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Present Status of Tamaraw (*Bubalus mindorensis*) in Mt. Aruyan, Mindoro, Philippines

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ABSTRACT Tamaraw (*Bubalus mindorensis*) is a wild water buffalo endemic to the island of Mindoro, Philippines. It is one of the world's critically endangered species, and only three mountainous areas have confirmed tamaraw populations. One of the habitats, Mt. Aruyan, is inhabited by hundreds number of indigenous peoples (Mangyan) who live in clusters of villages. To understand the present status of the tamaraw in Mt. Aruyan, especially human-tamaraw conflicts, we conducted a field survey by camera trap, route censuses, and interviews with the Mangyan. One adult male was identified by camera trap and some individuals were identified by signs. Tamaraw habitat and the domiciles of the Mangyan completely overlap, and slash-and-burn farming by the Mangyan has significantly reduced tamaraw habitat. Moreover, outsiders poaching with guns directly contributed to the decline of tamaraw population. These results indicate that the conservation of tamaraw in the Mt. Aruyan habitat is extremely difficult. Therefore, conservation in other habitats is considered a higher priority.

Keywords: Bovidae, camera trap, critically endangered species, wildlife conservation

INTRODUCTION

Tamaraw (*Bubalus mindorensis;* Heude, 1888) is a wild water buffalo endemic to the island of Mindoro, Philippines. The animal is listed in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Appendix I and a critically endangered species listed in the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species (CITES, 2008; Hedges et al. 2008).

The tamaraw is the largest animal (180-220kg) in the Philippines. They are largely solitary, with the only lasting association being between a mother and her offspring (Talbot and Talbot, 1966). According to Kuehn (1986), 82% of adult males were lone individuals, while 66% of adult females were either solitary or accompanied by calves. Tamaraw feed primarily on grasses and young bamboo shoots in open grasslands (Talbot and Talbot, 1966).

Although tamaraw were present on the main Philippine island of Luzon during the Pleistocene, during historic time they have been restricted to the island of Mindoro (Kuehn, 1986). At present, due to increasing human populations and the impact of activities such as hunting, logging, and agricultural expansion, only three mountainous areas, Mt. Iglit-Baco National Park, Mt. Aruyan, and Mt. Calavite, have confirmed tamaraw populations. All three locations are located in the province of Occidental Mindoro. The number of mature individuals is estimated to be less than 250, with a 25% decline projected over the next three generations (generation length estimated at 10 years) (Hedges et al. 2008).

Mt. Iglit-Baco National Park (75,445 ha; altitude range 600-1,000 m) is the largest known tamaraw habitat, wherein lies the primary area of the Department of Environment and Natural Resources 16,000 ha Tamaraw Conservation Program (TCP). As the original lowland

dipterocarp forest has been largely cleared by logging and fire, through natural succession the area is at present covered with grassland vegetation (Custodio et al., 1996). A few papers on tamaraw population and social characteristics in Mt. Iglit-Baco National Park have been published (Keuhn, 1986; de Leon et al. 1996; Ishihara et al. 2007). Since 2000, the TCP and other NGO partners have conducted tamaraw population monitoring.

At Mt. Aruyan, the population was estimated to be 15 to 20 individuals, with six recent confirmed sightings (de Leon pers. comm. 2006 in Hedges et al. 2008). In contrast to the low indigenous peoples (Mangyan) population density of Mt. Iglit-Baco National Park, Mt. Aruyan is inhabited by hundreds number of Mangyan living in clusters of villages. Therefore, efforts to guarantee the conservation of the tamaraw in Mt. Aruyan require an understanding of the area's human-tamaraw conflicts.

In this study, by using camera trap, route censuses for field signs, and interviews with the Mangyan, we surveyed the tamaraw's current status including human-tamaraw conflicts in Mt. Aruyan.

MATERIALS AND METHODS

Mt. Aruyan (12°47′N, 120°56′E) is located in the central part of Mindoro approximately 100 km from San Jose, Occidental Mindoro (Fig. 1). The area is about 3,600 ha and is covered by lowland limestone forest dominated by species of the family Dipterocarpaceae, Anacardiaceae, Fabaceae, and Gramineae (Bamboo species, *Schizostachyum lumampao*). The climate is humid-tropical with a mean annual temperature minimum of 24.2°C and maximum of 32.1°C. Precipitation follows the pattern of a rainy season (June-November) and a dry season (December-May). For the period of 1996 until 2006, the mean annual precipitation at San Jose was 2297.3 mm (Climate Data Division, Climatological Agrometeorogical Branch, Philippine Atmospheric, Geophysical, and Astronomical Service Administration).

To select a site for this intensive study (high-population site), a population distribution survey was conducted by the TCP. The Mt. Aruyan area was divided into four 3 × 3 km grids, and a population distribution survey was conducted for each grid. During a period of 13 days from July 5 to 17, 2007, surveys were conducted through interviews with local residents and censuses on foot and from four-wheeled vehicles. As a result, the eastern part of Aruyan near the Buayan and Kapihan creeks (altitude range 210-350 m) was selected for this study.

