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Abstract # 5285: "ORANGUTAN NEST CHARACTERISTICS AND POPULATION DISTRIBUTION ACROSS ANTHROPOGENIC LANDSCAPES IN EAST KALIMANTAN: CONSEQUENCES FOR CONSERVATION" Submitted By Yaya Rayadin

1 Title and Text 2 First Author 3 Affiliations 4 Other Authors 5 Scientific Terms 6 Questions

ORANGUTAN NEST CHARACTERISTICS AND POPULATION DISTRIBUTION ACROSS ANTHROPOGENIC LANDSCAPES IN EAST KALIMANTAN: CONSEQUENCES FOR CONSERVATION

Y. Rayadin^{1,2} and S. N. Spehar³

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Borneo is increasingly characterized by a mix of plantations, coal mines, and logging concessions, interspersed with patches of natural forest. It was assumed that orangutans could not survive in such areas, but recent research reveals that these areas harbor substantial numbers of orangutans. Our team has carried out long-term research (2006-present) in three anthropogenic landscape types in East Kalimantan, Indonesia (forestry plantations, palm oil plantations, and coal mining concessions). This research utilizes nest surveys, camera trapping, and observations to reveal an overall picture of orangutan use of these areas. In anthropogenic habitats orangutans exhibit different nesting characteristics and nest and population density than in natural forest. In acacia, oil palm plantations, and reclamation forest in coal mining concessions, orangutans practice crop raiding (consuming the cambium of young *Acacia mangium* trees, the inner pulp of immature oil palm trees and young trees in reclamation forest); habitat use is driven by access to planted areas but orangutans also appear to rely heavily on patches of natural forest. Our findings reveal the importance of natural forest areas; orangutans that are isolated in small patches in heavily degraded areas must often be relocated to forest preserves. We are using these data to help companies develop orangutan management plans that can mitigate human-orangutan conflict and support orangutan survival in East Kalimantan, where much orangutan distribution falls outside of protected areas.

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Orangutans in a multifunctional landscape in East Kalimantan, Indonesia

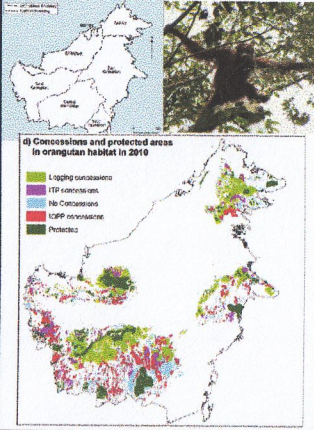
Yaya Rayadin^{1,2}
Stephanie Spehar³

¹Biodiversity Conservation Laboratory, Forestry Faculty, Mulawarman University, Indonesia, ² Ecology and Conservation Center for Tropical Studies (ECOSITROP), Indonesia, ³Antropology Program, University of Wisconsin Oshkosh

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Context

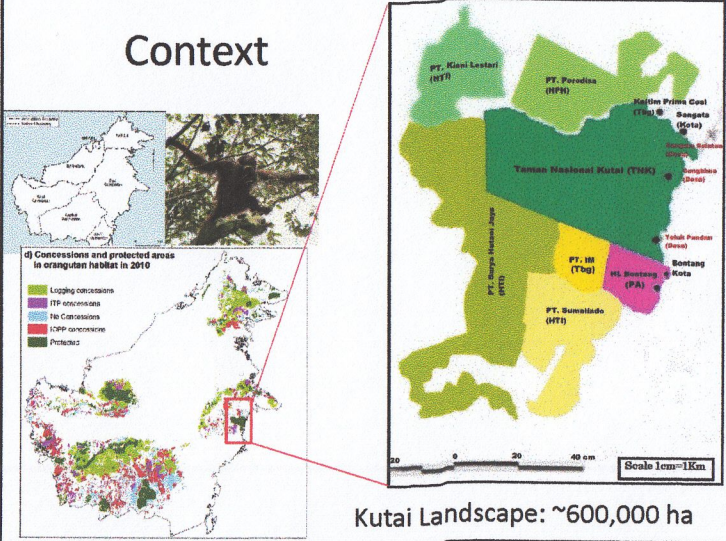


East Kalimantan, Indonesia:

- Northeastern Bornean orangutan (*Pongo pygmaeus morio*)
- 15% of total Bornean orangutan distribution
- Land use:
 - 23% protected areas
 - 32% logging concessions
 - 45% IOPP, ITP, production, or conversion forest

Wich et al. (2012) *PLoS ONE* 7(11): e49142.

