Monitoring the Outcomes of Rehabilitation and Reforestation for Biodiversity Conservation

Rachmat Budiwijaya Suba, Chandradewana Boer, Sutedjo
Forestry Faculty of Mulawarman University Samarinda, East Kalimantan

Content:

- Background and Objectives
- Methodology
- Results (The occurrence of Large Mammals in the Sebulu Experimental Forest)
- Conclusions and Future Directions

Background problem

- The main goals of rehabilitation and reforestation schemes in Indonesia ideally are addressed the problems of land degradation, environmental recovery, and habitat restoration
- Even a well-managed rehabilitation area has been performed, the valuation of its success is problematic
- Some projects only reported technical and organizational outcomes, such as area planted and labor-days expanded
- There has never been a formal scheme to monitor the progress of rehabilitated sites that would inform us about progressive changes in land cover and their possible implication for biodiversity



Background concept (ecological point of view)

- Following the time, habitat heterogeneity in rehabilitation areas occurs over time and space showed by better land coverage
- Wild animal species will respond to the running habitat changes in various ways, as resources also become available
- Information about selected species in this area could function as a baseline for biodiversity data which could be periodically monitored

Background (objectives)

 This study is meant to acquire information about the presence of selected group of wild animal species and inform their ecological characteristics in order to understand habitat development within rehabilitation sites → can be an indicator for the success of rehabilitation effort

Methodology



- Observation of some selected species is considered to be sufficient to make an analysis which is based on ecological knowledge on selected species that could reflect the progress of rehabilitation areas (large mammals)
- Large mammals → direct observation, signs searching and camera trapping

The occurrence of large mammals in the Sebulu Experimental Forest

Species	Common name
Order: PRIMATES	
Family: CERCOPITHECIDAE	
Macaca fascicularis	Crab-eating Macaque, Cynomolgus Monkey, Long-tailed Macaque
Macaca nemestrina	Pig-tailed Macaque
Family: HOMINIDAE	
Pongo pygmaeus morio	Northeast Bornean Orangutan
Order: RODENTIA	
Family: HYSTRICIDAE	
Hystrix brachyura	Malayan Porcupine
Order: CARNIVORA	
Family: VIVERRIDAE	
Viverra tangalunga	Malay Civet
Paradoxurus hermaphroditus	Common Palm Civet
Hemigalus derbyanus	Banded Civit, Banded Palm Civet

The occurrence of large mammals in the Sebulu Experimental Forest

Species	Common name
Family: HERPESTIDAE	
Herpestes brachyurus	Short-tailed Mongoose
Family: FELIDAE	
Prionailurus bengalensis	Leopard Cat
Order: CETARTIODACTYLA	
Family: SUIDAE	
Sus barbatus	Bearded Pig
Family: TRAGULIDAE	
Tragulus kanchil	Lesser Oriental Chevrotain, Lesser Malay Chevrotain,
	Lesser Mousedeer, Mouse Deer
Tragulus napu	Greater Oriental Chevrotain, Greater Mousedeer,
	Larger Malay Chevrotain, Larger Mousedeer, Napu
Family: CERVIDAE	
Muntiacus muntjak	Barking Deer, Bornean Red Muntjac, Sundaland Red
	Muntjac
Rusa unicolor	Sambar Deer





Pig-tailed macaque (Macaca nemestrina)

- The density of *Macaca fascicularis* could temporarily increase and tend to invade early successional forest (Johns & Johns 1995)
- Macaca nemestrina are less commonly observed in the slightly disturbed forest compared to the undisturbed forest (Meijaard et al. 2005)



Long-tailed macaque (Macaca fascicularis)

