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NUTRITION OF THE SUMATRAN RHINOS

SUMMARY

Rhinos are among the world's most endangered large mammals. In fact, the Sumatran rhinos (*Dicerorhinus sumatrensis*) have considered as one of the two endangered rhino species in Indonesia. This evidence has raised interest of some researchers to conduct some studies in many aspects to prevent the extinction of this species.

The wild population and distribution of the Sumatran rhino may have been in very closed relationship with plants which occur in their habitats. Several studies of the species and variety of plant related to habitat and feed of the Sumatran rhino are underway. On the other hand studies on soil and animal relationship in term of soil pH, plant nutrients, animal nutrients have been conducted elsewhere in the country, however a knowledge regarding to the Sumatran rhino and its nutrient is poorly known.

To fill the gap of the above information, this proposal suggests a study on the Sumatran rhinos nutrition which is considered to be a very high and appropiate priority in effort to maintain and if possible to increase the Sumatran rhino's population. Based on the previous studies an experiment on the rhino's nutrition will be constructed. If the rhinos should be kept in confinement and raised in captivity, the nutrition and the feed formula which is similar to that consumed by the rhino in the wild has to be created. After the formula has been created, the feeds produced have to be tested to the animals. Some general parameters such as feed consumption, palatability, and other biological performance will be measured. Before the new feed is applied, some days of adaptation periode has to be done in order to gest a good nutrition trials. The treatments inculeded in the experiment are different of protein and energy levels size and form of feed, and other supplements (flavour, minerals).

The studies above will be conducted in collaboration with the Kerinci Seblat National Park, Bukit Barisan Selatan National Park, Sumatran Rhino Sanctuary Way Kambas Lampung Sumatra, Safari Park Cisarua Bogor, Ragunan Zoo Jakarta, and Surabaya Zoo all in Indonesia. The number of treatments will be adjusted according to the number of rhinos that could be provided for this experiment, and therefore the design of the experiment will also be adjusted accordingly.

A veterinarian is needed to monitor the health condition of the animals during the period of the experiment, and if possible, a routine blood tests before, during and after the experiment will also be conducted for minerals as well as for blood analysis as to prevent any nutritional deficiencies.

Background and Justification

Rhinos are among the world's most endangered large mammals. Two species of rhinos in Indonesia (Javan *Rhinoceros sondaicus* and Sumatran *Dicerorhinus sumatrensis*) and one sub-species in Africa (nothern white *Ceratotherium simun cootoni*) teeter on the edge of extinction. Rhino numbers have declined for two main reasons. First,

loss of rhino habitat has been especially serious in the rain forests and floodplains of Asia. Second, rhino horns are used in medicine and as dagger handles and other rhino products such as as skin and blood are used to a lesser extent. Therefore, when the Convension on International Trade in Endangered Species of Wild Fauna and Flora (CITES) entered into force in 1975, rhinos were among the first species included on the CITES Appendices (William, 1993).

Decreasing the population of rhino in Indonesia has become encouraging more atention on efforts to keep in stability and further increasing population growth of rhinos.This sloping down of the rhino population is mainly due to the forests (the habitats of rhinos) losses. About two hundred years ago 80 % land cover of Java was still forest cover (Whitten, 1994), where our Javanese rhino lived "happily." Now the forest land cover is within the range of 5 – 7 % of the total area of Java and this kind of process is running widespread and uncontrolled deforestation in Sumatra's forests and many other islands'; many of the remaining forests have been converted to estate plantations, transmigration areas, industrial forest areas with less appreciation on conservation and sustainability.

Manan *et al.* (1986) reported that Sumatran rhino can live in low lands as well as in the mountains. It is nomadic, solitary and nocturla. In order to obtain its feeds, it travels over a quitte an extensive area. The distance covered each day could be reached 7 km length and the total area covered may be an avarage of 10 km^2. Forage species eaten by rhino were observed more than 100 plan species. It eats parts such as leaves, flowers, fruits twigs and others. This animal prefers *Glutarenghas* (rengas) and *Laportea stimulans* (pulus). It feeds usually very early in the morning and at nightfall. This animal rests during the most of the day time, prefering to wallow in the shade. This rhino usually spends several days in one place before moving to another place.

The Sumatran rhinoceros is a typical browser, eating leaves and stems of broad-leaved herbs, shrubs and trees. Feed is usuallly taken from some distance above the ground and rhinos also break down saplings and small trees (van Strien, 1982).

Browsers are noted a) primarily consuming large amount of forbs and shrubs, b) commonly consume substantial amount of green grass during rapit growth stage but avoid dry mature grass c) often experience digestive upsets if forced to consume diets

dominated by mature grass.The browsers are best represented by moose, pronghorn, antelope and deer, domestic goats. Rhino itelf is considered as a browser.

