

SABAH FORESTRY DEPARTMENT

**BIRD AND LARGE MAMMAL SURVEY
IN PIN SUPU FOREST RESERVE**

FINAL REPORT

DECEMBER 2009

By

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1.0 Executive Summary

This Final Report for Pin Supu Forest Reserve reviews the findings of surveys conducted throughout November 2009, including lists of bird and animal species found, and the presence of rare and protected species at both State and international levels.

Given the volume of work available on the Kinabatangan Landscape, a review of known threats is given. Recommended strategies for improving management and protection of the Forest Reserve, and enhancing the wildlife resources in the overall Kinabatangan Corridor of Life are also outlined.

In the Pin Supu Final Report, the survey findings are discussed and summarised, and over riding recommendations outlined for implementation.

The Pin Supu Forest Reserve lies in the centre of the Kinabatangan Corridor of Life; split into three areas; referred to as A, B and C and located East and West of the highway, and south of the Kinabatangan River respectively.

The forest reserve displays an impressive array of habitats from ox-bow lakes and small tributaries to peat swamp forest, lowland Dipterocarp forest and limestone hills. The reserve is only 4,696 ha, but is part of a much larger landscape of forest and agriculture that supports some of the highest mammal diversity and populations in Sabah, as well as a booming tourism industry, and some of the most fertile agricultural land in Sabah.

The Pin Supu Forest reserve is close to several population centres; notably the villages spread along the Sandakan Lahad Datu Highway between Areas A and B that further limit connectivity options between these two areas of the FR.

After over eighteen days of ground survey through the area, plus a brief helicopter recce for assessment of landscape level issues, the basic species counts for birds stands at 79, and mammals at 24. Further data on previous surveys undertaken by MESCOT is being sought to expand these records.

Due to the high level of study along the Kinabatangan, no results have been surprising, and the presence of several large, rare and protected animals has been confirmed through direct sighting, tracks, and discussion with the local community.

As with many Forest Reserves in Sabah and the Kinabatangan, the timber and wildlife resources are under ongoing pressure from humans. However, with the inclusion of the local community in tourism and conservation initiatives through KOPEL, many negative impacts have ceased. Apart from the fragmentation of Pin Supu into three sections, remaining threats include:

- Illegal Logging

- Encroachment (making farms and planting crops inside the Forest Reserve)
- Hunting
- Forest Fires (on both hill sites and peat swamps)
- Palm Oil Effluent entering Sg Kaboi
- Degradation of archaeological sites

Primary strategies under discussion include the further development of tourism and recreation opportunities with the local community, and improving connectivity between FRs.

Secondary recommendations for implementation include:

- Expansion of the FR to include areas to the West of Pin Supu A
- Demarcation of all three parts of the FRs to confirm and control encroachment
- Enhancement and restoration of degraded areas
- Periodic monitoring of indicator species

Overall, it is expected that at least some Individuals of the full range of faunal diversity of the Kinabatangan floodplain are present in the Pin Supu Forest Reserve, with some resident (e.g. smaller vertebrates) and some entering the Reserve periodically (e.g. elephants, orang utan, hornbills). In particular, Pin Supu A is well endowed with wildlife and benefits from having the best connections to larger forested areas. Pin Supu C is isolated within oil palm estates, but appears to hold a very small remnant Orang Utan population, some individuals of which may range to obtain supplementary food in the estates.

Populations of animals throughout the Kinabatangan appear to be dynamic; given the rapid changes in landuse over the last 20 years and lack of comparative data, the observed high densities of some animal species is likely to be in part natural, and in part the result of overcrowding due to immigration from deforested areas in the long term, population adjustments seem likely - with some species probably settling to lower number - though the magnitude and impacts can not be predicted with any accuracy. Wildlife monitoring work in Pin Supu in the future would be vital in obtaining accurate long term data on populations to allow discussion of future scenarios.

In summary, Pin Supu FR retains high diversity of wildlife, and occupies a critical location on which to base restoring coastal-inland connectivity along the Kinabatangan River.

2.0 Introduction

This Final Report has been prepared for Sabah Forestry Department for the project entitled “Bird and Large Mammal Survey in Pin Supu Forest Reserve”.

This project involves conducting a bird and large mammal survey, as well as undertaking literature review and community interviews to determine an overall species list birds and large mammals in Pin Supu (Class VI) Virgin Jungle Reserve.

