

Endangered Philippine Wildlife Species with Special Reference to the Philippine Eagle (*Pithecophaga Jefferyi*) and Tamaraw (*Bubalus Mindorensis*)

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Abstract

The Philippine is high on the list of priority countries in the world for wildlife conservation because of its remarkable biological diversity, large number of endemic animal and plant species, inadequate wildlife protection measures, and high rate of deforestation. Of the 180 species of mammals in the Philippines, 115 (67%) are endemic. To date, 9 mammals have already been categorized as "endangered" by the International Union for the Conservation of Nature (IUCN). These are the Golden-Crowned Flying Fox, Negros Naked-Backed Fruit Bat, Philippine Tube-Nosed Fruit Bat, Panay Bushy-Tailed Cloud Rat, Ilin-Tailed Cloud Rat, Visayan Warty Pig, Calamian Hog-Deer, Visayan Spotted Deer and Tamaraw.

The tamaraw is a small buffalo found only in the island of Mindoro, south of Manila. It closely resembles the Philippine water buffalo (carabao) except for its massive horns, which grow upward and caudally forming a V. Its population is down to 300 now due to wanton destruction of its habitat and poaching. The Tamaraw Conservation Program (TCP) was established to restore the tamaraw habitat, conduct information and education campaigns, and population and habitat studies. The Philippine eagle is the largest bird of prey in the Philippines and, perhaps, one of the largest in the world. They used to be seen in large number in dipterocarp forests but because of illegal logging, agricultural practices and collection for illegal trade, only around 300 Philippine eagles are left in the country today. The Philippine Raptors Conservation Program (PRCP), Center for Philippine Raptors (CPR) and the Philippine Eagle Conservation Foundation, Inc. (PECFI) were established to protect the Philippine eagle and other endangered birds of prey and their habitats.

1. Introduction

The Philippines, composed of 7,101 islands, lies in the heart of Southeast Asia with the vast Pacific Ocean on the west and South China Sea on the east. It is blessed with rich natural resources such as rare plants and animals found nowhere else in the world. However, it disheartening to note also that no

country in the world has its plants and animals being destroyed at an alarming rate than the Philippines. For instance, the Philippines has already lost about 97% of its original vegetation and has even more critically endangered avian and mammalian species than any other country (Tacio, 2000). For this, the Philippines has been tagged one of the "hot spots" in the world for conservation concern. Other reasons are the (1) remarkable biodiversity of animal and plant species in the country, (2) extraordinarily high percentage of endemism among the species wherein some 67% of these species are present only in the Philippines and, (3) high rate of deforestation and other forms of habitat destruction (Oliver and Heany, 1997). To these a fourth reason can be added and that is the apparent lack of political will to enforce existing laws to safeguard wildlife species and their habitat. Countless national and local legislation have been passed to protect wildlife and their habitat but unfortunately they seemed to be ignored rather than followed. As a result deforestation and hunting continue at an alarming rate. The biodiversity of the Philippine islands is exceptionally rich as shown by its 556 avian species, 172 (44%) of which are endemic, 180 mammalian species, 115 (67%) of which are endemic, and 293 reptilian and amphibian species, 214 (73%) of which are endemic (Oliver and Heany, 1997). The Philippines ranks fourth in the world with the highest number of threatened species totaling 384. Malaysia is first with 804, Indonesia second with 763, and India third with 459 species. It is interesting to note that these are all Asian countries. In the 1994 Review of the Distribution and Conservation Status of the Birds of the World by the Birdlife International, the Philippines topped the list of countries in terms of the number of critically endangered endemic bird species, and second after Brazil for the number of most threatened bird species under endangered and critically endangered categories. Its national bird, the Philippine eagle and national animal, the tamaraw are likewise seriously threatened with extinction. The rainforests homes to most of the wildlife species are also fast disappearing giving way to agricultural expansion and urbanization.

2. Endangered Wildlife Species in the Philippines

What are endangered species? According to the definition given by the International Union for the Conservation of Nature and Natural Resources (IUCN), endangered species are plants or animals that are being threatened with extinction due to excessive hunting and large scale destruction of their habitat. Conservationists all over the world are alarmed by the 1996 Report of the International Union for IUCN stating that the number of critically endangered mammals in the world has increased significantly from 169-180, primates from 13-19, fresh water turtles from 10-24, and birds from 168-182. Of the list for endangered mammalian species, nine are endemic to the Philippine islands. These are the Golden-crowned flying fox, Negros naked-backed fruit bat, Philippine tube-nosed fruit bat, Panay bushy-tailed cloud rat, Ilin hairy-tailed cloud rat, Visayan warty pig, Calamian hog deer, Visayan spotted deer, and tamaraw. Among the critically endangered avian species in the report is the Philippine eagle. Although no endangered marine mammals were mentioned in the report, whale sharks are fast disappearing from Philippine waters (Esplanada, 2000). For example, the *Rhiodon typus* (also known as *pating patola* in Zambales, *toko* in Mindoro, *balilan* in Cebu and Bohol and *butanding* in Bicol and Palawan), which regularly visits the waters of Donsol, Sorsogon (located at the tip of Bicol Peninsula) from November to May are rarely sighted in Philippine waters now. These gentle, polka dotted whale sharks are widely hunted by local fishermen for its meat and fins, which are reported to command a high price abroad. To prevent the *Rhiodon typus* from completely disappearing from the Philippine waters, the Philippine government in 1998 declared the whale shark endangered; thus, banning poaching and exporting of its

