

Draft

On the horns of a dilemma:

Is long-term conservation of the Sumatran rhinoceros (*Dicerorhinus sumatrensis*) in Kalimantan, Indonesia, still feasible ?

by

Erik Meijaard

October 1995

**The International MOF Tropenbos Kalimantan Project, P. O. Box 319, 76103
Balikpapan, KalTim, Indonesia.**

Introduction

The Bornean rhinoceros (*Dicerorhinus sumatrensis harrissoni*) is considered to be a subspecies of the two-horned Sumatran rhinoceros (Groves, 1965). Compared to the Sumatran rhinoceros of Sumatra and the Asian mainland, its teeth are relatively small, the skull is slightly different in proportions, and the animal is believed to be smaller (Strien v., 1985). It also appears that the Bornean subspecies generally has longer hair (Strien v., pers. comm.).

The total distribution range of the Sumatran rhino is rapidly decreasing, as hunting and the disappearance of suitable habitat has brought the species to the brink of extinction in many parts of its former range. In 1993 the total world population of the Sumatran rhinoceros was estimated to range between about 400 and 550 individuals, most of them living in Indonesia and Malaysia, with some possible survivors in Myanmar and Thailand (YMR, 1993). At present, the species is listed as "Endangered" on the IUCN Red Data List of Threatened Animals, meaning that it is "facing a very high probability of extinction in the wild in the immediate future" (Groombridge, 1993). As precarious as the situation is for the mainland and Sumatran form of the Sumatran rhino, the situation for the Bornean subspecies seems to be even more serious. The rhino has vanished from most of the island of Borneo, and there are virtually no populations left in the reserves.

Distribution in Kalimantan

Since 1840 the rhinoceros is known to inhabit Borneo, but agreement about its specific identity was not reached until 1895 (Rookmaker, 1977 a). It appears from historic data that, until relatively recent times, the Sumatran rhinoceros was widely spread throughout Borneo. Rookmaker (1977 b) provides a map with the rhino's approximate range in 1850, which shows that the species was still present in all of Borneo, apart from the following areas: 1) the coastal area of northern Sarawak, 2) the Sangkulirang peninsula in what is now East-Kalimantan, 3) the southern part of what is now Central-Kalimantan, roughly between Banjarmasin and Kotawaringin, 4) in West-Kalimantan north of the Kapuas River, nor just south of it in the lower part of its course and 5) in southern Sarawak. Within the next hundred years, until approximately 1940, the Sumatran rhino disappeared from most of the lowland areas of West, Central, South and East Kalimantan.

After the surveys and literature studies which were conducted in the 1930's by Zondag (1931), Westermann (1939) and Witkamp (1932), rhino data in the scientific literature from Kalimantan became scarce. This paucity of new data was generally interpreted as a sign that the Kalimantan population had all but disappeared. Rookmaker (1977 b) stated that "I am confident that some individuals survive in Kalimantan, but probably not more than five...A few wandering individuals, or tiny remnant populations, may still occur in the upper reaches of the Mahakam, Kayan and Bahau Rivers, and in northern East-Kalimantan. More information does not exist."

However, now and then, rhino reports of sightings or signs of rhino's would still show up in survey reports or newspaper articles. Pfeffer (1958), for instance, reported the tracks of two animals in the mountainous parts of East-Kalimantan. Van der Zon (1977) and Cockburn and Sumardja (1978) reported tracks in the Banamuda area in East-

Kalimantan. However, after a survey was conducted in this latter area in 1980 and no signs of rhino were found, it was concluded that there was no viable rhino population. Further rhino sightings were reported in the Numukan area in 1975, around Muara Teweh in 1978, and in 1981 - 1982, it was also reported that Sarawak hunters regularly crossed the border with Indonesia to hunt rhino in the upper Kayan or upper Mahakam area. (Strien van, 1985). Van Strien (1985) stated, based on this information, that "these reports indicate that there might be rhinos left in some forgotten corners of this vast island. If the rumours are true there might be a few rhino's left along the Kalimantan - Sarawak border, probably in the upper Kayan or upper Mahakam. This needs further confirmation, but the chances that a viable population can be found in the Indonesian part of Borneo are extremely slim. The rhino is probably not extinct, but very rare."

