

CONSERVATION AND MANAGEMENT OF JAVAN RHINO (*Rhinoceros sondaicus annamiticus*) IN VIETNAM

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Abstract

The Javan rhino (*Rhinoceros sondaicus*) is perhaps the most endangered species of large mammal in the world. Only two populations of it are known in the wild: one in Indonesia and another in Vietnam. None exist in the zoos. In March 1991, a survey was carried out in the Lam Dong province about 250 km north-east of Ho Chi Minh City to re-assess the status of the Javan rhino and establish a sanctuary for its protection. The survey indicates that between 8–12 animals may still survive in the 35,000 ha area which is a low-land, semi-evergreen forest dominated by the commercially important family Dipterocarpaceae. The area is inhabited by a number of families belonging to the Stieng and Chauma minority tribes who practice slash and burn agriculture and also hunt big game for meat. Therefore the principal threats to the rhino are poaching and forest clearance. On the basis of the survey, a core area was demarcated as the Rhino Sanctuary and protected further from human encroachment with the establishment of buffer zones both to the north and south of the sanctuary. It is further recommended that the Rhino sanctuary and its buffer zones be linked to the Nam Bai Cat Tien National Park in the Dong Nai province adjacent to the Lam Dong province. It is also recommended that the entire conservation area incorporating the Rhino Sanctuary, Buffer Zones and Nam Bai Cat Tien National Park be declared a Man and Biosphere (MAB) Reserve. A comprehensive project proposal for the conservation and management of Javan rhino in Vietnam was prepared for 1991–1994, and it has the support and endorsement of the Ministry of Forestry (MOF) in Hanoi, Vietnam.

Introduction

In the past, until about a hundred years ago, the Javan rhinoceros was widely distributed throughout much of South and South-east Asia. Its geographic distribution stretched from Assam and Bangladesh in the Indian Sub-continent, eastwards through Burma,

Peninsular Malaysia, Thailand, Laos, Cambodia, Vietnam and possibly south-west China and further south-eastward into the islands of Sumatra and Java in the Indonesian archipelago (Loch, 1937; Sody, 1959; Groves, 1967; Schenkel and Schenkel-Hulliger, 1969; Hoogerwerf, 1970; Rookmaaker, 1980). But over the years, a combination of forest conversion and poaching for the horn had eliminated the species throughout much of its range. At the turn of the century the only population that was known to have had any long-term survival prospects was that in the Ujung Kulon National Park in the south-western tip of Java where today, about 57 animals survive (Santiapillai *et al.*, 1990). In addition it was thought that there would be some animals still surviving in Thailand, Laos and Cambodia (McNeely and Laurie, 1976) and in Vietnam (Talbot, 1960; Rookmaaker, 1980; Penny, 1988). There is at present firm evidence for the continued survival of a small population of Javan rhino in Vietnam (Dang, 1986; Schaller *et al.*, 1990; Dang *et al.*, 1990; MacKinnon, 1990). This paper re-assesses the status of the Javan rhino population in Vietnam and recommends the conservation and management measures needed to ensure its long-term survival in its natural habitat in Vietnam.

Distribution of Javan Rhinos in Vietnam

In the distant past, both the Javan and the Sumatran rhino (*Dicerorhinus sumatrensis*) co-existed in Vietnam. By early this century, the Sumatran rhino had become extinct (Schaller *et al.*, 1990). The Javan rhino by contrast has managed to survive although in very small numbers up to the present time. Until about 50 years ago, its distribution extended from the Lai Chau province in the north down through Son La to the western parts of Thanh Hoa and Nghe Tinh provinces and in the south from Gia Lai-Con Tum province through Dac Lac, Lam Dong and Dong Nai to Song Be province. Today, however, the last stronghold of the Javan rhino appears to be the Lam Dong province along the Dong Nai river where the four provinces (Dac Lac, Song Be, Dong Nai and Lam Dong) meet.