Work undertaken included gaining entry permits into the Forest reserve, identifying logistics and site details within the Project Site, identifying literature requirements from SFD resources, undertaking over 18 days of survey on site and a brief helicopter survey to access landuse scale issues such as connectivity, and reconnaissance for orang utan nest.

The study area lies centrally in the Kinabatangan Corridor of Life and straddles the Sandakan-Lahad Datu highway; one of the main constrictions to connectivity along the floodplain.

Much has been undertaken in Pin Supu Virgin Jungle Reserve included animal surveys by MESCOT, reforestation works by MESCOT/KOPEL, oxbow lake rehabilitation and preparation of a Forest Management Plan (CREST Planning Consultants, 2008). The Kinabatangan Floodplain as a whole has already been the subject of conservation research attention over the past 30 years leading to a wealth of secondary information available for use in this project.

The target of the surveys is, therefore, to clarify the presence of rare and endangered species that may require conservation and special management. Surveys may also highlight the potential for recreational and tourism developments in the area to add value to the natural resources of the location.

Targeted Birds and Large Mammals include those on the IUCN Red List and Borneo endemic species, as well as those charismatic species that can become icons for tourism marketing. Of particular interest are Orang Utans (*Pongo pygmaeus*), Sun Bear (*Helarctos malayanus*), Clouded Leopard (*Neofelis nebulosa*), Great Argus (*Argusianus argus*), Pittas (*Pitta sp.*), Hornbills, etc.