Context



Kutai Landscape: ~600,000 ha

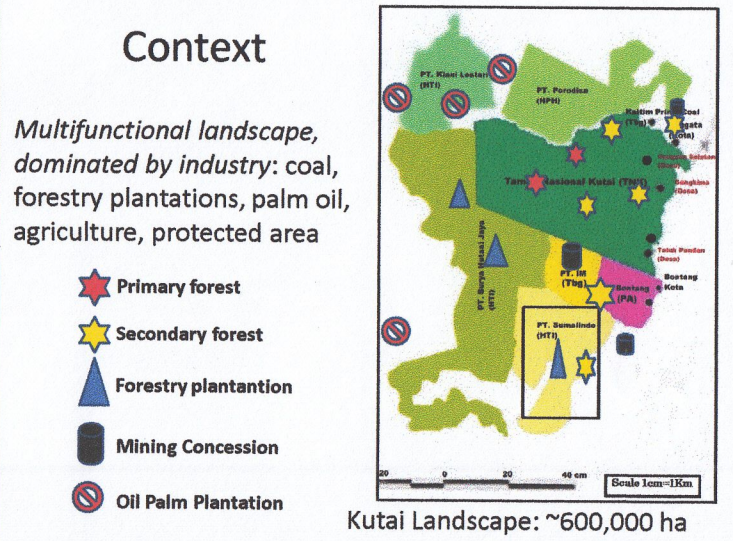
Legend:

- Logging concessions
- ITP concessions
- No Concessions
- IOPP concessions
- Protected

Labels on map: PT. Kian Lestari (ITP), PT. Parodisa (IOPP), Haldim Prima Coal (Tbk) (Mta), Taman Nasional Kutai (TNK), PT. IRI (Tbk), PT. Sumastada (ITP), Bontang Kota, Tahi Paudin (Desa), Sanghwa (Desa), Bontang Kota, PT. Sempurna Hutan Jaya (ITP).

Context

Multifunctional landscape, dominated by industry: coal, forestry plantations, palm oil, agriculture, protected area



Kutai Landscape: ~600,000 ha

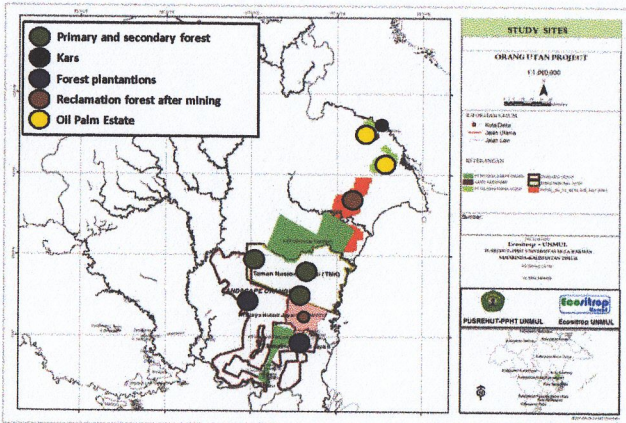
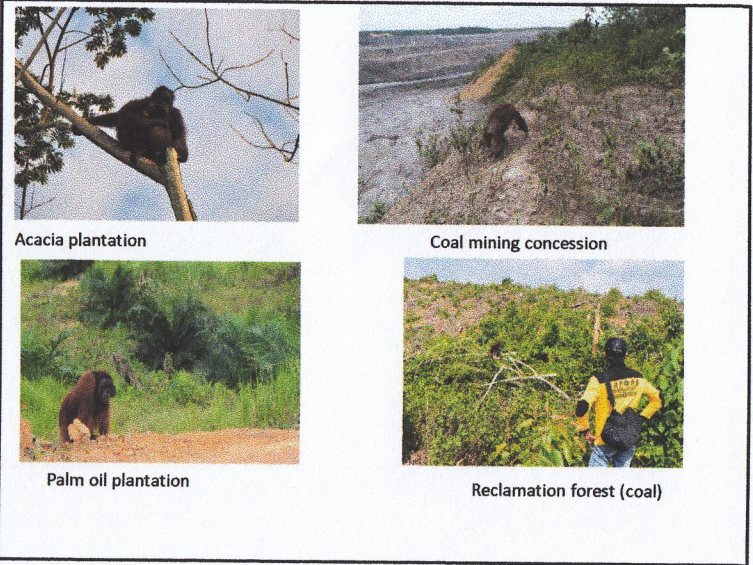
Legend:

- Primary forest
- Secondary forest
- Forestry plantation
- Mining Concession
- Oil Palm Plantation