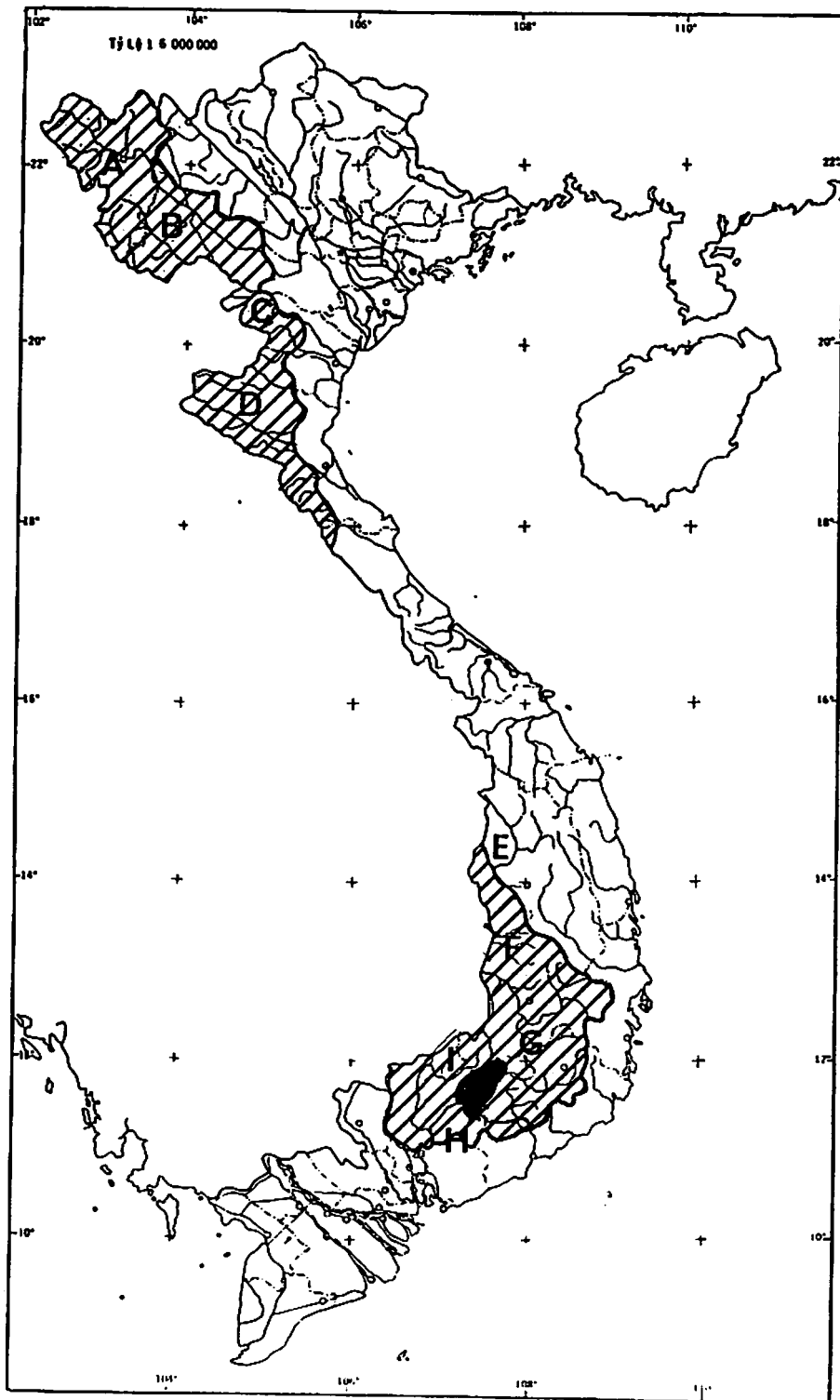


Fig. 1 Map of Vietnam showing the extent of the past (cross hatching) and present (solid shading) distribution of the Javan rhino in Vietnam.

Provinces: A: Lai Chau, B: Son La, C: Thanh Hoa, D: Nghe Tinh,
 E: Gia Lai-Con Tun, F: Dac Lac, G: Lam Dong, H: Dong Nai, I: Song Be