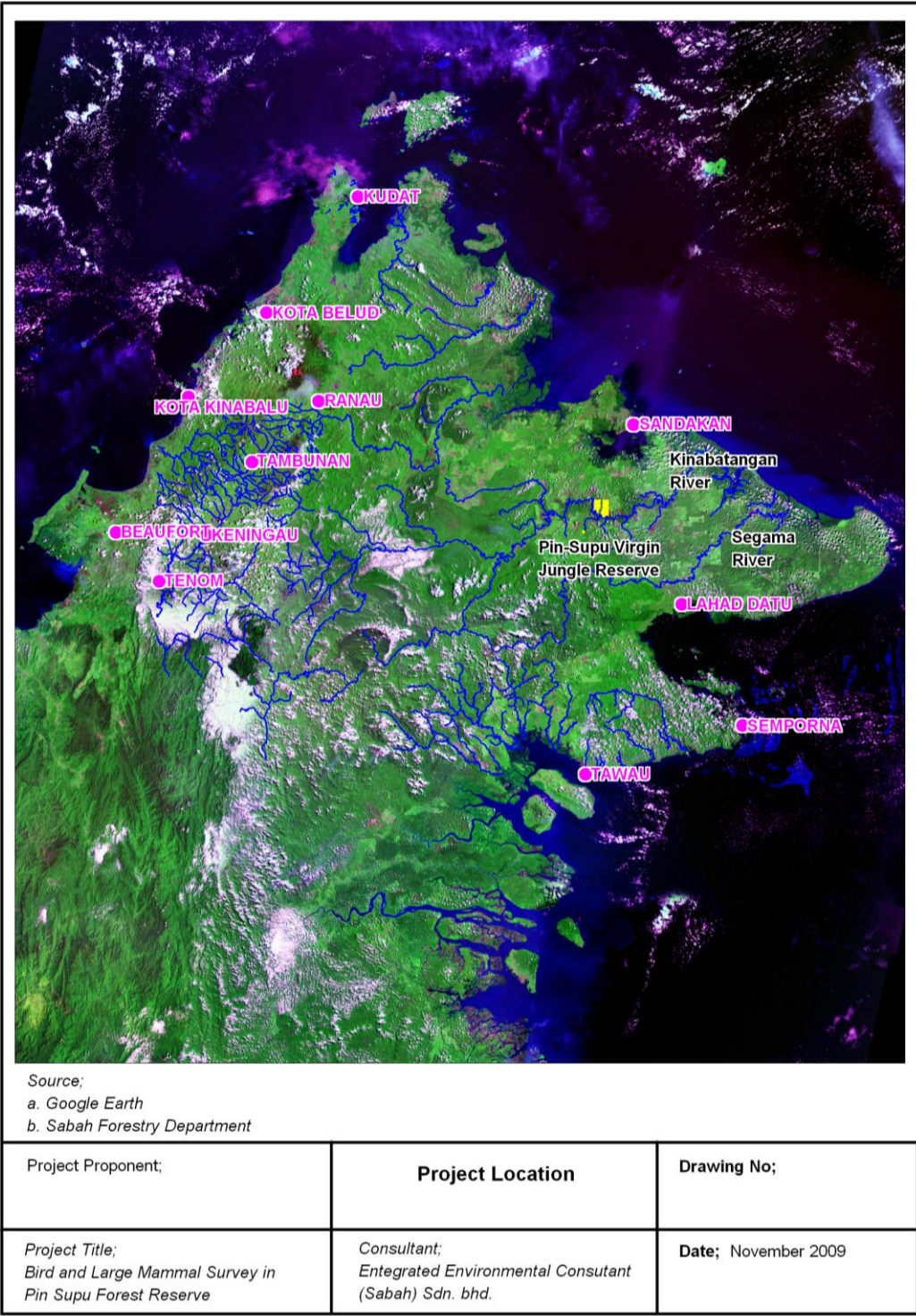


Figure 1; Study Area Location

Pin Supu Forest Reserve is divided into three sections; known as Pin Supu A, B and C. they are located East of the highway, West of the Highway and South of the river respectively.

3.0 Term of Reference

This section outlines the goal, objective, scope of work and output of the study.

The Terms of Reference for this project are:

- Attend an initial site visit for appraisal of site and to obtain general local understanding
- Prepare the Interim Report based on the initial investigation, secondary literature review, and discussion with the team members on methodology for use in the field.
- Attend presentation to the client to present the Interim Report
- Attend a site visit during the surveys to further explore the site, and to understand the methodology undertaken.
- Prepare a Final Report to include the finding of the bird and large mammal survey, and recommendations for conservation and management based on the species identified through discussion with the client and project team.
- To review the likely impact on wildlife of farm, plantations and garden along the Sandakan – Lahad Datu Highway that impinge on Pin Supu Virgin Jungle Reserve.
- To determine the movement of elephant in the Pin Supu VJR might be modified in favour of wildlife especially through re-establishment of habitat corridors for large mammals
- To suggest ways in which land use in and adjacent to Pin Supu VJR might support the wildlife conservation role of Pin Supu VJR
- To review how forest and habitat restoration and improvement carried out by MESCOT in and around Pin Supu VJR have improved the wildlife conservation value of the Reserve

3.1 Overall Goal

The overall goal of the study is to develop a greater understanding of the remaining large fauna using or resident in the Pin Supu Forest Reserve, to understand the ongoing threats and human pressure on this wildlife resource, and to offer management recommendations for maintaining the biological values of area.

3.2 Objectives

The specific objectives of this study are;

- To obtain a species lists for mammals and birds using the project area;
- To suggest future activities and ways in which land use in and adjacent to Pin Supu VJR might be modified to support wildlife conservation

3.3 Scope of Work

The scope of work for this study includes detailed bird and large mammal surveys in all accessible areas of the Forest Reserve to establish a species list of birds and large mammals.

This information, together with data obtained from formal and informal community surveys has been used to compile a species list for the area and develop management recommendations.

3.4 Output

The output that has been prepared is this Final Report detailing the methods, results, and the management recommendations for the Forest Reserve.

4.0 Study Area

4.1 *Kinabatangan Floodplain*

The Kinabatangan floodplain has been identified as a centre of biodiversity for a number of years. The combination between alluvial soils fertilised by flood borne sediments every year, and the traditionally low levels of inhabitation (Marsh, XX) have combined to form a rich flora and fauna.

In more recent years, agricultural development has flourished based on these same nutrient rich soils, and the availability of large tracts of land unencumbered with existing land claims. This has resulted in a mosaic landscape of agriculture and forest; most of which is now protected.

Due to the opportunistic method of land development, the remaining forests have been left isolated in a largely agricultural landscape. This has brought about significant issues for fauna (particularly predators and mega-herbivores with large natural ranges). Traditional migration routes along the Kinabatangan of elephants have been disrupted by agriculture, electric fences, drainage ditches, village development, highways, etc. Section 7,4 looks at fragmentation within the Pin Supu FR in more detail, but even this fragmented PA exists within a larger fragmented landscape.