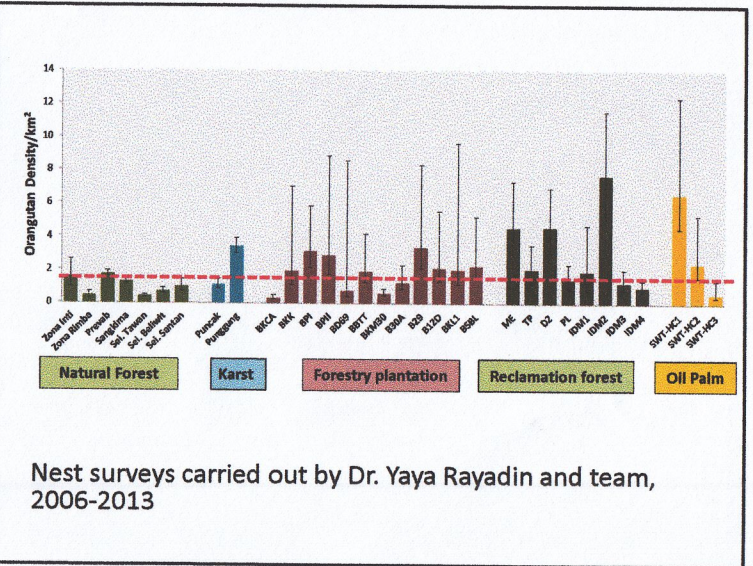
Labels on map: PT. Kian Lestari (ITP), PT. Parodisa (IOPP), Haldim Prima Coal (Tbk) (Mta), Taman Nasional Kutai (TNK), PT. IRI (Tbk), PT. Sumastada (ITP), Bontang Kota, Tahi Paudin (Desa), Sanghwa (Desa), Bontang Kota, PT. Sempurna Hutan Jaya (ITP), PT. Sema Inda (ITP).

Orangutans in the Kutai Landscape: What We Know

- Orangutans use this landscape extensively



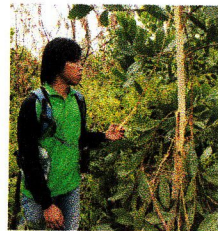
Nest surveys carried out by Dr. Yaya Rayadin and team, 2006-2013



Nest surveys carried out by Dr. Yaya Rayadin and team, 2006-2013

Orangutans in the Kutai Landscape: What We Know

- Orangutans use this landscape extensively
- Crop raiding and potential for conflict: estimated 30-50 young oil palms or 30-40 young acacia trees per indiv per day (Y. Rayadin, unpublished data)



Indonesia police arrest 2 in orangutan killings

Associated Press, Jakarta | Reuters | Wed, November 22 2011, 2:53 PM

National News
Abuse says share about 2nd year

Two Indonesian plantation workers have been arrested for allegedly killing at least 20 endangered orangutans and proboscis monkeys as a means of "pest control," police said Wednesday.

Arrested 2nd year
for 2nd year

Col. Amantus Wenu Surtita, a police spokesman, said the suspects admitted to cheating down the primates with dogs, then shooting, stabbing or hacking them to death with machetes.

Find of the
of the

The men allegedly sold authorities the owners of several palm oil plantations on Borneo island, eager to protect lucrative citrus from

Dr. Yaya Rayadin inspecting the exhumed bones of orangutans killed by oil palm plantation workers, Kutai Kertanegara, East Kalimantan, Nov 2011

Orangutans in the Kutai Landscape: What We Need to Know

Is this a viable long-term habitat for orangutans? What will it take to ensure the long-term survival of these populations?

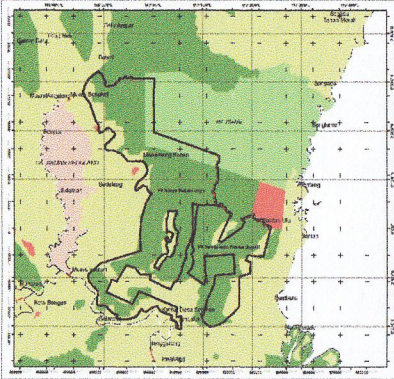
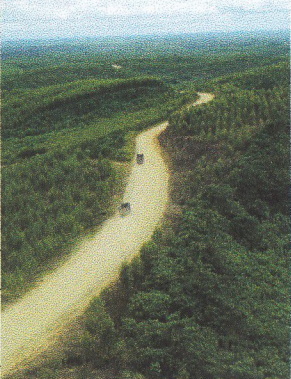
- Habitat use: where within these landscapes do they feed, build nests, travel? Relationship with protected areas (e.g., Kutai NP)?
- Diet and foraging strategies: Relative contribution of plantation crops and wild foods?
- Activity patterns?
- Long-term impacts on health and reproduction?

