

Final Report

Defining Space in a Fragmented Landscape: Home Range and Dispersal of the Endangered Philippine Hawk-eagle (*Nisaetus philippensis*)

Summary

The North Philippine Hawk-eagle (*Nisaetus philippensis*) is an endangered raptor endemic to the forests of Luzon and Mindoro Island, Philippines. Despite its conservation importance, little is known about the species and its ecology. Here, we sought to address the knowledge gap about the species' home-range and habitat use as recommended in its IUCN species assessment. A pair of hawk-eagles breeding in a heavily modified landscape near human settlements provided an opportunity to tag and track their movements. In April and June 2021, we captured an adult female and juvenile hawk-eagle using traps and tagged them with GPS transmitters. Preliminary results from the adult hawk-eagle's tracking data (623 points) indicated a home-range size of 3.32 km² using 95% Minimum Convex Polygon (MCP) and 2.82 km² based on 95% kernel density estimate (KDE) during the breeding season. Its habitat was mostly comprised of built areas (65.2%), intermixed with patches of forest (28.8%) and grasslands (5.9%). Home-range for the juvenile was not computed due to low number of locations collected. Although the species was thought to be a forest specialist, the adult hawk-eagle appeared to be tolerant of human disturbances. More studies are needed to determine if this is an exception or evidence of species adaptation.

Introduction

The North Philippine hawk-eagle (*Nisaetus philippensis*) is an endangered raptor endemic to Luzon and Mindoro island, Philippines with an estimated population size of 400-600 mature individuals (BirdLife International, 2016). It is threatened by habitat loss and hunting, and the population is currently in decline. The species is one of the top predators in the forest ecosystem and thus plays an important role in prey regulation. However, much remains to be known about its ecology. This lack of biological information is prevalent among Philippine raptors, with the Philippine Eagle most likely the most well-known among them. Addressing this research gap can aid in species conservation, for example by informing population trends and habitat requirements.

The study site was inside a gated community, which is expectedly becoming more populated and built-up over the years. The increasing urbanization and expansion of suburbs will lead to further fragmentation and eventual destruction of the remaining forest habitats. This is the main threat to the hawk-eagles breeding in the area as well as to other native species. Within the past year alone, we have observed four new constructions happening around the vicinity of the nest tree. Aside from habitat loss, the eagles' proximity to human settlements also posed threats from hunting or poaching.

IUCN assessment for the species recommended the study of its home range as a research priority. This site provides a unique opportunity for us to understand how the hawk-eagles move and utilize resources within this human-modified landscape. We hypothesized that they would have a large home-range, comparable to similar sized raptors in the region. Raptors, in general, have wide home-ranges and occur in low densities as most are territorial. Through tracking their movements using GPS tags, we aimed to gain insights into the species' habitat requirements and the influence of anthropogenic factors on their ecology.

Project Objectives

The study aimed to determine the home-range and habitat use of North Philippine Hawk-eagles using GPS telemetry.

Methods

Study site

The study site is inside a private or gated community in the Rizal province on Luzon Island. It is a patch of green space at the periphery of Metro Manila, the capital region, and surrounded by urbanized area. The site is quite hilly with elevation ranging from 20 m a.s.l. to 150 m a.s.l. Although it is a residential area, houses are spaced apart because many lots remain undeveloped. A network of paved roads and a river runs through the site. Secondary lowland forest growth has been established in unoccupied lots, and steep slopes, with the most prominent emergent tree in the area being the Malabulak tree (*Bombax ceiba*). The main stakeholders are the residents, which are governed by a homeowner association.

Capture and Tagging

Three tags were procured from KoEco, one 34 g WT-300 Buzzard (donation by KoEco) and two 39 g WT-300 Harrier models (OBC funding). The tags were programmed to log locations every hour from 0500 – 1900 H and to transmit once a day at 1200 H. The logged locations were monitored remotely using KoEco's Wild Tracking System page.

We conducted fieldwork in five legs from April to July 2021, covering 15 days of trapping at the Antipolo study site. Each day, we set-up a bownet and two improvised balchatri traps, a dome-shaped and a flat design, at sunrise (0500 H). The bownet was always within the field of view of a hidden team member, while the balchatri traps were monitored every 15 mins. Traps were packed up at sunset (01730 H).

When an eagle was captured, we immediately extracted it from the trap and used a hood to cover the eagle's eyes. The veterinarian in the team also did a general check-up to assess its health, and then we collected biometrics, such as weight, wing and tail lengths. Afterwards, we followed the protocol used by the Philippine Eagle Foundation in attaching the GPS tag on its back using a Teflon harness. Once we had ensured that the tag was transmitting, we released the eagle in the vicinity of capture. The traps were reset to try and capture the remaining targets.

However, the male hawk-eagle never attempted to come near the traps despite our efforts in modifying the trap locations and bait. To not waste the remaining tag, we took the opportunity to attach the last WT-300 Harrier tag on a rescued hawk-eagle that was about to be released by the local wildlife rescue center. It was released last 9 November 2021 at Carranglan, Nueva Ecija.