In recent years, there have been increased efforts to manage the Kinabatangan landscape. The Lower Kinabatangan Wildlife Sanctuary protected much of the remaining forests, and the recently proposed Kinabatangan Corridor of Life Wildlife Conservation Area gives further controls over intervening landuses. One of the major issues affecting connectivity is the Sandakan-Lahad Datu highway. Together with the expansion of the Kg. Batu Puteh/Kg. Mengaris villages and the development of the old SAFODA rattan plantation to oil palm, the elephant migration patterns have been curtailed to only the lower Kinabatangan between the bridge and Abai (Alfred at.al., 2007).

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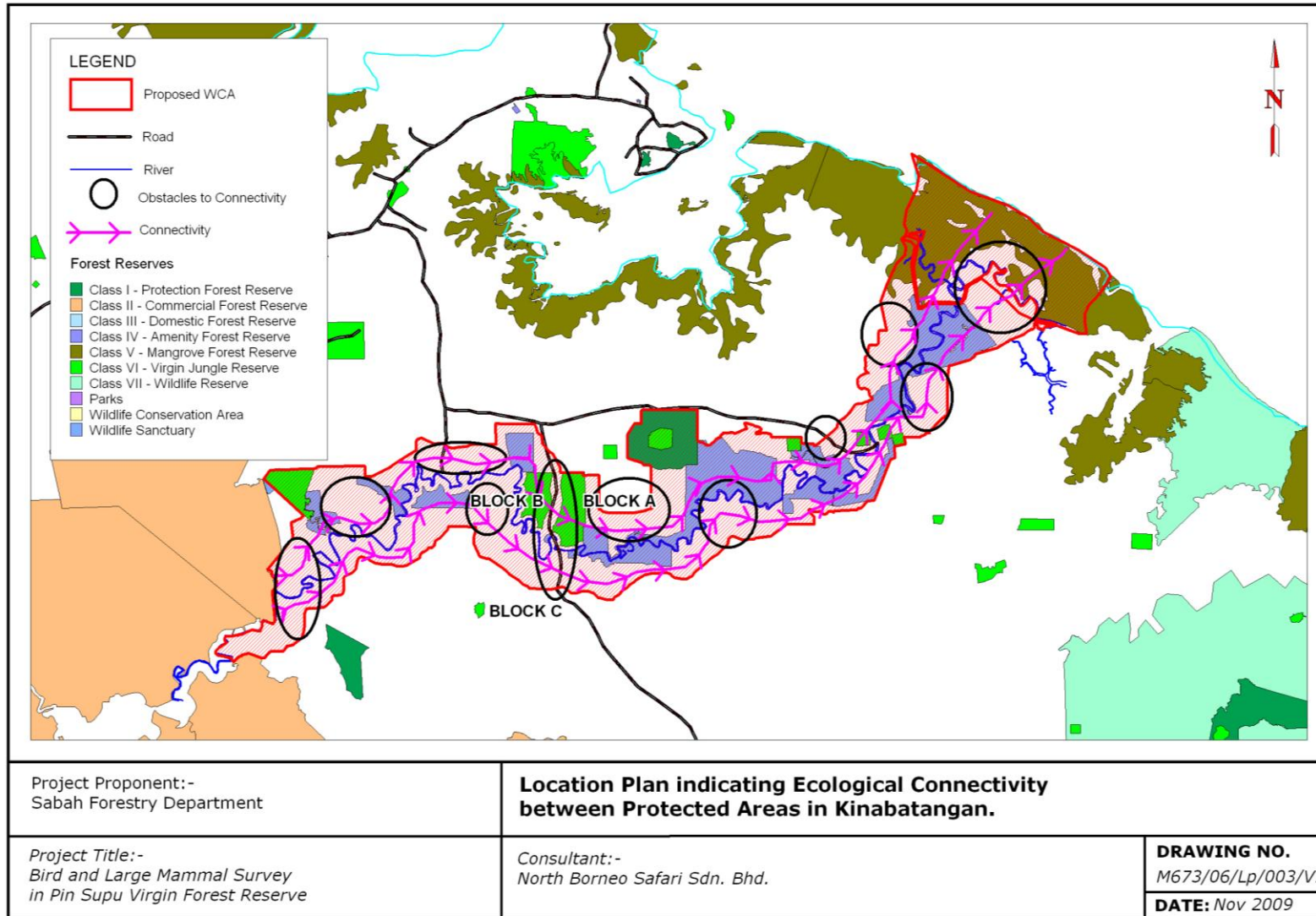


Figure 2; Ecological Connectivity through the Study Area.