Current Focus

- Ecology of orangutans in a forestry plantation: habitat use, diet, nesting behavior, activity patterns, population structure, indicators of overall health
- Recommendations for management
- Sept 2012-ongoing
- This talk will discuss **preliminary** results and implications

Study Area

PT Surya Hutani Jaya & PT Sumalindo Hutani Jaya


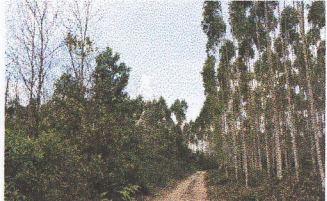

Acacia magnium plantations: 268,000 ha, or 2680 km²

Study Area


PT Surya Hutani Jaya & PT Sumalindo Hutani Jaya

Not homogenous! Major habitat types:


- *Acacia magnium*
 - Stands 0-7 years in age
- *Eucalyptus pelita*
- Secondary forest (~20%; 100-4000 ha in size)
 - Riverine corridors, conservation areas, buffer zone with Kutai NP


Eucalyptus 4 years



Secondary forest (Buffer zone TNK)



Acacia 7 years

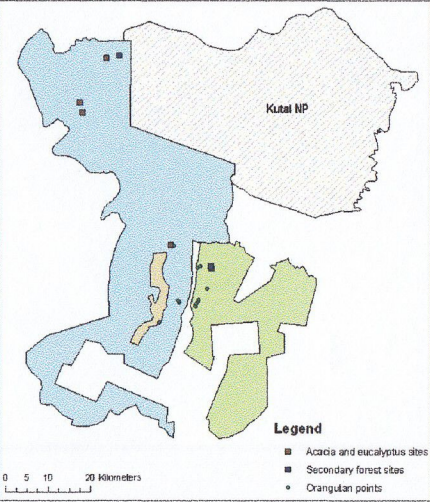


Acacia 2.5 years

Methods

- Camera trapping (Sept 2012-Mar 2013)
- Nest surveys (Sept 2012- Mar 2013)

Habitat type	camera trap arrays	nest transects
Secondary forest	3	3
<i>Acacia magnium</i>	8	6
Eucalyptus	3	2



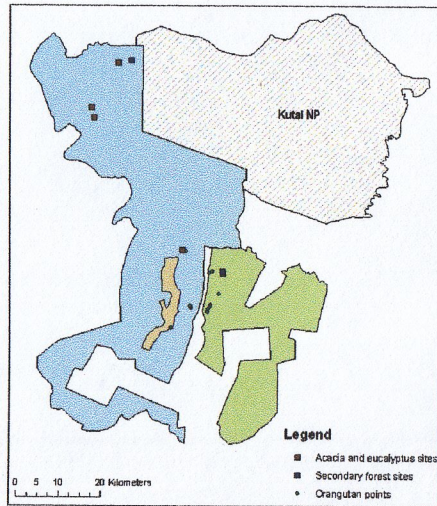
Legend

- Acacia and eucalyptus sites
- Secondary forest sites
- Orangutan points

0 5 10 20 kilometers

Methods

- Camera trapping (Sept 2012-Mar 2013)
- Nest surveys (Sept 2012- Mar 2013)
- Behavioral observations (May-Sept 2013)
- Relocations (2006-2013)

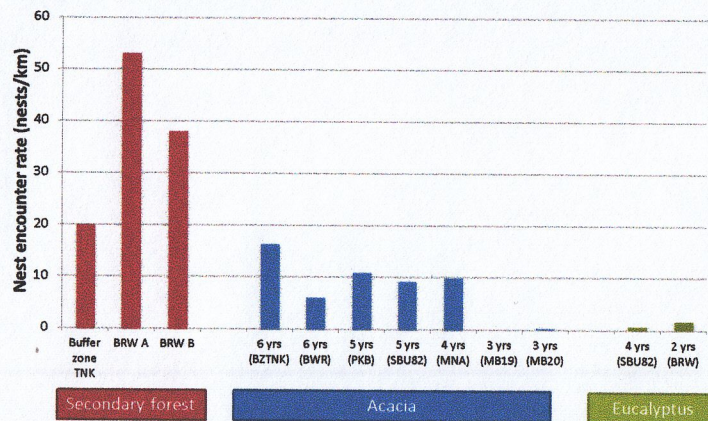


Results: Nest surveys



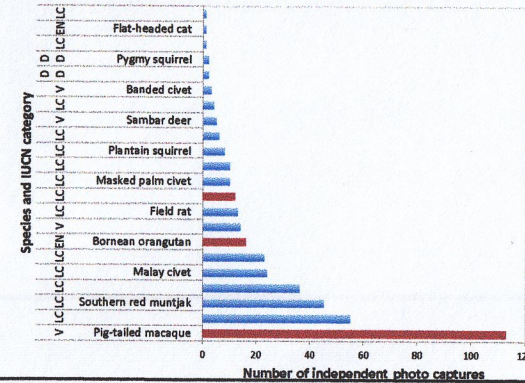
Site	Transect length (km)	Nest count
Secondary		
Buffer zone TNK	3	60
BRW A	1	53
BRW B	1	38
Acacia		
6 yrs (BZTNK)	3	49
6 yrs (BWR)	3	18
5 yrs (PKB)	3	33
5 yrs (SBU82)	3	28
4 yrs (MNA)	3	30
3 yrs (MB19)	3	0
3 yrs (MB20)	3	1
Eucalyptus		
4 yrs (SBU82)	3	2
2 yrs (BRW)	3	5