Probably due a combination of this gloomy outlook for long term conservation of the rhino in Kalimantan, limited financial means for conservation work and an extensive potential distribution range for the last surviving rhinos, no further surveys were conducted to elucidate the present conservation status of the Sumatran rhino in Kalimantan.

In 1994, a survey was initiated to investigate the present distribution range of the Bornean orang utan (*Pongo pygmaeus pygmaeus*) in Kalimantan. This survey was conducted in co-operation with the Ministry of Forestry - Tropenbos - Kalimantan Project which is based in East-Kalimantan. As this survey was going to cover potential rhinoceros habitat in Kalimantan, it was decided to include the gathering of information on recent sightings of rhinoceros in the orang utan survey. A budget for this was provided by the "van Tienhoven Stichting" in the Netherlands.

This paper will provide the, mostly anecdotal, reports of rhino sightings in Kalimantan, as they were recorded during the above mentioned orang utan surveys.

Methods

The information on absence and presence of both the orang utan and Sumatran rhinoceros has been collected in an indirect manner. First, the available literature, both historic and recent, on the rhino distribution was studied. This included all available recent Environmental Impact Assessment (EIA) reports of logging concessionaires and the Department of Transmigration, as well as research reports from a wide variety of exploratory sectors. Second, experienced field workers from a number of research projects in Kalimantan were contacted to ask about their knowledge of recent rhino sightings. Last, and perhaps most important, a number of field surveys were undertaken in Kalimantan. The 1994/1995 surveys were executed by Meijaard, in co-operation with the Directorate General of Forest Protection and Nature Conservation (DG PHPA) of the Ministry of Forestry of the Republic of Indonesia.

Because of the wide variety of sources, it must be realised that the incoming information may have been of varying accuracy. Consequently, the information was interpreted as absence or presence only. In addition, the sources of information were divided into classes, and the information evaluated in relation to a supposed reliability of presence statements by each class.

These reliability classes were differentiated as follows:

- 1.00: Actual sightings of rhinos, their tracks or other clear signs of their presence, by the author.
- 0.75: Sightings of rhinos, their tracks or other clear signs of their presence, reported in the literature.
- 0.50: First hand information on the sightings of rhinos by others than the authors (mainly local people interviewed during the surveys).
- 0.25: Second hand information on the sightings of rhinos, either directly reported to the authors or reported in literature.

All individual presence reports are recorded and duly supplemented with data on the source of information, the longitude and latitude of the location, the name of the location, the date (year) of reported sighting, estimated value of reliability and numbers of rhinos sighted. In some cases it was impossible to provide the exact geographical location of a rhino sighting, when for instance a relatively large area was mentioned to contain rhinos. In that case the approximate central point of the area was used as the geographical location of the sighting. The value of geographical accuracy (A) indicates how far the actual geographical location of the sighting may be located from the point provided in the text: 1: between 0 and 20 km, 2: between 20 and 50 km and 3: between 50 and 100 km.

Nonetheless the resulting interpretations are not more than a very generalised indication of absence or presence of the rhino in a particular area varying between a few hundred to tens of thousands of hectares of more or less degraded rainforest. For the present objective - i.e. to get a quick, general overview of the whereabouts of remaining rhinos to prioritise action for survival of the species - such crudeness is considered tolerable. However, it will be evident that this coarse-grained picture should be refined once the priorities have been set and detailed up-to-date information becomes available.

In order to acquire insight in the geographical distribution of rhinos, the presence data were plotted on maps. In due time the data may be verified by both field-surveys for suspected or alleged "hot-spots" and be fed into a Geographical Information System which can distinguish and relate specific habitat features. The first layers of data-sets of the computerised GIS, using the PC ARC/INFO and ARCVIEW software, have been established on an accurate geographical basis.

The process for entering the rhino sightings into the GIS followed methodology previously developed for entering point location data, such as transect points. Co-ordinates of reported rhino locations, were determined by locating them on the digital base map within the GIS. These point co-ordinates were recorded and stored within a point file. The point file consisted of a list of eastings and northings prefixed with the code number of the sighting.

