Preferences of Sumatran orangutan nesting tree at Bukit Lawang Forests of Gunung Leuser National Park

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Abstract. Sumatran orangutans (SOUs) are an endemic great ape and the populations are limited distributed at the northern tip of Sumatra as well as recorded as critically endangered, globally. Forest loss and degradations are major causes of the decline of SOU populations from time to time. This research was aimed to identify the preferences of nesting trees of SOU in natural habitat as a consideration in the selection of tree species to restore orangutan habitat. Vegetation analysis using combination line transects and quadrat methods were done at Bukit Lawang Forests (BLF) of Gunung Leuser National Park (GLNP). There was 4 line transects as well as 25 25m x 25m sampling plots were established in each line transects. Each tree in all sampling plots that contain orangutan nests is identified and counted. Based on inventory, there were 121 SOU nests on 58 tree species with 14 tree species classified as preferences of SOU nesting trees. *Litsea firma* (Lauraceae) was recorded as the most preferences of SOU nesting trees, followed by *Knema latericia* (Myristicaceae), *Cleistanthus* sp. (Euphorbiaceae) and three species of Dipterocarpaceae, such as *Shorea ovalis*, *S. parvifolia*, and *S. leprosula*.

1. Introduction
Sumatran orangutan (*Pongo abelii*) populations are declining from time to time. Based on a simulation study, about 4,500 individuals of SOU can be disappearing by 2030 due to deforestation in Sumatra [1]. Subsequently, SOU is an endemic great ape and their population is limited distributed at the northern tip of Sumatra as well as recorded as critically endangered, globally [2]. On the other hand, the SOU habitat is decreasing from time to time due to forest loss and degradation.

Therefore, the application of special actions to reduce deforestation and avoid negative impacts on the forest environment as a habitat for orangutans needs to be done [1]. Subsequently, the simple principles of orangutan conservation are to minimize unnatural deaths and to maximize the availability of suitable habitat [3].

A large arboreal wildlife with their activities is more spent on trees, forest loss and degradation are recorded as mayor driver of SOU extinction [1]. Therefore, good habitats need to be protected and degraded habitats should be restored based on scientific and multidiscipline approaches. Based on some publication [4-6], the orangutan population density is significantly influenced by the availability of feed source trees as well as nesting trees. As a first step, the preferences of SOU nesting tree, as well as feeding trees have to be known clearly. This study aimed to assess the preferences on nesting trees of SOU in natural habitat as a consider in restoring habitats of SOU.
2. Materials and methods
The field study was carried out at Bukit Lawang forests (BLF) of Gunung Leuser National Park (GLNP) from August 2017 to April 2018. The forests are known as viewing centre of SOU and very popular as an ecotourism destination in the western part of Indonesia. There was 4 line transects as well as 25 25m x 25m sampling plots were established in each line transects. The distance between a sampling plot to others in each transect was 20 m.

Each tree in all sampling plots that contain orangutan nests is identified and counted. SOU nest observations were counted two times during the fieldwork session with the first and second observation distance was 3 months. Neu’s method [7] was applied to determine the preferences of nesting trees of SOU.

3. Results and discussions
There were 121 nests of SOU during the research period with 99 nests and 50 nests were found in first and second observations, respectively. All nests were placed on 58 tree species.

Based on Neu’s method [7], about 14 tree species or 24.1% of total nesting tree species was classified as preferences of SOU nesting trees (Table 1).