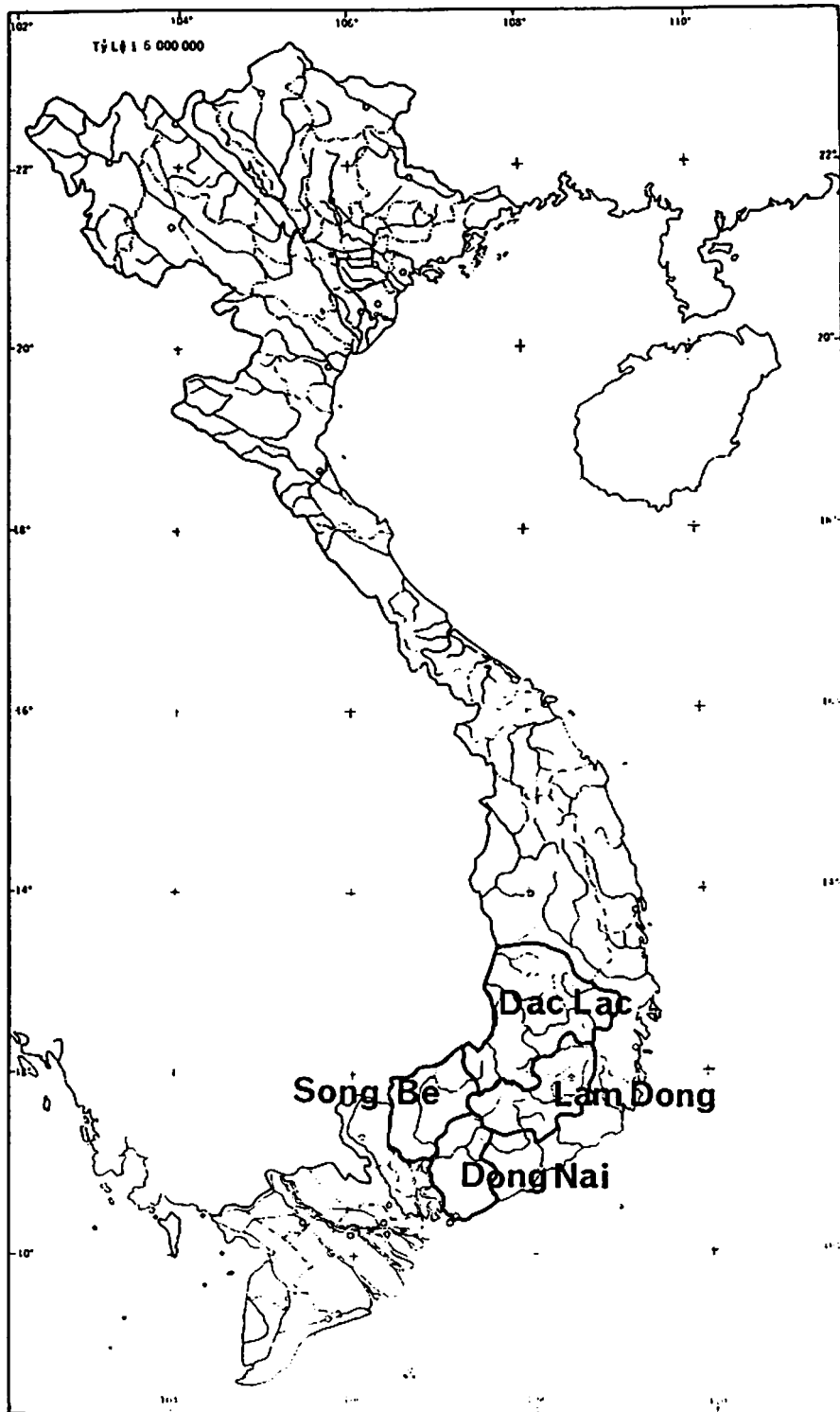


Fig. 2 Map of the four provinces integral to the Javan rhino conservation

Rhino Area

The rhino area is in the north-west of Lam Dong province and incorporates the two districts of Cat Tien and Bao Loc and is bordered on the west and north by the Dong Nai river. The survey was carried out in the Cat Tien district in March 1991, assisted by Forestry officials from Lam Dong Province. The core area inhabited by the rhinos amounts to about 35,000 ha and it includes both Cat Tien and Bao Loc districts. The area receives about 2,400 mm of rain, much of it falling during the period May to October. The dry season extends from November to April.

Habitat and Vegetation

The core area inhabited by the rhinos represents one of the few tracts of lowland forests left in Vietnam. Much of the area is between 100–600 m in altitude and is characterised by a range of low hills covered with tropical semi-evergreen vegetation dominated by the commercially important family Dipterocarpaceae. Logging still goes on but the extraction of timber is selective.

