The Correlation of Tree Phenology with nest number of Orang Utan Sumatera (Pongo abelii) on Primary Forest, Resort Sei Betung, Gunung Leuser National Park

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Abstract. Food availability affect the orangutan activities, including activities to make nests. This study was conducted to determine the correlation between the phenology of trees with the number of nests made by orangutans in primary forest Resort Sei Betung, Gunung Leuser National Park. Multi linear regression was used in this study to determine the relation and correlation between phenology and the presence of orangutan nests on a track that has been created. It took over 6 months (March - August 2015). There were 15 orangutan nests found on the track during the study. The equation model was: $y = 27.649 - 0.011X_1 - 0.104X_2 - 0.056X_3$, and there was no significant differences (sig > 0.05). The value of $R^2$ was 70.3%. It means that all predictors simultaneously explain 70.3% of the presence of orangutan’s nest, and there is an expected predictors that may be the most affect on nest presence. The season or the intensity of rain may consider as an expected predictor.

1. Introduction

Orangutan (Pongo abelii) is an endangered species based on IUCN list (IUCN, 2007)[1] and also including Appendix I on the CITES list. Some conservationist said that orangutan is an umbrella species, which is the sustainability of this population become an indicator of sustainability of the forest as its habitats. Most of orangutan activities are on the trees, known as arboreal and terrestrial species (Galdikas,1978)[2] and McKinnon (1971)[3]. Further, said that orangutan always makes a new nest on the tree every night. On its natural habitat, orangutan is an opportunist wildlife that gathered many kind of food on the forest, but fruits are its main food. The distribution of quantity and quality of fruits affect on orangutan activities, including on nesting (Blouch,1997[4]; Singleton & van Schaik, 2001[5]; Meijaard et al., 2001[6]). According to Felton et al. (2003)[7], the density of new nests was significantly correlated with the number of fruiting trees. The study of fruiting trees, as a part of how the biological world times natural events is called phenology. Phenology is an important subject to study, because it helps us understand the health of species and ecosystems. The timing of one species phenological events can be very important to the
survival of another species (Natural Wildlife Federation, 2016)[8]. Phenology study was not just studying on fruiting only, but its starts from the formating of young leaves and flowering, continued by fruiting. The productivity of young leaves, flowering and fruiting may affect on nesting, as said above by Felton et al. (2003)[7]. This study was conducted to determine the correlation between the phenology of trees which describes by the productivity of young leaves, flowering and fruiting with the number of nests made by orangutans in primary forest Resort Sei Betung, Gunung Leuser National Park.

2. Methods
This study was done on primary forest at Resort Sei Betung, Gunung Leuser National Park, divided on three tracks have been available. Each track sized 5 m in width and 1.000 m in length, with distances 300 m from others. This study consists of field study for six months and continued with data analysis using multi linear regression. Field study was done on the existing track on primary forest. Primary data observed for the number of nest found on the track, while phenology data was collected from secondary data from Hartini et al. (2015)[9]. In this study, phenology describes by the productivity of young leaves, flowering and fruiting, while the estimation of productivity measured using Zweifel Method (Harrison et al, 2013)[10].

Multi linear regression was done for understanding the relation and correlation between tree phenology (estimation productivity of young leaves, flowering and fruiting) as independent factors and number of nests have been found as dependent factor, using SPSS software. The Model equation is: $Y = a + b_1X_1 + b_2X_2 + b_3X_3$, which is $Y =$ number of nest; $a =$ intercept; $b_1, b_2, b_3 =$ coefficient of regression; $X_1 =$ estimation productivity of young leaves; $X_2 =$ estimation productivity of flowering; and $X_3 =$ estimation productivity of fruiting.

3. Results and Discussions
The number of nests found quite varied each month. On first track, nests were found in March until May with 6 nests. In second track, nests were found in April until July with 5 nests. On third track, nests were only found in April with 4 nests. Based on these data, most nests were found in April, with the total nests on the third track were 8 nests. However, in the last month of observation (August) no nests were found on both of the three tracks. It can be caused by low availability of food which in Figure 1, can be seen the low percentage of fruiting, flowering and young leaves obtained during the observations included in August. It features of all species found on three tracks, both food trees and non food trees. The highest fruiting percentage occurred on August, only 0,89%, and the lowest was on March (0,1%). The highest flowering percentage occurred on July (1,24%) and the lowest occurred on May (0,7%). Unfortunately, flowering on this research mostly occurred on non food trees, such as Endospermum diadenum and Macaranga lowii. Flowering percentage might caused by the fluctuation of productivity of trees on each months. Wright and Cornejo (1990) in Nugroho (2011)[11] said that the differences of flowering patterns correlated with the diversity of species on tropical forest. Flowering and fruiting process also correlated with the internal factors such as genetics, hormones and nutrients and external factors such as humidity, temperature, rain intensity and also light intensity. There are also possibilities that flowering were aborted and then fruiting will be failed. If the availability of fruits were low, orangutan will use young leaves as an alternative food. The highest percentage of young leaves occured on March (27,8%) and the lowest was on August (20,2%). It might caused by the long dry season.
Figure 1. Phenology of tree species on primary forest of Resort Sei Betung