In order to produce a map of distribution of the points the point file was converted to a point coverage using the ARC/INFO GENERATE command. The point attribute file of the coverage and the attribute data (name of location, year, reliability of sighting, number/density etc.) held within an EXCEL database file were physically joined to produce one file containing all spatial and attribute data. This file was added to the GIS using the ARCVIEW software. The data was added as one layer in the GIS and can be easily overlaid with any other theme.

The rhino presence data set forms a basic layer of the GIS. The rhino presence can thus be related to very crude topographic features (mountains, swamps), protected areas, forest cover and locations from where illegal hunting of rhinos was reported.

Information on the geographical extent of protected areas and the current forest cover is still crude (scale 1 : 1 000 000); it was obtained from the World Conservation Monitoring Centre (WCMC), the Directorate General PHPA, and the Tropical Ecosystem Environment Observation by Satellites (TREES) Project.

Results

None of the following reports have been confirmed by the author. The estimated reliability of each report is expressed in the value of reliability (R), while A is a measure for the geographical accuracy of a reported sighting.

1) Samarinda. An informant at the board of tourism heard of a rhino sighting by people in Kutai Lama (E 117.42 S 0.62) in 1993. The informant went to check it in the village, but couldn't verify the sighting. If information is correct there might be one or a few rhinos left in the swamp-mangrove area east of Samarinda. R = 0.25, A = 1.

2) Sungai Sebuku. During a survey around the S. Sebuku (E 117.31 N 4.04) in 1994 the informants from "Plasma", a nature conservation NGO in Samarinda, East-Kalimantan were told of encounters with elephants and very occasional ones with rhinoceroses. The informants also told that around S. Sebuku, Kecamatan Nunukan, rhinos were still reported by logging concessions in 1980. R = 0.25, A = 2.

3) Gunung Belayan. On his rhinoceros distribution map, Yasuma (1994) indicates one location of "information of inhabitation from hearing" at ± 20 km North of Gunung Kong Botak (E 116.17 N 1.42). R = 0.25, A = 1.

4) Meratus Mountains. Rhino droppings and tracks were found by an Australian geologist, Dr. Hawke on a survey in the Meratus area (E 115.74 S 1.72). Dr. Hawke works for the PT Kelian Equatorial Mining and accompanies gold explorations. R = 0.25, A = 3. Unfortunately, so far it has not been possible to further substantiate this information.

5) Bentuang Karimun Nature Reserve. An employee of the Agency for the Conservation of Natural Resources (SB KSDA) in Pontianak, West-Kalimantan, had heard rumours from local people in the Bentuang Karimun Nature Reserve (E 113.47 N 1.22) that there were still rhinos around. Further affirmative information on rhino presence in the Bentuang Karimun Reserve came from employees of the provincial Department of Forestry (Kanwil Kehutatanan) in Putussibau, upper Kapuas. R = 0.25, A = 3.

6) Bentuang Karimun Nature Reserve. Tasker (1994) reported that "on the Kalimantan side (of Lanjak Entimau) (E 112.30 N 1.40), the rare Sumatran rhinoceros has been seen". It is unclear what the original source of information had been. R = 0.25, A = 2.

7) S. Irun, south-east of the Apo Kayan area. In the Ulu S. Irun (E 115.25 N 1.72) rhinoceros droppings of one animal were found in 1995 by a WWF fieldworker.

According to the local people in that area rhino's were occasionally encountered, and also in the same area an army helicopter pilot claimed to have seen a rhino at the side of a river. R = 0.75, A = 1.

8) Upper S Bahau. On the border between Indonesia and Malaysia, Indonesian army field surveyors saw tracks of rhinos in the area up from Ulu Bahau (E 115.62 N 3.45). R = 0.25, A = 2. Elephants were also reported to occur in this area.

9) Ulu S. Iwan in Apo Kayan. In the area between Ulu S. Punjungan, Ulu S. Iwan and Ulu S. Lurah (E 115.48 N 2.38) the sightings of three rhinos, or signs thereof (unclear if animals were actually seen), were reported by "geharu" (*Aquilaria malaccensis*) collectors. R = 0.25, A = 2.