For data analysis, home-range area was estimated using 95% minimum convex polygon (MCP) and 95% kernel density estimate (KDE). Its territory was characterized in terms of land cover types using the 10m Sentinel-2 Land Cover Map (ESA, 2022). Computations and map visualization was done in R and QGIS, respectively.

Results and discussion

Overall, we were able to track two out of the three North Philippine Hawk-eagles in the study site. We obtained 623 points from tracking the female from 26 April 2021 to 4 April 2022, and 258 points from the juvenile tracked from 15 June to 25 July 2021.

The female hawk-eagle was caught on 26 April 2021 using a rabbit bait on the bownet. She was tagged with WT-300 Buzzard given her larger body size compared to the other two (i.e., male and juvenile). During this time, the chick was about two months old, and the female went back to the nest and continued brooding a few minutes after release. No immediate adverse effect was detected on either the female or the chick. Meanwhile, the hawk-eagle fledgling was caught on 15 June after being attracted to a pigeon on the flat balchatri trap. We mounted a WT-300 Harrier on its back and released it immediately after.

The tags did not work as well as expected. Unfortunately, the tag on the hawk-eagle in Carranglan did not transmit any location post-release, while the tag on the juvenile transmitted only for a month before its battery died. In contrast, the bigger tag on the female performed well and continued to transmit albeit erratically until May 2022, when it stopped and just only transmitted again this September 2022.

Nevertheless, the home-range area of the species was estimated with the available data (Figure 1). We did not get many location points from the juvenile to calculate a good home-range estimate, which was unrealistically small between 0.074 km² (MCP) and 0.096 km² (KDE). Hence, the discussion here was based on the adult hawk-eagle.

The home-range area was 3.32 km² and 2.82 km² based on MCP and KDE, respectively. It had smaller home-range area compared to other hawk-eagles in the region. The Flores Hawk-eagle has 38.5 km² (Raharjaningtrah & Rahman, 2004), while the Javan hawk-eagle was more comparable at 4 km² (Gjershaug et al., 2004). Previous population estimate of 200-220 pairs in 1998 was based on an average of 17.5 km²/pair (Gamauf et al., 1998) and likely to be an underestimate, but this requires further study.

