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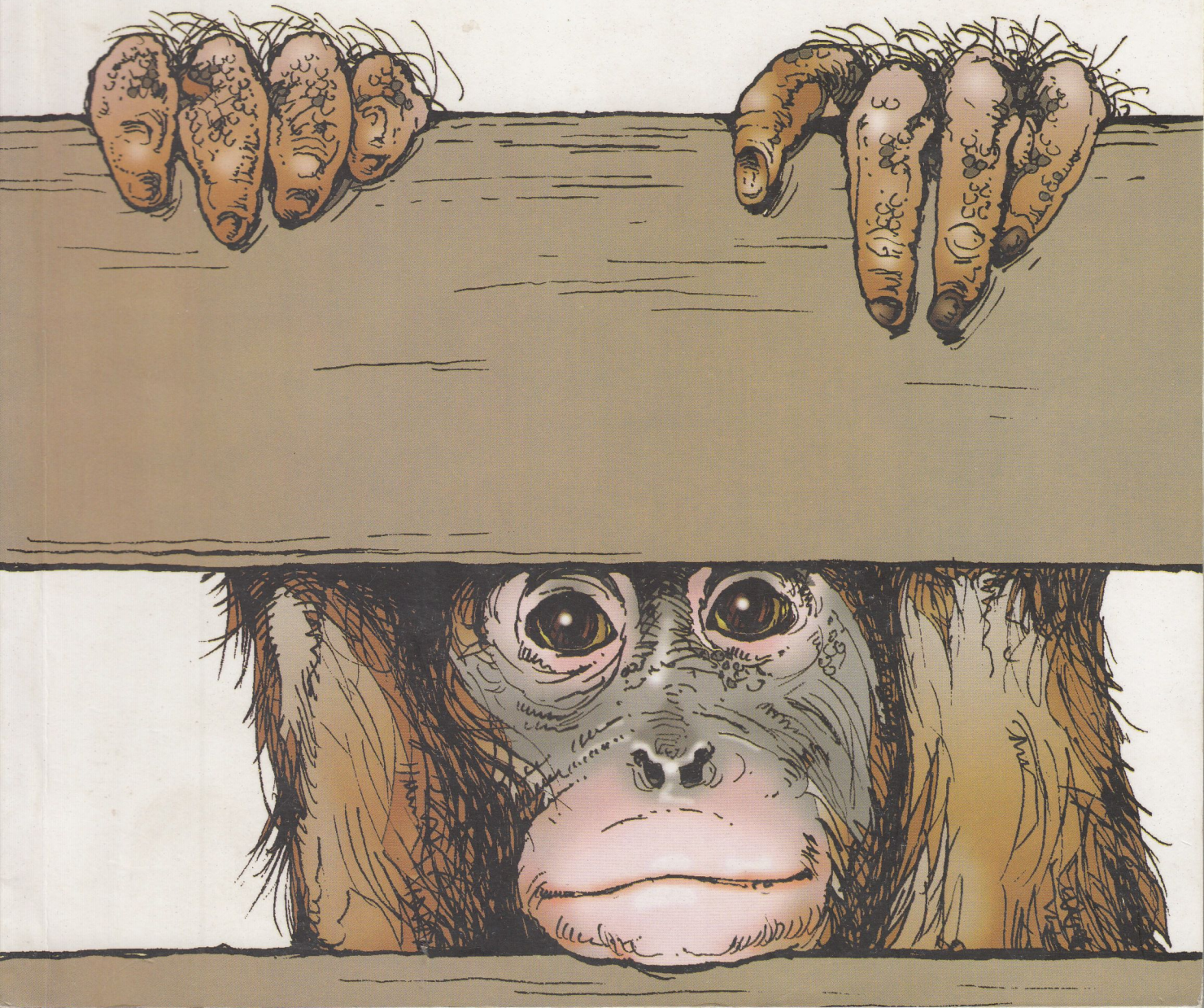
WORKSHOP PROCEEDINGS

INTERNATIONAL workshop on Orangutan CONSERVATION

Sanur Beach Hotel | Bali | Indonesia | 15 - 17 July 2010



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The Ministry of Forestry of the Republic of Indonesia
The Indonesian Orangutan Forum (FORINA)

SUPPORTED BY:
The USAID Orangutan Conservation Services Program (OCSP)