meat, which is a delicacy in some Asian countries. Other non-governmental conservation groups such as the World Wildlife Fund Philippines (*Kabang Kalikasan ng Pilipinas*) and large business conglomerates like Nokia Philippines, Megaworld Corporation and International Container Terminal Services Incorporated have supported the government's campaign to protect the whale shark. The Philippine Daily Inquirer a leading Philippine newspaper also supports the save the whale shark campaign. Other endangered Philippine species are the Hawksbill turtle (*Eretmochelys imbricata*), Olive Ridley turtle (*Lepidochelys olivacea*), Leatherback turtle (*Dermochelys coriacea*), Philippine crocodile also known as Philippine freshwater crocodile and Mindoro crocodile (*Crocodylus mindorensis*), Indo-Pacific crocodile or salt water crocodile (*Crocodylus porosus*), Mindoro bleeding heart (*Gallicolumba platenae*), Mindoro bleeding heart (*Ducula mindorensis*), lesser eagle owl (*Mimizuki gurneyi*), Philippine eagle owl (*Bubo philippensis*), silvery kingfisher (*Alcedo argentata*), Mindoro hornbill (*Penelopides mindorensis*), celestial monarch (*Hypothymis coelestis*) and Isabela oriole (*Oriolus isabellae*). The Philippines - Japan Crocodile Farming Institute (CFI) based in Palawan Island has successfully bred the *Crocodylus mindorensis* in captivity. Only the endangered terrestrial mammals (cloud rats, fruit bats, deers, wild pig and tamaraw) and the Philippine eagle will be described in this paper.

2.1 Cloud Rats

Cloud rats are gentle and lovely rodents found only in the Philippine. Six species of cloud rats inhabit the Philippine. These are the Northern Luzon slender-tailed cloud rat (*Phloeomys pallidus*), Southern Luzon slender-tailed cloud rat (*Phloeomys cumingi*), giant bushy-tailed cloud rat (*Crateromys schadenbergi*), Ilin Island cloud rat (*Crateromys paulus*), Dinagat Island cloud rat (*Crateromys australis*) and Panay Island bushy-tailed cloud rat (*Crateromys heaneyi*). The Panay bushy-tailed cloud rat and the Ilin-hairy tailed cloud rat are extremely endangered while the Ilin hairy-tailed cloud rat found only in the Ilin Island south of Mindoro is on the verge of extinction. Others claim it is already extinct. The smallest is the *Crateromys paulus*. The *Phloeomys cumingi* and *Phloeomys pallidus* are still off the endangered list because there is still a healthy population of these species in the wild. Unlike their parasite and disease carrying cousin rats in urban places, cloud rats are forest dwellers. They are slow moving creatures but are excellent tree climbers. Cloud rats are nocturnal creatures spending most of the day sleeping in the hole of large trees. Their diet is simple consisting mostly of tender young leaves, bananas, guavas, and young corns (Novak, 1999). Survival of cloud rats is threatened by hunting and wide scale deforestation. Cloud rats are usually hunted for their meat, which is a favorite finger food or *pulutan* during drinking session in rural areas. Others keep them as pets. Cloud rats are among the wildlife species protected by the Haribon Foundation for the Conservation of Natural Resources a member of the World Conservation Union with linkages with a number of conservation groups nationally and internationally. Basic studies on the biology and health aspects of cloud rats should be encouraged to complement various on-going conservation measures. In the Philippines, Maala and Arreola (1996) described the hair cuticles of the cloud rat from those of flying lemur and Philippine monkey by means of scanning electron microscopy. Based on the result of their study the three species could be differentiated from each other through the cuticular patterns of their hair. A study on the anatomy of the cloud rat is presently undertaken at the Institute of Biological Sciences, University of the Philippines Los Banos.

2.2 Flying Foxes

Flying foxes or fruit bats are forest dwellers, which subsist mainly on forest fruits. They are known