10) S. Kat. Rhino tracks were found between the headwaters of S. Punjungan and S. Kat. (E 115.58 N 2.27) close to Apau Napu in 1988. Informants were pretty sure that footprints were made by mother and young (two animals). R = 0.25, A = 2.

11) Bkt Buringajok. 10 years ago a rhinoceros was killed in the Bkt. Buringajok area (E 115.28 N 0.03) close to the border between Central and East Kalimantan. According to the informant, a Dayak from Damai in the Melak region, they don't hunt rhino's anymore now that there is a law against this. It is unclear if rhinos still exist in this area. R = 0.25, A = 1.

12) S. Boh, close to Kubu Long Bakung. The informant himself saw 1 dead rhinoceros (that had been killed by hunters) around S. Boh (E 115.33 N 1.33) (tributary of S. Mahakam) and he saw tracks of 2 rhinoceroses. This happened in the years between 1969 and 1972. R = 0.50, A = 2.

13) G. Batuajau, East Kalimantan. In 1986 the informant, Bpk. Ajang Gun (Dayak Uma from Batu Majang (Long Bagun)), clearly identified rhino tracks and droppings in a pass between lime stone rocks on G. Batuajau (E 114.82 N 0.80). R = 0.50, A = 1.

14) Upper Kapuas, West-Kalimantan (E 114.00 N 1.25). Several accounts were collected from people in Putussibau, upper Kapuas, West-Kalimantan:

-Rhinos are possibly still present in the Ulu Kapuas area; in the mountains upstream from Putussibau geharu collectors sometimes see their tracks. They are still being hunted for the medicinal and ornamental value of their horn.

-In the 1950's and 1960's there were quite a few Chinese and Dayak people who had specialised in rhino hunting. Several rhinos were shot in the near vicinity of Putussibau. Now these people have moved to Java as they are rich. People now never or hardly ever go out to look for rhinos.

-In the 1960's and 1970's people from the Ulu Kapuas were still hunting rhinos in the mountains, but now they say that rhino products can not be sold anymore, thus they have stopped looking for them. Also as a result of other work in the area (logging, gold mining, birds nests collecting), people are less willing to spent months in the forest looking for rhinos.

R = 0.25, A = 3.

15) Apau Ping. In the Ulu Bahau area (E 115.62 N 3.05) a WWF official was told of the presence of rhinos. No further information available. R = 0.25, A = 2.

16) Ulu Sembakung. A "few" rhinos were reported to exist in the Ulu Sembakung Nature Reserve (E 116.30 N 4.23) (YMR, 1994). R = 0.75, A = 2.

17) Ulu S. Ketingan and Ulu S. Kahayan. Rhinos were supposed to be present in 1987 in the area east of Bukit Raya, between Ulu S. Ketingan and Ulu S. Kahayan (E 113.33 S 0.30). A rather vague story, indirect information. R = 0.25, A = 3.

18) Ulu S. Barito, km 30 PT Tunggal Pemenang (now PT KTC)(E 114.05 S 0.68). An informant saw foot prints the size of a food plate in 1984, which he assumed to be of the rhinoceros. He was able to describe the shape and three toes that were clearly visible on the print. R = 0.50, A = 3.

19) Dudson *et al.* reported the following in "The avifauna of Barito Ulu. Dudson *et al.* 1990": "Sumatran rhinoceros and banteng were both rumoured by local people to occur to the north-east of Barito Ulu (E 114.31 N 0.49). While these reports are best treated with extreme caution, it is felt worthwhile recording them, considering the critical global status of these species." R = 0.25, A = 3.

20) S. Boh, S. Merasah (east of Long Pahangai) (E 114.93 N 1.28). A former inhabitant of this area claimed that rhino tracks were quite often found in this area in 1969, when he still lived in the area. However, he didn't know of any encounter of the animal themselves. R = 0.25, A = 4.

