CONSERVATION AND MANAGEMEENT OF JAVAN RHINO (*Rhinoceros sondaicus*) IN INDONESIA

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1.0 INTRODUCTION

Prehistorically, as many as 30 genera of rhinoceros may have roamed the world (Nowak and Paradiso, 1983). But today there are only four genera and five species left: three species in Asia and two in Africa. Of the three species of rhinos that are extant in Asia, two occur in Indonesia, viz. the Javan or lesser one-horned rhino (*Rhinoceros sondaicus*) and the Sumatran or two-horned rhino (*Dicerorhinus sumatrensis).* Both are in conflict with man and are among the species of large mammals that are most seriously endangered in Indonesia.

Because of the high price of rhino horn on the international market, the rhinos in Indonesia, like their cousins throughout Asia and Africa, are currently suffering from drastic reduction in numbers through illegal hunting. The Javan rhino in Ujung Kulon National Park at the southwestern tip of Java (Fig. 1) finds itself with its back against the wall. It is on the verge of extinction on account of its small numbers, localised distribution, and vulnerability to poaching, disease and environmental disturbance such as loss of habitat through human encroachment.

The Sumatran rhino although more widely distributed in Sumatra, and perhaps also still occurring in Kalimantan, is nevertheless threatened by a combination of indiscriminate deforestation and poaching. Both species are among those animals legally protected in Indonesia. However, legislation and statutory provisions to protect the two species of the rhino and the establishment of reserves have not been sufficient to prevent the rhinos coming to the verge of extinction. The rhino reserves still lack adequate and strong protection. This is necessary to save Indonesia's rhinos.

2.0 SPECIES ACCOUNT: JAVAN RHINO

Of all the species of rhinos in the world, it is the Javan rhino that is in the most precarious situation (Sheeline, 1987). There are only two known populations: one in Indonesia and the other in Vietnam and the entire world population is thought to number less than 100 animals (Dang *et al.* , 1990). Poaching which had extracted a heavy toll in the past is still the main threat to the Javan rhino.

2.1 Distribution & Population: Historically, the Javan rhino enjoyed wide geographic distribution and good numbers in South and Southeast Asia. Until about 150 years ago, prior to the large scale modification of its habitat by man, the range of Javan rhino extended from Assam in the west through Asia south of the Himalayas to Indochina in the east. It was known from India, Bhutan, the Sunderbans (Bangladesh), Burma, southern Thailand, Peninsular Malaysia, Laos, Cambodia, Vietnam, Southwestern China, Sumatra and much of Java (Loch, 1937; Sody, 1959; Groves, 1967; Schenkel and Schenkel-Hulliger 1969; Hoogerwerf, 1970; and Rookmaker, 1980). The main limiting factor seems to be the

availability of suitable habitats. This is perhaps the reason why the rhino's range could not extend into northern Thailand or eastern Java (Groves, 1967). The habitats with the greatest potential rhino carrying capacity were the fertile flood plains in Asia. These are also the habitats most severely disturbed by man, for conversion to agriculture. Human pressure on the lowland plains had been intense since earliest times. This may perhaps explain why the Javan rhino was never recorded from central regions of Burma and Thailand in recent historical times (Ammann, 1985). Today, the Javan rhino is known from only two places: Ujung Kulon National Park in west Java (Fig. 1) and an area near the Dong Nai river in the Bao Loc District of Western Lam Dong Province about 130 km northeast of Ho Chi Minh City in Southern Vietnam (Schaller *et al.*, 1989, Dang *et al.*., 1990).

During the 18th century, the number of rhinos in Java were so numerous and the damage they caused to agricultural plantations so heavy that the Government of the day was forced to pay a premium of 10 crowns for every animal that was killed (Hoogerwerf, 1970). Until about the turn of the century, the rhino was common in Java as far east as Kediri (Fig. 2) and even recorded in the vicinity of Jakarta in the Krawang area (Hoogerwerf, 1970). Since then the decline in the rhino's range and numbers has been dramatic. Today, perhaps only about 60 animals are estimated to occur in Ujung Kulon National Park (Santiapillai*et al.*., 1990), while between 10-15 animals are likely to survive in Southern Vietnam (Dang *et al.*., 1990)

2.2 Reserves where Javan rhino occurs: In Indonesia the Javan rhino is found only in the Ujung Kulon National Park, which is 300 km^2 in extent and is situated at the southwestern tip of Java. Ujung Kulon was first established as a Nature Reserve in 1921 and declared a National Park in 1980. It has remained relatively undisturbed ever since the eruption of the Krakatau volcano in 1883 when tidal waves wiped out human settlements along the coast (Santiapillai and Suprahman, 1986).