About this publication

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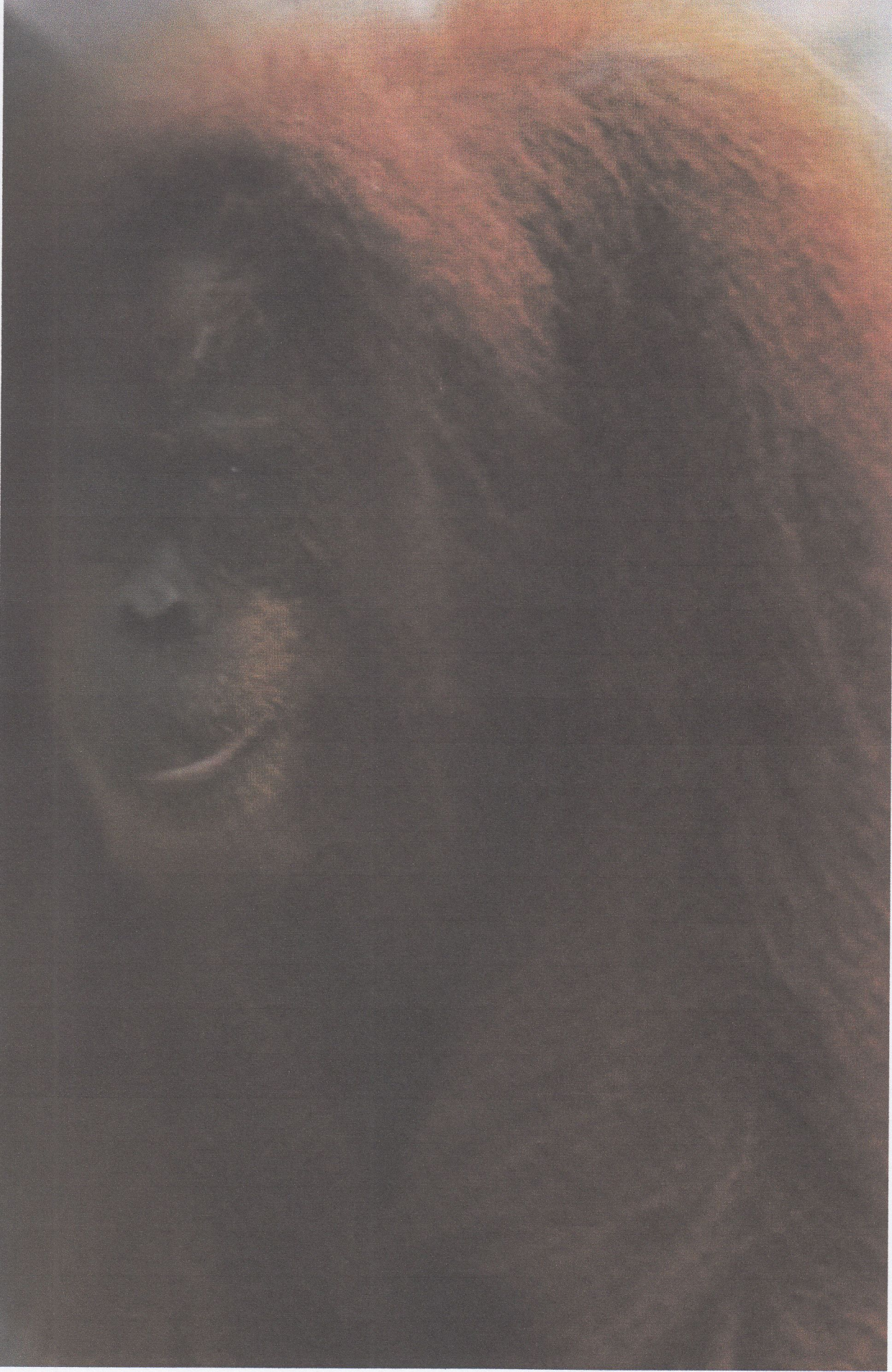

Session 2 - Variation in Forest Structure and Composition: The Effect of Habitat Quality on Bornean Orangutan (*Pongo pygmaeus morio*) Population Density and Nest Features