4.2 *Pin Supu Forest Reserve*

4.2.1 Legal Status

Withint eh Kinabatangan Floodplain, and straddling the Sandakan-Lahad Datu Highway, the Pin Supu Forest Reserve, located in the Kinabatangan District, covers an area of 4,696 ha of land. This Forest Reserve comprises of 3 blocks of land, Block A, Block B and Block C. Block A and B are situated east and west of the Sandakan-Lahad Datu main road just north of the Kinabatangan bridge whilst Block C located 11 kilometres southwest of the other two blocks.

Part of the Pin Supu Forest reserve was previously under Sungai Pin FR which was first gazetted in 1958. In 1982, the whole of Sungai Pin FR was excised except 151 ha, which was added to what was to be known as Pin-Supu FR. The Pin-Supu FR was later regazetted as Class VI FR in 1984

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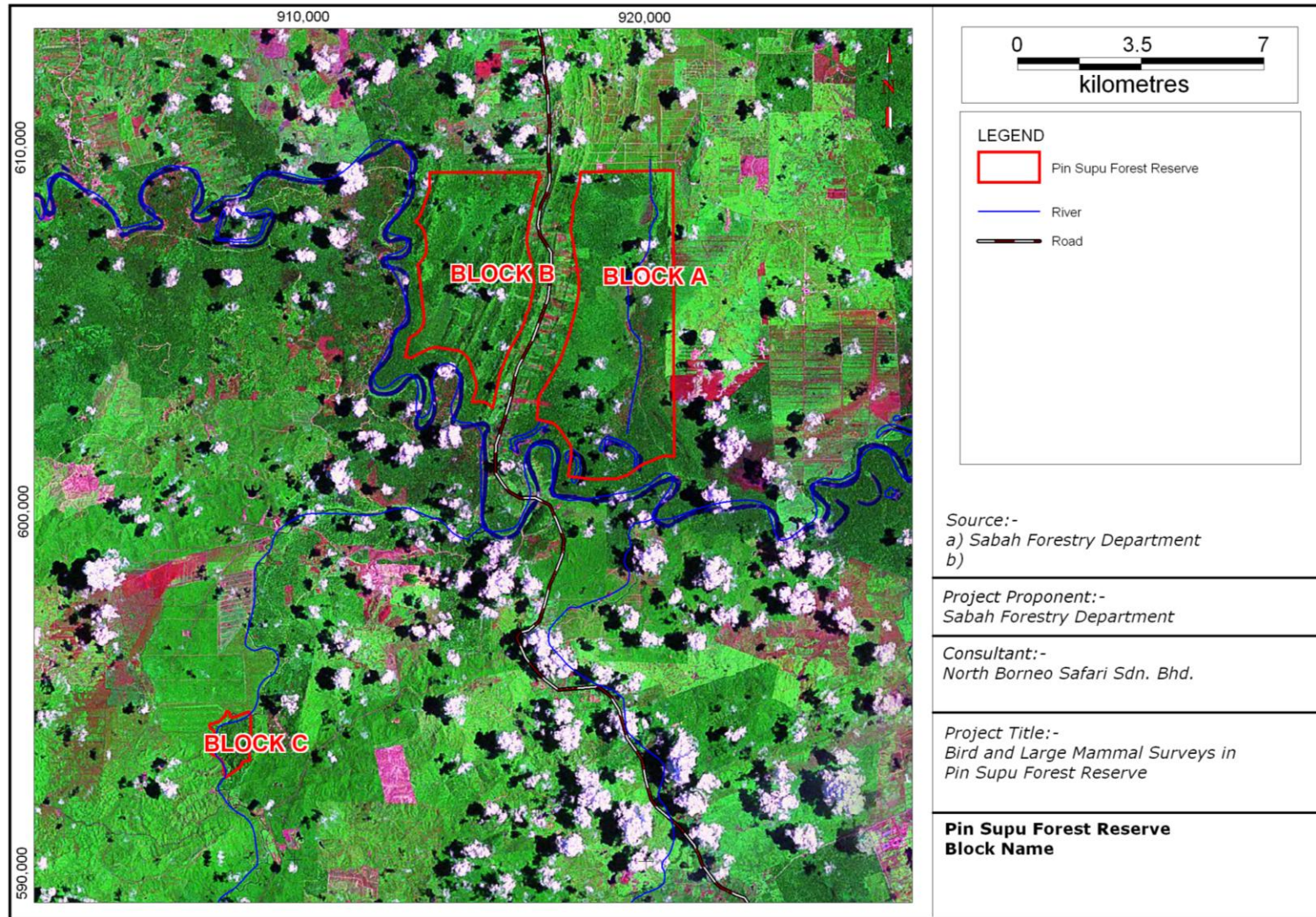


Figure 3; Pin Supu Forest Reserve Blocks Name Map

4.2.2 Geology and Soils

Approximately 80 percent of the Pin Supu Forest Reserve area is underlain by geologically recent (Holocene) alluvium. The alluvium that is a parent materials for different soil associations is the result of combined coastal and riverine alluvium that covers almost the entire area of Block A and B.

