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Nest Stuctures in Bornean Orangutan

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ABSTRAK

Struktur Sarang Orangutan Kalimantan. Nest-building techniques processes related parties in choosing the trees, the basic building structure, making layers, and adding nest locking system with accessories. There are Lacks of data about the pattern of the orangutan nest and only van Schaik (1995) described four Variations of nest structure. By Following 22 orangutans with instantaneous focal animal method, 19 vertical nest structures are found, and horizontally variations orangutan nest forming butterfly pattern. Tree species are *Elaocarpus mastersii* that mostly used by Orangutan to build nest with type of branch direction and height of first branch as the Reasons. Nest was built in 5-9 meters height and they were seldom to rebuilt or reuse old nest. They seldom to develop their nest in the last fruit trees to avoid night-predators.

Kata Kunci: Orangutan, Struktur dan pola, sarang.

INTRODUCTION

Like other great apes, orangutans make a new nest every day. But there are cases of flanged male orangutan in Tanjung Puting sleep on large branches or on the ground without making the nest (Galdikas 1978). The main purpose of orangutans make nests is as a rest and protection against predators (Sugardjito, 1983). Although, several cases were found using the nest as a place to play (van Schaik, 2003), copulations (Goodall, 1968), and culture (van Schaik 2003; Merrill, unpublished). In general, the nesting behavior has been described in chimpanzees (Goodall, 1962; McGrew, 1992; Izawa & Itani 1966), gorillas (Bolwig 1959) and rehabilitant orangutan (Harrison 1969). All reports described of the process consist of making a nest foundation - making the layer on top of foundation, and creating a pillow (McGrew 1992; Ergenter 1998). Prasetyo *et al* (2009) describe process of nest building in the orangutan, in the following order:

1. Choice of a nest tree. Before nesting orangutans must choose to nest in a tree. Previous studies have noted that orangutans and other great apes, even though they want to use many species, but in fact they are selective in choosing a nest tree (Sugardjito 1983; Fruth & Hohmann 1996).
2. Making the nest base. Once a suitable tree has been chosen, an orangutan

start to construct the framework of the base or on their nest. Orangutans pull towards some big branches and under themselves, uniting them at the same point. Orangutans are precise and selective in choosing branches for the foundation of the nest. In Some cases orangutans will move to another tree after the first bending branches, perhaps indicating that the branches are not suitable. At this stage, the orangutans usually stand in a fixed location, orienting in a fixed direction, bending and adding branches. These actions tend to create a butterfly pattern of branch endings, concentrated in two, roughly opposite corners.

3. Making the mattress. After the foundation has been made the orangutan bends smaller branches into its nest, usually branches with many leaves, in order to create a layer, referred to as mattress. For other great apes this behavior has only been reported in chimpanzees (Fruth & Hohmann 1996).
4. Locking,. this is the last phase of nest building. Orangutans braid branches while standing on the nest. The tips of these branches are folded at the center of the nest and intertwined with the mattress. Until this process continues the nest has a strong structure. Goodall (1962) and Nissen (1931) A different methods have reported for chimpanzees, n locking branches are crossed with the foundation of the nest instead (crosspieces system).
5. Add special features, orangutans make certain additions to the nest that might be to enhance the comfort of the nest. These can be some pillows, blankets, roofs, or a second nest bunk. Pillows are small leafy twigs arranged on one side of the nest, often with the stick-ends (rather than the leaf-ends) outward pointing. Blankets leafy branches are loose laid on top of the body after animal lies down in its nest. A roof is a loose cover of braided branches, woven together to make a solid, nearly waterproof object. The nest is a separate bunk platforms built a few meters above the nest.

There are no reports describing the construction of a orangutan nest in horizontal view, almost all great ape expert said that the form nests are generally rounded, Goodall (1962) described of the locking system on the foundation of chimpanzee nests. While vertically nest construction has been reported by several researchers, van Schaik et al (1995) reported four positions on the orangutan nests, Bolwig (1959) reported four forms of land on gorilla nest construction, and Izawa & Itani (1966) reported there were six nest constructions in chimpanzees.

