Bird Seed Dispersal and Restoration of the Sundaland Biodiversity Hotspot in Sumatra

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by
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SUMMARY

Eleven transects had been carefully selected to represent various secondary forest gradation in the study site. At each transect there were 11 point which was 200 m apart. These points were the data collection point for both the bird and habitat survey. The bird and habitat survey for the first season was conducted between October and December 2011. Approximately 150 bird species had been recorded but the final figure will wait after full identification of bird recordings taken during the survey. Four transects were selected for the seed trap survey (transects no 2, 4, 7 and 12). At each transect, seed traps were placed in the first four points on each transects (10 seed traps per point). In total I used 160 seed traps. The germination experiment was implemented for *Polyalthia* spp., where seed collected from under the fruiting trees and germinated in seven different locations to represent habitat degradations.

INTRODUCTION

In Southeast Asia, the tropical rainforest and its associated biodiversity is disappearing fast, and this is threatened the continuous existence not only the forest but also other biodiversity that live within the tropical forest (Sodhi *et al*., 2004). Asian tropical forest is unique as, for instance, it has many groups of birds that are more diverse in this region than elsewhere (Corlett, 2007). Together with other tropical forest in the world, tropical forest covers only 10% of the Earth land surface but it has 50-60% of world's species (Dirzo & Raven 2003).

Indonesia, with about 138 million ha or 10% of the world's remaining tropical forests, holds one of the largest areas of tropical forest of any country. Approximately 60 million ha of Indonesia's forests are classified as production forest, and many of these forests have been degraded and/or fragmented. Besides that, there is a tendency that secondary forest and heavily logged forest will most likely to be converted to oil-palm monoculture (Fitzherbert *et al.,* 2008). It was estimated that, under a business-as-usual scenario, 14 million ha of production forest could be lost or seriously degraded by 2030 (IFCA Consolidation Report, 2008). In 2004, the Indonesia Ministry of Forestry issued legislation for a new type of forestry license in production forests – namely a license for ecosystem restoration. This license is granted for up to 95 years and requires the holder to protect and restore the forest ecosystem. As logging is forbidden, the holder is required to find income from alternative sources. This is a good opportunity for these forests to "recover" and be managed sustainably in the future (e.g. extension of the cutting cycle and reducing the logging effect on residual stands (Sianturi & Kanninen, 2006).

Animal seed dispersers play an important role in delivering propagules to other part of the forest and or disturbed areas (Muscarella & Flemming 2007), and is defined as the removal and deposition of viable seeds away from parent plants (Nathan & Muller-Landau, 2000). Poor seed dispersal has been considered as a major limiting factor for forest recovery (Wunderle Jr., 1997; Ruiz-Jaen & Aide, 2005; Babweteera & Brown, 2008), hence understanding the current seed dispersal system that is still operating in the intended restoration area will greatly help in deciding what type of intervention (e.g. intensity of planting, type of species to be planted) that is needed to be implemented in a particular site.

Plant species have evolved several different mechanisms of seed dispersal to achieve dispersal from the mother plant including anemochory (wind-dispersed), hydrochory (water-dispersed), barochory (gravity-dispersed), autochory (self-dispersal by explosion), and zoochory (animal-dispersed, Wilson & Traveset, 2000). Within this variation of mechanism, promoting animal seed dispersal has the potential to speed up restoration process (Corlett & Hau 2000, Forest Restoration Research Unit, 2008). Among vertebrates, birds and mammals are probably the most important seed dispersers in terms of the number of dispersed seeds (Stiles, 2000). This dispersal mechanism can play a crucial role in the maintenance of species diversity in a plant community (Levey *et al.* 2002).

Many studies have shown that anthropogenic disturbances, such as logging and/or forest fragmentation, can impact the frugivore bird abundance and composition; hence influence the pattern of seed dispersal and plant regeneration (Moran *et al.* 2010, Lehouck *et al.* 2010, Meijaard *et al.*, 2005). A recent study by Garcia *et* al*.* (2010) in three different temperate ecosystems (secondary forest, shrublands and mature forest) revealed that frugivore bird abundance is a good indicator on the degree of seed dispersal. They also found that even in the degraded habitat the bird visitation was still intense, thus these habitats still received disperse seeds. A similar pattern was also found in the tropical rainforest system where seeds were seeds are still being dispersed into disturbed/degraded area but with lower intensity due to decrease in visitation rate of particularly frugivore (Babweetera & Brown, 2008). However, even within the same frugivorous guild there will also difference in their contribution as seed dispersers to the future reproduction of a given plant (Schupp, 1993). In this sense, the seed delivered can also be an indication of the plant resources available within that area; hence one may want to introduce native tree species that are not present in the delivered seeds. In short, as suggested by Hobbs (2007) that it is important to identify when ecological system can recover unaided and when they require active restoration efforts.