| No | Species                  | Family      | \( \rho(\%) \) | \( \eta \) | \( \mu(\%) \) | \( \omega \) | \( b \) |
|----|--------------------------|-------------|----------------|-------|-------------|---------|-------|
| 1. | Litsea firma             | Lauraceae   | 1.72           | 9     | 7           | 4.31*   | 0.07  |
| 2. | Knema latericia          | Myristicaceae| 1.72          | 7     | 6           | 3.36*   | 0.06  |
| 3. | Cleistanthus sp          | Euphorbiaceae| 1.72         | 6     | 5           | 2.88*   | 0.05  |
| 4. | Shorea ovalis            | Dipterocarpaceae| 1.72      | 6     | 5           | 2.88*   | 0.05  |
| 5. | Shorea parvifolia        | Dipterocarpaceae| 1.72     | 6     | 5           | 2.88*   | 0.05  |
| 6. | Shorea leprosula         | Dipterocarpaceae| 1.72    | 5     | 4           | 2.40*   | 0.04  |
| 7. | Aglaia tomentosa         | Meliaceae   | 1.72           | 4     | 3           | 1.92*   | 0.03  |
| 8. | Artocarpus dadah         | Moraceae    | 1.72           | 4     | 3           | 1.92*   | 0.03  |
| 9. | Actinodaphne glabra      | Lauraceae   | 1.72           | 3     | 2           | 1.44*   | 0.02  |
| 10.| Dipterocarpus lamellatus| Dipterocarpaceae| 1.72      | 3     | 2           | 1.44*   | 0.02  |
| 11.| Hopea odorata            | Dipterocarpaceae| 1.72     | 3     | 2           | 1.44*   | 0.02  |
| 12.| Litsea angulata          | Lauraceae   | 1.72           | 3     | 2           | 1.44*   | 0.02  |
| 13.| Polyalthia sumatranana  | Annonaceae  | 1.72           | 3     | 2           | 1.44*   | 0.02  |
| 14.| Shorea gibbosa           | Dipterocarpaceae| 1.72     | 3     | 2           | 1.44*   | 0.02  |
| 15.| Aglaia argentea          | Meliaceae   | 1.72           | 2     | 2           | 0.96    | 0.02  |
| 16.| Aporosa elliptifolia     | Euphorbiaceae| 1.72        | 2     | 2           | 0.96    | 0.02  |
| 17.| Aporosa frutescens       | Euphorbiaceae| 1.72        | 2     | 2           | 0.96    | 0.02  |
| 18.| Castanopsis sp           | Fagaceae    | 1.72           | 2     | 2           | 0.96    | 0.02  |
| 19.| Dipterocarpus tempehes   | Dipterocarpaceae| 1.72     | 2     | 2           | 0.96    | 0.02  |
| 20.| Dysoxylum sp             | Meliaceae   | 1.72           | 2     | 2           | 0.96    | 0.02  |
| 21.| Fagaceae                 | Fagaceae    | 1.72           | 2     | 2           | 0.96    | 0.02  |
| 22.| Glochidion rubrum        | Euphorbiaceae| 1.72       | 2     | 2           | 0.96    | 0.02  |
| 23.| Nepheleium mutabile      | Sapindaceae | 1.72           | 2     | 2           | 0.96    | 0.02  |
| 24.| Parkia javanica          | Leguminosae | 1.72           | 2     | 2           | 0.96    | 0.02  |
| 25.| Quercus turbinata        | Fagaceae    | 1.72           | 2     | 2           | 0.96    | 0.02  |
| 26.| Sterculia rubiginosa     | Sterculiaceae| 1.72       | 2     | 2           | 0.96    | 0.02  |
| 27.| Aglaia elliptica         | Meliaceae   | 1.72           | 1     | 1           | 0.48    | 0.01  |
| 28.| Alangium javanicum       | Alangiaceae | 1.72           | 1     | 1           | 0.48    | 0.01  |
| 29.| Alseodaphne glabra       | Lauraceae   | 1.72           | 1     | 1           | 0.48    | 0.01  |
| 30.| Artocarpus tomentosulus  | Moraceae    | 1.72           | 1     | 1           | 0.48    | 0.01  |
| 31.| Castanopsis tungurut     | Fagaceae    | 1.72           | 1     | 1           | 0.48    | 0.01  |
Table 1. Continued