Map 1 shows an overlay of the rhino presence reports and the proposed and existing protected areas in Kalimantan. Numbers on the map refer to the rhino sightings in the text.

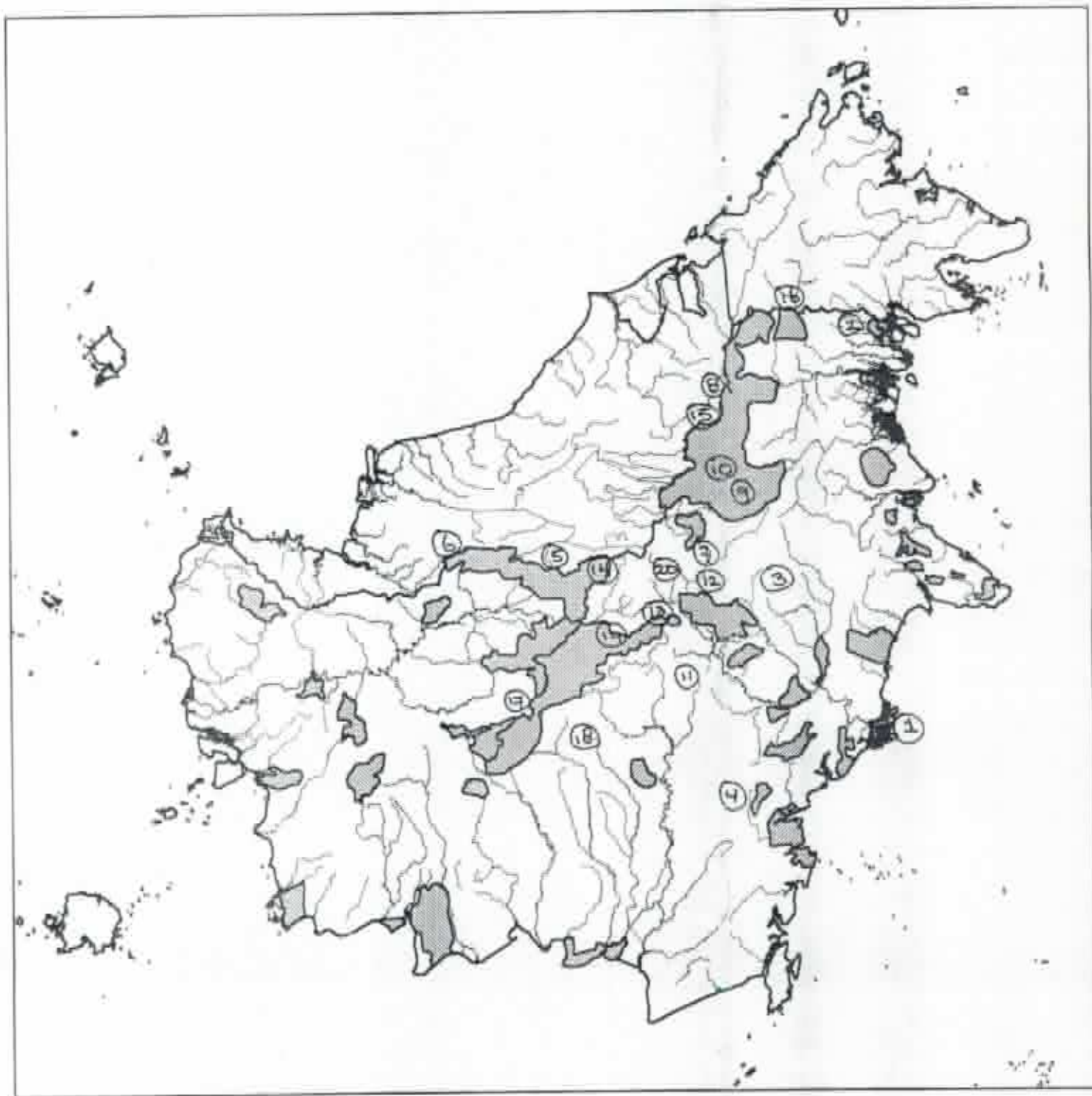
Conclusion

Recent reported sightings indicate that the Sumatran rhino is still present in Kalimantan. Although the reports probably vary in accuracy and reliability, a careful conclusion may be that since 1985 at least some 20 rhino sightings, including one young, have been reported in Kalimantan. Twice the killing of a rhino was reported. The rhino sightings imply that the remaining animals are spread out over the most mountainous and remote areas of Kalimantan. The present distribution range of the Sumatran rhino in Kalimantan most likely includes the Ulu Bahau area and the southern region of the Kayan-Mentarang Nature Reserve, the Ulu Sembakung Reserve, the S. Sebuku area, possibly the Bentuang Karimun Reserve in the Upper Kapuas area, the area south of Kayan-Mentarang, towards Central-Kalimantan, the Ulu Barito, Ulu Kahayan and Ulu Ketingan areas in Central-Kalimantan and possibly the Meratus Mountains in East and South Kalimantan.

Discussion

The paucity of reported rhino sightings during this survey, may have had two different reasons. Firstly, the survey was designed for the gathering information on the distribution patterns of orang utans, and not specifically for information on rhinos. While orang utan

Rhinoceros sightings in Kalimantan



density generally declines precipitously with increasing altitude, rhinos now seem to be restricted to mountainous areas. This implies that a relatively large amount of survey time was spent away from potential rhino habitat, limiting the amount of information that could have been gathered. Secondly, rhinos are rare in Kalimantan and information on the abode of this elusive animal is hard to obtain. In addition, rhinos are still highly valued as an illegal hunting item in Kalimantan, and therefore people may be less enthusiastic about sharing information on the animals' whereabouts.

Kayan-Mentarang

The results of the survey indicate that the present rhino population is probably concentrated in and around the 1.6 Million hectare of the Kayan-Mentarang Reserve in East-Kalimantan. Inside the reserve there are probably two important areas:

- 1) the headwaters of the S. Bahau in the G. Latuk (1850 metre) and Bkt. Kalung (1724 metre) areas.