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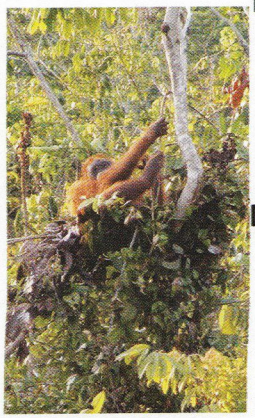
Nest construction is a daily habit of independent orangutans. Because nests are reliable indicators of orangutan presence, they have been used commonly to estimate local population density, identify nest site preferences and to determine ranging behavior.. Although studies utilizing nests have improved our understanding of some aspects of orangutan ecology, these findings are limited because they do not fully consider variation in forest structure and composition. This study investigated the effect of forest structure and composition on orangutan population density and their nest features. Specifically, we consider different habitat types across several sites in Eastern Borneo including Kutai National Park (Main zona, Rimba Zona, Sangkima, and Prevab) as well as Birawa forest. Data analysis demonstrated that variation of orangutan population densities is influenced not only by habitat quality but also influenced by habitat size. In addition, variation in nest features demonstrate a good correspondence with forest structure and composition.

Introduction



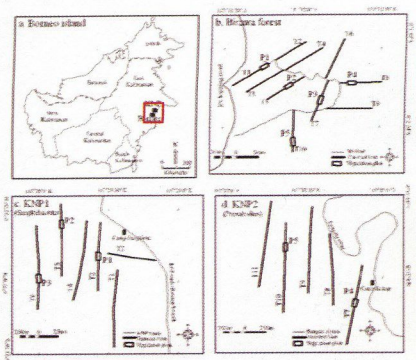
- Nest-tree preferences caused by habitat changes is important aspect of habitat requirements of orangutans
- Factors and causes on nest tree preference are still unclear: "No single ecological factors explain nest tree preferences"

Objectives

To determine of nest-tree preferences of wild Bornean orangutan in relation to habitat quality and population densities

To give insight into the vegetation requirements of orangutans, which are vital to forest conservation programs

Study sites



Kutai National Park (PF)
-Primary forest
-11 line transects
-5 vegetation plots
-0.2 ha for each plots

Birawa forest (SF)
-Secondary forest
-10 line transects
5 vegetation plots
-0.2 ha for each plots

Research outline

"*used*" resources (Tree used for nesting sites)

Transect survey
PF = 423 on 319 nest trees
SF = 437 on 300 nest trees

Nest tree features

"available" resources (Tree available for nest sites)

Vegetation survey
Tree DBH > 10 cm

-Tree features
-Strength of tree branches

Nest tree preferences
Orangutan population densities

Data analysis

1. Preferences in relation with availability of resources
Log-likelihood test (Manly et al., 2002)

$$\chi^2_L = 2\sum_{i=1}^{I}\left[u_i \log_e\{u_i / E(u_i)\} + m_i \log_e\{m_i / E(m_i)\}\right]$$

u = the number of "*Used*" resources unit,
m = the number of "*available*" resources unit

2. Preference for each categories
Selection ratio (w_i) for each categories

$$w_i = o_i / \pi_i$$

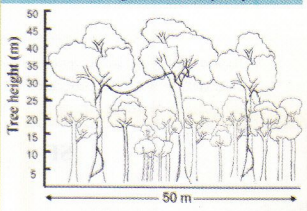
o = *proportion of "used" resources*, π= proportion of "Available" resources
wi were tested using the 95% Benferroni confidence intervals (CI)

3. Statistical analysis were performed using R for statistical computing

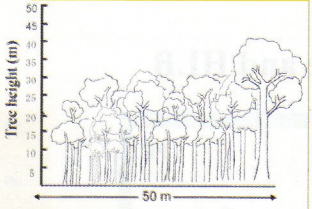
Result and discussion

"*Available*" resources for nesting sites

Primary Forest (PF)



Secondary Forest (SF)

