INTRODUCTION

The family Rhinoceridae includes four genera and five species. For the purposes of this discussion, the needs of four species will be discussed: the Sumatran or hairy rhinoceros, *Dicerorhinus sumatrensis*; the Indian or greater one-horned rhinoceros, *Rhinoceros unicornis*; the black or hook-lipped rhinoceros, *Diceros bicornis*; and the white or square-lipped rhinoceros, *Ceratotherium simum*. The Javan rhinoceros, *Rhinoceros sondaicus*, is nearly extinct and none are currently maintained in North America.

All species of rhinoceros are heavy-bodied herbivores which are solitary except when females are in estrus. White rhinoceros are the only exception, some individuals forming temporary aggregations or small cohesive groups.

Rhinoceroses rely on a highly developed olfactory sense and chemical signal system that is transmitted through urine-spraying and dung heaps. These behaviors allow them to maintain territorial boundaries and dominant-subordinate relationships. When developing management recommendations, this system should be considered. It should also be remembered that while the horns of rhinos, some of which are well developed, are used primarily in ritualistic conflict rather than overt aggression, all species can be dangerous if cornered or threatened. Their horns may also be destructive to poorly designed enclosures.

Rhinoceroses may, for the purposes of captive management and husbandry recommendations, be divided into two groups according to overall size and feeding habits. Both white and Indian rhinoceros are large species, averaging 4410 - 6615 lb. (2,000 - 3,000 kg); black and Sumatran species are smaller and average 3308 lb (1,500 kg). Both white and Indian rhinoceros are considered grazers and feed on grasses while black and Sumatran rhinos are browsers and feed primarily on leaves, twigs and shoots. These classifications may necessitate different housing and husbandry requirements.

GENERAL HUSBANDRY

The following aspects of management pertain to all species of rhinoceros. Those requirements unique to certain species or groups of species are noted.

**Temperature:** Although rhinos are tolerant of a wide range of temperatures, exposure to temperatures below 32 degrees F (0 degrees C) should be considered minimum, and as long as there is no snow or rain. Precipitation and winds should be taken into account in calculating minimum temperature exposures.
Localities which experience average daily temperature below 51 degrees F (10 degrees C) (average of high and low temperatures over a 24 hours period) should provide heated facilities capable of maintaining a minimum temperature of 55 degrees F (12 degrees C).

All outdoor facilities should provide shade, windbreaks, mud wallows, and protection from the rain. These should be available at all times.

**Lighting:** Normal light cycles are adequate for all species of rhinoceros. Where animals are held indoors for more than 12 hours at a time, indoor facilities should provide skylights or artificial lighting to simulate normal light cycles. Incandescent or fluorescent lighting are both adequate.

**Ventilation and Humidity:** Indoor facilities should be maintained with a negative air pressure. Air exchange rates should range 8 - 10 per hour. Relative humidity should be 40 - 70 percent. Shower sprays or water baths should be offered in regions frequently experiencing low humidity.

**Water:** Fresh, potable water should be available at all times. Water should be changed daily, or be supplied from an automatic fill or continuous flow device. Regular cleaning and disinfecting should be at a rate which prevents the growth of algae and bacteria. Water devices should be substantially constructed to prevent upset, spillage, or leakage. All species need access to water pools and/or mud baths for skin health. Mud wallows will need to be cleaned periodically to prevent contamination.

**Sanitation:** Natural substrates should be spot cleaned and raked daily. Ground soil will be adequate to maintain communal defecation sites. Hard-surfaced areas not exposed to the elements should be dry cleaned or hosed daily, and disinfected once weekly. Indoor housing surfaces should be cleaned daily with a disinfectant/cleaner. Walls and rub areas should be cleaned in the same manner. Periodic steam cleaning is encouraged to prevent buildup of manure and dirt. In facilities which maintain free-ranging herds, daily cleaning may not be practical. Under those conditions, periodic removal of dung heaps, and the turning of soil and scattered manure, will be necessary.