Nest encounter rate was highest in secondary forest and acacia >4 years

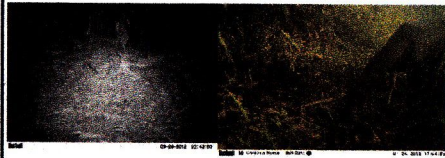


Results: Camera trapping

Over 3420 camera trap nights (# cameras x nights deployed), detected 22 mammalian species



Secondary forest had higher species richness (barely)....



Flat headed cat
Prionailurus planiceps



Sambar deer
Rusa unicolor

Prionailurus bengalensis

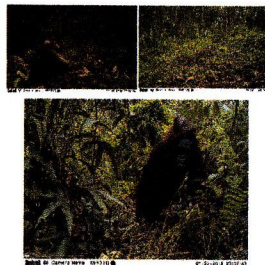
Habitat type	Sites	Camera trap nights	Species richness	As % total
Secondary forest	3	576	16	73%
Acacia	8	2174	15	68%
Eucalyptus	3	670	13	59%
Total		3420	22	100%

Species name	Common name	Secondary forest	Acacia	Eucalyptus
Scluridae				
<i>Callosciurus notatus</i>	Plantain squirrel	1		1
<i>Exilisciurus spp.</i>	Pygmy squirrel			1
Tupaillidae				
<i>Tupaia picta</i>	Painted treeshrew	1	1	
<i>Tupaia tana</i>	Large treeshrew		1	
<i>Tupaia minor</i>	Lesser treeshrew		1	
<i>Tupaia glis</i>	Common treeshrew		1	
Muridae				
<i>Rattus spp.</i>	Field rat	1	1	
Cercopitheidae				
<i>Macaca fascicularis</i>	Long-tailed macaque	1	1	1
<i>Macaca nemestrina</i>	Pig-tailed macaque	1	1	1
Pongidae				
<i>Pongo pygmaeus</i>	Bornean orangutan	1	1	1
Cervidae				
<i>Rusa unicolor</i>	Sambar deer	1	1	
<i>Muntiacus muntjak</i>	Southern red muntjak	1	1	1
Tragulidae				
<i>Tragulus napu</i>	Greater mouse deer	1	1	1
Suidae				
<i>Sus barbatus</i>	Bearded pig	1	1	1
Hystriidae				
<i>Hystrix brachyura</i>	Malayan porcupine	1	1	1
Viverridae				
<i>Paguma larvata</i>	Masked palm civet	1	1	1
<i>Herpestes semitorquatus</i>	Collared mongoose	1		1
<i>Hemigalus derbyanus</i>	Banded civet	1		
<i>Viverra zangalunga</i>	Malay civet		1	1
<i>Arctogalidia trivirgata</i>	Small-toothed palm civet			1
Felidae				
<i>Prionailurus bengalensis</i>	Leopard cat	1	1	
<i>Prionailurus planiceps</i>	Flat-headed cat	1		

But the species found within each habitat type vary

Species name	Common name	Secondary forest	Acacia	Eucalyptus
Scluridae				
<i>Callosciurus notatus</i>	Plantain squirrel	1		1
<i>Exilisciurus spp.</i>	Pygmy squirrel			1
Tupaillidae				
<i>Tupaia picta</i>	Painted treeshrew	1	1	
<i>Tupaia tana</i>	Large treeshrew		1	
<i>Tupaia minor</i>	Lesser treeshrew		1	
<i>Tupaia glis</i>	Common treeshrew		1	
Muridae				
<i>Rattus spp.</i>	Field rat	1	1	1
Cercopitheidae				
<i>Macaca fascicularis</i>	Long-tailed macaque	1	1	1
<i>Macaca nemestrina</i>	Pig-tailed macaque	1	1	1
Pongidae				
<i>Pongo pygmaeus</i>	Bornean orangutan	1	1	1
Cervidae				
<i>Rusa unicolor</i>	Sambar deer	1	1	
<i>Muntiacus muntjak</i>	Southern red muntjak	1	1	1
Tragulidae				
<i>Tragulus napu</i>	Greater mouse deer	1	1	1
Suidae				
<i>Sus barbatus</i>	Bearded pig	1	1	1
Hystriidae				
<i>Hystrix brachyura</i>	Malayan porcupine	1	1	1
Viverridae				
<i>Paguma larvata</i>	Masked palm civet	1	1	1
<i>Herpestes semitorquatus</i>	Collared mongoose	1		1
<i>Hemigalus derbyanus</i>	Banded civet	1		
<i>Viverra zangalunga</i>	Malay civet		1	1
<i>Arctogalidia trivirgata</i>	Small-toothed palm civet			1
Felidae				
<i>Prionailurus bengalensis</i>	Leopard cat	1	1	
<i>Prionailurus planiceps</i>	Flat-headed cat	1		