The triangular-shaped Ujung Kulon peninsula is joined to the mainland by a narrow isthmus. The National Park extends from the eastern slopes of Gunung Honje in the east to the southwestern tip of Java and includes the islands of Peucang, Handeuleum and Panaitan (Fig. 1). But the rhinos inhabit mostly the peninsula and some parts of the mainland especially in the southeast. The animals have not been recorded from Gunung Honje in recent times.

2.3 Rhino habitat: The Javan rhino is essentially an animal of the lowlands, in contrast to the Sumatran rhino which prefers forests at higher altitudes (Groves, 1967). In the peninsula where most of the rhinos occur, the principal topographical feature is the Gunung Payung (mountain) which rises to a height of 500 m. The rest of the area is under 150 m in altitude. Rainforest occurs only on the upper slopes of Gunung Payung while on the lower slopes the vegetation is strongly dominated by one species of palm tree, namely *Arenga obtusifolia* (Hommel, 1987). Palms and especially spiny rattans are common throughout the park and there are also extensive stands of bamboo-forests and shrub vegetation. The common occurrence of spiny-rattans has been largely responsible for the inaccessibility of Ujung Kulon's interior to man and thus has contributed somewhat to the survival of the rhino and other fauna to date (Hommell, 1987). In addition there are several open grasslands, grazing grounds a result of past human activities. At the time of the Krakatau volcanic eruption in 1883, a village existed in Djungkulon just opposite the Peucang island, now the location of one of the main grazing grounds in the mainland. Other human settlements occurred along rivers such as Cibunar, Cigenter, Cikarang and Cibandawoh, where rice was cultivated (Hommel, 1987). These areas today support extensive patches of grasslands. Coastal vegetation is either mangrove in the north or dense thickets of *Pandanus tectorius* (Ammann, 1985).

2.4 Population trends: It was only in 1910 that hunting of the rhino without a legal permit was made a criminal offence. Until then, the animal was so numerous that its killing was even encouraged by the Government. However, with the increase in human population and the availability of firearms, the decline in both range and number of rhino in Java was rapid. By 1930, Ujung Kulon had become the only area where the Javan rhino could survive (Hoogerwerf, 1970). Even then, poaching continued within the reserve. Table 1 provides the number of Javan rhino known to have been killed (or reported dead) in Ujung Kulon between 1929-1967 and from 1967-1990.

Table 1. Number of Javan rhino killed (or reported dead) in Ujung Kulon between 1929-1967 and from 1967-1990

Year	Number	Authority
1929	2	Hoogerwerf, (1970)
1931	3	"
1932	4	"
1935/36	10/15	"
1939	3	"
1943	1	"
1946/50	5	"
1955	1	"
1954/64	11/13	Talbot and Talbot, (1964)
1965	6	Hoogerwerf, (1970)
1967	1	Hoogerwerf, (1970)
1967 WWF/PHPA programme commenced to improve and strengthen the protection of Ujung Kulon NP.		
1978/80	2 (dead*)	Ammann, (1985)
1981/82	5 (dead#)	Schenkel and Schenkel, (1982)
	1	Haerudin *et al.*, (1982)
1984/85	1	PHPA
1986/87		PHPA

* from old age
# cause unknown (perhaps disease or poison)

It is significant to note that prior to the improvement of the protection of the nature reserve in 1967, the Javan rhino was under constant threat from poachers. In the 39 years from 1929 to 1967 on average, one rhino was poached annually. Under improved management, the number of Javan rhino increased from about 25 in 1967 to 52 in 1980, giving an average rate of population growth of 6.2% per annum (Ammann, 1985). The latest estimate of the number of Javan rhino in Ujung Kulon NP is 57 (52-62) (Santiapillai *et al.*, 1990). Given adequate protection and better management of the rhino habitat, it is likely that this trend will continue and that the Javan rhino numbers will continue to increase in the years to come. In the past Ujung Kulon may have supported up to 100 Javan rhinos. Therefore as Hoogerwerf (1970) points out, "the most urgent measure is ensuring that the sanctuary is adequately guarded; this is a *sine qua non* for saving *Rhinoceros sondaicus* from

disappearing. Only when surveillance is adequately regulated can other means of expanding the rhino population be sought".

