Nesting Characteristics of The Tapanuli Orangutan (*Pongo tapanuliensis*) in Two Unprotected Forests of Batang Toru, North Sumatra

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**Abstract.** Tapanuli orangutan (*Pongo tapanuliensis*) is the new great ape species that only occurred in the Batang Toru forest. The long term survival of this population is threatened due to habitat loss and hunting. Performing a nest survey is important to give a deeper understanding of the ecology and help determine the best protective management measures. We provide a basic data of orangutan nesting characteristics in two unprotected forests of Batang Toru: Sitandiang (West Batang Toru) and Hopong (East Batang Toru). A line transect method was conducted to obtain the nest data and sampling quadrat method was used to analyze the condition and sustainability of the habitat. Our result showed that there were similarities in the choosing of tree diameter and species, while there were disparities in the choosing of tree height, nest height, and nest position for nesting. The species diversity index in Sitandiang and Hopong was categorized high, with values found to be 4.5 and 4.6 respectively which mean that these locations potentially serve nest and food tree for the orangutans. Considering our findings, we recommend to allocating these areas into protected forests for long-term survival of Tapanuli orangutan in Batang Toru.

**Keywords:** Batang Toru, nesting characteristics, orangutans, *Pongo tapanuliensis*, unprotected forest

1. **Introduction**

The orangutans population has been declining overtime. Combination of habitat loss [1] and hunting [2,3] are reasons that leave the orangutans vulnerable to extinction. The main factor leading to habitat loss for orangutans is human encroachment which include illegal logging, forest conversion for timber, plantation, road construction and settlement [4]. One of the viable orangutan populations was found in Batang Toru in southernmost part of Sumatra. This population was rediscovered in late 1990’s [5] and termed Tapanuli orangutan (*Pongo tapanuliensis*), which just established as new species of orangutan [6] recently. Fewer than 800 individuals combined with geographic isolation made this new great ape species under high conservation concern [6]. This new species might be lost by 2030 [7] if there is no conservation improvement.

Saving the orangutans requires that the habitats of viable orangutan populations are protected from deforestation and hunting [8]. One such effort is get a deeper understanding about its ecology for
effective conservation efforts. Understanding the nesting characteristics gives a pertinent information about their preferred species of tree and habitat. This information is important because it helps determine the conservation plan of a particular area [9].

Orangutans are an arboreal great ape that builds nest [10]. The apes construct a nest to allow for uninterrupted sleep and promote longer individual sleep stages, resulting in higher sleep quality [11]. The main function of the nest is to provide comfort in resting, protection from predation, heat loss, and parasites [10]. A new nest is made every day for a rest and protection against predators [12]. Orangutans have experience with the available nest building materials and use it to construct a safe and comfortable nest [13]. Information regarding the availability and quality of nest sites plays an important role in understanding an effective conservation effort [14].

We provide a basic data of orangutan nesting characteristics in two unprotected forests of Batang Toru. We also assess the vegetation condition of these forests to analyze the condition and sustainability of the orangutan’s habitat in these locations. Unfortunately, publication of nesting characteristics in Batang Toru is still rare. The previous studies were limited in West Batang Toru which one of them was conducted in the SOCP monitoring site, while the other one was in another site of Sitandiang. There are no current publications about nesting characteristics in the East Batang Toru (Sarulla) area.

2. Study sites and methods

2.1 Study sites

Batang Toru forest is the last refuges for the new species of orangutan, the Tapanuli orangutan (Pongo tapanuliensis) [15]. This forest is split by Batang Toru river into two blocks; West Batang Toru and East Batang Toru (Sarulla). Lies in three districts comprised of North, Central, and South Tapanuli, the elevation of this area ranges from 120 masl up to 1800 masl. Four hundred orangutans are estimated living around West Batang Toru, while a guess-estimate of 150 individuals are living in East Batang Toru [16]. The mean orangutan density of Batang Toru is 0.23 ind/km² [17], with the lowest mean being compared to other populations in Sumatra which range from 0.30 to 10.80 [18,19]. The study was conducted in two locations of unprotected forest of Batang Toru: Sitandiang in West Batang Toru and Hopong in East Batang Toru/ Sarulla (figure 1).

2.2 Data collection

Line transect method [20] was conducted to obtain the nest data in Sitandiang and Hopong between June to October 2015. Transects were designed using systematic random sampling method based on landsat image using Distance 5.0 and ArcGIS 9.3. Twelve transects in each location were made, each being 500 meters in length and 500 meters apart. Nest characteristics recorded include: nest height, nesting tree height, nest position, nesting tree diameter, and nesting tree species. The nest position was categorized into five patterns which differ based on how the main platform is created (figure 2) [21]. Sampling quadrat method was conducted to analyze the vegetation composition, which describe the habitat condition. A total of 25 plots which comprised of 10 m x 10 m and 20 m x 20 m were chosen randomly. Each tree’s diameter at breast height (dbh) in each plot was measured.