locally by various names such as *paniki*, *kabag* and *bayakan*. Eight species of large flying foxes have been documented in the Philippines. Of these, the Golden-crowned flying fox (*Acedoron jubatus*) and the Philippine tube-nosed fruit bat (*Nyctimene rabori*) are considered endangered, and the Negros naked-backed fruit bat (*Dobsonia chapmani*) extinct. The *Acedoron jubatus* is the largest bat in the world weighing almost 1.1 kg (Heaney and Heideman, 1987). Deforestation and extensive hunting and collection have largely depleted their population. In the late 1800s and early 1900s one readily encounters colonies of Golden-crowned flying fox numbering 100,000 individuals per colony but nowadays bat colonies of that size are hard to find. Colony size has dwindled to 5,000 bats per colony. Fruit bats are usually hunted for food and as pets. Because of prevailing poverty in rural areas exotic food such as bat meats are cheap source of animal protein in the diet. Fruit bats are also favorite finger foods or *pulutan* among rural folks during drinking sessions. Selling fruit bats is also a source of additional income for the people. In some parts of the country, skinned or live fruit bats are sold openly in public markets. Even in other countries such as the Pacific Islands, fruit bats are considered a delicacy. For example the Chamorro people of Marianas Islands consider fruit bat the most important of the local delicacies and is always served during special occasions (Payne, 1984). There is also a demand for bats as sources of ingredients of traditional medicine and aphrodisiacs. According to Morgan (2000), folk medicines such as the traditional Chinese medicine are endangering the survival of a growing number of wild animals and plants. The traditional Chinese medicine alone has been reported to be worth \$ 6 B to \$ 20 B. Derivatives of wildlife species are not only used in traditional medicine but are also used as raw ingredients in the preparation of modern medicine. The extinction of the Negros naked-backed fruit bat has been blamed to guano mining, hunting and forest destruction. (Heaney, 1997). The relationship between fruit bats and forest is a symbiotic one that is they protect each other. Bats are economically beneficial animals in pollination of fruit trees, dispersal of seeds of fruit and forest trees, and as a source of guano fertilizer. As seed dispersers, Tuttle (1983) cited a recent West African study, which showed that bats are more effective seed dispersers than birds. A more effective conservation measures could be implemented if basic information such as reproductive physiology and health management aspects of this species are understood. However, there are only few studies conducted on Philippine bats. These included the work by Guico and Maala (1994) on the histological and histochemical description of the fundic gland region of the stomach of insectivorous *Hipposideros diadema* bat and frugivorous *Rousettus amplexicaudatus* bat. In Japan, Yamada et al. (1988) reported the presence of cholecystokinin, gastric inhibitory peptide, motilin, neurotensin and bovine pancreatic polypeptide immunoreactive cells in the stomach of two species of insectivorous vespertilinid bats. In a study on five North and Central American bats, Rouk and Glass (1970) reported that the stomach of *T. brasiliensis*, *N. velifer* and *A. pallidus* do not differ histologically from each other. They observed however that there are only a few chief cells in the stomach of *L. sanborni*.

2.3 Visayan Spotted Deer, Visayan Deer (*Cervus alfredi*)

There are three species of Philippine deer: Visayan spotted deer, Calamian hog deer and Philippine brown deer (*Cervus marianus*). Only the Visayan spotted deer and the Calamian hog deer are presently threatened. Few heads of Visayan spotted deers are still found in the remaining forests of Negros and Panay islands. They were previously reported in Cebu, Guimaras and Masbate Islands but excessive hunting and deforestation lead to their extinction in these places. The Visayan spotted deer is a small, attractive animal measuring about 80 cm tall at the shoulder. Their characteristic white spots remain

throughout their life. The Visayan spotted deers are the most endangered deer in the world. They are listed in the Appendix I of the Convention on International Trade of Endangered Species (CITES), which means that trade of Visayan spotted deer is strictly regulated by law. It is believed that there only about 200 heads of Visayan spotted deer in the wild today. It is seriously threatened with extinction unless illegal hunting and rampant degradation of their habitat are stopped. Conservation measures that have been adopted included the International Philippine Spotted Deer Conservation Program a joint venture between the Philippine Department of Environment and Natural Resources (DENR) and the *French Parc Zoologique et Botanique De La Ville De Mulhouse* (PZBM) (Oliver, 1996). There were two components of the program: establishment of a new national park in Panay and the setting up of captive breeding and rescue centers. The Philippine Wildlife Loan Agreement (PLWA) signed in 1987 by DENR and Mulhouse Zoo implemented these. Under this agreement West Berlin Zoological Society would provide financial assistance for faunal survey and preliminary management plan for the proposed Panay Mountains National Park. In 1990, the captive breeding component of the Philippine Spotted Deer Conservation Project was realized with the launching of the Philippine Spotted Deer Captive Program. Mulhouse Zoo and the Zoological Society of San Diego funded the project. Two breeding and rescue centers were initially established, one in Bitu Farm, Iloilo specifically for spotted deers of Panay origin and the other one in Siliman University, Negros Occidental for spotted deers of Negros origin. A third breeding center was later on put up in Bacolod, Negros Occidental. The ultimate aim of the breeding centers was to establish a "world herd" of Visayan spotted deers. The initial population in these centers was composed of Visayan spotted deers donated by private persons who keep these animals as pets and also those caught from the wild. In 1995, DENR and Melbourne Zoo signed an agreement to establish a Philippine spotted deer Conservation Center for Panay Island population of the deer. This agreement was enlarged in 1998 to include the White Oak Conservation Center in Florida. Under this agreement, Melbourne Zoo, which provides financial support to the program, will receive a group of Philippine spotted deer in 2000 to start a regional Australasian zoo program. Incidentally, the Negros Forest and Ecological Foundation, Inc. (NFEFI) reported the birth of the first captive bred spotted deer fawn on November 20, 1996 at its Conservation Center in Bacolod. Research on basic nutritional requirements and reproductive physiology of the Philippine spotted deer should be encouraged to complement various conservation measures. Blood values, blood clotting time, respiratory rate, pulse rate and temperature important in disease diagnosis should be established in this species. Maala and Saguibo (1997) who examined the cuticular patterns of the hairs of Calamian deer, Visayan spotted deer and mouse deer by means of scanning electron microscopy claimed that it is possible to distinguish the Visayan spotted deer from the Calamian deer through the cuticular patterns of their hairs.

