that animals are being killed more quickly than they can reproduce. But he also can see the effects of his own action.

"In 1990, I shot so many drills (very large apes), and I was a rich man. But the whole of this year I've not seen any. I don't know why."

"They cannot finish, because I only shoot big ones and leave the little ones to grow up, but the ones aren't so big any more. If we keep shooting them, yes, in 10 years there will be no more drills left. In 10 years, we'll see what to do then."

The Bowdens don't want to wait until it's too late. They're considering finding a driving job for Mesumbe to tempt him into giving up hunting, but they know someone else will just take his place. "I have a gun that's owned by a big man near here," says Mesumbe. "He's a soldier and he gives me all my ammunition and makes sure I get no trouble, and I give him half of all I catch. He loves bush meat so much."

edly optimistic. Three other fertile eggs laid by captive eagles in the past did not hatch, and frequent power outages threatened the survival of Pag-asa, which was under a 24-hour watch. But conservationists say that unless the country's denuded forests are revived, Pag-asa may well remain in a cage. The Philippine eagle has become a critically endangered species because of the loss of the

use their struggle to preserve Philippine wildlife. The Philippines' tropical rainforests are a rich repository of biological diversity but rapid deforestation has made the country one of the world's ecological hotspots. Lack of expertise and controversy often hamper efforts to breed endangered species in captivity. The first tamaraw born in captivity in 1990 died a year later.

captive Philippine eagle; was conceived through artificial insemination. Its parents both had surrogate human partners who induced the eagles to produce semen and lay eggs through a process called 'imprinting'. The world's largest bird of prey, the Philippine eagle has a wingspan of nearly two metres and stands about a metre tall. It is a vital barometer of the state of the country's

# Good Things Come in Small Packages

by Sandra Mbanefo

As we circled over the southern sector of the Garamba National Park, a vast expanse of savannah, our pilot made such a sharp turn, that our stomachs lurched in reply. About 30 metres below, two northern white rhinos ran frantically away from the noise of the propellers. Dr Kes Smith, who monitored and researched rhinos for almost a decade, turned towards the back seat of the little Cessna, and over the din of the engines, shouted that this was Kunt with her male calf Solo.

Astonished at her ability to identify the rhinos from so far away, we asked how she could be so certain. "The female is fairly recognizable," she shouted. "She has a broad second horn, and if you see it from the side, it looks really wide." The first time I met Dr Smith, the saying, "great things come in small packages" came to mind. I was surprised at the petite stature of one of the world's leading rhino conservationists.

We met on a small dusty footpath in the Garamba National Park — just near the Dunga River, where the elephants take their evening bath. Over the next couple of days, she showed me around and talked about her work.

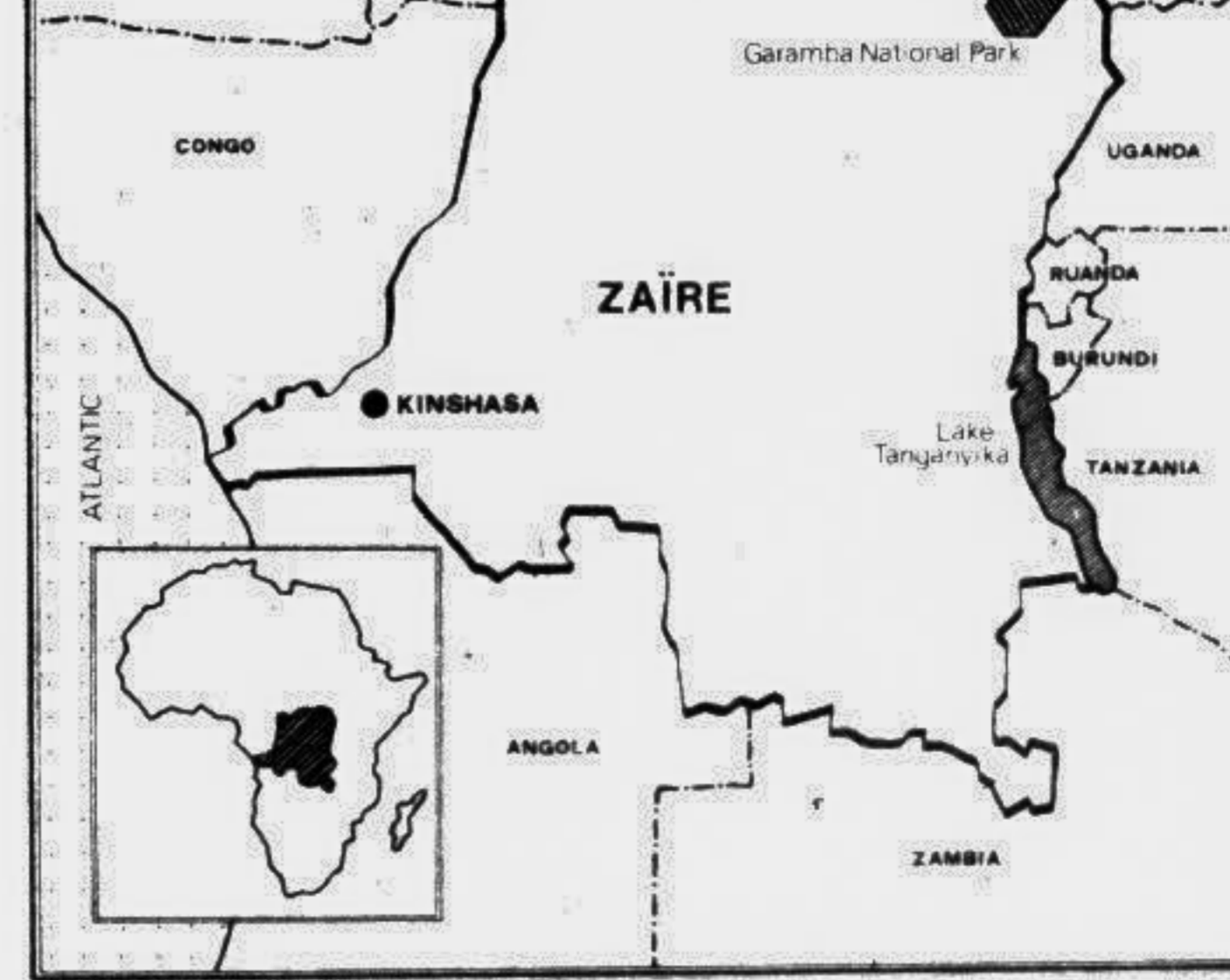
In the seventies, when Dr Smith was doing elephant research with Ian Douglas-Hamilton in Kenya, they realized that poaching was having a proportionally greater effect on rhinos than on elephants — especially with there being fewer rhinos. With funding from the New York Zoological Society and working with the late Major Ian Grimwood, who represented the WWF Rhino Campaign, Dr Smith began survey of the status of rhinos throughout Africa; a project that took two and a half years of travelling across the continent in an old beat-up Landrover.