The aim of this study is to assess the natural bird seed dispersal in assisting the restoration of secondary lowland rainforest in Sumatra, Indonesia, with the specific objectives of:

1. To document patterns of bird seed disperser assemblages in various types of secondary forest.
2. To quantify seed rain in various types of secondary forest under several different types of microhabitats (What seeds are dispersed and where);
3. To quantify the germination success of dispersed seeds in various types of secondary forest.

PROJECT DESIGN AND METHODOLOGY

The study will be conducted in the Harapan Rainforest, and will cover three secondary forest types (young, intermediate, and old) in order to capture bird-habitat relationship and seed dispersal at each forest type (Figure 1). At each forest type four 2 km transects will be used (total 12 transects), each transect will be placed at least 1 km apart to avoid spatial autocorrelation. All survey data collection will be conducted on these transects. The study will be conducted between Sept 2011 and August 2012 in order to capture seasonal variations in seed dispersal service.

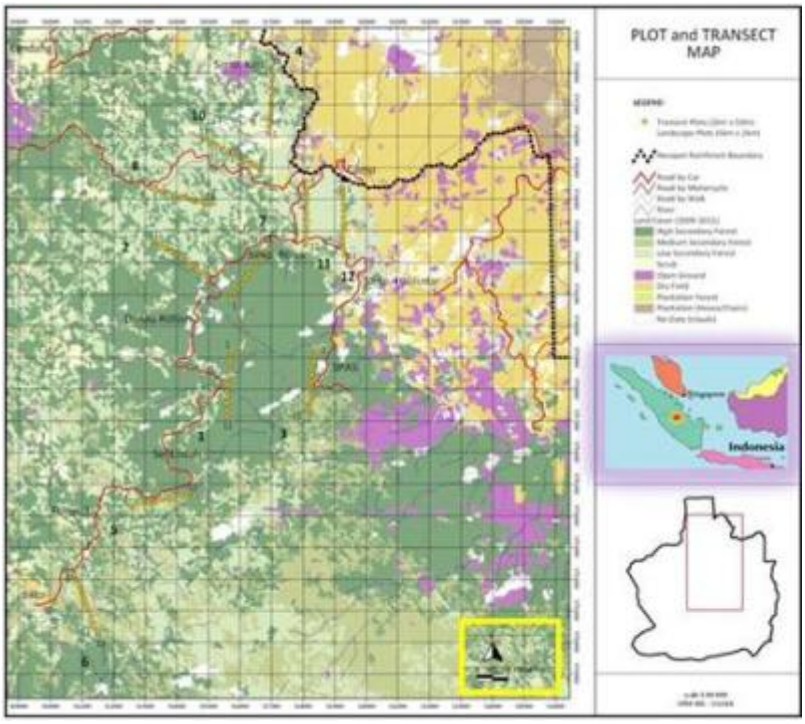

Figure 1. Location of the study area and transects placement

STUDY AREA

The Harapan Rainforest (http://www.harapanrainforest.org) covers an area of 98,554 ha, located in the Jambi and South Sumatra Provinces. It is the first ecosystem restoration in production forest in Indonesia. The whole area has been logged; hence the current habitat consists of mosaics of approximately 40% old secondary forest, 25% intermediate secondary forest, 25% young secondary forest (Figure 1). The remaining 10% comprises of scrub and open ground.

PROGRESS TO DATE – up to 20 December 2011

1. Transects preparation and selection

Eleven transects had been carefully selected to represent various secondary forest gradation in the study site. The previous planned was to select 12 transects, however due to accessibility and safety issues I can only made 11 transects that were located within the accessible area for survey (Figure 1). At each transect there were 11 point which was 200 m apart. These points were the data collection point for both the bird and habitat survey.