Table 2. List of Mammals found in Ujung Kulon (Hoogerwerf, 1970)

	Common name	Scientific name	IUCN Status
1.	Javan rhino	*Rhinoceros sondaicus*	E
2.	Banteng	*Bos javanicus*	V
3.	Rusa deer	*Cervus timorensis*	
4.	Wild boar	*Sus scrofa*	
5.	Mouse deer	*Tragulus javanicus*	
6.	Barking deer	*Muntiacus muntjak*	
7.	Wild dog	*Cuon alpinus*	V
8.	Leopard	*Panthera pardus*	T
9.	Javan gibbon*	*Hylobates moloch*	E
10.	Long-tailed macaque	*Macaca fascicularis*	
11.	Silvered leaf monkey*	*Trachypithecus auratus*	
12.	Javan leaf monkey*	*Presbytis comata*	E
13.	Fishing cat	*Felis viverrina*	
14.	Leopard cat	*Felis bengalensis*	
15.	Small-toothed palm civet	*Arctogalidia trivirgata*	I
16.	Javan civet	*Viverricula malaccensis*	
17.	Common palm civet	*Paradoxurus hermaphroditus*	
18.	Bearcat	*Arctitis binturong*	
19.	Javan mongoose	*Herpestes javanicus*	
20.	Small-clawed otter	*Aonyx cinerea*	K
21.	Hairy nose otter	*Lutra sumatrana*	K
22.	Giant squirrel	*Ratufa bicolor*	
23.	Plantain squirrel	*Callosciurus notatus*	
24.	House rat	*Rattus rattus*	
25.	Flying lemur	*Cynocephalus variegatus*	
26.	Malay tree shrew	*Tupaia glis*	
27.	Javan tree shrew	*Tupaia javanica*	
28.	Flying fox	*Pteropus vampyrus*	
29.	Javan leaf-nosed bat*	*Hipposideros larvatus*	
30.	Javan warty pig*	*Sus verrucosus*	E
31.	Javan tiger	*Panthera tigris*	Ex

E = Endangered; V = Vulnerable; I = Indeterminate;
T = Threatened; & K = Insufficiently known; Ex = Extinct (IUCN 1988). * Javan endemics.

In addition, van der Zon (1976) records the presence of the following species:

32.	Slow loris	*Nycticebus coucang*
33.	Pangolin	*Manis javanica*
34.	Collared field rat	*Rattus surifer*
35.	Javan porcupine	*Hystrix javanica*
36.	Clawless otter	*Lutra perspicillata*

2.5 Conservation importance of Ujung Kulon: Ujung Kulon is not only vital for the survival of the Javan rhino but it is also a habitat that supports a spectacular array of other wildlife species which will benefit directly from any effort to improve the protection and security of the park. Of the 29 species of mammals that Hoogerwerf (1970) identified as being present

in Ujung Kulon (Table 2), 9 (or 31.0%) are on IUCN's (1988) Red List of Threatened Animals. These include 3 (or 10%) species that are endangered (Javan rhino, Javan gibbon and Javan leaf monkey). As far as the birds are concerned, Ujung Kulon supports about 50% of all the species known from Java: 233 species out of a total of 460 birds (MacKinnon, 1988), including the green peafowl (*Pavo muticus*) and the white winged wood duck (*Cairina scutulata*) listed as Vulnerable by IUCN (1988).

At least 10 species of amphibians have been recorded in Ujung Kulon and this includes a new species of frog, *Kalophrynus pleurostigma* not known from elsewhere in Java (Hoogerwerf, 1970). At least 14 species of reptiles are known to occur in Ujung Kulon including the common monitor lizard (*Varanus salvator*) and two endangered species such as the estuarine crocodile (*Crocodylus porosus*) and the green turtle (*Chelonia mydas*). There are important turtle nesting beaches on the south coast.