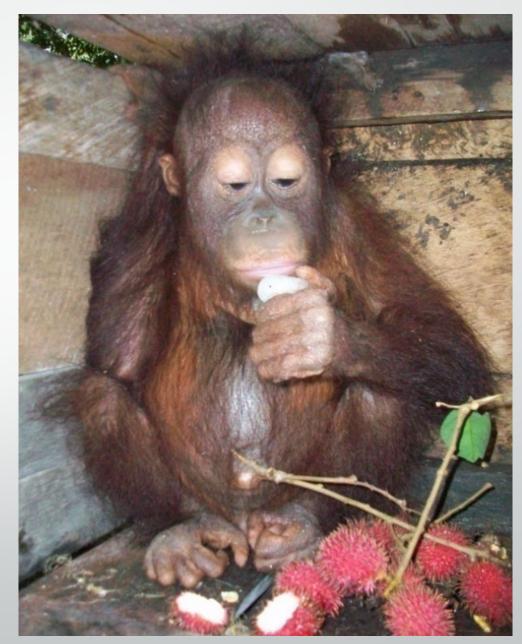


Primates

- The ability to change the relative proportions of different food types in the diet, specifically to exploit available young leaves in the absence of fruit (Meijaard et al. 2005)
- The degree of terrestriality (Meijaard et al. 2005), where most Old World Monkey species (incl. macaques) capable of colonizing secondary forest are at least semi-terrestrial inhabits, which must facilitate survival in small patches
- Macaques are opportunistic feeders and take a much more full range of foods in their diet than most monkey species; they occupy a broad niche (MacKinnon et al. 1996)



- Orangutan population has attempted to occupy and survive in the 'artificial' habitats which have been modified by humans such as rehabilitation areas
- The Orangutan presence in SEF has shown the fact that the area is part of Orangutan's remaining range and as a refugee when Orangutan's habitats have been destroyed and converted into oil-palm plantations







- SEF is one of Orangutan's remaining habitat, although, the quality itself is still questionable as habitat. The area are connected with some villagers' fruit plantation
- Some fruits that have been planted are durians *Durio zibethinus*, rambutans *Nephelium lappaceum*, mangoes *Mangifera indica* and *kelengkengs Litchi chinensi*, and they are considered as important foods of Orangutan. Orangutan attack the fruit plantation when mass fruiting period comes



Rodentia

- Porcupine is considered to be the most dispersed rodent species across their habitat, both in natural covers and cultivated areas
- They had never encountered in the plantation forest in two sampling occasion.
 This occurrence seems to correlate with food abundance. They mainly consume fallen fruits (Payne et al. 1985)



Malayan porcupine (Hystrix brachyura)



Carnivora



Leopard Cat (*Prionailurus bengalensis*)

- The Leopard Cat is the most frequently recorded small cat across most of its wide range (Sanderson et al. 2008), but secondary forest might be the preferred habitat of the Leopard Cat (Santiapillai & Supraham 1985)
- Among other small Asian felids, the Leopard Cat is more tolerant of disturbed areas. It can inhabit areas with human settlements. It is also a generalist, feeding on the most available prey.
- Higher survival rates (92%) were recorded in a protected area with little human influence, compared with lower rates in areas with greater human activity (53-82%) (Sanderson et al. 2008)



Malay civet (Viverra tangalunga)



Banded palm civet (Hemigalus derbyanus)



Common palm civet (Paradoxurus hermaproditus)



Short-tailed mongoose (Herpestes brachyurus)



Carnivora

- Some species of Viverridae represent more opportunistic predator group. Despite their taxonomic status within the Carnivora, some civets feed almost exclusively on fruit, generally favoring sugar-rich and softpulped fruit (Heydon & Bulloh 1996; Rabinowitz 1991)
- Short-tailed mongoose *Herpestes brachyurus* has wide distribution, presumed large population, tolerance to some degree of habitat modification (Widmann et al. 2008). It is found near rivers, in lowland primary and secondary forest and plantations (Payne et al. 1985; Heaney et al. 1998)





Cetartiodactyla

- Four species of ungulates that were detected in research area are common in a plantation, secondary forest, forest edges, riverbanks, grassy clearings, secondary scrub and open farmlands (Nowak 1999).
 They can inhabit in both open and dense interior forest. They can be categorized by general feeding behavior and habitat selection
- Both species of mouse-deer are mainly dependent upon the fallen fruit of strangling figs (*Ficus* spp.), although they also feed on other items, such as leaves (e.g., *Octomeles sumatrana*) or mushrooms (*Russula* sp.) (Matsubayashi et al. 2003).