2. Bird point transect survey

The bird survey for the first season was conducted between October and December 2011. All transects prepared had been surveyed, with each transect was surveyed three times (in three different days). There are 11 bird point counts in each transect, hence within the survey period I had surveyed in total 132 bird point counts. The total number of bird species recorded is still awaiting bird call field recording. However, based on the confirmed species I had recorded 151 bird species during the bird point transect survey. The same survey will be repeated again between April-June 2012.

3. Bird habitat survey

The bird habitat survey was also completed in all of the bird transects. The analysis of the habitat data will be done after the finalization of the bird data identification.

4. Seed traps survey

Four transects were selected for the seed trap survey (transects no 2, 4, 7 and 12 – *see* Figure 1). At each transect, seed traps were placed in the first four points on each transects (10 seed traps per point). In total I used 160 seed traps. The first designed of the seed trap is not working (where I used PVC pipe to hold up the seed trap above the ground) because it is destroyed by wild pigs. So, I change the design by using plastic rope and hang the seed traps above the ground to avoid the disturbance from wild pigs (Figure 2).

The data collection is still continuing to date by the field assistant until I return to the field for the second field season in April 2012.

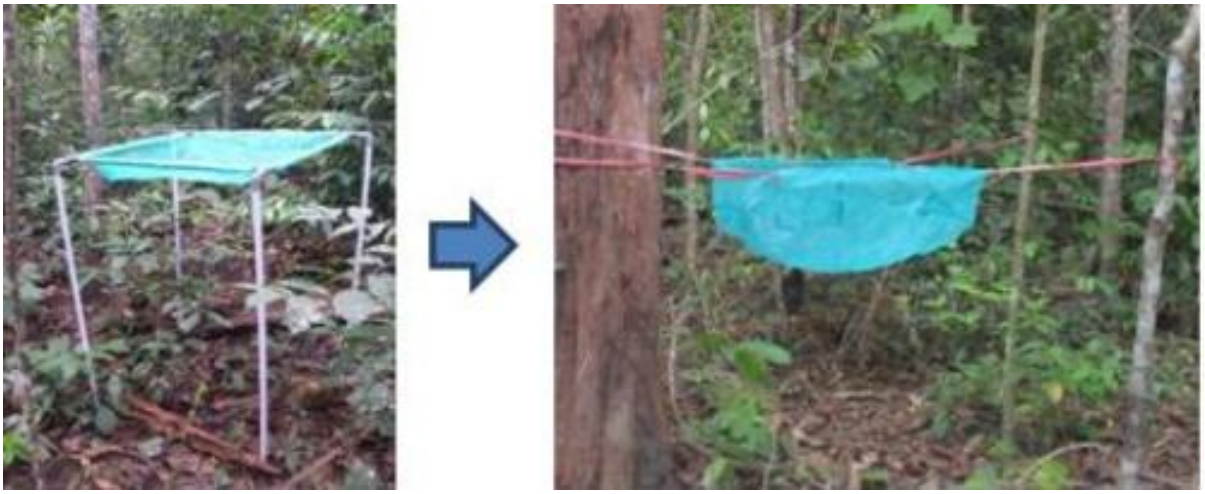

Figure 2. Modification of seed trap design

5. Germination experiments

The number of seeds collected from the seed traps were not sufficient to satisfy the requirements in germination experiments (multiple seeds germinate in multiple habitat conditions). To overcome this, during the survey I tried to find fruiting trees and observed what bird species consume the fruits. Until the end of the first survey period (December 2011) I made observation on five *Ficus* tree species, two species from Myristicaceae family, and one species from Annonaceae family (*Polyalthia spp.*). From these species, all the *Ficus* spp. are strangling figs where they need tree host and high humidity for germinations (Laman, 1995) hence require a different type of experiments. In this sense, I only try to germinate the fig seeds in the nursery with the aim to evaluate the easiness (time) of germination (Figure 3). For the two species from Myristicaceae family, the germination experiments were only conducted in the nursery because the limited number of seeds available. Several of the *Polyathia* spp. seeds were also germinated in the nursery to understand the germination time (Figure 3).

Figure 3. Germinations of *Polyalthia* spp. (left) and *Ficus* spp. (right) in the nursery

The germination experiment was implemented for *Polyalthia spp*. Seven planting sites were selected to represent habitat degradations and at each planting site five seeds were planted inside the fence and five were spread on the ground without "protection". The first result indicates that all seeds in all planting site germinate within 10-14 days after planting.

The next progress report will be submitted after the analysis of the first bird point count data which is expected to be finalized before end of March 2012.

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