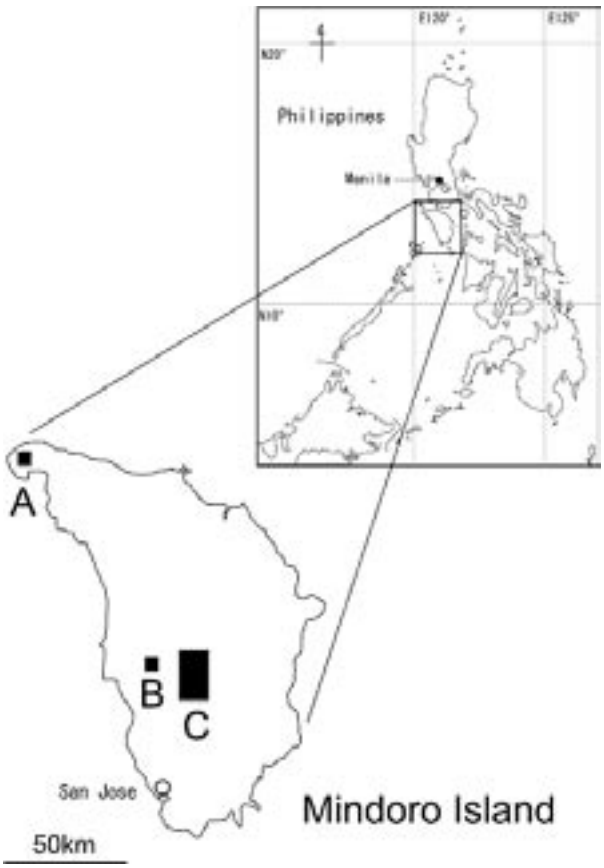

Fig. 1. Location of Mindoro Island and Major habitat of tamaraw (■).
A, Mt. Calavite; B, Mt. Aruyan (this study); C, Mt. Iglit-Baco National Park

To identify the surviving individuals/species and understand the human-tamaraw conflict, we conducted camera trap, censuses on foot, and interviews with Mangyan near or adjacent to the selected intensive study site for 12 days from February 20 to March 2, 2008. A total of nine stations were set up with infrared-triggered camera-trap systems (sensor camera Field Note II, Marif, Yamaguchi, Japan). The stations were positioned for 12 days (83 camera days) at major animal trails near the Buayan and Kapihan creeks and the ridges. In conducting interviews about slash-and-burn farming and hunting, we relied on some of the Mangyan settlers (6 groups) and the TCP rangers stationed in the area.

RESULTS AND DISCUSSION

A total of 9 photographs were taken at 9 camera-trap stations near the two creeks. In total five species of mammals, namely a long-tailed macaque (*Macaca fascicularis*, Primates), one of the endangered species of Oliver's warty pig (*Sus oliveri*, Cetartiodactyla; Oliver, 2008), two species of rodents (*Rattus* spp. Rodentia), and

a tamaraw, were camera-trapped. The tamaraw was photographed at only one site (3 shots; 0.036 photos/day). The individual was an adult male (Fig. 2).

In our censuses, some signs of tamaraw presence such as footprints, foraging prints, and fresh feces were recorded in the area. Various footprint sizes, including that of an adult male, were noted at the creek and at the ridge near a slash-and-burn farm. Foraging prints in grassy areas, such as those found on talahib (*Saccharum spontaneum*), and fresh feces were recorded and collected at the ridge areas.

Tamaraw habitat and the domiciles of the Mangyan completely overlap. In fact, on a daily basis, we often observed Mangyan leaving their village and traversing tamaraw habitat to access their farms (Fig. 3). Around the Buayan and Kapihan areas, there are more than 4 villages of Mangyan consisting of about 6 families. The Mangyan people conduct slash-and-burn farming during the dry season. They cultivate banana, cassava, sweet potato, potato, a variety of upland rice, corn, and cigar tobacco in an area of about 2 ha per year. The cycle of slash-and-burn farming is 5 to 6 years. Such a short cycle may cause a significant decrease in tamaraw habitat. As a consequence of their reduced habitat, tamaraw often enter cleared and cultivated land to graze.

Fig. 2. Camera-trapped solitary adult male.

Fig. 3. Mangyan people.

In general, the Mangyan hunt only small to mid-sized animals for food. They use their traditional methods of either spear traps and/or snare traps and do so usually during the rainy season only. They refrain from hunting or killing tamaraw because they are aware of existing laws governing the conservation of the species; the Mangyan learned of the restrictions through written materials or were informed by the TCP rangers operating in the area. As a result, any pressure put on tamaraw by the hunting practices of the Mangyan is likely rather low.

On the other hand, outsiders hunting with guns pose a more serious problem. While hunters from the Barrios (lowland settlements) located in the northern area of Mt. Aruyan hunt long-tailed macaque, civets, wild boar, and deer, most of the hunters from the southern areas target the tamaraw. The black market price of tamaraw meat is around 300 pesos per kg. The price is higher than that of other animal meats such as water buffalo (120p/kg), domestic cattle (180-200p/kg), and wild boar (120p/kg).

This study showed that tamaraw habitat and the domiciles of the Mangyan completely overlap in a rather small area, and the most significant problem facing tamaraw conservation is outsiders poaching with guns. Additionally, although a captive-breeding program in the country from the 1960s to 1980s succeeded in capturing many of the animals, ex-situ conservation was very difficult. Tamaraw conservation is therefore extremely difficult, though there is the possibility of capture and translocation to Mt. Iglit-Baco National Park.

At present, the only applicable site for in-situ conservation of tamaraw is Mt. Iglit-Baco National Park (the animal population in Mt. Calavite is still unknown). The Tamaraw Conservation Area (16,000 ha) at Mt. Iglit-Baco National Park has the highest population (over 90%) of the animal (Hedges et al. 2008) and a low human population density. Further study is required to obtain additional ecological information about tamaraw in Mt. Iglit-Baco National Park and Mt. Calavite.

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