2.4 Calamian Deer, Calamian Hog Deer, Philippine Deer (*Cervus porcinus calamianensis*, *Axis calamianensis*)

The Calamian deer is endemic in Busuanga, Calauit and Culion (group of islands at the northern tip of Palawan) islands. It is known locally as *usa*. Since Calamian deers are listed in Appendix I of CITES, their trade is subject to strict regulation. The Calamian deer is a beautiful animal, which is tawny brown in the head, lateral side of the neck and on the ventral side of the body. Its tail is characteristically short with white buffs of hair present on the ventral side of the tip. A 70-80 cm tall adult Calamian deer weighs 30-35 kg while a newborn weighs about 1 kg. Only male Calamian deers have antlers. Calamian deers are largely threatened by shrinking habitat and illegal hunting and collection. Rural folks fancy the

meat of Calamian deer resulting in their over hunting. In 1976, a Presidential Proclamation was signed by then President Marcos establishing the Calauit Island Game Reserve and Wildlife Sanctuary, which were thought to protect the wildlife species in this island. However, it turned out that the sanctuary was not intended to provide haven to the native animals there but instead to accommodate the African wildlife species donated by the Kenyan government to Marcos. Contrary to the belief that the introduction of alien species of animals into a certain place can have long term negative effects on native animals (Janetos, 1997), the Calamian deers and other wildlife species survived despite the presence of the African species. In fact, the population of the Calamian deer increased dramatically from 35 in 1977 to about 550 in 1991 (Panol, F. W., 1986). Other Calamian deer conservation measures included the international cooperative breeding program established by an agreement between DENR and the Zoological Society of San Diego (Oliver, 1996). The Zoological Society of San Diego provided financial support to the project. The Calauit Island Game Reserve and Wildlife Sanctuary is threatened by the residents who have returned to the Calauit Island to reclaim their lands when Marcos was toppled from power in 1987. These people were displaced from their lands when the wildlife sanctuary was established in 1976. When they returned to the island they brought with them animals, which may serve as reservoir of infectious diseases that endanger not only the Calamian deers in the area but also other wildlife species. It is surprising to note that not much basic information about the Calamian deers is available in the literature. For example the hematology, temperature and respiratory and pulse rates important in disease diagnosis are not yet established in this species. Studies along these lines should therefore be encouraged. The skull (Maala et al., 1990) and vertebral column (Maala et al., 1992) of the Calamian deer have been described. Some external and gastro-intestinal parasites such as *Damalina sp.*, *Strongyloides sp.*, *Oesophagostomum sp.*, *Bunostomum sp.* and *Moniezia sp.* have been identified in Calamian deers (Eduardo et al., 1991; Eduardo, 1995).

2.5 Visayan Warty Pig (*Sus cebifrons*)

There are three species of Philippine wild pigs: Visayan warty pig, bearded pig (*Sus barbatus*) and Philippine warty pig (*Sus philippensis*). However, only the Visayan warty pig is considered endangered by the IUCN. Visayan warty pigs are endemic to the islands of Cebu, Guimaras and Masbate, although recent reports show that they are now extinct in Cebu and Guimaras. The Visayan warty pig is a small, forest-dwelling pig. In general, boars are larger than sows. Their snout is elongated, mobile and terminates in an expanded flat disk, the snout. The head is elongated and bears the well-developed upper and lower canines. They are usually black in color with an abundant mixture of silvery white bristles on the sides producing a general whitening effect on these parts. In young pigs there is an orange band running along the length of the body, which disappears at about 7 - 8 months of age. The wild pig is described in a more detailed manner by Rabor (1977). The animal's diet includes vegetables and fallen fruits. Threats to these animals include intense hunting and systematic destruction of their habitat such as illegal logging and spread of agriculture (Oliver, 1996). The main reason Visayan warty pigs are excessively hunted is their meat, which is fancied by rural folks. The meat of Visayan warty pigs is also popular among the health conscious people because of its low fat and cholesterol content. The sad plight of these animals is made worse by the negative attitude of local folks towards them because of their destructive nature. Food shortage in the forest forced these animals to migrate into lowland areas attacking agricultural crops like vegetables and corns. As a result, farmers regard them as pests and start hunting them with impunity. Conservation measures aimed at saving the remaining herd of Visayan warty pigs from

extinction are similar with those adopted for the Visayan spotted deer because both share the same habitat. A captive breeding center has been set up at Siliman University, Negros Oriental by virtue of an agreement between DENR and the Zoological Society of San Diego. It is stipulated in the agreement that should the project become successful, animals for breeding purposes will be loaned out to other breeding centers locally and internationally. The Negros Forest and Ecological Foundation, Inc. (NFEFI) a non-government conservation group established in 1986 is involved in the conservation of threatened endemic species and their habitats in Negros Island. It receives financial assistance from Melbourne Zoo and Rotterdam Zoological Society. In addition to the maintenance of a captive breeding facility, NFEFI conducts community educational program, and reforestation activities of the Bacolod hills. It is unfortunate that the animal, although on the extremely endangered list, has attracted very few studies. Since wild pigs are now raised in captivity basic information on their reproductive physiology, nutrition, and basic physiological information such as blood values, normal body temperature, and respiratory rate should be established. The last three are vital information in routine clinical examination. Among the studies conducted on wild pigs are those of Valle et al., (1998), which characterized the hair cuticles from different body regions of native pigs *Sus philippinensis* and a wild pig *Sus barbatus* and De Asis (1998), which compared the microscopic anatomy of the carpal of wild and native pigs. Valle et al. showed some differences in the hair cuticular patterns between *Sus philippinensis* and *Sus barbatus* that could be used to differentiate the two species. De Asis observed that the carpal gland, which is peculiar to porcine species, is more developed in *Sus barbatus* than in the *Sus philippinensis*. The pheromone-like secretion of the carpal gland is important for territorial marking. Recently, Corbe (2000) identified ticks, louse and a species of acanthocephalan worm from a captive wild pig *Sus philippensis*. Similar works have not been done on Visayan warty pigs.