| No | Species                  | Family       | $\rho$ (%) | $\eta$ | $\mu$ (%) | $\omega$ | $b$ |
|----|--------------------------|--------------|------------|--------|-----------|----------|-----|
| 32 | Calophyllum inophyllum   | Clusiaceae   | 1.72       | 1      | 1         | 0.48     | 0.01|
| 33 | Cinnamomum javanicum     | Lauraceae    | 1.72       | 1      | 1         | 0.48     | 0.01|
| 34 | Dillenia reticulata      | Dilleniaceae | 1.72       | 1      | 1         | 0.48     | 0.01|
| 35 | Diospyros celebica       | Ebenaceae    | 1.72       | 1      | 1         | 0.48     | 0.01|
| 36 | Dracontomelon dao        | Anacardiaceae| 1.72       | 1      | 1         | 0.48     | 0.01|
| 37 | Dysoxylum alliaceum      | Meliaceae    | 1.72       | 1      | 1         | 0.48     | 0.01|
| 38 | Ficus fistulosa          | Moraceae     | 1.72       | 1      | 1         | 0.48     | 0.01|
| 39 | Ficus sumatrana          | Moraceae     | 1.72       | 1      | 1         | 0.48     | 0.01|
| 40 | Glochidion littorale     | Euphorbiaceae| 1.72       | 1      | 1         | 0.48     | 0.01|
| 41 | Hopea sp.                | Dipterocarpaceae| 1.72  | 1      | 1         | 0.48     | 0.01|
| 42 | Knema galeata            | Myristicaceae| 1.72       | 1      | 1         | 0.48     | 0.01|
| 43 | Lithocarpus elegans      | Fagaceae     | 1.72       | 1      | 1         | 0.48     | 0.01|
| 44 | Litsea castanea          | Lauraceae    | 1.72       | 1      | 1         | 0.48     | 0.01|
| 45 | Magnolia lasia           | Magnoliaceae | 1.72       | 1      | 1         | 0.48     | 0.01|
| 46 | Mangifera quadrifida     | Anacardiaceae| 1.72       | 1      | 1         | 0.48     | 0.01|
| 47 | Nephelium cuspidatum     | Sapindaceae  | 1.72       | 1      | 1         | 0.48     | 0.01|
| 48 | Phoebe grandis           | Lauraceae    | 1.72       | 1      | 1         | 0.48     | 0.01|
| 49 | Polyalthia sp.           | Annonaceae   | 1.72       | 1      | 1         | 0.48     | 0.01|
| 50 | Pterandra rostrata       | Melastomataceae| 1.72 | 1      | 1         | 0.48     | 0.01|
| 51 | Quercus spicata          | Fagaceae     | 1.72       | 1      | 1         | 0.48     | 0.01|
| 52 | Rinorea macrocarpa       | Violaceae    | 1.72       | 1      | 1         | 0.48     | 0.01|
| 53 | Sapium baccatum          | Euphorbiaceae| 1.72       | 1      | 1         | 0.48     | 0.01|
| 54 | Shorea acuminata         | Dipterocarpaceae| 1.72 | 1      | 1         | 0.48     | 0.01|
| 55 | Sterculia foetida        | Sterculiaceae| 1.72       | 1      | 1         | 0.48     | 0.01|
| 56 | Styrax benzoin           | Styracaceae  | 1.72       | 1      | 1         | 0.48     | 0.01|
| 57 | Symplocos sp.            | Symlocaceae  | 1.72       | 1      | 1         | 0.48     | 0.01|
| 58 | Vernonia arborea         | Asteraceae   | 1.72       | 1      | 1         | 0.48     | 0.01|

Total 100.00 121 100 58.00 1.00

* = preferences of SOU nesting trees

Table 1 shows that there 14 species were classified as preferences of SOU nesting tree species. The most preferences of nesting tree species were Litsea firma with selection index ($\omega$) was 4.31, followed by Knema latericia ($\omega$ = 3.36), Cleistanthus sp. and three species of Dipterocarpaceae, i.e. Shorea ovalis, S. parvifolia and S. leprosula with selection index ($\omega$) of 4 last species is similar (2.88). The other preferences of SOU nesting tree species have selection index between 1.44 and 1.92 (Table 1). This result is mostly similar to previous result [8-9] that the Dipterocarp trees are recorded as preferences of orangutan nesting trees in Batangtoru forests which orangutan populations of Batangtoru forests is known as Tapanuli orangutan (Pongo tapanuliensis) [10].

According to Neu’s method [7], 14 species of trees with $\omega \geq 1.0$ were favoured by orangutans as a place to build nests. On the other hand, 44 remaining species were not favoured as nesting tree species of SOU. Based on previous publications [4-6], the availability of tree species as feed sources and nesting place for orangutans is a very influential factor in the density of orangutan populations. Therefore, this result is important in restoring the degraded habitat of SOU.

4. Conclusions and recommendations
About 24.1% of nesting tree species or 14 species of total 58 species were recorded as preferences of SOU nesting tree species at BLF of GLNP. Dipterocarpaceae was recorded as the most favoured tree family by SOU to build a nest. On the other hand, Litsea firma was recorded the most preferences of
SOU nesting tree species. In order to the restoration of degraded habitats of SOU, the 14 species as preferences of SOU nesting trees should be selected as a priority to be planting.

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