As browsing animals, they have compatitive advantage in the bush land, shrubland, are generally more active, selective, walk longer distances in search of feed and variety in feeds. Buffaloes by comaparation are less selective and essentially grazing animals. Another feature of the feeding behaviour is ability to tate. Any animals can distinguish between bitter, sweet, salty and sour tastes and some animals show ahigher tolerance for bitter taste e.g. goat. Rhinos like other animals thrive on a variety feeds, they are always selective what they eat ; they choose plant species individual plants or plant parts of grasses, shrubs, tree leaves.

Forage plant species that are commonly preffered by browsing and or grazing and selected first by choice are labelled *preferred species*. Palatability or preference are always relative to the variety or alternatives offered for selection; preference also varies between animal species even individual animals (Ivins, 1955, cited by Vallentine, 1990). The selectivity index is one mean to measure forage preference or palatability (Rosieve *et. al.*, 1975, cited by Vallentine, 1990).

The relative simplified palatabilities are rated as the following :

1) Values greater than 1,0 indicate preference

2) less than 1,0 avaoidance.

Procedures for estimating the botanical composition of diets of grazing or browsing animals have been grouped and evaluated under five (5) categories : a) direct observation (field or case study), b) utilization (degree of use) studies, 3) fistula methods, d) stomaach contents, 5) fecal analysis (Holecheck *et al.*, 1982a, 1984, Theur *et al.*, 1976, cited by Vallentine, 1990). Oesophageal fistula methods are more accurate for estimating the botanical composition of diets than the rumen fistulas. However, fistula methods are difficult to use with wild animals, are costly and time consuming and research tools. Points a) and b) are considered the most convenient method for this study.

Measuring the nutritional status of animals is a complex. Information on the confined animal's nutritional status has been carried out by monitoring and mostofthem are vailable.But for the wild ones, are nearly almost available or not available, more specificy on rhinos. Animal species, differ markedly from the humid rain forest (like

rhino of Indonesia) to the dry deserts (Africa's rhino) and from the lowland plains to the high altitudes of the mountains.

Plant-animal sytems in many places in Indonesia, particularly for mineral contents have been evaluated and generalized by Thahar (1992) concerning animal requirements under the following :

a). Sodium (Na) is to be the most common suffering defficiency in all native fodder species.

b). Elements of Cu, P, Zn are believed to be potentially defficient in all fodder species.

c). Ca, P are likely defficient in the low soil pH levels and in the ground cover forages. But in three leaves, Ca element content is sufficient for animal requiremets, but not for P element.

There are some plants which indicate certain spesific mineral contain that may contribute for certain benefit to animal management purposes. The above pattern was reported by van Strien (1981) that P and Na elements of fodder species preferred by Sumatran rhino were most likely to be insufficient. Further information reported that all rhinos visited a sltlick regularly, indicated that saltlick is very important to the rhino. But the concentration of other nutrients (crude protein, Ca, Mg,K and Mn were more than sufficient.

In efforts to breed Sumatran rhino in captive environments (*ex situ*), there is very limited information on feeding behaviour and nutrition requirements. Therefore raising and breeding these animals in all zoological gardens in Indonesia have been unsuccessfully managed facing major problems on feeding and reproductive managements. Reproductive study has been initiated to understand on hormonal characteristics in 1997 (Agil, 1997), but on nutrional and feeding aspects need to be intensified.

Results of exploring study on rhinos' habitats (Mogea, 1998) has identified 31 forage species found at surrounding the rhinos' habitats in Ujung Kulon National Park. This preliminary study in accompanion with other field or former studies and experience, may offer further study of selectivity of a number of potential (preferred) plants. Information on mineral characteristics (macro and trace) of forages which are classified

into three stages of plants (land cover, shrub and tree forages) shwos better understanding on pattern of forage quality in relation to pH soils as reported by Thahar et. al (1992).

Palatability of forages and nutritional requirements which are noted as the major problems in efforts to beed this animal in all Zoological gardens in Indonesia most likely to be the priority of any project to develop rhino population, particularly in *ex situ* habitats. Therefore the urgent attention is now drawn on better understanding on feeding behaviour and nutrient requirements. Based on the results of gathered information of the previous and the actual studies, diet/ration of rhino will be formulated for the captivity of rhino rearing.

Carrying capacity is another aspect in wild herbivores particularly on rhinos that has never been estimated (calculated). In domestic animals (ruminants) has been developed by Ashari *et al.* (1992, 1999). In rhinos the method is needed to be developed in a purpose of to develop a new habitat of rhinos.

Purpose and objective

The purpose of the study is to create a diet formula of the Sumatran rhino in order to maintain the existence and if possible to increase the population in the wild as well as in captivity.

Methodolody

1. Habitat and feeding behaviour

   Habitat and feeding behaviour of the Sumatran rhinos will be studied by following the animals when available or observed the trails which are currently used by the rhinos based on the observation and information from local forestly guards. Plants as habitat and which have been eaten by the rhino will be recorded and measured using a modified quarter plot method (Michael, 1984) to obtain a score of the important value of the related species. About 25 plots of 100 m x 40 m will be set up along the trails every 1 km distance. Field studied will be conducted in both at peak months of a rainy and dry seasons, each for one month in the first and second year of the project. The sites will be selected around the Kerinci Seblat National Park, Bukit Barisan Selatan National Park, and Way Kambas Lampung.