This study was conduct in the Orangutan Research Station Tuanan, Mawas Project, and Central Kalimantan. This site located at 020 09 ’06.1 “latitude and 1140 26' 26.3” E (Figure 1) with peat swamp forest: 3-4 meters in depth. Average temperatures 23.10 C - 29.430 C and rainfall is 14.43 ml. Humidity had an average of 92% with water acidity (pH) in the forest is 4.8 (Azwar *et al.* 2004).

The secondary forest types have logged-over forest structure varies with canopy cover of about 70%. Common types of vegetation which consists of the families Annonaceae, Euphorbiaceae, Dipterocarpaceae, Lauraceae, and Ebenaceae with tree height of about 15-25 meters and a circumstances 10-50 cm (Azwar *et al.* 2004). Based on the results of orangutan population density survey by van Schaik et al (2005) estimated the orangutan density is very high, the density has 4,25-4.50 individu/Km2 with a total value of individual orangutans 3000-4000.

MATERIALS AND METHODS

This study conducted over 12 months by following the 22 orangutans (5 adult females with infant, 2 adolescent, 9 unflanged male and 6 flanged male) and data collection used direct observation with focal animal instantaneous in 2 minutes intervals (Altmann, 1974) from nest to nest (van Schaik, 2006 / www.uim.unich.zurich.edu).

Data acquisition of nest structure and pattern done by using vertical and horizontal observation:

Vertical observation

In this method, observation focused on the orangutan nest construction perpendicularly from the surface soil and which techniques orangutans used. This method is a combination of several reports that discuss about constructions of a nest in great apes (Bolwig, 1959; Izawa and Itani, 1996; van Schaik and Indrusman, 1996). The parameters that were taken in this method are:

1.Variation of nest construction based on reference 5 position by van Schaik (2006) / www.uim.zurich.unizh.edu.
- Position 0: The nest is made on the ground.
-Position 1: Nest located at the base of a tree branch and attached to the main trunk.
-Position 2: Nest in tree branch edges.
-Position 3: The nest is at the end of the main tree.
-Position 4: The nest is made of two or more trees.
2.The height, diameter and species of nest trees.
3.Factor the nest tree species selection, test correlation of the characteristics of the tree according Tjitrosoepomo (1999) and Bell (1991) : Higher first branching tree, highest second tree branching, lLength of leaf (short, medium, long, very long), width of leaves (narrow, medium, wide, very wide), type of leaf child (plural or singular), type of branching stems,
4.The height of nest from ground.
5.Condition of the nest that is used (new or repaired).
6. Fruit trees as nest trees.

Horizontal observation

This method used to observe positions of twig as a nest foundation, seen from above and or below the nest. All position of the twig were recorded and mapped by geographic compass degrees (0 º - 360 º with 10 º intervals).

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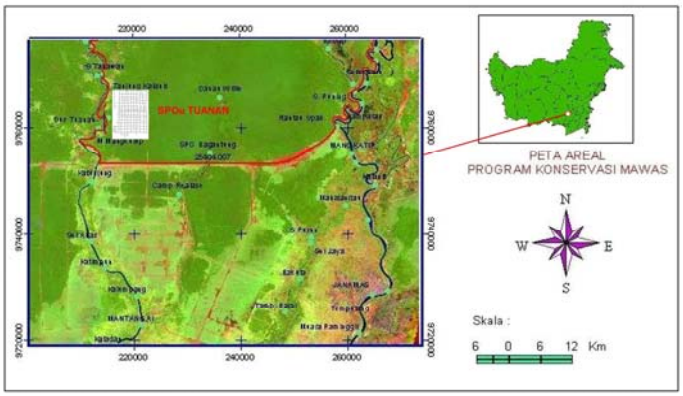

Figure 1. Tuanan research station, Central Kalimantan.