2.6 Philippine Eagle, Great Philippine Eagle (*Pithecophaga jefferyi*)

The Philippine eagle (Figure 1) is the largest bird of prey in the Philippines and considered the second rarest and largest in the world (Molinyawe et al., 1999). It is declared as the Philippine national bird in 1995. It is known locally as *agila*, *manaol*, *tipule*, *mamboogook*, *malamboogook* and *garuda*. The Philippine eagle is formerly known as Philippine monkey-eating eagle because of the wrong belief that it feeds only on monkeys. However, it has been found that its diet also includes other forest dwellers such as flying lemurs, squirrels, snakes, bats, deer, monitor lizard, young owl, young pig, and in captivity, the eagle also eats guinea pigs, rabbits, goat meats, beef and even chicken. The eagle has a black, narrow, 26 cm-arched bills, enormous black claws; generally, dark brown in color (in adult), partly feathered legs, and scaled lower legs (Grossman and Hamlet, 1964; Rabor, 1971). Its eyes are blue gray, the cere around the nostrils is blue green, and the head is surrounded by crest of long pale rufous feathers. It measures about one meter tall, 95 cm long and weighs approximately 4 kg. It has 6.5 ft wingspan. The Philippine eagle builds its nest on top of very tall trees and nests once every two years. Only one egg is laid, which is alternately incubated by both parents for a period of 60-61 days. The eaglet remains in the nest for about five and a half months. The breeding season ranges from as early as August to as late as January (Rabor 1971).

2.6.1 Distributions and Population

John Whitehead first reported the Philippine eagle in Samar Island in 1896 (Molinyawe et al., 1999). It is claimed that the eagle occurs only in Luzon, Samar, Leyte and Mindanao (Kennedy, 1977; Rabor, 1971). However, based on forest cover analysis and reports of additional sightings, Jensen et al., (1991) concluded that there is still a wild population of Philippine eagle in the Sierra Madre Mountain Range in eastern Luzon. Recent reports of sighting of Philippine eagle included those in the provinces of Cagayan, Isabela, Aurora and Eastern Samar (Labro, 1998). The Philippine eagle is listed under critically endangered by IUCN so that law strictly prohibits hunting and trade of this bird. The Philippine eagle population has dwindled to a dangerously level over the years. For example, forty years ago, the population of the Philippine eagle was estimated to be 6,000, but according to Ellis (1972) the population is fewer than 100. The Philippine Red Data Book published by the Wildlife Conservation Society of the Philippines in 1997 placed the population of Philippine eagle at approximately 200. Recent report from DENR showed that the present population of the Philippine eagle including those in captivity is 117 (Molinyawe et al., 1999).

2.6.2 Philippine Eagle Conservation Measures

The sad plight of the Philippine eagle was first brought to the attention of the world during the 1965 IUCN Conference held in Bangkok, Thailand. As a result, the Philippine Eagle Center now the Center for Philippine Raptors (CPR) was established (Molinyawe et al., 1999). It is based at Makiling Botanical Garden, University of the Philippine Los Banos, Laguna. It is mandated to conduct scientific researches, restore habitats, monitor and protect populations, conduct educational, and information campaigns for the protection of the eagle and its habitat. Captive breeding center has been established in Mindanao in support with the activities of the center. So far, five Philippine eagles have been successfully bred in captivity: *Pag-asa* (hope), *Pagkakaisa* (unity), *Pangarap* (dream), and *Bayani* (hero). In addition to the routine population survey and habitat studies, the basic nutritional requirements and reproductive physiology of the Philippine eagle in captivity should also be investigated. Various legislations have been enacted to further protect the Philippine



Figure 1 An adult Philippine eagle (Taken from *The Treasury of Birds* Published in 1972 by Octopus Books Ltd., London).

eagle and its habitats. These include Administrative Order 235 (1970) prohibiting the wounding, hunting, trading and killing of the eagle, Republic Act 6147 (1970) declaring the Philippine eagle as a protected bird in the Philippines, Parks and Wildlife General Administrative Order 1 (1971) establishing rules and regulations governing the preservation of the eagle, Proclamation 1732 (1978) changing the name "monkey-eating eagle" into Philippine eagle, Republic Act 7586 (1992) providing for the establishment and management of National Integrated Protected Areas System including known habitats of the Philippine eagle, Proclamation 615 (1995) declaring the Philippine eagle as the Philippine national bird (some critics argued the wisdom of naming an endangered species as a national symbol), and lastly Proclamation 79 (1999) declaring June 4-10 of every year as Philippine eagle week.