Only 9 mammalian species (36%), including orangutans, detected in all habitat types

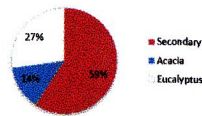


Species name	Common name	Secondary forest RAI	Acacia RAI	Eucalyptus RAI
Scluridae				
<i>Callosciurus notatus</i>	Plantain squirrel	0.661	0.00	0.493
<i>Exilisciurus spp.</i>	Pygmy squirrel	0.000	0.000	0.298
Tupaillidae				
<i>Tupaia picta</i>	Painted treeshrew	3.219	0.099	0.000
<i>Tupaia tana</i>	Large treeshrew	0.000	0.181	0.000
<i>Tupaia minor</i>	Lesser treeshrew	0.000	0.069	0.000
<i>Tupaia glis</i>	Common treeshrew	0.000	0.375	0.000
Muridae				
<i>Rattus spp.</i>	Field rat	0.397	0.338	0.149
Cercopitheidae				
<i>Macaca fascicularis</i>	Long-tailed macaque	0.132	0.168	1.149
<i>Macaca nemestrina</i>	Pig-tailed macaque	7.084	3.193	1.970
Pongidae				
<i>Pongo pygmaeus</i>	Bornean orangutan	1.367	0.240	0.657
Cervidae				
<i>Rusa unicolor</i>	Sambar deer	0.397	0.084	0.000
<i>Muntiacus muntjak</i>	Southern red muntjak	1.293	1.280	1.627
Tragulidae				
<i>Tragulus napu</i>	Greater mouse deer	5.703	0.300	1.642
Suidae				
<i>Sus barbatus</i>	Bearded pig	0.735	0.375	0.149
Hystriidae				
<i>Hystrix brachyura</i>	Malayan porcupine	3.410	0.227	1.298
Viverridae				
<i>Paguma larvata</i>	Masked palm civet	1.014	0.124	0.149
<i>Herpestes semitorquatus</i>	Collared mongoose	0.132	0.000	0.164
<i>Hemigalus derbyanus</i>	Banded civet	0.544	0.000	0.000
<i>Viverra zangalunga</i>	Malay civet	0.000	0.618	1.683
<i>Arctogalidia trivirgata</i>	Small-toothed palm civet	0.000	0.000	0.149
Felidae				
<i>Prionailurus bengalensis</i>	Leopard cat	0.265	0.150	0.000
<i>Prionailurus planiceps</i>	Flat-headed cat	0.132	0.000	0.000

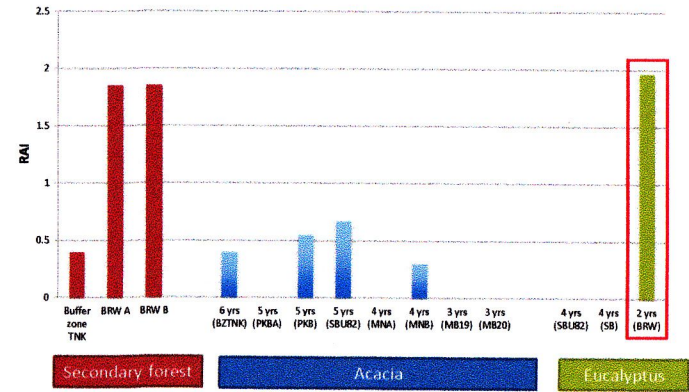
Relative abundance index (RAI) = captures/camera trap nights x 100