**Diet:** When evaluating digestive tract morphology, the horse, *Equus caballus*, is the best model for use in comparing the nutritional requirements of rhinoceros. The daily maintenance feed regime should consist of an 8% minimum protein commercial rhino or equid feed formulation. Young or lactating animals require 10-15% protein. Produce in season is also beneficial. Hay should be provided *ad libitum* and if possible, distributed in multiple feedings throughout the day. Grazing species (white and Indian rhinoceros) should be maintained on a good quality grass hay while browsing species such as the black and Sumatran rhinoceros, should be fed mixed grass/legume hays. Alfalfa hay by itself is not recommended. Diet quality should be based on a dry matter basis of 1.5% of body weight per day. Produce may be fed occasionally as a treat or for use in medication.
**Supplements**: Vitamin E, as based on natural browse composition, should be included in the diet of all rhino species at a rate of 150-200 IC Vitamin E per Kg dry matter of feed.

**Veterinary Care**: The services of a veterinarian with experience in large bodied, exotic herbivores is required by facilities holding rhinoceros. Periodic (at least biannual) fecal examinations are required to monitor and treat for endoparasitic infestations. When possible, visual examinations to detect ectoparasites should occur as part of daily husbandry. In areas where tetanus is endemic, vaccination on an annual basis is necessary for all species. Black rhinos require biannual vaccinations of a leptopiral bacterin (containing *Leptospirosis interrogans* serovar *icterohemorrhagiae*, *grippotyphosa*, *pomona*, *canicola*, *hardjo*, and *bratislava*), and leptospiral prophylaxis in other species should be considered in light of recent findings related to abortion in Indian rhinoceros.

Black rhinoceros are singly susceptible to a number of diseases of an unusual nature and uncertain cause. These include episodes of hemolytic anemia, as evidenced by passing blood in the urine and by bleeding out of one or more orifices. Mortality is high among affected individuals. Although not well understood, diet is thought to be involved in these processes and an experienced veterinarian knowledgeable about the species should be consulted if this problem is suspected. Black rhinoceros also suffer from a syndrome of oral and skin ulcers, an increased incidence of fungal pneumonia, hemosiderosis, and encephalomalacia (a degenerative brain disease).

Other problems experienced by rhinoceros are routine to most large animals, including foot problems and colic. Indian rhinoceros may suffer, of late, from an abnormally high number of abortions.

**SPECIAL REQUIREMENTS**

For the purposes of the following discussion, rhinoceros are discussed in terms of size, feeding habits, and social needs rather than any taxonomic relationships.

**Social Grouping**: All rhinoceros are predominantly solitary outside of the mating season and may be kept singly. White rhinoceros tend to be more gregarious than the other species and can be kept in multiple sexed groups provided the facility has the capability of separation when aggression occurs. In larger exhibits, white rhinos may also be mixed with other species such as zebra, giraffe, antelopes, and large birds.

Some aggression is to be considered a normal part of courtship behavior. If pairs are maintained, facilities should have the capability of separating and holding aggressive animals apart. Adult males should not be housed together in the presence of an estrus female. Males should also be held separately from females when maintained in confined quarters.

**Exhibit Size**: The minimum outdoor enclosure per individual rhinoceros should measure at least 1500 sq. feet (139 sq. m). Minimum indoor (night) housing should
possess at least 200 sq. ft. (18.5 sq. m.) per individual. More space may be needed for facilities which must keep animals indoors or together and/or inside for extended periods of time.

**Exhibit Type:** Enclosure perimeters should be constructed of type and material suitable for containing any large herbivore. The height of the primary barrier should be a minimum of 60 inches (152 cm) and be non-climbable. A vertical pole barrier, if utilized, should be placed 10 - 12 inches (22.5 - 30.5 cm) apart. Moats should have a minimum floor space of 5 feet (1.53 m), with one vertical wall being at least 5 feet (1.53 m) high) and the other wall sloping from the enclosure toward the floor at approximately a 30 degree angle. Moats possessing two vertical walls should be avoided in order to prevent injury to animals falling into the moat. Barriers of creosote-treated poles should also be avoided because of their toxicity (Miller, 1992).

**REFERENCES**


RHINOS: ENDANGERED SPECIES, Facts on File Publications, NY.

RHINO HUSBANDRY MANUAL DRAFT: Health.