Tree species include among others, *Dipterocarpus alatus*, *Dipterocarpus turbinatus*, *Lagerstroemia tomentosa*, *Lagerstroemia calyculata*, *Hopea odorata* and *Elaeocarpus dubius* while the bamboos are represented by *Oxytenanthera nigro-ciliata*, *Bambusa blumeana*, *Bambusa procera* etc. The rattans include *Calamus rudentrum*, *Calamus poilanei*, *Calamus tetradactylus*, *Daemonorop pierrei*, *Plectocomia elongata*. In addition there are many shrubs such as *Memecylon edule* and *Ixora coccinea*. Grass cover is mainly of *Pennesetum polystachion* and *Imperata cylindrica* (American grass) which is considered to be a weed that invades cleared areas rapidly and is difficult to eradicate.

There are many swampy areas throughout the habitat of the rhinos in the Cat Tien part and even during the dry season, some swamps remain wet enough to provide the wallows for the rhinos and other herbivores, especially the Gaur (*Bos gaurus*), the Banteng (*Bos javanicus*) and the Wild pig (*Sus scrofa*).

Status of the Rhino

For many years in the past, there had been reports

of the presence of Javan rhinos in the area in and around the Dong Nai river. Hunters and soldiers have reported having seen "herds" of rhinos of 14 and 20 animals (Schaller *et al.*, 1990). These are more likely to be exaggerations as the Javan rhino is largely a solitary animal and groups of more than 3 animals are unknown (Ammann, 1985). During the war, a number of animals might have been poached by soldiers and quite a few may have even succumbed to the land mines. In 1988, a rhino was killed by a member of the Stieng minority tribe in the Cat Tien district (Fig. 3) of Lam Dong province (A). Its skeleton was discovered by Mr. Pham Van An (Deputy Director of Forest Protection Department of Lam Dong Province) and the skull and bones were brought to Hanoi and assembled by Mr. Pham Mong Giao (Ministry of Forestry). Other reliable records of the Javan rhino comes from Bao Loc district in 1982 where an animal was seen in between the Da R Somi and Da Len rivers (B); another from the banks of the Da Dim Be river in 1984 (C) and later in 1988 (D). More recent information comes from the survey carried out by Schaller *et al.* (1990) when tracks of an animal were seen on both banks of the Dong Nai river in Song Be and Lam Dong provinces (E) & (F).

In our survey carried out in March 1991, we saw clear evidence for the presence of 3 or 4 animals in the Cat Tien district of Lam Dong Province. There were tracks of two animals measuring 26.0 cm and 17.0 cm, perhaps belonging to an adult female and her calf respectively (G). The longest distance between the fore and hind foot was 44.0 cm. These tracks were seen in a logged out area dominated by rattans and shrubs. Further about a km to the north we saw a pile of dung (H) with clear rounded boli that cannot be confused with that of either the Gaur or the Banteng. Further down in the swampy area, there was a wallow (I). We also saw a clear trail of a rhino within a forest patch dominated by rattan species. There were two foot prints (26.0 and 28.0 cm) in the vicinity (J).

We also talked to Stieng and Chauma tribe members who hunt. They told us that they had come across rhinos on several occasions in the past and that the animals were mostly solitary and were known to move seasonally in search of food and mates. Two members of these tribes accompanied us throughout the survey. In addition, staff from the logging unit based in the Cat Tien district told of sighting one animal in February 1991 just north of a Stieng Village (K), while another referred to seeing the foot prints of 3 animals in the central part of the core area in the Bao Loc district in July 1990 (L) and another reported encountering three animals along the southern boundary of the core area in