- 2) the Bkt Tikung (1804 metre) range in the upper reaches of the Kat, Iwan and Punjungan Rivers. The forest is relatively undisturbed, but geharu collectors are active in the area, which implies a potential threat to the population as these are often the people who track down the rhinos.

The Kayan-Mentarang Nature Reserve is currently the focus of a WWF community based management project to review existing boundaries. MacKinnon (1988) remarked that "the reserve, as gazetted, exists only on a map - no boundaries are marked on the ground and indeed maps of the area are rather inadequate and often wrong. The long, thin shape of the reserve and its huge size makes it impossible to manage, even if staff were sent into the field. Within the reserve boundaries are numerous old settlements and "ladang" lands -these should be excised". MacKinnon, further stated that "the Kayan-Mentarang Reserve adjoins Pulong Tau in Sarawak and the Maliau basin in Sabah. The adjacent Maliau basin is known to still have a resident population of rhinos, as does the adjoining Baram basin in Sarawak." MacKinnon did not find any direct evidence for the presence of rhinos in the reserve.

Up until now the WWF project has not addressed the presence of rhinos in the reserve, no extensive mammal surveys have as yet been conducted, nor have there been any attempts to pin-point the remaining rhinos in the reserve by means of the indirect gathering of information. The reasons for this are twofold: 1. WWF personel do not believe that rhinos are present in the Kayan-Mentarang area, as rumours on their presence are considered unreliable and 2. If any rhinos do exist within the reserve it would be better to leave them alone because surveys would only draw the attention of rhino hunters. The second point should be carefully considered; would a possible rhino population benefit from the increased attention generated by conservation attempts? and how should these conservation attempts be directed in order to avoid negative effects.

The author still suggests to conduct surveys in the two above mentioned areas in the Kayan-Mentarang Reserve, in order to establish the present conservation status and survival changes of the remaining animals. This should be done as soon as possible, preferably in a secretive way and in co-operation with very reliable people. The outcome

of these surveys should indicate if there is a viable population and if so, what sort of future activities are needed to improve protection.