Ujung Kulon National Park thus provides a refuge for not only the Javan rhino but also hundreds of other species that are being increasingly squeezed out of their habitats elsewhere in the over-crowded and highly agricultural island of Java. This alone is a sound justification for safeguarding the park against any further encroachment and poaching.

3.0 THREATS TO JAVAN RHINO

Today, the Javan rhino in Ujung Kulon faces a number of threats that range from poaching, outbreak of epidemic diseases and habitat encroachment to the deleterious effects of inbreeding given the population's small size and localised distribution.

3.1 Poaching: In the early 1960's, one-third of the Javan rhinos fell victim to poachers (Martin and Martin, 1982). Although the incidence of poaching (reported officially) seems to have declined somewhat since 1967 in comparison to the pre-1967 situation in Ujung Kulon, poaching still remains the paramount threat to the rhinos. The park is easily accessible to poachers especially via the Handeuleum Bay, and the present anti-poaching measures are not adequate. Moreover, it is relatively easy for a single poacher to kill a rhino and remove its horn without attracting attention (Western, 1982), for rhino is rather solitary with a small home range and so is relatively easy for an experienced poacher to track.

In Kenya, it was intensive poaching that was responsible for the reduction of rhino numbers to near extinction (Hillman and Martin, 1979). According to the IUCN's Captive Breeding Specialist Group (CBSG), "the removal of 1 animal (Javan rhino) every 2 years is sufficient to prevent population growth and is a threat to survival of this small population" (Seal and Foose, 1989). Unfortunately, Ujung Kulon is still not secure from the threat of poaching.

3.2 Epidemic diseases: In 1981-1982 five rhinos died in Ujung Kulon, possibly from a disease such as anthrax (Schenkel and Schenkel, 1982). Given the number of villages that lie around the eastern boundary of the park, disease can be transmitted from infected cattle that may stray into the park. This is another good reason for improving protection to keep out encroaching cattle. Threats to a single population from disease are also a possible reason for establishing a second population.

3.3 Habitat encroachment: This is particularly a serious problem in the eastern part of Ujung Kulon as a result of human activities (Schenkel et al. 1978). If this area were to be strengthened and protected, then the rhinos will have even larger area in the Gunung Honje region to move into. This is another important reason why every effort must be taken to prevent Gunung Honje being converted to plantations.

3.4 Volcanic eruption: The likelihood of another volcanic eruption is sometimes raised as a possible threat for the rhino population. However, the likelihood of another eruption on the 1883 scale is probably very small even though Krakatau had shown some signs of

renewed activity in 1982. Moreover the volcanic eruption in 1883 may have helped the rhino to survive till today. The huge tidal waves destroyed a number of settlements that dotted the northern coast of Ujung Kulon. Had these villages remained unaffected, the rhino might have become extinct long ago as a result of habitat clearance. (The danger of volcanic eruption is probably overstressed. After all here in San Diego and Los Angeles we are sitting on the San Andreas fault yet the zoos here are keen to captive breed the rhinos!)

3.5 Inbreeding depression: Given its small size, the population of the Javan rhino in Ujung Kulon 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. For captive populations, as Lacy (1987) points out, "the loss of evolutionary flexibility may be especially rapid and particularly hazardous to long-term survival".

However, not all small populations in the wild are necessarily doomed.

3.5.1 In the Kaziranga nature reserve in Assam (Northeast India), the number of the great Indian one-horned rhino (*Rhinoceros unicornis*) increased its number from a much depleted stock of a dozen or so in 1908 to about 400 in 1940 (Gee, 1952). Today, the number of rhinos in Kaziranga is estimated to be about 1000 (Singh and Rao, 1984).

3.5.2 In Nepal, as a result of indiscriminate forest encroachment within the Royal Chitwan National Park, the number of Indian rhino fell from 1000 to 120 in 1960 (Pelnick and Upreti, 1972). Today however, as a result of strict protection of the park, the number of Indian rhino in Chitwan has increased to more than 400.

3.5.3 In Garamba National Park in Zaire, the number of rhinos increased from 100 in 1939 to more than 1000 in 1963 (Verschuren, 1967).

3.5.4 In South Africa, the number of white rhinoceros (*Ceratotherium simum*) in the Umfolozi National Park increased in number from a stock of about 20 animals to over 600 within 50 years' time and in an area of comparable size to that of Ujung Kulon (Schaurte, 1960).