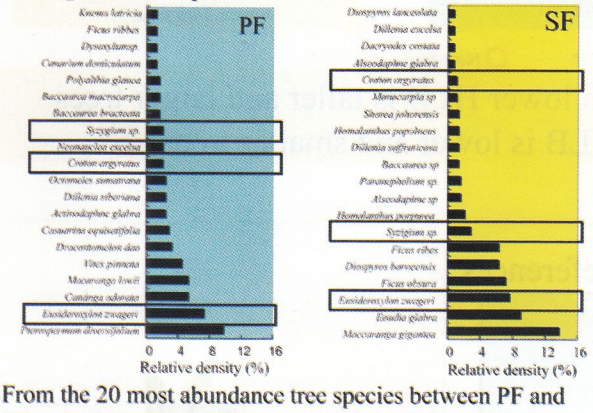


Vegetation survey (Tree DBH > 10 cm)	PF	SF	Total	*SSI*
Tree density (/ha)	244	377	-	-
Basal area (m^2/ha)	21.48	13.68	-	-
Number of species	86	107	148	0.47
Number of genera	62	72	88	0.69
Number of families	36	38	42	0.86

Forest structure differences

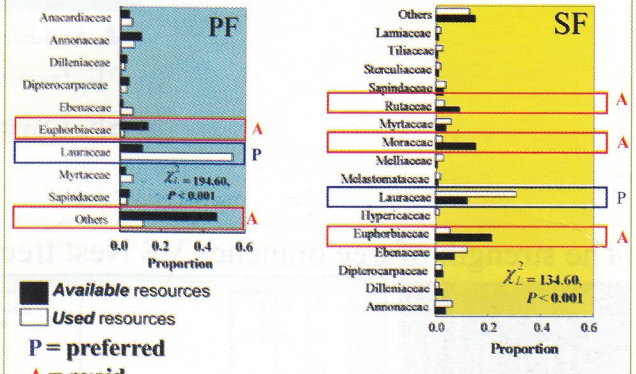
	KNP			Birawa			*t*-test	*P*-value
	n	Mean	SD	n	Mean	SD		
Vegetation Survey (Tree DBH > 10 cm)								
Height tree (m)	244	20.1	6.49	377	13.2	4.48	15.791	< 0.001
Tree diamater (cm)	244	28.9	17.43	377	19.3	9.21	7.556	< 0.001
Height lowest branch (m)	244	11.6	4.96	377	6.7	3.33	14.859	< 0.001
Nest survey								
Height nest-tree (m)	319	24.2	6.80	300	17.4	5.64	13.464	< 0.001
DBH of nest-tree (cm)	319	50.1	25.57	300	28.0	12.18	13.624	< 0.001
Height lowest branch (m)	319	9.2	6.16	300	8.3	4.54	2.540	0.039
Nest-site height (m)	423	18.7	6.26	437	14.0	4.53	12.751	< 0.001

Tree species compositions

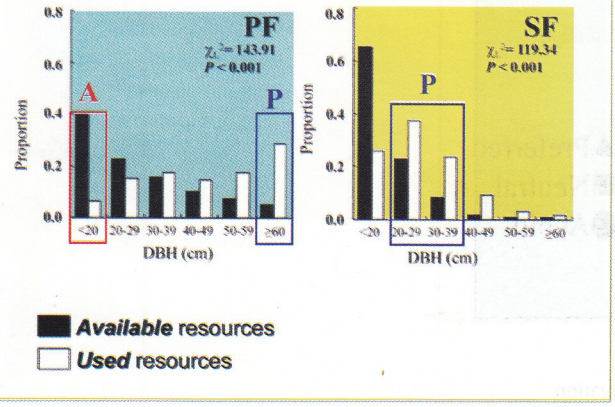


From the 20 most abundance tree species between PF and SF, only three tree species common in both forest