Figure 1. describes the phenology of all trees and species found on both three tracks. Numbers of trees found on all tracks were 1567 trees including on 37 families and 107 species which divided as food trees (837 trees including on 20 families and 37 species) and non food trees (730 trees including on 28 families and 70 species). Unfortunately, this research only found 15 individual trees from 8 species were used as orangutan nests. Mostly are not known as food trees. Those species and its height and diameter showed on Table 1., and Figure 2. shows orangutan’s nests found in this research.

Table 1. Height and Diameter of tree species where orangutan nests found

| No | Species                | Track | Month | Height (m) | Diameter (cm) |
|----|------------------------|-------|-------|------------|---------------|
| 1  | *Endospermum diadenum* | 1     | 2     | 21         | 49.6          |
| 2  | *Polyalthia sumatrana* | 1     | 2     | 17         | 24.52         |
| 3  | *Endospermum diadenum* | 1     | √     | 18         | 20.7          |
| 4  | *Polyalthia sumatrana* | 1     | √     | 17         | 21.02         |
| 5  | *Endospermum diadenum* | 1     | √     | 20         | 23.89         |
| 6  | *Alangium langifolium* | 1     | √     | 16         | 22.61         |
| 7  | *Shorea parvifolia*    | 2     | √     | 13         | 21.3          |
| 8  | *Microcos sp*          | 2     | √     | 12         | 31.5          |
| 9  | *Macaranga indica*     | 2     | √     | 11         | 19.8          |
| 10 | *Endospermum diadenum* | 2     | √     | 20         | 37.9          |
| 11 | *Endospermum diadenum* | 2     | √     | 20         | 45.6          |
| 12 | *Styrax sp*            | 3     | √     | 16         | 31.2          |
| 13 | *Polyalthia sumatrana* | 3     | √     | 17         | 21.7          |
| 14 | *Shorea sp.*           | 3     | √     | 15         | 35            |
| 15 | *Homalanthus sp*       | 3     | √     | 16         | 43            |
Figure 2. Orangutan’s nest on *Endospermum diadenum* and *Macaranga lowii*

Nesting can be done on the tree which is not including as food tree, the consideration is the availability of food tree surrounding its nest. As stated by Rijksen (1978)[12], orangutans do not use a food tree for nesting as a strategy to avoid encounters with other wildlife. Orangutan activities i.e. eating, moving, resting and nesting, closely related with the productivity of food tree.

Number of nests found in this study were less, it caused by the lack of feed plant. Fruit season is not coming yet caused by dry season, then orangutans need times to found feed plant around the forest. Bismark (2005)[13] said the absent of orangutan nests were indicated of extend home range area of orangutan and lack of feed plant. According on Meijard *et al.* (2001)[6] the home range of male orangutan is about 5-10 km² and the female is more than 3 km².

The result of multi linear regression showed the equation model: \( Y = 27,649 -0.011X_1 -0.104X_2 -0.056X_3 \), and there were no significant differences (sig >0.05) on that model, its means that the productivity of young leaves, flowering and fruiting were not the significant factors that affect orangutan to build their nest. Others factors must be considered on advanced research. Although there were no significant differences, the value of coefficient determinant (R²) relatively high (70.3%) and the coefficient correlation was 0.84. It means that all predictors simultaneously explain 70.3 % of the presence of orangutan’s nest, and there is an expected predictors that may be the most factor affect on nest presence. As mentioned on the discussion above that the research was done on the dry season which is affect the productivity of phenology, then other factor consider to predict on nesting was the season or the intensity of rain.

4. Conclusions
This research found there were no significant differences for multi linear regression. All predictors simultaneously explain 70.3 % of the presence of orangutan’s nest, and there is an expected predictors that may be the most factor affect on nest presence. This an expected predictor is the season or the intensity of rain, but still need further research.

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