



Technical Report on Habitat Assessment and Tamaraw Distribution in Mts Iglit-Baco Natural Park – Mindoro - Philippines Relevant to Tamaraw Conservation and Management

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Research Work Conducted in the Frame of the MANGYAN - TAMARAW DRIVEN LANDSCAPE PROGRAM

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GENERAL BACKGROUND

The tamaraw (*Bubalus mindorensis*) is a Critically Endangered species of wild buffalo endemic to the island of Mindoro, in the Philippines. The species has suffered serious decline in its range and population size in the last century. Nowadays, tamaraw is found in only four isolated locations. Mts Iglit-Baco Natural Park (MIBNP), the largest Protected Area of Mindoro (106,665 ha) hosts the biggest population. Tamaraw numbers in MIBNP have been steadily increasing in the past decades following cease of the cattle ranching activities in Mindoro, then the declaration of the place as protected, followed by the deployment of rangers to patrol the area. Ultimately, 1,600ha were delineated as a Non Hunting Zone (NHZ) in 2016, following agreement with the residing communities of the Mangyan Tau Buid tribe whose territories overlap with the tamaraw range, in order to stop traditional hunting within it. These successes can be measured by the result of the tamaraw population count, carried out annually by local authorities. Count result increased from 153 at first count operation in 2000 up to 480 in 2019. The bulk of the tamaraw population can be found within and around the 2,200 ha of the counting area, therefore referred as the *Core Zone of the Monitoring (CZM)*. The CZM concentrates most of the monitoring and patrolling efforts thereby allowing the species to increase its abundance there.

RATIONALE OF THE RESEARCH WORK

Despite the apparent success, it appears that the actual area occupied by tamaraw has dramatically shrank by more than 50% in the past two decades: In 2000, when the Tamaraw Annual Count was started, tamaraw were observed to occupy an area of around 5,000 ha within MIBNP, while in 2016-18, increasing numbers of tamaraw were restricted to no more than 2,500 ha monitored areas (Long et al., 2018). These facts raise multiple questions that must be addressed to design proper protection measures and develop consistent conservation strategy in the future.

Ranger's monitoring reports attest that poaching from outsider lowlanders remains a regular threat of variable intensity, while traditional IP practices including hunting with traps are a source of disturbance and occasional casualties in tamaraw, but at an unknown extent. Besides, field monitoring and observation show fluctuation in tamaraw range over years and between seasons. Both seasonal traditional practices of IPs and use of fire regime to burn grasses prior to each count operation might influence it.

While authorities measure an estimate abundance of the species thanks to the annual count, there is very little information on tamaraw behaviour, ranging, feeding, and even on the habitats where it is present. The latter is even more important as MIBNP presents populations of other species of importance, such as the Philippine deer (*Rusa marianna*), and the Mindoro warty pig (*Sus oliveri*). Therefore the research work primary aimed to address two biological questions:

- What is the **habitat composition** and structure of those areas frequented by tamaraw, deer and warty pig within the study area?
- How do tamaraws and other large species **use their habitat**?

MATERIAL and METHOD

Intensive field work was undertaken within the CZM of MIBNP, from March 2018 until March 2019, to answer these questions. This research work ultimately aimed to help in tamaraw conservation efforts, and to contribute to the upcoming MIBNP Management Plan. Information from this work was compared to the one obtained in successive tamaraw annual counts to find population and distribution trends. Tamaraw and other ungulate presence was noted by undertaking **23 indirect sign transects** stratified by annual count vantage points for comparison, and marking the geographical position of dung, tracks, sleeping areas and remains. Habitat composition and diversity was assessed using **124 random stratified quadrats** by annual count vantage point areas, while trying to represent marginal habitats within the study area.

RESULTS

Main findings of the habitat assessment

To our knowledge, this is the first in-depth study on the habitats of the central Mindoro highlands, and the ungulate species of Mindoro. Results, historical background and field observations indicate that the grassland that dominates the study area, and further areas within MIBNP, is not a natural habitat: it is a result of a history of deforestation and intensive cattle ranching. Additionally, the regular fire regime used for decades at the study site prevents the natural succession process which would see tracts of grassland become secondary forest, instead favouring the dominance of pioneer grasses such as cogon grass (*Imperata cylindrica*), wild sugarcane or talahib (*Saccharum spontaneum*) and kangaroo grass or agyon (*Themeda arguens*). **Grasslands presented fewer endemic species of plants, less species diversity per sampled quadrat, and higher incidence and dominance of introduced species.**

Introduced species are widespread, and some of them, mainly Siamweed or hagonoy (*Chromolaena odorata*), Billy goatweed or makmak basong (*Ageratum conyzoides*) and common bracken (*Lantana camara*), are invasive. The current fire regime used at the study site has likely aided in their expansion.

Forests are crucial in maintaining biodiversity as they act as biodiversity reservoirs, not only for plant families that are absent or underrepresented in the dominant habitat at the study site, the grassland, but also for many rare and endemic species. Most Mindoro wildlife endemics have been recorded in or close to forested areas, and they are essential to preserving deer populations in the study area, as their distribution is significantly influenced by forest presence.