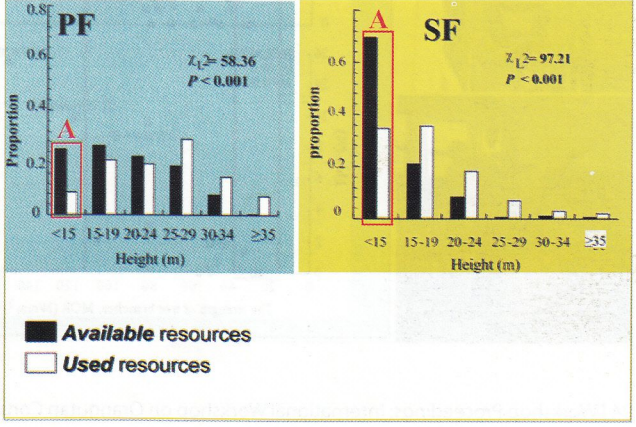
Nest-tree family preferences



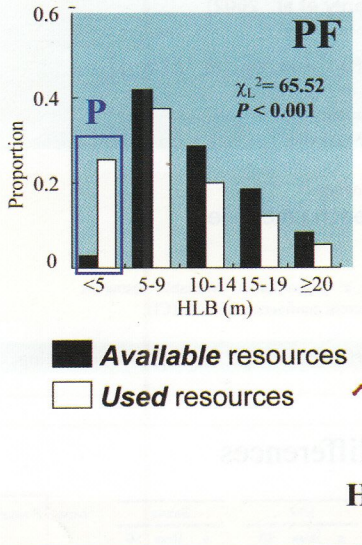
Tree diameter preferences



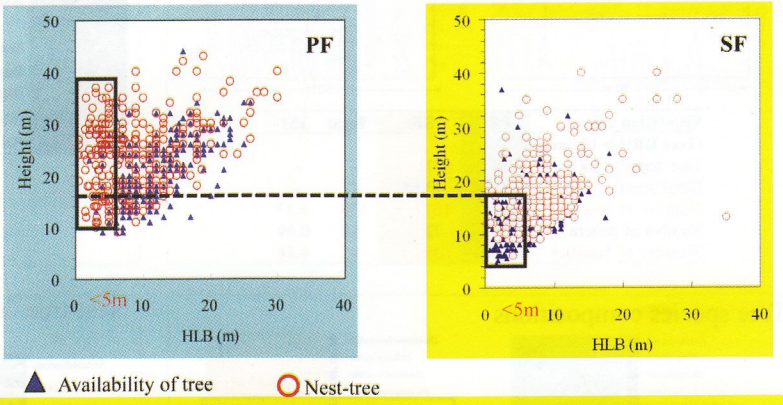
Tree height preferences



HLB Preferences

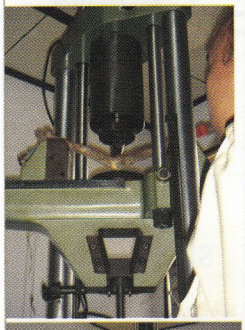


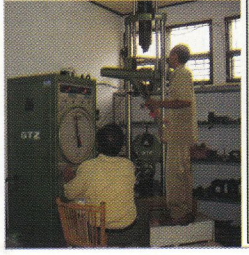
Height tree and HLB

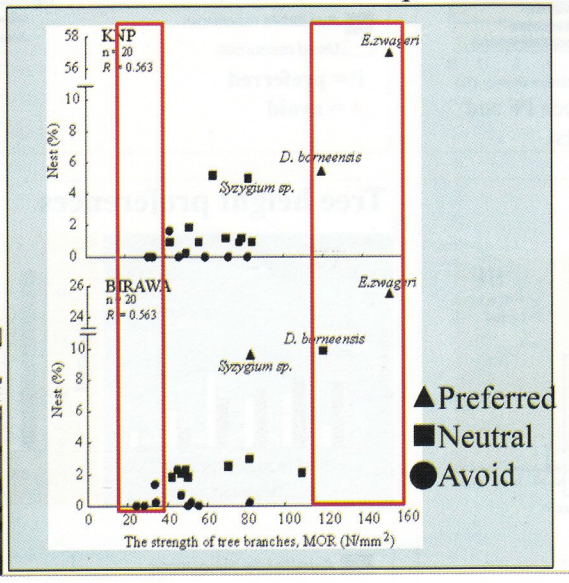


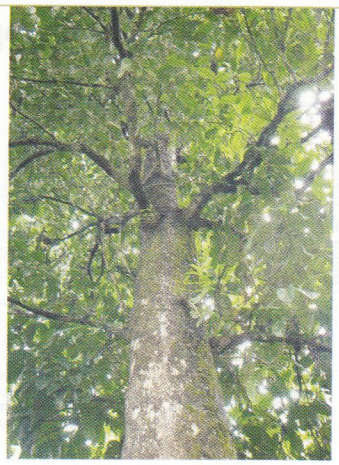
In PF, tree with lower HLB is taller and larger trees
In SF, lower HLB is lower and smaller trees

