The diversity of tree species as feed sources of Sumatran orangutan in Bukit Lawang of Gunung Leuser National Park

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Abstract. Sumatran orangutan (SOU) or *Pongo abelii* lives semi-solitary and arboreal as well as frugivorous which the main feeding sources are fruits. Bukit Lawang Forests (BLF) as part of Gunung Leuser National Park is a habitat of SOU as well as popular ecotourism destination in Northern Sumatra. This study aimed to assess the diversity of tree species as feed sources of SOU and to identify the part of the SOU feed trees that eaten by SOU. Vegetation analysis with combination of line and quadrat method was used. There were 181 tree species within plot samples that 81.8% of them or 148 species were recorded as feed sources of SOU. Fruits were recorded as main part of tree species (65%) that eaten by SOU. The most fruit consumed by SOU was from the family of Moraceae and Clusiaceae. This result showed that the BLF has rich tree species as SOU feed sources and the feed sources trees of SOU should be priority in restoration activities both in degraded and corridor areas.

1. Introduction

Sumatran orangutan (SOU) (*Pongo abelii*) is an endemic great ape as well as critically endangered species. The SOU population distribution is limited to northern Sumatra. Leuser forest ecosystem (LFS) in the northern part of Sumatra is the main habitat of SOU where the Gunung Leuser National Park (GLNP) is the heart of SOU habitat. The SOU population is declining from time to time. Based on the latest inventory [1], SOU population is recorded 14,613 individuals where most of them live in GNLP. The main driver of SOU extinction is forest loss and degradation as well as habitat fragmentation [1][2].

According to previous publications [3][5], it is known that the availability of tree species as feed sources and nesting place for orangutans is a very influential factor in the density of orangutan populations. The more available food source trees and nesting sites will impact the higher the population density in the area. In addition, orangutan nesting behaviour is also negatively affected by the presence of gap (gap) [5][6], both due to logging and falling due to natural factors. Thus, habitat ecology, including feed diversity and species of Sumatran orangutan nesting trees and linkages with other flora and fauna is important to study as an important part of SOU conservation activities.

One of the important efforts to block the extinction rate of SOU is by restoring the degraded habitat and construct corridors [1][7][10] for connecting one habitat and other habitat that is fragmented due to forest conversion between them. The activity requires scientific evidence related to the species of tree as feed sources of SOU to be planted in restoring both degraded habitat and constructed corridors between fragmented habitats. To date, the information was very limited, for example only for Tapanuli
orangutan \((Pongo\ \text{tapanuliensis})\) in Batangtoru forest ecosystem with an altitude is above 500 m asl \cite{11}\cite{12}.

While most of the SOU habitat is spread in the northern part of Lake Toba and most of the degraded and fragmented habitats occur at lowlands with an altitude is below that 500 m asl. Therefore, this research becomes very important in an effort to support the restoration of SOU habitat, both within the GLNP and the surrounding areas. Thus, the aims of this research were to assess the diversity of tree species as feed sources of SOU and to identify the part of the SOU feed trees that eaten by SOU.

2. Materials and methods

2.1. Research site and period

The field study was carried out at Bukit Lawang forests (BLF) of GNLP from October 2017 to April 2018. BLF of GNLP is known as former orangutan rehabilitation centre (ORC) which the area is known as the first ORC in Indonesia that established at 1979. The ORC in Bukit Lawang was closed at 1987 and continued as orangutan viewing centre (OVC) until now as well as popular ecotourism destination in Northern Sumatra which SOU as the main attraction to observe by visitors. Therefore, most of the SOU in the area is habituated.

2.2. Data collection and analysis

Four transects, each 1 km long were established. Systematic sampling was used in setting up the sampling plot that 25 sampling plots of each 20m x 20m were placed in each transect. The distance between sampling plot was 20 m. All trees with stem diameter (DBH) of 20 cm up in all sampling plots were counted and identified.

The tree species as SOU feed sources in sampling plots as well as the tree parts that consumed by SOU were recorded during the field works. Based on the collected data, the composition of SOU feed sources both tree species and part of tree species that eaten by SOU was calculated.

3. Results and discussion

A total of 181 species of trees was recorded in all transects. About 141 species or 81.76% of the total tree species were SOU feed sources. The tree species as SOU feed sources (141 species) belonged to 36 families which riches family having the SOU feed sources was Euphorbiaceae (18 species), followed by Lauraceae (16 species), Fagaceae (13 species), Meliaceae, Myrtaceae and Moraceae (each 9 species). The other families (30 families) contain from 1 species to 5 species in each family. The family composition of the SOU feed sources in BLF of GLNP is mostly similar to Tapanuli orangutan feed sources in Batangtoru forest \cite{11}\cite{13}.

As frugivore, the SOUs live nomadically, moving from one area to others. However, they will stay in an area as long as food availability is abundant. Orangutans mostly preferred fruits with soft fleshy and seedy, including single and multiple berries from \textit{Ficus} or fig trees. Several pig tree species were found in this study, such as \textit{F. glomerata}, \textit{F. religiosa}, \textit{F. stupenda}, \textit{F. sumatrana} and \textit{F. fistulosa}. However, the fig trees were not dominant in the BLF of GNLP.

Fruits were recorded as popular feed sources of SOU which fruits were accounted of 64.7% of SOU feed sources, followed combination of fruits and buds (14.7%) and buds itself (8.7%). The other parts of tree species consumed by SOU were lower than 4% each (Figure 1). During this field research did not include fruiting peak seasons. Based on observation, fruits include Moraceae and Clusiaceae were recorded as popular eaten by SOU in the period (October 2017 to April 2018). Therefore, fruits were the main sources of SOU feed in BLF of GLNP.

The proportion of fruits as feed sources of SOU in this study was higher than previous publications. Fruit proportions as feed sources of orangutan are ranges from 55.6%, followed by leaf (35.5%) \cite{14}. \cite{15} stated that orangutans are frugivore that 61% of their feeding time is used to consume fruits. This study showed that the BLF of GLNP has the richest diversity of SOU feed sources.
Figure 1. Proportion of tree species that consumed by Sumatran orangutan in Bukit Lawang Forests of Gunung Leuser National Park, Indonesia

4. Conclusions
BLF of GLNP has rich feed sources of SOU that reached 81.79% of total tree species in the forests. Although not the peak of the fruiting season, fruits were recorded as main sources of SOU feed sources. Therefore, for sustaining habitat restoration of SOU, the fruit source trees of SOU feed should be priority in restoration activities both in degraded and corridor areas.

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