Main findings on species distribution and habitat use

This study contributes to better understand tamaraw ranging and geographical distribution within the CZM while providing the most accurate list of plants consumed by tamaraw to date. Spatial structural pattern show bigger concentration of Tamaraw in the central and western areas of the CZM, while fewer animals were detected in the eastern and southern reaches of the study site. Our results show that, in opposition to what many reports and papers have been suggesting for decades, **tamaraw are not an obligate grassland grazing specialist**: tamaraw frequented forested areas, and vegetation clad riversides, and reports indicate **that the species feeds on widespread and dominant tree species which are characteristic of forested habitats and absent from grasslands**. Furthermore, tamaraw acted like **ecological generalists**, where no recorded bioclimatic factors had any significant influence on their presence or distribution at the study site. This means that their current, shrunk distribution and apparent spatial structuration pattern will be determined by other factors, such as human pressure.

Both Philippine deer and Mindoro warty pigs were significantly less frequently detected than tamaraw. Reports indicate that deer present a generalist diet at the study site, but their presence is significantly influence by the presence of forested patches in the vicinity. Mindoro warty pigs was the least frequently recorded species at the study site, which raises questions about their actual population numbers, as well as the hunting pressure currently put on them.

CONCLUSION

Results of the study reveal that most prevalent habitats in Mts Iglit-Baco Natural Parks, especially in the Core Zone of the Monitoring where tamaraws are now restricted, are a consequence of a long lasting history of cultural practices, pastoral activities and choice of management. Therefore, it is ambitious to conclude that, despite being the cornerstone of tamaraw protection and monitoring, any results of studies on tamaraw ecology conducted inside the Park could be extrapolated to other tamaraw populations in Mindoro or applied to the species in general.

Tamaraw has adapted to a quite degraded environment, being mostly constrained to a relatively low diverse grassland habitat. In other terms, it is fortunate that the species feeds on the few numbers of strong pioneer and highly competitive grass species that dominate this habitat.

Furthermore, the spatially structured distribution observed in the study site and absence of correlation with bioclimatic parameters suggests a significant anthropogenic influence: both human pressure through poaching or traditional hunting with traps and deliberate use of fire might explain the fewer frequency of the Philippine deer and Mindoro warty pig, while raising concerns on the current type of protection measures and habitat management in the protected area.

Tamaraw is trapped by the need to maintain the bulk of the population within actively managed landscape for the purpose of the annual counting operation, hampering natural dispersion of animals in surrounding but nevertheless unfavourable areas at the same time. Meanwhile, invasive plant species benefiting from the fire regime in use are likely to pose a serious problem in terms of resource availability and carrying capacity in the future, while impacting lifestyle of residing indigenous communities with whom there is a need to collaborate.

This technical report provides elements to help in designing future research work and in guiding conservation practices and habitat intervention strategy in the protected area and beyond.

SUMMARY of the RESULTS

Following tables and graph summarize the main results and findings of the research work:

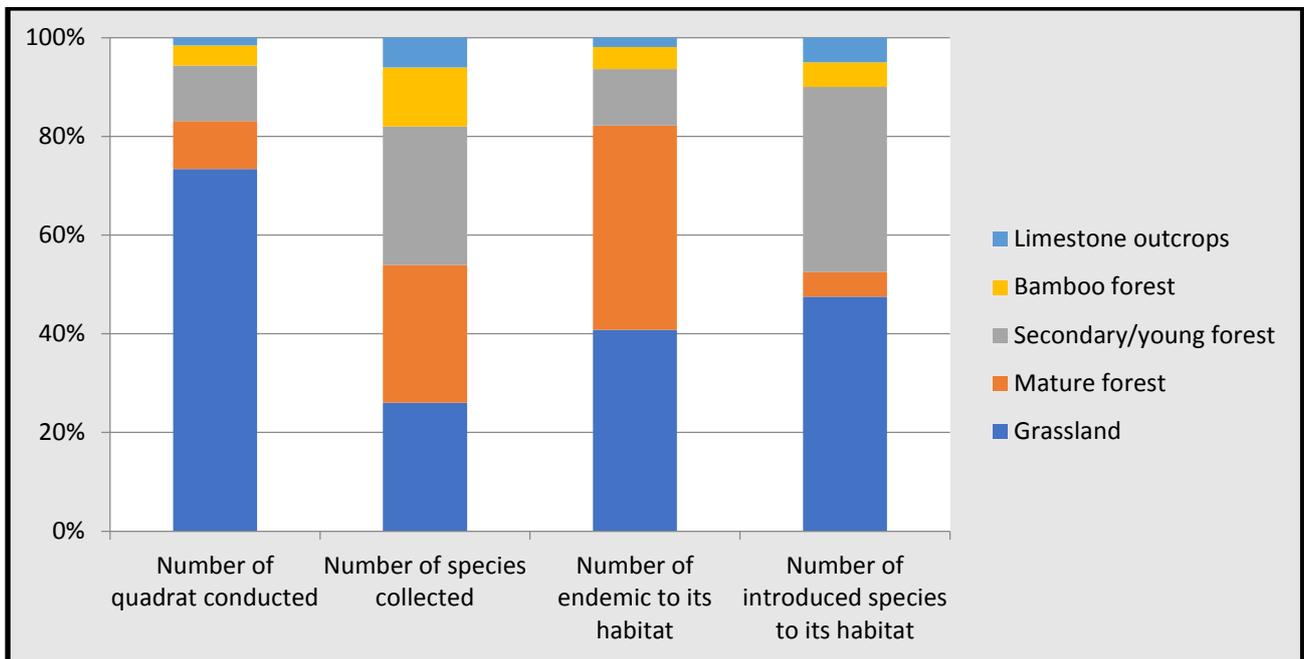
Table.1. Conclusions of the main two questions addressed in the research work:

Questions	Conclusions
<p>What is the habitat composition and structure of those areas frequented by tamaraw within the study area?</p>	<ul style="list-style-type: none"> ➤ Most available habitats for tamaraw are grassland; ➤ Grasslands are mostly a product of human disturbance: deforestation, fire regime, cattle ranching; ➤ High incidence of competitive pioneers and invasive species; ➤ Relative low diversity of the plant community in grassland ➤ More sampling efforts in forest habitat shall reveal more diversity ➤ Natural vegetation succession, especially forest regeneration and tree cover is hampered by the current fire regime at the CZM.
<p>How do tamaraw use their habitat?</p>	<ul style="list-style-type: none"> ➤ Tamaraw are most frequent and densely distributed in the central areas of the CZM around ranger's base camps; ➤ Tamaraw frequents forested areas; ➤ We observed no impact of bio-climatic variables on tamaraw presence and distribution within the CZM.

Table.2. Ecological importance of the ten most dominant species in the study site:

Vernacular name	Scientific name	Family	Habitat importance
Cogon	<i>Imperata cylindrica</i>	Poaceae	<ul style="list-style-type: none"> ✓ Most dominant and frequent species at the study site ✓ Aggressive pioneer favoured by current fire regime at the CZM ✓ Tamaraw food item
Hagonoy	<i>Chromolaena odorata</i>	Asteraceae	<ul style="list-style-type: none"> ✓ Among the five most dominant and frequent species at the study site ✓ Introduced and invasive ✓ Unpalatable to ruminants ✓ Prevents the establishment of native species, affects traditional Mangyan agriculture
Talahib	<i>Saccharum spontaneum</i>	Poaceae	<ul style="list-style-type: none"> ✓ Among the five most dominant and frequent species at the study site ✓ Aggressive pioneer favoured by current fire regime at the CZM ✓ Tamaraw food item when young, unpalatable when matures ✓ Frequent in areas with degraded soil
Agyon	<i>Themeda arguens</i>	Poaceae	<ul style="list-style-type: none"> ✓ Among the five most dominant and frequent species at the study site ✓ Tamaraw food item
Samong-samong	<i>Themeda triandra</i>	Poaceae	<ul style="list-style-type: none"> ✓ Among the five most dominant and frequent species at the study site ✓ Aggressive pioneer favoured by current fire regime at the CZM ✓ Tamaraw food item
Saong	<i>Mikania cordata</i>	Asteraceae	<ul style="list-style-type: none"> ✓ Tamaraw food item ✓ Widespread throughout a variety of habitats within the CZM
Bracken	<i>Pteridium aquilinum</i>	Dennstaedtiaceae	<ul style="list-style-type: none"> ✓ Widespread fern in grasslands. ✓ Introduced species ✓ Invasive due to profiting from conditions caused by frequent fire regimes at the CZM
Hawili	<i>Ficus septica</i>	Moraceae	<ul style="list-style-type: none"> ✓ Most frequent and dominant tree species at the CZM ✓ Dominant in both forests and secondary forests ✓ Pioneer tree that leads the natural succession from grassland to forest
Bulso	<i>Melastoma malabathricum</i>	Melastomataceae	<ul style="list-style-type: none"> ✓ Dominant in secondary forests ✓ Pioneer tree that leads the natural succession from grassland to forest ✓ Tamaraw food item
Makmak basong	<i>Ageratum conyzoides</i>	Asteraceae	<ul style="list-style-type: none"> ✓ Highly dominant and frequent species at the study site ✓ Introduced and invasive ✓ Prevents the establishment of native species, affects traditional Mangyan agriculture ✓ Pioneer favoured by current fire regime

Graph 1: Importance of the number of total species, endemic species to its habitat type and introduced species, for each habitat categories, as a proportion of the total number of quadrats conducted (n = 124) and total species collected (n = 610).



Tamaraw family group in Mts Iglit-Baco Natural Park (A. M. Gonzalez)