2.6.3 Threats to the Philippine Eagle

Destruction of dipterocarp forests the known habitat of the Philippine eagle is by far the most serious threat to the survival of the Philippine eagle. The Philippine dipterocarp forests are populated by broad-leaved dipterocarp tree species that include red and white *lauan*, *tanguile*, *tiaong*, *almon*, *bagtikan* and *mayapis* of the Philippine mahogany species. The Philippine deforestation rate, which was reported to be 91,000 ha a year is considered high among the Southeast Asian countries (Matsuoka, 1998). With this rate of deforestation, it is projected that the Philippine forest will be completely denuded by the year 2036. Tabaranza, Jr. (1997) stated that most of the Philippine endemic birds except the Philippine duck *Anas luzonica* are forest dependent, and the alarming rate of on going forest destruction should be a major concern to prevent the global extinction of endemic birds. The Philippine eagle and its mate require 50 - 100 sq km territory and a home range of some 30 sq km within which no other similar eagle must nest (Labro, 1998). Protecting the habitat of the Philippine eagle therefore will result in saving a significant amount of the remaining tropical rain forest in the Philippines (Tabaranza, J., 1997). Another equally important threat to the Philippine eagle is illegal hunting. It is a known fact that Philippine eagles are usually hunted as pets. Some found their way into local and foreign zoos. The eagle is listed in Appendix I of CITES, so that law strictly prohibits trade of this bird. According to Ellis (1972) it is a status among Filipinos to possess a stuffed, mounted eagle. It is however unthinkable to hunt Philippine eagle just to have it stuffed. Maybe Ellis is referring to other Philippine raptors such as the smaller Philippine hawk-eagle (*Spizaetus philippensis*) that are not yet presently threatened.

2.7 Philippine Tamaraw (*Bubalus mindorensis*)

The tamaraw (*tamarao*, *tamarau*, *timarau*) (Figure 2) is found only in Mindoro Island, south of Manila. It closely resembles the highland *Bubalus anoa depressicornis* and the lowland *Bubalus anoa quarlesi* of Indonesia. Maybe this explains why the tamaraw is previously called *Bubalus arnee mindorensis* and *Anoa mindorensis*. Tamaraws are fierce, nocturnal and wary animals. Most of the time, they are observed occurring individually or found in small groups. In contrast with other animals, tamaraws conceal their calves rather than being with them constantly in the open. When provoked, they bring their heads down and shake them laterally. There are no records on the domestication of tamaraws but some claim that they could be trained into valuable domestic animals. However, their diminutive size may not be ideal for farm tillage. Tamaraws are not choosy with their diet. In fact, its diet consists mainly of new growth of *Saccharum spontaneoum*, *Imperata cylindrica* or "cogon" grass and even bamboo shoots that are quite abundant in the area. Just like the carabao, the tamaraw requires adequate supply of water for drinking and wallowing so that during summer they were observed to travel to lower areas in



Figure 2 An adult Tamaraw bull at the "gene pool" in Mindoro Island.

search of water. With regards to wallowing behavior Momongan et al., (1996) reported that tamaraws wallow more during the day than at night and during rainy season compared to the dry season. Their observations were based on tamaraws in confinement.

2.7.1 Physical Description of Tamaraw

The tamaraw closely resembles the Philippine swamp buffalo or carabao (*Bubalus bubalis*) in all aspects except that it is much smaller physically. It measures only a meter tall at the shoulder and weighs roughly 300 kg. Because of this, the tamaraw is also known as "miniature carabao" or "dwarf carabao". A striking feature of tamaraws is their short massive horns, which are triangular on cross section and curve straight caudally forming a "V", whereas in carabaos the horns are directed laterally and caudally forming a "C" (Walker et al. 1975). The haircoat of adult tamaraw is dark brown to grayish black in both sexes. Newly born calves, however, are reddish brown in color but it changes to adult color when the animal reaches 5 years of age (Kuehn, 1976). Change in haircoat color and shape of the horns could be used in the estimation of the age of tamaraws (Kuehn, 1986). Tamaraws have short and stocky legs, more hairs in the body and short external ears. The skeletal system of the tamaraw has already been adequately studied (Sumulong, 1931; Maala and Momongan, 1993). The other body systems have yet to be described.

2.7.2 Habitat

Tamaraws used to roam in open pasture, dense bamboo vegetation, marshy river valleys and upland forests in Mindoro Island but because of pressures from hunting and shrinking habitat, the animals defensively retreated to forested areas (Kuehn, 1986). Cox and Woodford (1990) described the physical features and vegetation prevailing in Mt. Iglit-Baco National Park, one of the tamaraw conservation areas. The Mt. Iglit-Baco National Park is a 75,500 ha area located in a mountainous terrain in the central region of Mindoro. The vegetation of the western part of the park is dominated by botanical species such as *Themedia triandra*, *Saccharum spontaneoum* and *Imperata cylindrica*. There are also small areas with mixed bamboo and secondary forest growths. The vegetation along rivers is dense and this

provides good pasture and cover to the tamaraws. The eastern side of the park that receives adequate rainfall throughout the year favors the growth of tropical rainforest.