They discovered that the northern white rhino was near extinction. Where the animal had once ranged across much of Zaire, Sudan, Uganda, Central African Republic, and Chad in the early 1900s, very few were left in Zaire and Sudan. In fact, between 1979 and 1982, most of the remaining rhinos in the Sudan had been poached. And of the estimated 1,300 rhinos found in Zaire in 1963, only 15 remained in

1984. It's one of the world's 12 most threatened animals. With the concerted effort of WWF-World Wide Fund for Nature, the Frankfurt Zoological Society (FAS), the Food and Agriculture Organisation (FAO), the United Nations Educational, Scientific and Cultural Organisation (UNESCO), the world conservation Union (IUCN), and the Institute Zairois pour la Nature (IZCN), a rhino conservation project was developed in Garamba National Park.

"You can't just go up and count all the rhinos because they're dispersed over 900 square kilometres, and you won't find them. We recognize each individual by their horns, ears, tails, and the wrinkles on their noses." Dr Smith, who flies her own plane, spends much of her time doing aerial surveying. When she's not airborne, together with her Zairois counterpart, Dr Mbayma Atala, she spends time monitoring rhinos on the ground. Going on foot patrols with guards, they often

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Situated in north-eastern Zaire, Garamba covers 492,000 hectares. It was made a World Heritage Site in 1980 because of its large concentrations of animals and unique population of northern white rhinos. The project was aimed at getting the park back on its feet and protecting the wildlife. Dr Smith's part of the project focuses on rhino research and monitoring of the park's ecosystem in conjunction with Zairois (IZCN) researchers. Rhino monitoring can be a complex and personal affair. "We monitor by individual recognition," explains Dr

Fraser Smith, Kes' husband, set up the anti-poaching surveillance system together with the park authorities. He trains the guards and coordinates both the ground and aerial surveillance of the park. With the northern white rhino increasing at the same rate (9.7 per cent per annum) as the southern white rhino, which increased from 100 to 5,000 animals, conservationists are somewhat optimistic. "Unfortunately the northern white rhino is starting from a much lower level and is likely to run into inbreeding depression," says Dr Smith. "The population might have to be genetically managed in the future."

She recently attended a meeting on rhinos in the USA, and was excited by some of the new findings confirming her suspicions about possible means of communication by rhinos. "We were occasionally seeing aggregations of female groups (mothers and calves) in a fairly small area, between two river valleys," she said. "You'd see four or five groups within 50 square kilometres (their total range is usually 900 square kilometres) and we were wondering how they communicate their movements. It's a whole exciting new field to look at!"

Married with two small children, Dr Smith would eventually like to write a book on rhinos. In over 10 years of rhino research she has much to write about. "It's fantastic to be working towards conserving a very valuable ecosystem," she told me. "I love animals and natural areas but what I really like about life here is it's challenging — you're not just muddling along in a mediocre grain!"

sometimes find an association with the male and female."

Presently, there are 31 rhinos roaming across Garamba's savannah; the population has doubled in just seven and a half years. This is largely due to added protection from anti-poaching patrol units.

"Since the park received help from international organizations, we have not come across any traces of rhino poaching," says Mohindu Mesi, Garamba's chief warden. "The animal most hunted for meat is the buffalo. We fly over the park and locate the poachers' camps. Then the ground patrols go to those areas by vehicle."

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