Species name	Common name	Secondary forest RAI	Acacia RAI	Eucalyptus RAI
Scleridae				
<i>Parionomys notatus</i>	Manabak squirrel	0.963	0.900	0.495
<i>Exiliscirus</i> spp.	Pygmy squirrel	0.000	0.000	0.298
Dipodidae				
<i>Parupa pata</i>	Painted tree-shrew	3.215	0.095	0.000
<i>Dipodops tana</i>	Large tree-shrew	0.000	0.181	0.000
<i>Dipodops minor</i>	Lesser tree-shrew	0.000	0.069	0.000
<i>Dipodops giles</i>	Common tree-shrew	0.000	0.375	0.000
Meridae				
<i>Sorex spp.</i>	Shrew	0.397	0.938	0.149
Cercopitheciidae				
<i>Macaca fascicularis</i>	Long-tailed macaque	0.132	0.168	1.149
<i>Macaca leonina</i>	Lighted macaque	7.086	3.453	1.570
Primate				
<i>Presbytis pygmaea</i>	Sumatran orangutan	1.367	0.243	0.437
Cervidae				
<i>Busa ambly</i>	Sambar deer	0.957	0.084	0.000
<i>Muntiacus muntjak</i>	Southern red muntjak	1.293	1.280	1.627
Tragulidae				
<i>Tragulus nabi</i>	Crested mouse deer	5.705	0.300	1.542
Suidae				
<i>Sus barbatus</i>	Bearded pig	0.755	0.375	0.149
Hystriidae				
<i>Hystrix brachyura</i>	Malayan porcupine	3.410	0.227	1.198
Viverridae				
<i>Paruma larvata</i>	Musked palm civet	1.014	0.124	0.149
<i>Herpestes semitorquatus</i>	Collared mongoose	0.132	0.000	0.164
<i>Semigaleus derbyanus</i>	Sandrat civet	0.544	0.000	0.000
<i>Viverra zanglana</i>	Malay civet	0.000	0.618	1.683
<i>Arctogalidia trivirgata</i>	Small-toothed palm civet	0.000	0.000	0.149
Felidae				
<i>Prionailurus bengalensis</i>	Leopard cat	0.265	0.150	0.000
<i>Prionailurus planiceps</i>	Flat-headed cat	0.132	0.000	0.000

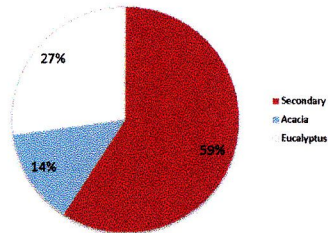
Percentage of species with highest RAI in each habitat type



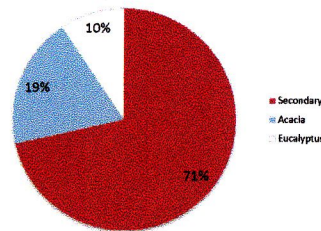
RAI for orangutans across habitat types shows similar patterns to nest surveys, except for eucalyptus site that directly abutted secondary forest



Percentage of species with highest RAI in each habitat type



Eucalyptus plot BRW included

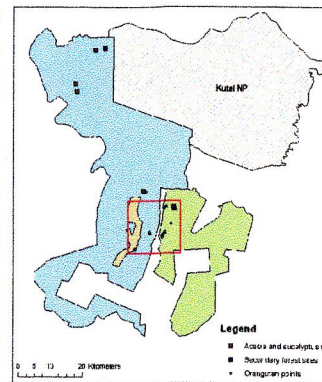


Eucalyptus plot BRW excluded

Implication: proximity to secondary forest key

Results: Behavioral observations

- 600 hours logged
- 62 hours of observation



Study area: ~75 km²

Indiv	Age/Sex Class	Days sited/followed
FEMALES		
T&T	Adult + juv male	4
R&R	Adult + juv male	1
C	Adult	1
M	Subadult	2
MALES		
K	Unflanged adult	1
I	Unflanged adult	5
AK	Subadult	5
W	Flanged adult	3
T	Flanged adult	1
G	Flanged adult	1

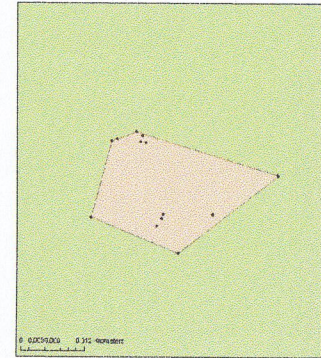
Preliminary impressions:

- Ranging and grouping influenced by secondary forest and fruiting trees
- Generally small ranges but move longer distances when resources depleted
- Eucalyptus used only when near secondary forest or acacia
- More resting, frequent day nests
- Move frequently on ground



Example: Ipin (unflanged AM)

- 3 day follow covered 0.29 ha
- Restricted ranging to immediate vicinity of large fruiting tree
- 3 other individuals (adult female and infant, subadult female, subadult male) fed in the same tree
- Subsequent observations within 500 m