3. Results

A total of 103 nests in Sitandiang and 78 nests in Hopong were recorded. The nests were recorded along transects and outside of the transects. There were disparities in the choosing of tree height, nest height, and nest position for nesting between the two unprotected forests. Meanwhile, there were similarities in the preference of tree diameter and tree species.
Figure 1. Map of study area (1. Sitandiang; 2. Hopong).

Figure 2. The four basic patterns of nest in orangutans, along with an uncommon one (pattern 0) [21].
3.1 Disparities in nest characteristics preference

3.1.1 Tree and nest height. The orangutans in Hopong and Sitandiang showed disparities in the choosing of tree and nest height for nesting (figure 3). Tree and nest height found in Sitandiang was higher than in Hopong. The tree height ranged from 8 meters to 28 meters, while the nest height ranged from 7 meters to 25 meters. The average of tree height in Sitandiang was \(16.2\ m \pm SD\) and the nest height was \(14.1\ m \pm SD\ 4\ m\). The average of tree height in Hopong was \(14.3\ m \pm SD\ 3.3\ m\) and the nest height was \(11.1\ m \pm SD\ 2.7\).

![Figure 3. Tree and nest height classes in two locations of unprotected forest of Batang Toru (Sitandiang and Hopong).](image)

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There was a positive correlation between nesting tree and nest height (figure 4). This resulted in a linear regression coefficient of \(y = 0.844x - 0.118\ (R^2 = 0.760)\). It could be concluded that the variation of nesting tree and nest height pattern were not significantly different. Nesting tree height dominantly found in Sitandiang was >15 meters with dominant nest height being 10-15 meters, while nesting tree height dominantly found in Hopong was 10-15 meters with dominant nest height being 5-10 meters.

![Figure 4. Linear regression between tree height and nest height](image)
3.1.2 Positions of nests in trees. Both Sitandiang and Hopong showed disparity in nest position preference (figure 5). All pattern of positions of nests were found in both locations. However, position 2 was determined to be the most preferable in Sitandiang, while position 1 was the most preferable in Hopong.

![Figure 5](image)

**Figure 5.** Nest position in two locations of unprotected forest of Batang Toru (Sitandiang and Hopong).

3.2 Similarities in nest characteristics preference

3.2.1 Tree diameter. There is a similarity in choosing tree diameter for nesting in Sitandiang and Hopong (figure 6). Although all diameter classes were found in each location, the orangutan both in Sitandiang and Hopong were mostly using a tree with a diameter range between 10-30 cm.

![Figure 6](image)

**Figure 6.** Diameter of nesting tree in two locations of unprotected forest of Batang Toru (Sitandiang and Hopong).
3.2.2 Nesting tree. A total of 85 species and 29 families (one species could not be identified) were recorded as nesting trees in Sitandiang and Hopong (Sitandiang: 26 family, 46 species; Hopong: 17 family, 36 species) (figure 7). There were some families and species of trees that were unique to either Sitandiang or Hopong (Sitandiang: Altingiaceae, Apocynaceae, Bombacaceae, Dipterocarpaceae, Elaeocarpaceae, Flacourtiaceae, Guttiferae, Meliaceae, Myristicaceae, Theaceae; Hopong: Leguminosae, Ochnaceae, Proteaceae, Symplocaceae). Despite that disparity, the nests in Sitandiang and Hopong were mostly built in the tree species Hoteng (local name for Oak tree) of the Fagaceae family (Sitandiang: Lithocarpus meijeri (9.2%); Hopong: Lithocarpus sp. 3 (10.2%)). The genus of this family including: Castanopsis, Lithocarpus, and Quercus.

Figure 7. Nesting tree species in: A. Sitandiang, B. Hopong
3.3 Habitat analysis

The species diversity index in Sitandiang and Hopong was categorized high, with values found to be 4.5 and 4.6 respectively (table 1). In the 25 vegetation plots (1 Ha), we identified a total of 396 trees (plot of 20 m x 20 m) and 142 trees (plot of 10 m x 10 m) from 205 species in Sitandiang. There was a total of 328 trees (plot of 20 m x 20 m) and 125 trees (plot of 10 m x 10 m) from 178 species in Hopong. Of these, 84 species in Sitandiang and 90 species in Hopong are potential feeding trees for orangutans. This high diversity of trees can also serve as potential nesting tree for orangutans.

| Vegetation parameters       | Sitandiang | Hopong |
|-----------------------------|------------|--------|
| Diversity index (H’)        | 4.4        | 4.5    |
| Species richness index (R)  | 18.9       | 25.8   |
| Species dominance index (C) | 1          | 1      |
| Evenness index (e)          | 0.9        | 0.9    |

4. Discussion

Orangutans in Batang Toru have a preference for what tree they choose to nest in. We assumed that orangutans might choose their nesting tree based on comfort, sturdiness, and security. Orangutans will also build nests in an area with enough food sources [22]. Since primates spend a significant amount of time at sleeping sites [23], it is crucial to choose stable and secure nest tree for their security and fitness [24].