RESULTS

Orangutan Nest Pattern

Sixty-eight orangutan nests were identified have a pattern look alike butterflies on the composition of twigs as a nest foundation, this is seen from the location of a branch that is more concentrated on the two sides of the nest (Figure 2). Nest pattern on each orangutan sex classes showed no clear particular pattern. Adult females orangutan nest does not show a particular form, this condition also occurs in adolescent and unflanged male nest. Invisibility of nest pattern by sex classes due to the number of branches that are used as nest foundation. Adult female orangutan need more branches as the foundation (n = 49, mean = 8 branches/ nest, SD = 2.78) by the reason of convenience in weight support and child protection. This condition is different from adolescent orangutan nest, the average of branch used as the nest foundation is 6 with a standard deviation 1.30, over at least a branch that is used due to lighter body weight.

Variations orangutan nest structure

Nest structure in vertically shown the grouping of trees used as nest. There are 41.67% orangutans used one tree as nest tree and 58.33% orangutan nest made with two or more trees. The amount of frequency utilization of two or more trees as a nest due to the factor of density and height of trees in research area. By using four categories based on variations of nest tree (one tree, two trees, three trees and four trees or more) was found 19 variations of orangutan nest.

1. Variation of orangutan nest with a single tree

Based on one tree as nest, identified six different variations. Variation 1A, orangutans make a nest by using a big branch as nest support, nest foundation derived from small twigs around the tree. Variation 1B, where nest foundations attached to base of a tree branch, so the position of nest at two different points of the main tree and branch. Variation 1C shown orangutan nest at the top of tree with the utilization of the main tree as a

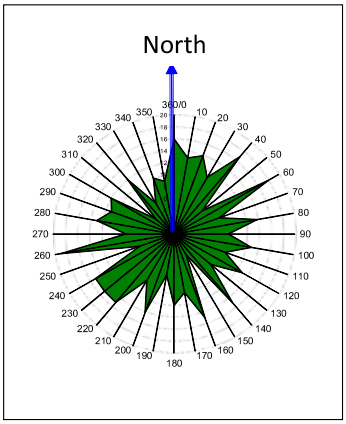

Figure 2. Horizontally orangutan nest pattern.

support. Variation 1D can be viewed on position of nest is located on the edge of tree branch, it was chosen as a nest support especially with the greatest circumstance. Variations 1E shown the same case with variation A, but used a middle branch for supporting a nest and utilize the twigs on a tree branch as nest material. Variation 1F shown a similar shape with variation C, but in this case orangutans make nests right on the top of the main branch by utilizing twigs of trees as a nest support.

Based on frequency of nest structure with one tree as a nest support, variation 1F is frequently used by orangutans (28%), as well as variation 1C (20%). The magnitude of frequency in variation 1F and 1C is influenced by habitat conditions of the study area which have a range of 15 meters tree tall, orangutan will make a nest at the top of the main tree cause strength and balance to the nest.

Furthermore, variation 1A is found only in the adolescent, this is due at the nest processing of twigs needed is very small and nest located on higher tree, and caused orangutan use a branch as nest support. This condition is different from the nest variation 1F was only found in adult orangutans, the number of branches used is high and located at a low position of tree, so orangutan build their nest on top of tree. Variation 1B, 1C and 1E was found uniformly in orangutan, there is no particular reason from this variation used as a nest support.

2. Variation of orangutan nest with two different trees

The utilization of two trees as nest support was found six variations. In contrast to the variation of one tree, the utilization of two tree in addition to functioning as a support also has a function as a “lock” the nest (Figure 4). Variation 2A, orangutan make a nest look alike variation 1C, which distinguishes it from this case that there is other trees used as nest lock (red color). Variation 2B, orangutan make nest on two branches of different trees, the nest located in the middle of branches combined. Variation

2C shown an interesting behavior, orangutan make nest like variation 1F and then nest located on another main tree to sustain and more stable. Variation 2D shown nest located on top of two different trees, while variation 2E shown a nest built on the top of tree with support from tree branch another tree. Variation 2F has a similar shape with variation 2E, but in this case branches are not used as a support but as a lock of nest.

The high frequency of used two trees as a nest support occurred at variation 2B and 2E with 25% cases from 12 identified nest. The selection of this variation due to the influence of height and density of trees in the area. And this variation is most powerful and stable when compared with four other variations, because support of nest come from two different trees.