Bentuang Karimun

The presence of rhinos in the 600,000 hectare Bentuang Karimun Nature Reserve could not be substantiated as reports were contradictory. However, rhinos were hunted in the upper Kapuas area until quite recently. Furthermore, the Bentuang Karimun area is virtually uninhabited and recent satellite imagery shows that its forests is more or less untouched. The area is almost exclusively visited by geharu collectors, but these people tend to penetrate deep into even the most remote corners, and are likely to track down the potentially remaining rhinos. It is interesting to note that it was reported that professional hunting in the area had stopped since the 1970's, because the density of the remaining animals had become economically too low to sustain the hunters, and other more rewarding activities were developed. This may mean that hunting pressure for the remaining rhinos, if any, is currently low. The Bentuang Karimun Reserve is going to be part of a WWF management project from 1995 onward.

S. Irun/G. Belayan/S. Boh

Four different sources mentioned the presence of rhinos in the area of G. Belayan, among which the reported finding of tracks and faeces in the upper S. Irun is thought to be very reliable. The S. Irun report is located in the area of the proposed Apo Kayan Reserve. It is unclear if this population or individual is in any way connected to the reported rhinos around the very remote G. Belayan. The areas of S. Boh and S. Kayaniut on the west side of the G. Belayan complex are very inaccessible because of the large numbers of rapids on the rivers and the quality of the (mostly heath) forest, which provides travellers with very few forest products. Consequently, the density of the human population is very low.

Ulu Sembakung

The proposed 500,000 ha. Ulu Sembakung Nature Reserve was reported to contain Kalimantan's only wild populations of elephants and possibly rhinos (MacKinnon, 1981). YMR (1994) mentions that a few rhinos occur in this proposed reserve, but it is unclear which source of information has been used.

G. Meratus

It was tried to substantiate the supposed sighting of rhino signs in the Meratus Mountains area, but up until now, a request for further information remained unanswered. The exact location of the sighting had to be guessed, because there is both a mountain named G. Meratus and a mountain range named the Meratus Mountains. Although in the same area, these two locations could be as far apart as 200 kilometres. Supposedly there are photographs available of the reported tracks and faeces, but so far the author has not been able to obtain these.

Bkt. Batuajau/S. Murung

A few rhinos may still roam the mountains between Central and East Kalimantan and also between Central and West Kalimantan. Several reports of rhino sightings came from this large area, however none of these stories were considered to be very convincing. This large mountainous area consists mostly of Protection Forest, and therefore threats of habitat destruction are neglectible. However, a lot of people move through these forest in search of "geharu", edible swift birds nests and other forest products, and this can be considered a potential threat to potential surviving rhino individuals or populations.

The author was surprised to find several indications of the presence of rhinos, and although some of them may be unreliable, the author can't escape the idea that more rhinos remain in Kalimantan than was previously assumed. An optimistic attitude towards the rhino's future may however be premature, because the remaining rhinos face an uncertain future with an expected increase in human encroachment, habitat perturbation and fragmentation. Unless some drastic improved protection of the species is enforced, the disappearance of the last remaining rhinos of Kalimantan may just be a matter of time.

Recommended Action

1) Conduct initial small scale rhino surveys in the following areas (areas are listed in accordance to decreasing priority of action):

- upper S. Bahau
- upper reaches of the Kat, Punjungan and Iwan Rivers
- Ulu Sembakung
- G. Belayan/S. Boh/S. Kayaniut
- upper S. Irun
- S. Sebuku area
- the eastern part of Bentuang Karimun
- G. Meratus

2) Based on the initial surveys select the areas where highest densities of rhinos are expected, and conduct more detailed surveys in order to indicate local densities and distribution range.

3) Decide whether the population is thought to be large enough to withstand the combined effects of demographic, environmental and genetic chance events, based on Minimum Viable Population estimates.

4) Decide whether the in situ protection of the selected population of rhinos is feasible, and if so produce a management plan for the implementation of this protection.

5) Take the necessary steps to provide long term protection for the selected population of rhinos.

Acknowledgements

I gratefully acknowledge in the first place to the Ministry of Forestry, in particular its Directorate General for Forest Protection and Nature conservation, and the teamleader of the MOF-Tropenbos Programme in East Kalimantan, Dr Willie Smits.