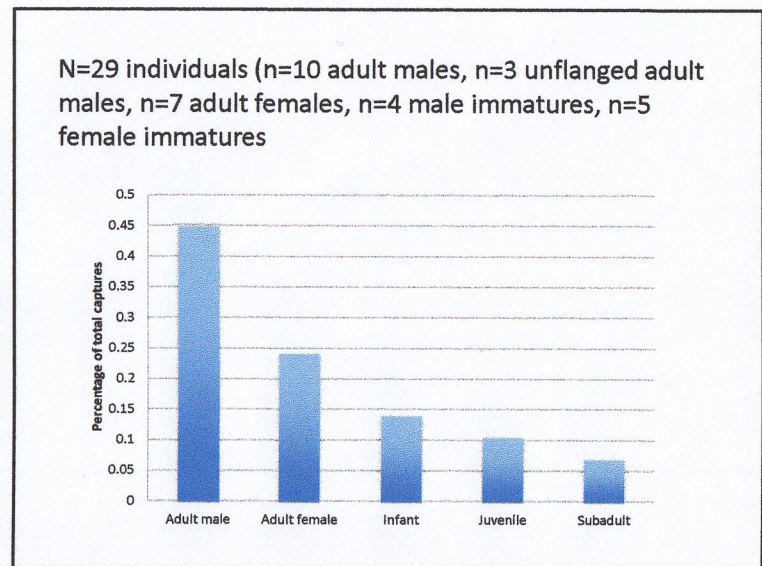
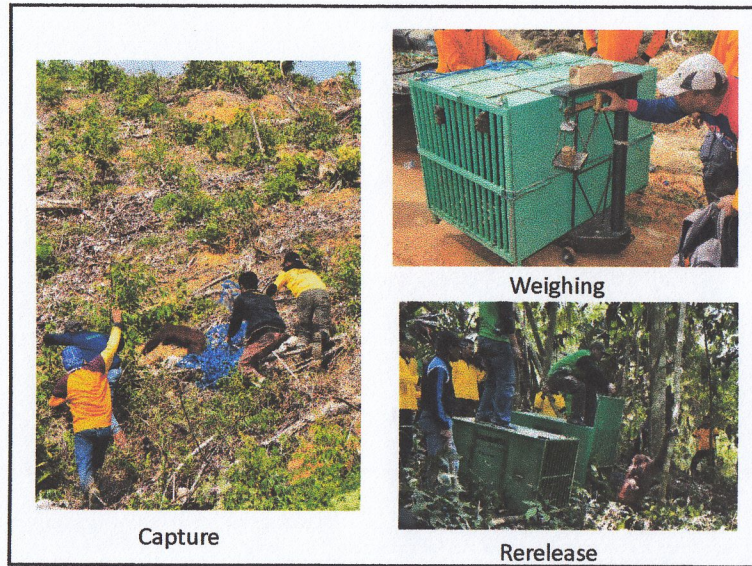


Results: Relocations

- Across larger landscape: oil palm and acacia plantations, 2006-2013
- "Stranded" orangutans



Orangutan rescue teams established by Dr. Yaya Rayadin



Comparison to Markham & Groves (1990)

- lower mean weights (14.7% for flanged adult males and 7.6% for adult females)
- but higher range

Flanged adult males				Adult females			
Study	N	Range	Mean	Study	N	Range	Mean
MG	4	80-91	86.3	MG	5	33-45	38.3
This study	10	58-97	70.6±10.72	This study	7	25-48	35.38±7.32

ID	Weight (kg)	Age	Habitat	Juvenile
Flanged adult males				
Je	58	30 to 35	FP	N/A
Ha	62	18 to 22	OP	N/A
Kl	68	25 to 30	OP	N/A
Tl	69	30 to 35	OP	N/A
Ka	74	26 to 30	OP	N/A
Kr	75	26 to 30	FP	N/A
Yo	76	26 to 28	OP	N/A
Jo	78	25 to 30	OP	N/A
Sa	79	25 to 30	OP	N/A
Su	97	25 to 30	FP	N/A
Mean	73.6			
Unflanged adult males				
El	38	18 to 22	OP	N/A
Ph	51	20 to 25	OP	N/A
Nu	58	20 to 25	FP	N/A
Mean	49			
Adult females				
Rl	25	18 to 22	FP	Rr
De	29	15 to 20	FP	Dr
Ka	35	10 to 15	OP	Kl
Re	35	12 to 15	FP	Rn
Nn	36	15 to 20	FP	Na
Bo	39	25 to 30	OP	Br
Ro	48	25 to 30	OP	Rs
Mean	35.29			



Unflanged male Elvis: 38 kg, isolated in small patch for ~ 6 months

Many remaining questions

- Further analysis of the influence of secondary forest on habitat use
- Movement in and out of Kutai NP
- Detailed information on foraging strategies, including relative importance of cultivated vs wild resources
- Social interactions: does ability to monopolize and exploit resources influence individual "success" in landscape?
- influence on health: Nutrition, stress, disease

Takeaway

- Plantation is primary habitat for orangutans of all age-sex classes
- Use all habitat types, but presence of both 1) secondary forest patches and 2) acacia >2 years most important determinant of habitat use
- Connectivity is crucial



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Thank you to:

- Erik Meijaard and Marc Ancrenaz
- Research assistants: Kara Norby, Nikki Thurley, Kat Scott
- Ecositrop Team and Mulawarman University, Samarinda
- Management of PT Surya Hutani Jaya & PT Sumalindo Hutani Jaya
- RISTEK
- Funding: Arcus Foundation, Ecositrop, UW Oshkosh