Variation shown in two trees as nest material has a function as a support and lock the nest. Variations of trees as a support found in all adolescent and adult orangutan. While variations of the nest tree as the lock was found only in adult orangutans, this condition is caused by the body weight factor of orangutan and vegetation availability in the area. The aim of locking system by used other tree nest is in order to make the structure stronger and more stable. The high variation of the nest structure by using more than one tree is affected by the altitude and magnitude of the trees in the area, vegetation plots census shown average of height trees is 14.76 meters with an average circumference 16.4 cm. This condition is in accordance with the position of the nest that is used by orangutan choose position 4 (used more than two trees) that is equal to 40.5%.

3. Variation of orangutan nest with three different trees

This nest tree has shown four different variations with space below the nest, this assumes that the structure of the nest would be stronger. Variation 3A, orangutan used the end of tree branches held together as a nest material. Variation 3B, nest is made at the top of tree as a support and material of nest. Variation 3C can be seen same structure with variation 3B, but in this case orangutan used two trees for locking the nest. This technique also shown in variation 3D.

Variation of the nest structure that is often used by orangtuan is variation 3C with 33.33% with 66.67% was found in adult orangutan. This condition is caused by the weight factor and the protection of infant during resting.

4. Variation of orangutan nest with four or more different trees

Based on used of four or more trees as nest support found three different variations. Variation 4A shown combination between variation 3A and 3B, in addition to using a branch as a nest support, orangutan also use top of tree as a nest support. Variation 4B also has the combination of variation 3C and 3D, orangutan use several trees as a nest support and as a lock. Variation 4C is rare cases that orangutan built their nests on the ground, in this case orangutan use of soil as a nest support. Variation of the nest structure is often used by orangutan is a variation 4A, this nest structure is

considered most powerful and stable when compared to two other nest structures, because the whole tree is used as a nest support. Like variations that occur in three trees, variations with four trees or more was only found in adult orangutan. The reason is come from body weight, protection against predators and comfortable during sleep, in addition to habitat conditions.

Techniques in orangutan nest building

1. Tree species

Orangutans have a good instinct in determining tree species as nest material, since it deals with the comfortable and protection when sleeping or resting. There are 65 tree species were identified as orangutan nest tree in study area. The most common tree species used by orangutan is Mangkinang blawau (*Elaocarpus mastersii*) with 11.39% frequency and Karandau (*Neoscortechinia kingii*) of 8.74%. Different conditions occur on the type of trees used as day nest. Of the 51 species of trees, the species most often used is Karandau (*Neoscortechinia kingii*) of 13.4% and Tutup kabali (*Diospyros pseudomalabarica* or *D. pendule* cf) of 9.7%.

Distribution of tree species in study area shown no correlation between dominant tree species with orangutan tree species, this condition indicates there is a nest tree selection by orangutan. Selection of nest trees aimed at getting the comfortable place for resting and saving energy during the process of making a nest. For example, the reason of choice Mangkinang blawau tree is this tree has a thick of twigs and leaves. In addition there is the assumption that these species have a high flexibility branches with great strength, and a function as insect repellant (further study is being conducted).

Unlike night nest tree selection, tree species used as day nest has a correlation with distribution of tree species in study area. This is because the orangutan has not a tendency to select the type of trees, the nest relatively used in short time (average of 16.37 minutes) and has a simpler structure.

The use of tree species based on the sex class of orangutan shown that adult female, adolescent and flanged male more often use Elaocarpus mastersii as a nest tree with percentage of 17.84%, and in unflanged male kind of prefer *Tetractomia tetranda* as the nest with a percentage of 11.63%. However, the selection of tree species as da nest, adult females and adolescent more frequently use Neoscortechinia kingii of 11.18%, unflanged male preferred Tutup kabali *Diospyros pseudomalabarica* or *D. pendule* cf of 12.31%, and flanged male preferred *Mezzettia* sp tree, *Palaquium* sp and *Diospyros pseudomalabarica* or *D. pendule* cf with equal to 10.34%.

Based on the six characteristics of tree used as nest tree selection factor, height of the second tree branch and branch types is a characteristic that affects of tree selection as night nest [($r = 0.043$, $P = 0.056$, $r = 0.008$, $P<0.05$, backward method). The correlation caused by these three characteristics is due to the convenience orangutan nest

position on the buffer tree, this condition can be seen from a tree branch type used is roux and massart who have type branching direction 90 ° from the main tree.