2. Plant collection and identification

Plant collection and identification will be conducted according to a modified Scherinfurth technique (Steenis, 1950) namely a temporary preservation. The samples will be kept and pressed in old newspaper, tightened with strong plastic strings and then put in a thick polythane bag. Before closing the polythane bag, the samples are wetted with alcohol 70% upon arrival at the Herbarium Bogoriense, the collection will be dried, labelled, mounted, sterilized from insects through a freezer of –20°C, and identified.

3. Nutrition composition of the feed plants

One hundred samples of plant species consisted of fodder leafs, fruits, and other materials which are normally eaten by rhinos' habitat as much as 0.5 kg for each species. Crude protein, crude fiber, gross energy, Ca, P, Mg, Na, K, S, Mn, Zn, Fe, Cu, Co, and Mo content will be analyzed from the samples. A routine blood tests before, during and after the experiment will also be conducted for minerals as well as for blood analysis as to prevent any nutritional deficiencies.

4. Carrying capacity

Method for estimation the carrying capacity of the Sumatran rhinos is based on a modification of the method (Thagar, 1992) which had been used for domesticated ruminants. The carrying capacity status is obtained from the value of carrying capacity index. The carrying capacity index is defined as the amount of DDM of feed produced in a given ecosystem divided by total feed requirement of the existing rhinos population.

5. Diet formulation

Three types of formula will be created. The three types will differ in the protein and energy content. Another three forms of the feed i.e: the size of the pellets, in this case a free-choice of nutrition experiment will be applied.

6. Field trial

The experiment will be conducted in Lampung, South Sumatra. The number of treatments will be be adjusted according to the number of rhino that could be

provided for this experiment, and therefore the design of the experiment will be adjusted accordingly. Parameters measured included .....

Materials and Facilities

Most of the laboratory equipments and facilities to conduct the research above are available at Bogor such as at the Life Sciences-Inter University Center, Animal Research Center and Herbarium Bogoriense. The laboratory equipments available are :

- Equipments for "weede proximate analysis"
- Feed grinder and mixer
- Low temperature freezer down to –20°C
- Electric drier
- 2,000,000 number collection of tropical plants (as references)
- geographic position system (GPS)

References

Djaja, B., H.R.Sajudin and L.Y. Khian (1982). Forage Study as Javan Rhino,s Feeds *(Rhinoceros sondaicus* Desmarest. Specal Report. No.1. IUCN/WWF Project No. 1960. Faculty of Biologi, National University.

Manan, S., Sutarman and Sudhono (1986). 0n the Efferts to Breed the Sumatran Rhino (*Dicerorhinus sumatrensis*) in Captivity in Indonesia. Proceedings of the 4th IUCN/SSC Asian Rhino Specialist Group Meeting, October 13 – 14, 1986,Jakarta, Indonesia.

Michael, P. 1984. Ecological Method for Field and Laboratory Investigations. McGraw-Hill Publishing Company Limited. New Delhi.

Mogea, J.P. (1998). Identification of forage species surrounding the rhino's habiotats in Ujung Kulon, Biological Indonesian Science. Preliminary report.

Sukohadi, W. (1973). Notes on Javan Rhino. Ujung Kulon and Panaitan Protected and Nature Reserve. Labuan. West Java.

Steenis, C.D.G.J., van. 1950. The technique of plant collecting and preservation in the tropic. Flora Malesiana I (1): xlv-lxix.

Thahar, A. A. Yusran, A. Bamualim, Hastomo and D. Santoso (1992). Mineral characteristics of feed used for Draught animal power (DAP) in Indonesia. A paper for the Aciar Workshop on Draught Animal Power, November 25-27, 1992, Kasersart University, Bangkok.

Thahar, A. and P. Mahyuddin (1998). Feed Resources. In: Telini, E., R.S.F. Campbell and D. Hoffman (edits). Draught Animal System and Management. Indonesian Study. ACIAR. Canberra.

Valenntine, J.F. (1990). Plant Selection in Grazing, Kind and Mix Grazing Animals. In : Grazing Management. Academic Press, Inc. London.

Van Strie, N.J. (1982). The Sumatran Rhinoceros (Dicerorhinus sumatrensis (Fischer, 1914) in the Gunung Leuser National Park, Sumatra, Indonesia. Its Distribution, Ecology and Conservation, Doctoral thesis. University of Leiden. The Netherlands.

Whitten, A.J. (1994). Conservation of Java's Flora. In : Suherman, G. Butler, Fuaddini, J. Preiffer M. Richarson and Suhendar (edits) Strategies for Flora Conservation in Asia. The Kebun Raya Bogor Conference Proceedings. The kebun Raya Bogoer, Indonesia.

William, N.L. (1993). The World Trade in Rhino Horn : A Review. A Traffic Network Report. National Westminster Bank.

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