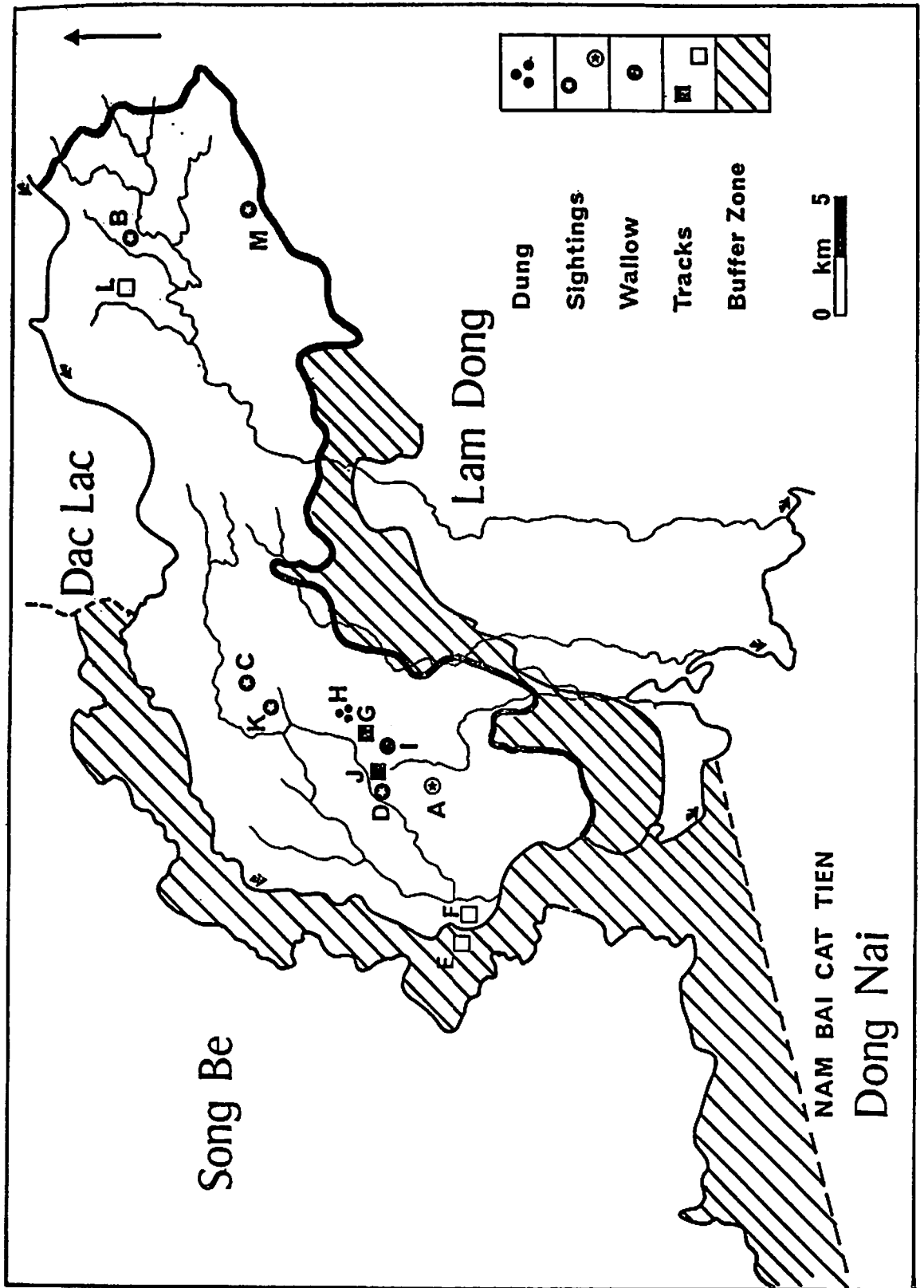


Fig. 3 Map of the Lam Dong Province showing the known rhino localities within the proposed Javan Rhino Sanctuary.

Number of Rhinos

We estimate a minimum of 8 animals in the core area based on the evidence seen in the field. There could be between 8 to 12 animals in the 350 km² core area. Schaller et al. (1990) estimate that at most 10–15 animals may survive in the 750 km² area which includes the core area as well as buffer areas to the north and west of it.

Although the Javan rhino population in Lam Dong province is very small, it does not necessarily mean that it is doomed. Small populations of rhinos have showed remarkable recovery and increased in number substantially in Asia under strict protection. The Ministry of Forestry in Hanoi and the Forest Protection Department in Lam Dong Province have identified the *in-situ* conservation of the Javan rhino as a high priority.