Geology of the Tanjong formation can be found at the western and eastern hilly area on Block B and a small area in Block C. The formation is a combination of mudstone, sandstone, siltstone, conglomerate, minor limestone and lignite. Only a small area of Tanjong formation with the combination of sandstone, mudstone, siltstone, shale, conglomerate, and limestone can be found on the south of Block C. Emergence of this formation is also the cause of the small hills also can be found in the northeast of Block A.

The 3 blocks of land at Pin Supu Forest Reserve area consist of wide variety of soils that are influenced by parent material, elevation, incidence of flooding and drainage characteristics. There are 6 types of Soil Association present in Block A alone where the alluvial Kinabatangan Soil Association is widely present. The main soil unit for this association are Gleyic Acrisol, Gleyic Luvisol, Humic, Dystric and Eutric Gleysols and an alluvium as parent material. This type of soil lies mostly on floodplains area.

The Klias Soil Association can be found on the west side of the Block A. This peat soil forms in swampy areas. The Kretam Soil Association is present on the west and southwest side of the Block A, the parent material of this soil association are mudstone, sandstone and miscellaneous rocks, and the soil can be found on moderate hills with 0-20° slopes.

On the south of Block A, the Tuaran Soil Association of deposited river sediment forms the levee bank of the river. This soil parent material is Alluvium and the main soil unit are Eutric Fluvisol, Gleyic, Dystric and Eutric Cambisol, Humic Dystric and Eutric Gleysols. The Sapi Soil Association can be found in the non-peat swamps in the north and southwest of the Block A.

The Silabukan Soil association can be found on the low hills in northeast part of the forest reserve, the main soil unit for this type of soil are Gleyic, Ferric and Orthic Acrisol, Gleyic, Ferric, Chromic and Orthic Luvisols while its parent material are Mudstone and Alluvium.

The Lokan Soil Association covers a large area on the Block B at the Pin Supu Forest Reserve. This soil type can be found often on hills with altitude up to 300 m and slopes often greater than 25°. These types of soil unit are Orthic Acrisol and Dystric Cambisol while their parent materials are Mudstone and Sandstone.

In the low hills and valley floors with slope range from 0-25 degrees, the Silabukan Soil Association can be found in four different areas on the Block B. The Sapi Soil Association present at the swampy areas while Gomantong Association lies in the hilly slope on the northeast of the Forest Reserve. These types of soil main unit are Calcic Luvisol and Rendzina while its parent material is limestone.

Block C of the Pin Supu Forest Reserve is area mostly covered the Lokan Soil Association (80%), this type of soil mostly can be found on the hilly areas slope. The Kinabatangan and Kretam Soil Association also present in a small areas on Block C.

4.2.3 Topography and Hydrology

The Block A of the Pin Supu Forest Reserve area is relatively flat, low lying and consists of peat and freshwater swamps. There are three ox-bow lakes near the Kinabatangan River. Danau Biandong, Danau Tungong and Danau Kaboi are the ox-bow lakes present at the Block A. The patches of hills above 30 metres can be found in the northeast, east and the south.

Block B has hills over 90 m and slopes often greater than 25° along the eastern boundary; crests are often very narrow. The hills are formed of interbedded sandstone and mudstone. Towards the north are low hills (between 30 and 60 m) and valley floors, with amplitudes less than 15-30 m and with a regular pattern of dissection. Slopes range from 0-25° but are commonly in the 10-15° range.

A steep and high limestone outcrop in the northwest corner of Block B can be found. The peak is called Bukit Supu Besar (about 180 m). The central portion is very low-lying, enclosed by hills. In addition, external drainage is impeded by broad levee zones on the Kinabatangan River in the south and this has caused development of organic peat swamps. Block C is generally very hilly and the terrain is similar to the hills of Block B.