I am indebted to our sponsors, namely the Van Tienhoven Foundation, the World Wide Fund for Nature (WWF) Netherlands, the Lucie Burger Stichting, and the Golden Ark Foundation in the Netherlands.

I am grateful for the support we received from several staff members at headquarters and provincial offices of the Directorate General of Forest Protection and Nature Conservation (DG PHPA). Without their help in administrative matters, their support and advice concerning the surveying and the provision of staff to accompany us in the field, it would have been impossible to operate.

I would especially like to thank Ms. Rona Dennis and Mr. Rencana Tarigan of the ODA/PHPA Remote Sensing/GIS Unit, for their invaluable assistance in the preparation of the maps.

Finally, I would like to express my appreciation and thanks to all other people who were a valuable source of information on whereabouts of rhinos in Kalimantan, and to everyone who has assisted me in the execution of my work.

References

Cockburn, P.F. & Sumardja, E. A. 1978. World Wildlife Fund Project 1524. Kutai, Kalimantan, Indonesia.

Groombridge, B. (ed.), 1993. 1994 IUCN Red Data List of Threatened Animals. IUCN Gland, Switzerland and Cambridge, UK. 1VI + 286pp.

Groves, C. P. 1965. Description of a new subspecies of rhinoceros, from Borneo, *Didermocerus sumatrensis harrissoni*. *Säugetierk. Mitt.*, 13 (3): 128 - 131.

MacKinnon, J. et al., 1981. A National Conservation Plan for Indonesia (Vol. V: Kalimantan). UNDP/FAO. Bogor, Indonesia.

MacKinnon, J. & Warsito 1982. Gunung Palung Reserve. Kalimantan Barat. Preliminary Management Plan. UNDP/FAO Field Report.

MacKinnon, K. 1988. Consultant's report of biodiversity specialist, for USAID PID mission. natural resource management in Kalimantan. Unpublished.

Pfeffer, P., 1958. Situation actuelle de quelques animaux menacés d'Indonesie. *Terre et Vie*, 105: 128 - 145.

Rookmaker, L. C., 1977 a. The rhinoceros of Borneo: a 19th century puzzle. *J. Malay. Brch. R. Asiat. Soc.* 50 (1): 52 - 62, pls. I - IV.

- Rookmaker, L. C., 1977 b. The distribution and status of the Rhinoceros, *Dicerorhinus sumatrensis*, in Borneo - A Review. *Bijdr. Dierk.*, 47(2): 197 - 204, map 1, table 1.
- Strien v. , N. J., 1985. The Sumatran Rhinoceros - *Dicerorhinus sumatrensis* Fischer, 1814 - in the Gunung Leuser National Park, Sumatra, Indonesia; its distribution, ecology and conservation. PhD thesis, 21 June 1985, Wageningen, the Netherlands.
- Tasker, R. 1994. *Far Eastern Economic Review*, December 8, 1994.
- Westermann, J. H. , 1936 - 1938. *Natuur in Zuid- en Oost Borneo*. In: 3 jaren Indisch Natuurleven, 11e jaarverslag (1936-1938). Ned. Ind. Ver. tot Natuurbescherming.
- Witkamp, H. 1932. Het voorkomen van enige diersoorten in het landschap Koetai. *Trop. Natuur* 21 (10): 169-175.
- Yasuma, S. , 1994. An invitation the mammals of East-Kalimantan. PUSREHUT Samarinda.
- YMR, 1993. *Conservation Strategy Rhinoceros Indonesia* (in Indonesian). Directorate General of Forest Protection and Nature Conservation of the Indonesian Ministry of Forestry (DG PHPA) and the Rhino Foundation (Yayasan Mitra Rhino).
- Zon, A. P. M. v.d. 1977. Sumatran rhino in Kalimantan (Borneo). *Tigerpaper* 4 (2): 12.
- Zondag, J.L.P. 1931. Het voorkomen van eenige diersoorten in de Zuider- en Oosterafdeeling van Borneo. *Trop. Natuur* 20 (12): 221-223.