Food and Feeding

The study area showed ample evidence of rhino feeding activity. A crude analysis of the dung also revealed the presence of undigested plant material, some of which were identifiable. Among the plants that formed the diet of the rhinos were: *Acacia pennata*, *Calamus tetradactylus*, *Calamus poilanei*, *Combretum* sp., *Bambusia procera*, *Bambusa blumeana*, *Plectocomia elongata*, *Daemonorop nigro-ciliata*. In addition, it appears that the rhinos might be feeding on wood-fern (*Cyathea* sp.) and even on *Strychnos nuxvomica*, which is highly poisonous to many other species of animals.

Threats to the Javan rhino

The Javan rhino occurs only in two areas in the world: the Ujung Kulon NP in West Java in Indonesia and in the Lam Dong province in Vietnam. None exist outside these areas, not even in the zoos. Of the two populations, the one in Vietnam appears to be the most seriously endangered. The main threats to the rhino population are poaching and habitat destruction.

Poaching

This is the most serious threat facing the rhinos

today. It is serious given the small number of animals extant in Lam Dong province. In the past, hunters from the Stieng minority tribes have killed rhinos for the horns which were sold to Chinese merchants in Ho Chi Minh City. There are two small populations of Javan rhino in Cat Tien and Bao Loc districts of the Lam Dong Province. In each there may be about 4–6 animals. Given the uncertain sex ratio, poaching of any animal could easily undermine the long-term survival of the species. The problem is further compounded by the fact that there are many guns and rifles (a legacy of the long war with the Americans) available freely for anyone wishing to poach. Besides, hunting is a traditional way of life for many of the minority tribal people. Most of them being illiterate do not realise the importance of the rhino in their scheme of things. But fortunately, the poaching problem is being brought under control by the authorities concerned. Since 1988 there have been no new reports of rhinos being killed by poachers or hunters.

Logging

The rhino area is rich in commercially important timber species which are being exploited by the Forestry Department. The extraction of timber is based on a system of selective felling that specifies a minimum diameter (dbh) of 60 cm felling limit and a cutting cycle of 35–40 years. Logging as it is carried out in Vietnam in itself is not a direct threat to the rhinos. In fact, the logged out areas offer some of the best habitats to the rhinos and other herbivorous mammals. Selective logging provides ample food resources for the rhinos. However, the threat to the rhinos is indirect: By opening up the forests through the construction of motorable logging roads, the core area of the rhinos are made accessible to the people and poachers alike. Hitherto inaccessible areas where the rhinos may survive are made vulnerable to the threat of poaching. Herein lies the threat from logging.

Slash and Burn Agriculture

Almost all the minority tribal people resident within the rhino habitat practice slash and burn agriculture. The fires set by farmers inhabiting the rhino area may easily spread into the forests, especially during the dry season when there is plenty of combustible plant material. Shifting cultivators have been identified as one of the primary agents of forest destruction throughout Asia and Vietnam is no exception.

Inbreeding Depression

Given its small size, the population of Javan rhino in Lam Dong Province may suffer from loss of genetic diversity through random losses of rare genes and increased levels of inbreeding. An immediate effect of the depletion of genetic variability is increasing homozygosity of the individuals in the population (Lacy, 1987). Without genetic variation, the population may not be able to adapt to changing conditions in its environment and is therefore vulnerable to diseases, parasites, changes in food supplies and climate, and inter-specific competition. However, inbreeding depression does not mean the end of the population. In respect of viability of small populations, inbreeding initially may cause a loss of fitness through the exposure of deleterious recessives, but once these have been selected out, viability of the population usually returns.

Management of Javan Rhino

As Caughley (1977) points out, the aims of population management are few and specific. In fact there are only three problems of population management:-

1. The treatment of a small or declining population to raise its density (i.e. conservation).
2. The exploitation of a population to take from it a sustained yield (i.e. sustained yield harvesting).
3. The treatment of a population that is too dense, or which has an unacceptably high rate of increase, to stabilize or to reduce its density (i.e. control).

In Vietnam the most overriding concern is to enhance the long-term survival of the Javan rhino population in its natural habitat. To achieve this long-term goal, several short term measures need to be adopted in Vietnam. They are:-

1. **Government support:** The most important requirement for any successful conservation programme must surely be the Government support for the programme. In Vietnam this was forthcoming. At a meeting held after

the survey in Dalat, the Vice-Chairman of the Lam Dong Province gave us his unstinted support in establishing a special Rhino Sanctuary to ensure the long-term survival of the species. Given the global importance of the Javan rhino population, the Provincial Government plans to stop logging and ban hunting within the core area.