2. Tree height and nest height

Height of trees used as night nest is in the range of 5-9 meters, the same value also occurred at the height of the nest. While on day nest, the height of trees used as nest buffer is in the range of 10-14 meters with the nest height 5-9 meters.

Based on differences of sex class, the height of trees used as night nest on adult female, adolescents and unflanged male in the range of 10-14 meters, while flanged male use nest trees with a height of 5-9 meters. A different situation occurs in the day nest, trees are often used as a nest by a adolescent is 20-24 meters, unflanged males on 15-19 meters, and an adult female and flanged male located at an altitude of 10-14 meters (Figure 9).

Selection of nest tree height is strongly influenced by regional ecological conditions, although factors predation also played. The case in study site shown that nest height in the range of 5-9 meters, this condition has a correlation with tree conditions that exist in areas with an average height of 14.47 meters. A similar case occurred in Kinabatangan Orangutan (Ancrenaz *et al*. 2004) and Ketambe (pers. Com).

3. Condition of nest

In general, orangutans always built a new nest on each day, although there were reports a few orangutan repaired or reused the old nest (Galdikas 1978). From the observations of night nest, orangutans in study area 90.49% built a new nest and 9.51% repaired old nest. This condition also occurs in day nest, amounting to 81% of orangutan built a new nest and only 19% orangutan repaired or reused old nest.

Based on orangutan sex class there were not significant differences in utilization of the old nest as a night nest ($X2 = 0.92$ with $á < 0.05$), this condition generally found at night on certain conditions such as in the dark or when it rains, but this case is very rare. Different conditions encountered on utilization of old nests as day nest, the analysis shown differences between sex class of orangutans ($X^2 = 0.01$ with $á < 0.05$), adult female orangutans built day nests more frequently if compared the other orangutans (27.71%), this condition is caused by energy saving factor during rest.

4. Fruit tree preferences

Orangutans are highly selective and conservative in selecting and maintaining of food resources, but this condition strongly influenced by fluctuations in the amount of fruit availability. At fruit season's, orangutans not to maintain one fruit tree as the sole energy source, if there are dominant orangutan then they will move to other feeding tree (Utami *et al*. 1997). This condition occurs when the availability of fruit tree limited, orangutans will try to maintain the fruit trees in various ways, one of which is build a nest in fruit tree (Sugardjito 1983).

From the results obtained, the orangutan is very rare used the last fruit

tree as a nesting site. At night nest was found only 2.56 % orangutan used the last fruit tree as nest trees and 16.55% of fruit trees used as nest trees during the day. Based on Mann-Whitney U test shown a significant differences between the last fruit tree as night nest and day nest (U test = 0.02 with P= 0.05). Preferences of fruit trees as day nest tree aims to save energy, the orangutan will make a nest and keep feeding in the nest. But different conditions occur in the night nest, because predators more often found in or around the fruit tree, the orangutans is very rarely use of tree as nest site (Sugardjito 1983).

The reason of orangutan not to use fruit trees as a nest tree is a protection from night predators, such as clouded leopards and pythons (Sugardjito, 1983). Based on the results of a survey of mammals and reptiles in the study sites, there are two types of potential predators to kill the orangutan is the clouded leopard (*Neofelis nebulosa)* and python (*Python reticulatus*) (Azwar *et al.* 2004).

CONCLUSIONS

Orangutan has intelligence techniques in the nest building, was found 19 variations of the vertical nest structure and butterfly pattern in horizontally, and each technique has a specific function and purpose in obtaining of comfortable and protection. Distribution of fruit trees will affect with distribution of adult female nests, whereas adolescent, unflanged male and flanged male nest was influenced by reproduction reason or territory system. Based on nest building technique, identified *Elaocarpus mastersii* as tree was orangutan used as a nest with 5-9 meters of height. Orangutan in generally build a new nest and very rare reused or repaired old nest. The selection of nest tree species was influenced by branching tree type, height and second branch type, this condition is very different from the selection of tree species in day nest.

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