2.7.3 Threats to the Tamaraw Population

The tamaraw is listed in Appendix I of CITES which means that the population of this animal has reached an alarmingly low level; thus, poaching and trade of tamaraws are strictly prohibited. It is one of the Philippine mammalian species facing extinction unless the causal factors are eliminated. Harrison (1969) reported that the population of tamaraw dropped from a high of 10,000 in 1900 to just 100 heads in 1969. Lustria and Callo (1992) reported that there are still about 133 tamaraws in the wild. DENR claimed that the population of the tamaraw has increased to 300. As to the sharp decline in the population of tamaraw from 1900 to 1949, this was attributed to the outbreak of rinderpest in the Philippines in 1930. Rinderpest, which was introduced into Africa 100 years ago, was responsible for the eradication of millions of wildebeests, hartebeests and others in that continent. Among the threats to the remaining tamaraw population, include the continuous destruction of their habitat by human settlers in the tamaraw reservation areas. One such activity is cattle ranching near the Mangyan Heritage Park, which has resulted in the destruction in large proportion of the tamaraw's remaining habitat. Cox and Woodford (1990) have reported that about 14 pasture permits (the number could have easily doubled now) covering approximately 6,616 ha of the Mangyan Heritage Park have been issued by the Philippine government for commercial cattle ranching. Burning, a common practice by cattle ranchers especially during summer resulted in the appearance of less suitable and palatable botanical growth such as *Imperata cylindrica*. One cannot also discount the possibility of diseases and parasites being introduced into the area by cattle ranching. In fact, gastro-intestinal tract parasites such as *strongyles*, *fasciola*, *amphistomes* and *trichuris sp.* normally present in cattle have already been reported in captive tamaraws (Anunciado et al., 1996). Even external parasites such as *Hematopinus tuberculatus* (louse), *Boophilus microplus* (tick), *Rhipicephalus sanguineus* (tick) and *Amblyoma sp.* (tick) have likewise been observed in these animals (Masangkay et al., 1996). Two tamaraws in their report were seropositive to *Leptospira sp.* and one animal reacted positively to bluetongue virus and leptospira.

There is no doubt that human encroachment on the Mangyan Heritage Park is by far the most serious threat to the tamaraw. Cox and Woodford (1990) reported that 2000 people have already illegally occupied a vast area in the southwestern part of the Mangyan Heritage Park. With the population of Filipinos expected to break the 80 million mark this century, human squatting even in wildlife reserve areas will continue at a faster rate. There is also the likelihood of outbreaks of highly infectious diseases of livestock such as foot and mouth disease (FMD), hemorrhagic septicemia (hemosep), tuberculosis, brucellosis (contagious abortion) and rinderpest (although this has already been eradicated in the country) in reservation areas as a result of squatting. Ross McPhee of the American Museum of Natural History in New York theorized that diseases introduced by human being are responsible for the disappearance from the earth of more than 100 species such as the mammoths, mastodons, giant armadillos, dog-size rodents and saber-toothed tigers (McKie, 2002).

Hunting definitely poses a serious threat to the remaining tamaraw in the wild. Among the people who have been known to engage in poaching are the indigenous people in the Mangyan Heritage Park, cattle ranchers, human settlers and sportsmen. It is doubtful, however, whether the indigenous people

living in the park actually hunt tamaraw. Of course, they are known to hunt wild pigs, wild deers and sometimes fruit bats for food but to kill tamaraws is yet to be proven. Because they are armed with deadly bolos and spears Cox and Woodford (1990) believe that these people will not hesitate to kill a tamaraw when the opportunity is there. It is true that skeletal remains believed to be those of tamaraws have been found in the park, but these specimens could belong to tamaraws that have died from natural causes. There are also unconfirmed reports of smuggling of tamaraws out of the country. Adult tamaraws could be declared as young carabaos because of their resemblance.

2.7.4 Conservation Measures

Judging from the number of conservation efforts, the tamaraw appeared one of the most protected wildlife species in the Philippines. However, despite the number of legislations that have been enacted to protect the tamaraw and its habitat the tamaraw population remained alarmingly low. Records show that as early as 1920 the F. B. Harrison Game Refuge and Bird Sanctuary and the Mt. Calavite Game Reserve have been declared tamaraw conservation areas. In 1936, the Commonwealth Act 73 was passed banning the killing, wounding or taking away tamaraws. Penalties for violation of this act include six months imprisonment or a fine of not less than 600 pesos (The present Republic Act 7586 or the National Integrated Protected Areas System Act of 1992 has increased the penalties to 50,000 pesos fine or one to six years imprisonment). The government established in 1960 a third tamaraw conservation area adjacent Mt. Iglit, which was later on linked with Baco Reserve to constitute the Mt. Iglit-Baco National Park. The latter was subsequently declared an Asean Heritage Park in 1982 (Petocz as cited by Cox and Woodford, 1990). In 1992, the Mt. Iglit-Baco National Park in consideration with the Mangyan indigenous tribe living near the park was renamed Mangyan Heritage Park (Oliver, 1993). The Tamaraw Conservation Program (TCP) was established in 1979 to safeguard the tamaraw and its habitat, establish a gene pool, conduct population and habitat surveys, undertake reforestation programs, and embark on information and educational campaigns about the need to protect the tamaraw and its habitat. Several various government and private organizations have managed TCP such as the Presidential Commission for the Conservation of the Tamaraw (PCCI), Conservation Resource Management Foundation (CRMF), Carabao Research and Development Center (CRDC) and the Park and Animal Welfare Bureau (PAWB) of DENR. DENR Region IV presently manages TCP. According to the report by Cox and Woodford (1990), TCP has failed in its mission to provide adequate protection to the tamaraw and to generate significant number of research studies. The population of the tamaraw remained low and only a dismal number of research studies have been accomplished. One reason for these could be the frequent changes in the management of TCP (Cox and Woodford, 1990). There was even a strong objection on the use of the tamaraws in the gene pool for experimental research purposes such as those involving artificial reproductive techniques (Dee et al., 1996). However, the Nagoya University and University of the Philippine Los Banos signed a memorandum of agreement to conduct genetic studies on the tamaraw. Among the research outputs from this agreement were:

- External characters and karyotypes of captive tamaraw (Namikawa et al., 1995)
- Hemoglobin phenotype of the tamaraw and Asian buffaloes based on isoelectric focusing (Solis et al., 1995)
- Electrophoretic blood protein variations in the tamaraw (Solis, 1996 Unpublished masteral thesis)
- Phylogenetic relationship among living species of genus *Bubalus* including tamaraw (Tanaka et al.,

1996)

- Transferrin polymorphism in the tamaraw and other Asian buffaloes (Solis et al., 1998)
- Cytogenetic analysis of the tamaraw (Tanaka et al., 2000)

The captive breeding component of TCP was realized when a 280-ha captive breeding facility known as "gene pool" was established near the southern border of the Mangyan Heritage Park. Captive breeding is undoubtedly a vital component of any wildlife conservation activities in order to prevent the population of a species from decreasing to critically low. Among the activities undertaken in the breeding facility are monitoring of tamaraws in the wild, husbandry and veterinary care of the tamaraws and capture of tamaraws. The tamaraws in the gene pool were caught using pit traps. It seemed that this method of trapping was too stressful because it resulted in some deaths. There were also tamaraws that died on their way to the gene pool. Mortalities were also recorded in the breeding facility due to infighting among adult bulls for dominance. The breeding facility was a failure because of its remote location, damage to the facilities from fires during summer and flooding during monsoon season, presence of armed insurgents, and delayed release of funds resulting in operational problems and low morale among the personnel (Cox and Woodford, 1990). If everything fails to get the tamaraw off the endangered list, the last recourse is cloning. Begley (2000) in her article which appeared in the October 23, 2000 issue of Newsweek stated that "with the growing number of species facing extinction, scientists have turned to a desperate strategy: replicate them - in surrogate moms." Who has not heard of Dolly, a sheep, and the world's first cloned mammal? In addition, just recently, scientists from the Massachusetts biotech firm Advanced Cell Technology reported the successful cloning of a gaur, the first endangered species to be cloned (Begley, 2000). Gaurs are oxen-like animals that are native to Southeast Asia and India. Their population has dwindled in recent years to 36,000. Unfortunately, the cloned gaur named Noah died from clostridial enteritis a day after birth (The Japan Times, January 14, 2000).

2.7.5 The Need for A Meaningful Conservation Education Program

The public education component of TCP, which I believe the most important in any conservation program, was not adequately implemented. According to Petocz (1989), there were on-going educational campaigns about the tamaraw aimed to raise the level of awareness among the people the need to protect the tamaraw such as poster making and drawing contests for school children. The tamaraw was even depicted in the Philippine one peso coin issued during Cory Aquino Administration. I think these measures failed miserably because they focused mainly on the tamaraw. The more important aspect of any educational campaign that is educating the people to respect and protect the habitats of wildlife was not given importance. People should be made to realize the negative impacts of lumbering and other forms of forest destruction on the survival of wildlife. This may be a tall order considering that many people largely depend on forest and forest products for their source of livelihood; but this can be done. Educational curricula at all levels of education should incorporate courses on wildlife conservation and protection of their habitat. Brochures, pamphlets and other forms of reading materials on wildlife conservation measures should be written in Pilipino and other native dialects understandable to all and most important readily available. It is sad to note that information on Philippine wildlife is very rare nationally. Much of the information is available only in international magazines or publications such as the National Geographic Magazine. However, how many Filipinos in rural areas have seen National Geographic Magazine or any publications on wildlife, much more can afford to subscribe one? Even if

they are available locally, they are written in technical manner not easily understood by most people. Information campaigns on wildlife protection should be aimed also at lawmakers who appear insensitive to the sad plight of forests, home to many precious wildlife species. Lawmakers seem to be interested more in passing laws that would make it a lot easier for Filipinos and foreigners to obtain logging concessions. Community based conservation programs could also adopted such as the CAMFIRE (Communal Areas Management Programme for Indigenous Resources) in Zimbabwe. Under this, approach " The people in a community through a representative asks the government wildlife department to grant them the legal authority to manage its wildlife resources. Some communities sell photographs and hunting rights to foreigners under rules and quotas set by them in consultation with the wildlife department." Considering the alarmingly rapid pace some wild species are becoming extinct, there is really an urgent need to take bold measures to prevent other endangered species from meeting the same fate. Otherwise, the future generation's knowledge of wildlife species will be solely based on photographs or illustrations found in books or on museum specimens such as mounted skeleton and preserved specimens. Although preserving organisms and then putting them on display in museums is one way of retaining them for posterity it would be nice also to keep a few of them alive either in zoos or in their natural habitat for future generations.

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