2. **Demarcation of core and buffer areas:** On the basis of the survey, it was possible to identify the core area and demarcate its southern and eastern boundaries, with the Dong Nai river making the western and northern boundaries (Fig. 3).

The proposed management plan recommends the establishment of appropriate buffer zones both to the north and south of the core area and linking the rhino sanctuary to the adjacent Nam Bai Cat Tien National Park (44,000 ha), thus effectively increasing the total area under conservation to about 100,000 ha.

3. **Guard posts:** At present, the rhino area has no guard posts. It is proposed, therefore, to establish 8 Guard Posts both within the core area and outside (Fig. 4) from where the guards after training could carry out the patrolling of the area. In order that the patrolling is carried out effectively, the guards and guard posts would be adequately equipped.
4. **Public awareness campaigns:** Conservation programmes, if they are to succeed, must have the support of the local communities that live nearby. This is especially important in Vietnam where many of the human populations inhabiting wilderness areas still rely on their traditional way of life (hunting, slash and burn agriculture, etc.). The Ministry of Forestry is aware of the importance of "educating" the people at large on the plight of the Javan rhino and other endangered species. It therefore plans to launch a conservation awareness campaign to promote greater understanding and co-operation among the tribal people. The Rhino conservation programme will, therefore, have a component to enhance the way of life of the people and improve their livelihood.

Conservation of the Javan Rhino Population

Despite the war and the damage caused to the forests by the massive spraying of defoliant and toxic chemicals such as Agent Orange, the Javan rhino has managed to retain a toe hold in Vietnam. That it has survived so far underlines the fact that as long as suitable habitat is available to them and poaching is eliminated, the animals will survive in their natural habitat. Not all small populations are necessarily doomed. Small populations of rhinos have managed to build up their numbers as a result of better protection alone. There are several examples of such recovery:-

1. *India*: The Great Indian one-horned rhinoceros (*Rhinoceros unicornis*) in the Kaziranga National Park in Assam, through rampant poaching fell to a dozen or so individuals at the turn of the century (Deb Roy, pers. comm.). However, improvement in the protection of the park resulted in a steady increase in the number of rhinos. By 1940, the animals increased to 400 (Gee, 1952). By 1980, there were about 1,000 animals (Singh and Rao, 1984). Today, Kaziranga is estimated to have about 1,500 animals (Dinerstein and McCracken, 1990).
2. *Indonesia*: Prior to the improvement of the protection of Ujung Kulon National Park where the Javan rhino occurs, the animal was poached so heavily that in the 39 years from 1929 to 1967, the numbers declined to about 25 in 1967. However, under improved protection, the number of rhinos increased at an annual average rate of 6.2% to 52 animals by 1980 (Ammann, 1985). Today, the number of Javan rhinos in Ujung Kulon is estimated to be about 57 (52-62) (Santiapillai *et al.*, 1990).
3. *Nepal*: Excessive land clearing and hunting fragmented the range of *Rhinoceros unicornis* in Nepal and led to the elimination of the species from all areas but the Chitwan Valley (Dinerstein and McCracken, 1990). The number of rhinos fell from 1,000 to 120 by 1960 (Pelnick and Upreti, 1972). Today, however, as a result of better and more efficient means of protection, the number of rhinos has increased to more than 400.

4. *South Africa*: The number of white rhinos (*Certaotherium simum*) in the Umfolozi Game Reserve according to Schaurte (1960) increased from a stock of about 20 animals to over 600 within 50 years' time and in an area of comparable size to that of both Ujung Kulon NP and the core area of the proposed Rhino Sanctuary in Lam Dong province in Vietnam.