In all these four instances, the increase in number of rhino was effected solely through better protection of the animal's habitat and a strict control on poaching. The lesson is clear: protection is easier, cheaper and likely to be more successful than captive breeding programmes which are difficult, costly and are likely to fail. PHPA must take the safest of the two options available to it as far as the Javan rhino is concerned.

4.0 CONSERVATION ACTION

4.1 *In situ* Conservation: The Javan rhino has become the emblem of Ujung Kulon, a flagship species which draws attention and funding to the National Park. There is considerable debate about whether the resident population of Javan rhinos in Ujung Kulon is viable in the long-term. Some members of the International Zoo community have therefore suggested an ambitious captive breeding programme for Javan rhinos. But the safest, easiest and cheapest way to protect Javan rhinos is *in situ* in their natural habitats. Better protection of Ujung Kulon will mean the survival of not only the Javan rhinos but many other sympatric species as well.

4.2 Establishment of a second population of Javan rhino: Since the Javan rhino population in Ujung Kulon is vulnerable because of its small size, it may make good conservation sense to look into the possibility of establishing a second population *in situ* within the species' former range in Indonesia.

One of the areas identified as a target site for re-introduction is Way Kambas Game Reserve (1,200 km^2) in Southern Sumatra, where Javan rhino did occur until 1930. Before any such translocation is even contemplated however, it is imperative to select an area in Way Kambas which would form the habitat for the founder population. This area needs adequate protection and rehabilitation. Thus, while management and protection are improved at Ujung Kulon, there should be parallel efforts to strengthen and improve management of the Way Kambas Game Reserve (already nominated as a National Park). In particular, encroachment must be stopped, anti-poaching measures must be strengthened and there should be research to establish that the food resources in the target area are appropriate and adequate to support the founder population of Javan rhinos.

In discussing the possibility of establishing a second population in Indonesia, it is important to heed Hoogerwerf's (1970) advice. According to him, "A second means of preserving this species from disappearance is the transfer of one or a few breeding pairs to areas outside the densely populated Java, first of all to places where the species is known to have lived before. But as long as there is no complete guarantee that surveillance there will be adequate, such an artificial transmigration is of course not of the slightest significance".

4.3 Captive breeding: The IUCN/SSC Asian Rhino Specialist Group's Action Plan for the Asian Rhinos Conservation (Khan, 1989) has suggested a captive breeding programme for Javan rhino. Prins (1991) has shown however that the "zoo option" is the one least likely to succeed in enhancing the long-term viability of Javan rhino population.

There is therefore increasing concern both inside and outside Indonesia at the CBSG plan to remove almost half the Ujung Kulon population of Javan rhino and possibly all breeding animals. Moreover the only programme with which we can compare, the Sumatran rhino captive breeding programme has already incurred 30% mortality and so far demonstrated no breeding success. Furthermore, since the whole purpose of captive breeding is to re-introduce animals into the wild, considerable effort will have to go into conservation of habitat anyway. In the case of Ujung Kulon and other reserves it will be much easier to save habitat with the rhinos there. It is indeed remarkable that Javan rhinos have survived on Java, an island with 100 million people and only 8% of forest remaining.

That it has survived is a tribute to the Indonesian Government's committment to conservation. Alone among the countries of South-east Asia, Indonesia has managed to preserve a viable population of Javan rhinos. Indonesia is protecting this rare and highly endangered species of large mammal as both a national treasure as well as a global rarity. This is both an honour and a responsibility. By continuing its committment to protect Javan rhinos in Ujung Kulon National Park, Indonesia in general and the Directorate of Forest Protection and Nature Conservation in particular are playing a crucial role in preserving our planet's biodiversity.