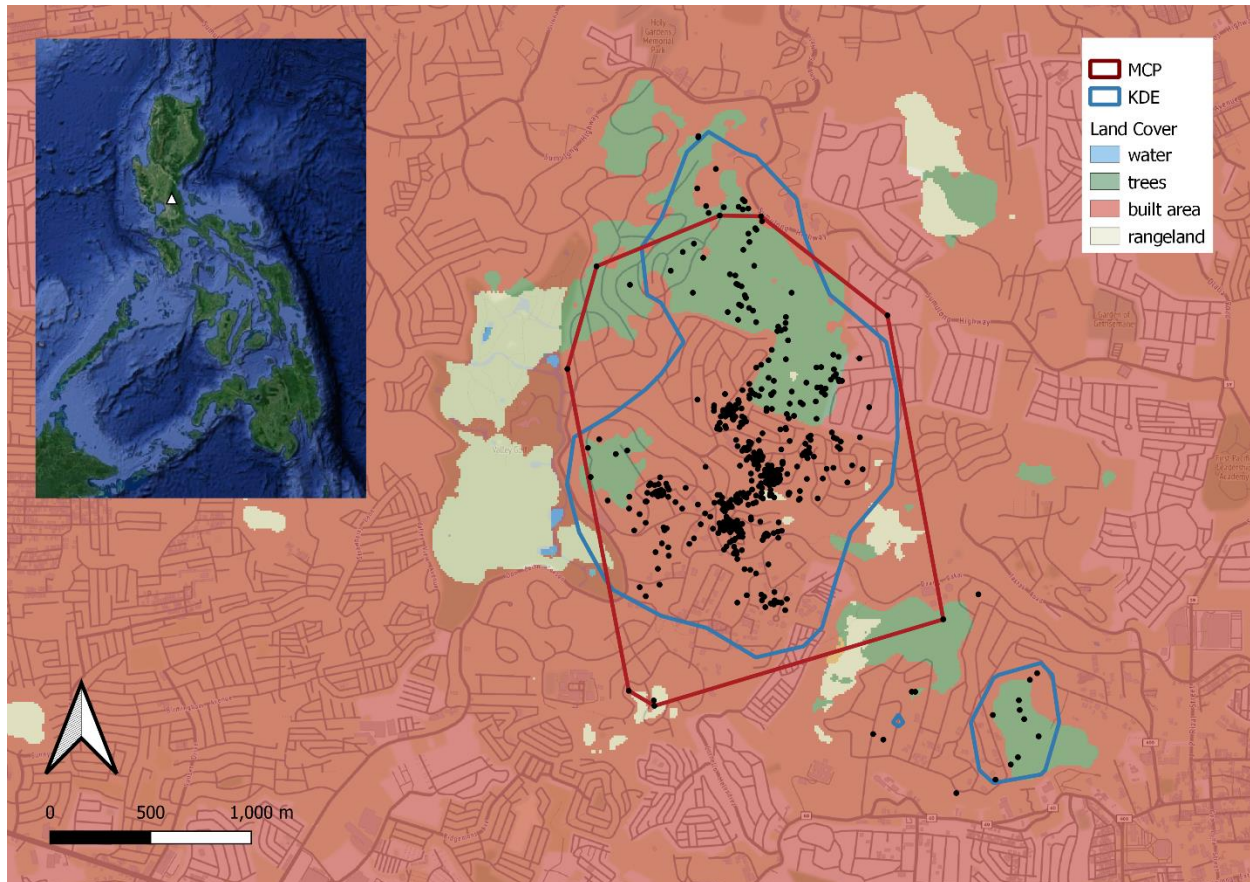


Figure 1. The home-range area of the North Philippine Hawk-eagle based on MCP (red contour) and KDE (blue contour) in a suburban landscape. Land cover types are indicated in colors.

Its habitat was mostly comprised of built areas (73.2%), intermixed with patches of trees (24.4%) and grasslands (2.4%). This was surprising as the species was thought to be a forest specialist. Both individuals were observed to be tolerant of human disturbances, such as cars, dogs, and construction works.

These results must be interpreted in the context of the individuals tagged. The female was tracked during the breeding season, when her activities were centered around the nest to care for the chick. On the other hand, the juvenile was a recent fledgling, and it was expected to hang around the vicinity of the nest because the parents continued to provide food.

Recommendations

From the observations and the tracking data, the recommendations are the following:

- Plant native tree species in open spaces to serve as potential nesting and foraging sites. They seemed to prefer emergent trees, like the *Malabulak* tree.
- Monitor the sightings and activities of the hawk-eagles near and during the breeding season to locate and protect the nest.

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- Formulate a protocol for viewing of the eagles and their nests to reduce disturbance and prevent attracting unwelcome attention from poachers.

The results have been shared with some of the stakeholders. This data, along with previous research findings, was passed on to a member of BirdLife International to inform the status update for the species. I have also created information posters about the findings – a technical research poster and a non-technical/popular poster. The former was presented at a movement ecology conference held in the United Kingdom, while the latter was shared on social media (i.e., Facebook, Twitter) and sent to the stakeholders (i.e., Antipolo Valley Ecological Society, DENR-BMB) (see below).

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Photos



The female North Philippine Hawk-eagle flies free after being tagged with a WT-300 Buzzard tag.



The juvenile North Philippine Hawk-eagle, with the GPS tag on its back, received a rat prey from its parents.

Defining Space: Home Range of the Endangered North Philippine Hawk-eagle (*Nisaetus philippensis*)

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NORTH PHILIPPINE HAWK-EAGLE

- Endangered bird of prey endemic to the Philippines
- Threatened by deforestation and hunting
- Much of its ecology remains unknown
- IUCN recommended research on ecology and home-range.

OBJECTIVE

To determine species home-range and habitat use

METHODS

1. Captured an adult female hawk-eagle using bownet.
2. Attached satellite tag on the bird with Teflon harness.
3. Tracked movement from 26 April 2021 to 4 April 2022.
4. Estimated home-range area using minimum convex polygon (MCP) and 95% kernel density estimate (KDE)
5. Characterized habitat based on land use type



Figure 1. The North Philippine Hawk-eagle is an Endangered raptor.

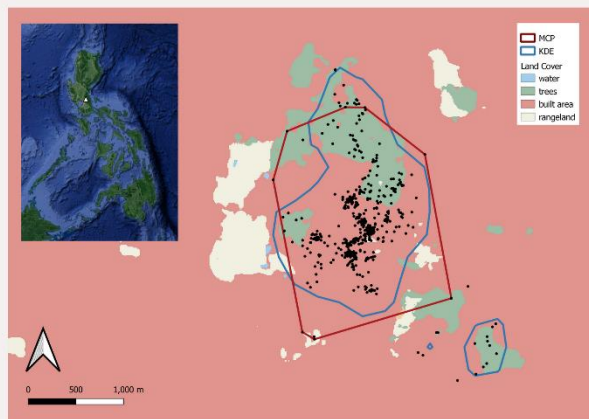


Figure 2. The home-range area of the North Philippine Hawk-eagle based on MCP (red contour) and KDE (blue contour). Land cover types are indicated in colors.

RESULTS AND DISCUSSION

A total of 623 location points were recorded. The home-range area was 3.32 km² and 2.82 km² based on MCP and KDE, respectively. Its habitat was mostly comprised of built areas (73.2%), intermixed with patches of trees (24.4%) and grasslands (2.4%). Compared to other hawk-eagles in the region, we found smaller home-range area. The Flores Hawk-eagle has 38.5 km², while the Javan hawk-eagle has 4 km². Previous population estimate was based on 17.5 km²/pair and likely to be an underestimate, but this requires further study.

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CONCLUSION

The tagged North Philippine Hawk-eagle in the study has a home-range of 2.82 - 3.32 km². It was more tolerant of disturbed habitats and used smaller areas than previously thought. However, this might be only true during the breeding season. More studies are needed to determine if this is an exception or evidence of species adaptation.



The non-technical poster on the results of the North Philippine Hawk-eagle tracking study that was shared in social media.