Recommendations

- The first priority is to legally establish a Rhino Sanctuary to protect the core-habitat of the animals in Lam Dong Province.
- Once the Sanctuary is established, logging and hunting within this core area must be stopped.
- For the protection of the rhinos and their habitat, a system of guard posts must be built both within and outside the core area and be manned by trained and fully equipped guards.
- The core area must be further isolated from human encroachment by the establishment of appropriate buffer zones both to the north and south.
- The rhino habitat could be vastly increased if the core area and the buffer zones are linked to the Nam Bai Cat Tien National Park situated in the adjacent Dong Nai province. This would increase the effective rhino habitat to 100,000 ha and thus would become the most important conservation area in southern Vietnam.
- The entire complex of the Rhino Sanctuary, its buffer zones and the Nam Bai Cat Tien National Park should be declared a Man and Biosphere (MAB) Reserve.
- A detailed survey must be carried out both within the core area and in its environs (especially in Dac Lac and Song Be provinces) to determine the range and number of rhinos.
- Regular surveys should be carried out to monitor the population trends. If there are some animals outside the protected area, then they must be captured and translocated to the core area.

- Stricter penalties must be meted out to persons killing rhinos or trading in rhino products. Buying and selling of rhino horn must be made illegal. It is in fact easier to stop the trade in the shops and ports than to catch all the poachers in the forest (MacKinnon, 1990).
- A strong conservation education programme must be mounted and be addressed at the villagers who still hunt animals so that the threat to the Javan rhino and other large mammals could be greatly minimised
- The conservation programme should also address the needs of the local communities that live in the vicinity of the rhino sanctuary and provide every assistance to improve their livelihood. Villagers could be given an alternative to practising slash and burn agriculture in favour of cultivating permanent plots of cash crops (Schaller *et al.*, 1990).

The Javan rhino is well adapted to respond to a "sanctuary strategy". The small population in Lam Dong province, if thoroughly protected, has every chance of increasing in number and becoming viable. The estimated 8-12 animals in Lam Dong province are valuable and so should be protected and not abandoned on the unproven hypothesis that genetic degeneration will set in and automatically eliminate them. In Vietnam, the factors adverse to the Javan rhino's long-term survival lie in the human population and its aspirations to an enhanced standard of living. Another hidden danger may come from the demands by industrialised countries for goods of the kind which lead to pressures on the rhino's life support systems.

References:

- Ammann, H. 1985. *Contributions to the Ecology and Sociology of the Javan rhinoceros (Rhinoceros sondaicus Desm.)*. Ph. D. dissertation, University of Basel.
- Caughley, G. 1977. *Analysis of Vertebrate Populations*. John Wiley and Sons. New York.
- Dang, H.H. 1986. *Biology and Ecology of Ungulates in Vietnam*. Science and Technology Publ. Hanoi (in Vietnamese).

- Dang N.X., Thuy, L.D., and V.T. Son. 1990. *Status and Conservation of the Javan rhino in Vietnam*. Mimeo
- Dinerstein, E. and G.F. McCracken 1990. *Endangered Greater One-horned Rhinoceros carry high levels of genetic variation. Conservation Biology*. 4: 417-422.
- Gee, E.P. 1952. *The Great Indian One-horned Rhinoceros*. *Oryx*. 1: 224.
- Groves, C. 1967. *On the rhinoceroses of south-east Asia. Säugetierk. Mitt.* 15: 221-237.
- Hoogerwerf, A. 1970. *Udjung Kulon: the land of the last Javan rhinoceros*. Leiden, R.J. Brill.
- Lacy, R.C. 1987. *Loss of Genetic Diversity from Managed Populations: Interacting Effects of Drift, Mutation, Immigration, Selection, and Population subdivision. Conservation Biology*. 1: 143-158.
- Loch, C.W. 1937. *Rhinoceros sondaicus, the Javan or lesser one-horned rhinoceros and its geographical distribution. J. Malayan br. Royal Asiatic Soc.* 15: 130-149.
- MacKinnon, J. 1990. *Review of the Natural Conservation System, National Parks and Protected Areas*. Ministry of Forestry, UNDP and FAO. Hanoi.
- McNeely, J. and A. Laurie. 1976. *Rhinos in Thailand. Oryx*, 13: 486-489.
- Pelnic, E. and B. Upreti. 1972. *A census of rhino in Chitwan National Park and Tamaspur forest Nepal*. HMG/UNDP/FAO National Parks and Wildlife Conservation Department Report, Kathmandu.
- Penny, M. 1988. *Rhinos: Endangered Species*. Facts on File Publ., New York.

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