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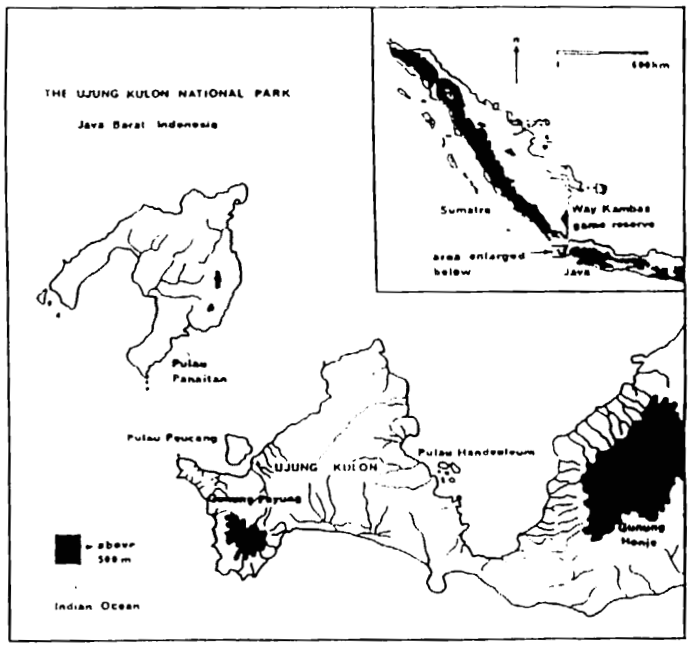

Fig. 1. Map showing the location of Ujung Kulon National Park in relation to Sumatra and Java.
Source: Santiapillai & Suprahman (1986).

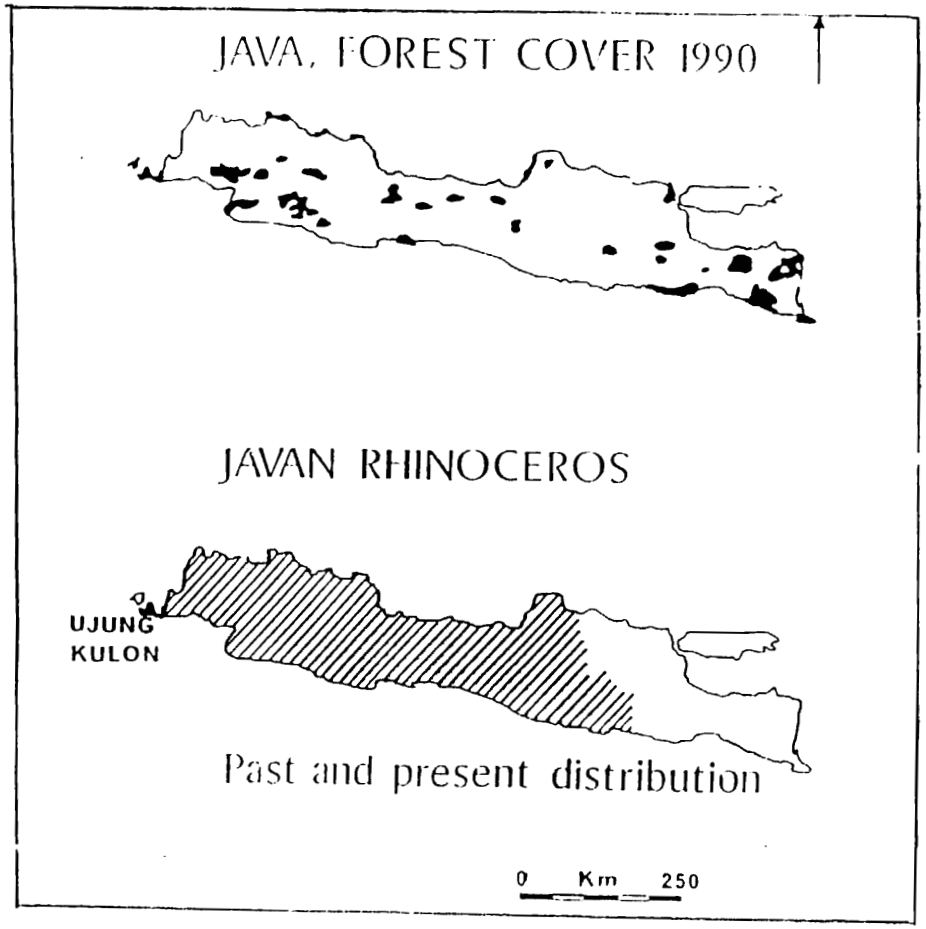

Fig. 2 Map of Java to show: a) the amount of forest cover left in 1990 and (b) the past (cross hatched) and the present distribution(solid shading) of Javan rhino. Widodo, Santiapillai & MacKinnon (1991).