Cetartiodactyla

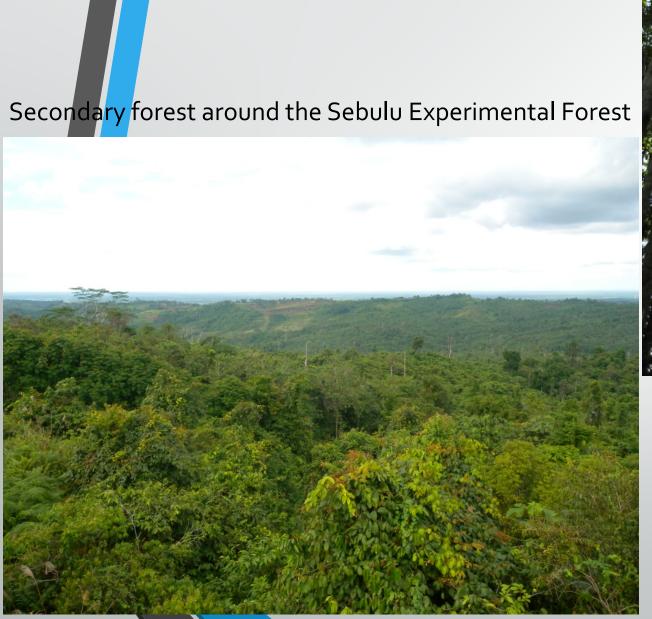
- The Bornean Red Muntjak feeds primarily on fruits and browse, being selective for plant parts, and remain within one or a few vegetation types throughout the year
- Sambar deer are generalist grazers and browsers that feed on a range of grasses and plant parts. They appear to be a species that benefits from forest conversion (Meijaard et al. 2005 and Payne et al. 1985)
- Bearded Pigs Sus barbatus utilize a wide variety of habitat types.

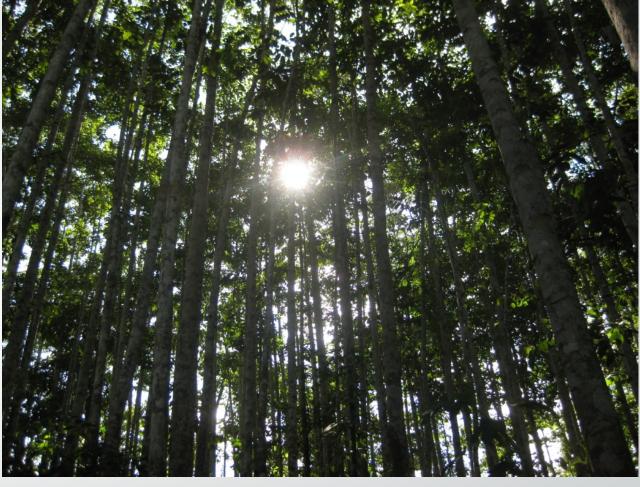
Conclusions

- Vegetative growth in the rehabilitation area provides multiple niches and habitat components for particular fauna populations, but any species may or may not come back upon restoration of the habitat, depending on the ecology of that species
- Generally, they mostly are omnivore and generalist with wide range of ecological amplitude. These characteristics seem to be the factors that make them could occupy the rehabilitation area (Sebulu Experimental Forest)
- When they start to occupy the areas is a critical point that indicates their response to habitat change.

Future Directions

- Rehabilitation areas could be a good model in studying the response of large mammal species, populations, and communities to dynamic conditions. Future research could emphasize the high ecological value of retaining remnant forest patches within highly human-dominated and managed landscapes for large mammals by:
 - Examine forest connectivity and the opportunities provided by rehabilitation techniques
 - Investigate the spatial distribution and size of wildlife source and sink areas;
 what inhibits and encourages the movement of particular species into post-rehabilitation
 - Consider the forest-agriculture boundary, its impact on wildlife, and how people view and respond to wildlife





Interior situation under the stand of *Shorea* spp.

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Thank You