The strength of tree branches VS Nest tree preferences

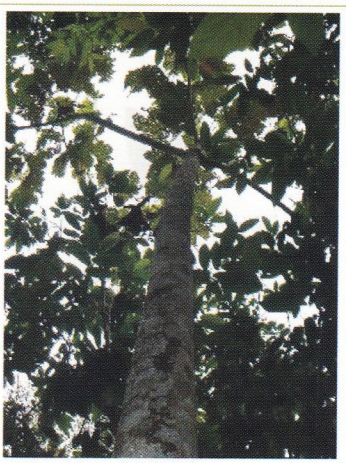








Lauraceae: Preferred
(*Eusideroxylon zwageri*)



Euphorbiaceae: Avoided
(*Macaranga gigantea*)

Factors on nest-tree species preferences

Exp. variables	PF RIV	PF *P*-value	SF RIV	SF *P*-value
HLB	0.516	0.141	0.377	0.832
Height	0.733	0.042	0.730	0.128
MOR	0.999	<.001	1	<.0001
Intercept		0.0003		0.0004

RIV = Relative importance of each variable
MOR = The strength of tree branches

The strength of tree branches are the most important variables for nest tree preferences in the PF and SF.

Estimation of population density

Nest density

$$d_{nest} = \frac{N}{L \times 2w}$$

Van Schaik et al., 1995

Nest density	PF	SF
Number of nest (*N*)	423	439
Transect (km) (*L*)	10.85	5.0
*Effective census width (w)(m	16.5	23.6
Nest density/km²	**1179.60**	**1860.10**
Lower 95% CI	976.1	1544.5
Upper 95% CI	1425.6	2240.2

*Software Distance 5.1 (Thomas et al 2006)

Orangutan density

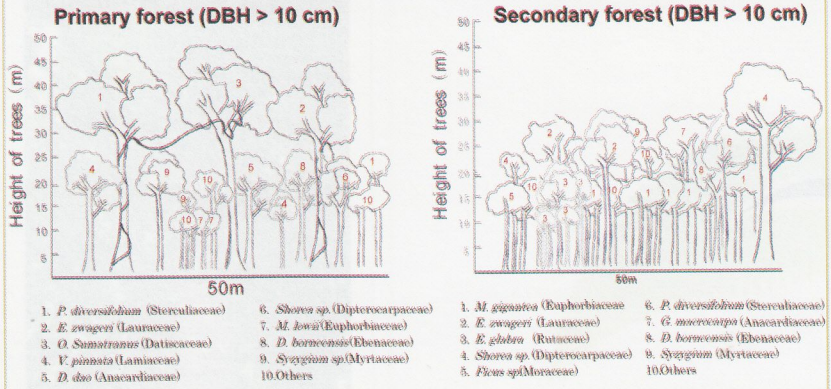
$$D_{OU} = \frac{D_N}{p \times r \times t}$$

Van Schaik et al., 1995

	PF	SF
Nest density D_N	1179.6	1860.1
[1].Proportion of nest builder,*p*	0.9	0.9
[2]Daily nest-building rate,*r*	1.08	1.08
[3]Nest decay time (*t* days)	602.49	602.49
D_{OU} Orangutans/Km²	**2.01**	**3.18**
Lower 95% CI	1.67	2.64
Upper 95% CI	2.43	3.83

1. Van schaik et al, 1995
2. Ancrenaz et al, 2004
3. Mathewson et al., 2008

Habitat quality in PF and SF

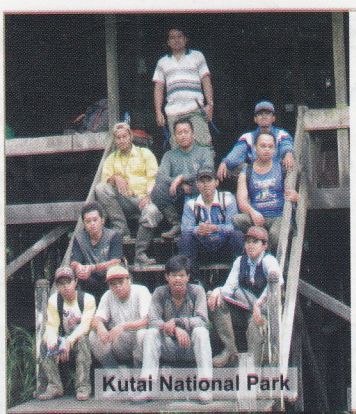


- In SF tree species as food resources (i.e. *M. gigantea, E. zwageri, Ficus, Syzigium* were still high)
- Orangutan relax their preference for nest tree in SF

Conclusions

There were different patterns in the nest site features and also nest-tree preferences between primary and secondary forest.

Protected and improving secondary forest from low quality to suitable quality of orangutan habitat is important aspect for orangutan conservations.



Acknowledgments

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