Orangutan in Sitandiang and Hopong showed disparities in choosing tree and nest height. These disparities might be due to disparity in vegetation condition between location. These study findings are consistent with Rijksen [25], which stated that nest height selection was reflecting the forest structure where the orangutan lives. In addition, tree height and nest height selection is limited by availability of nesting trees in the study area. Compared to Sitandiang, Hopong forest is dominated by shorter trees with smaller diameter. On the other hand, nest height selection is strongly correlated to the tree height. It means that the preference of nest height is linked with the nesting tree height. Thus tree height and nest height in Hopong was shorter than Sitandiang.

In general, orangutans in Batang Toru have a preference for intermediate sized trees for nesting. The height of arboreal nests is a reflection of an anti-predator strategy which reduces the accessibility to the sleeping ape [26]. Thus orangutans will not build a short nest which may put them at high risk of predation. Orangutans will also not build a high nest because it will be less comfortable due to strong wind, rain, and sun [27]. High trees are also not safe for orangutans due to their limited vision used for monitoring for predators. Tree height selection is strongly influenced by ecological condition and predation [28].

There was also disparity in choosing nest position between Sitandiang and Hopong. But overall, nest position in both location showed the same patterns with previous studies conducted in Batang Toru (SOCP monitoring site, Sitandiang, and Dolok Sibualbuali Nature Reserve) and Gunung Leuser National Park (Ketambe). The most common nest positions found in those location are position 1, 2 and 3, while position 4 is quite uncommon. Hopong is an exception where percentage of using position 2 and position 4 for nesting is nearly the same. Similarly with tree and nest height, this case can be explained by the ecological condition of Hopong.

Since both locations are in the same part of Batang Toru forest which mostly same habitat type, it is not surprising that orangutans in both location have similar preference in choosing nesting tree species and diameter. Domination in choosing Fagaceae for nesting tree in both locations was supported by previous studies that were conducted in west Batang Toru research station, some locations in west Batang Toru- including Sitandiang, and on the border of west Batang Toru [29-31]. just as for chimpanzees [32]. It is still a big question which factors lead orangutans to choose certain species of tree for nesting [21]. But morphologically, tree species from the Fagaceae family are sturdy,
dense horizontal branching, hairless and sapless leaves might be some of the reasons why they choose this tree.

The preference in choosing Fagaceae family for nesting has only been recorded in Batang Toru. Vegetation data showed an interesting finding which the dominate trees were not the most preferable nesting tree in these location. This result is consistent with Prasetyo et al. [21] that stated the nest species selection is universal. Preferred species may have relatively more trees with suitable characteristics, but choice for certain species could not be explained only based on physical properties [33].

Contrast with Bornean orangutans that prefer larger and taller trees [34], Sumatran orangutans prefer moderate diameter trees. This disparity might be due to predators existing in Sumatra, such as Sumatran tiger (Panthera tigris-sumatraeae) that does not reside in Borneo. This case was reflected in Sitandiang and Hopong that choosing moderate trees’ diameter. Considering their body weight, smaller diameter trees can not hold up the orangutans body which can be very risky for their safety. While larger diameter trees will decrease the sway of the tree’s stem while predators climb on it which can threaten the orangutan.

Result of vegetation composition data showed that both Sitandiang and Hopong are potential sustainable habitats for orangutans. The high diversity index that is present in both locations potentially serves as nesting and feeding trees for orangutans. All the great apes need a large forest area to survive [35]. Thus protecting this forested area is required to expand orangutan range and decrease the threat it faces. Unfortunately, these locations are allocated as unprotected forest, which land conversion tends to be more common [36]. This study strongly suggests to allocating these areas into protected forests due to important ecology services they provide and for orangutan survival.

5. Conclusion
Just as in other locations, orangutans in Batang Toru also have a preference in choosing a nesting tree. Unprotected forests of Batang Toru have a high diversity index of trees which potentially serves as nesting and feeding trees for orangutans. Therefore attention to conserving these forests is extremely important in order to prevent the rediscovered orangutans from losing their last habitat. This study was a preliminary report pertaining to nesting characteristics of Sumatran orangutans in two locations of Batang Toru. A wide range study involving the entire area of Batang Toru is needed in order to attain a complete data. Further study about the nest builder such as sex class will give more detailed information about nesting tree preference that can be very useful for conservation.

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