There are no large rivers in the Pin Supu Forest Reserve areas, though several lakes and small streams provide for an interesting hydrology. The Kinabatangan River flows past the southern portion of Block A, and the whole western boundary and half of the southern of Block B while Sg. Pin flows northwards from Block C to the Kinabatangan River.

4.2.4 Vegetation Types

Due to its 9 different soil types and varied terrain, there are about six forest types within the Pin Supu Forest Reserve area. However most of the natural vegetation of Pin Supu Forest Reserve now are gone, and most of the vegetation present now is secondary vegetation.

The secondary Mixed Dipterocarp Forest (MDF) and freshwater swamp forest can be found mostly on Block B with the northwest having MDF-limestone vegetation on the steep outcrops. The slopes in the eastern hills of Block B

were mainly covered with *Macaranga* spp. (i.e. *M. gigantea*, *M. pearsonii*, *M. hypoleuca* and *M. triloba*) and *Fagraea cuspidata*. The canopy height there was about 15 m. Primary species were few. Only two individuals of *Shorea mecisopterix*, at > 50 cm DBH, were observed in the transect. Other species included *Vernonia arborea*, *Melicope incana*, *Mallotus mollissimus*, *Canarium hirsutum*, *Neolamarkia cadamba*, *Ficus nota*, *F. treubii* and *Aporusa acuminatissima*. In some of the undisturbed MDF, trees were larger and primary species more common. Large trees (> 60 cm DBH) included *Koompassia malaccensis* (> 90 cm DBH), *Shorea* sp., *Canarium* sp., *Shorea xanthophylla*, and *Dehaasia* sp. Other species present were *Scaphium longipetiolatum*, *Bridelia penangiana*, *Meliosma* sp., *Azadiracta excelsa*, *Eusideroxylon zwageri*, *Shorea pauciflora*, *Hydnocarpus* sp., *Myristica* sp., *Pyrenaria limpato*, *Madhuca kingiana* and *Cynometra* sp.

The ridges in the eastern hills support scrub forest and some areas were burnt. In the northwest, *Uncaria* sp. and *Mallotus miquellianus* were common

There are steep limestone outcrops in the northwest of Block B with most of the vegetation undisturbed. Trees on the slopes were small-sized (below 50 cm DBH) except for a few individuals of *Shorea* spp. at > 80 cm DBH. The mean canopy height is about 15 m. Other species present were *Xanthophyllum* sp., *Hopea nutans*, *Polyalthia* sp., *Aquillaria malaccensis*, *Shorea falciferoides*, *Carallia brachiata*, *Drypetes* sp., *Walsura pinnata*, *Atuna* sp., *Cleistanthus* sp., *Canarium* sp., *Syzygium* sp., *Mamea calciphila*, *Madhuca* sp., *Saraca declinata*, *Chisocheton* sp., *Paranephelium xesthophyllum*, *Spatiostemon* sp., *Pterospermum javanicum*, *Cratoxylum* sp., *Myristica villosa*, *Macaranga tanarius*, *Pometia pinnata* and *Nauclea artocarpoides*.

On ridges (at about 120 m asl), most of the trees are <20 cm DBH. Mean canopy height was 15 m. Species present were *Glochidion* sp., *Octomeles sumatrana*, *Ficus treubii*, *Melicope confusa*, *Vitex pinnata*, *Xanthophyllum* sp., *Dracontomelon dao*, *Bridelia penangiana*, *Sphatiostemon* sp., *Saraca declinata*, *Polyalthia* spp., *Cassia javanica*, *Drypetes* sp., *Syzygium* sp., *Cynometra* sp., *Atuna* sp., *Litsea oppositifolia*, *Alangium griffithii*, *Canarium* sp., *Leea* sp., *Mallotus mollissimus*, *Pterospermum javanicum*, *Clausena excavata* and *Parashorea tomentella*.

Some parts of the limestone outcrop were burnt in the past. This regenerating forest is still quite diverse in terms of tree diversity. Almost all trees were small (<20 cm DBH) except for *Diospyros* sp., *Shorea guiso*, *Shorea pauciflora* and *Canarium* sp. which were more than 60 cm DBH. Common understorey trees were *Spathostemon javanicum*, *Chionanthus* sp., *Cynometra* sp., *Ficus variegata*, *Drypetes* sp., *Pterospermum javanicum* and *Saraca declinata*. Others include *Garcinia* sp., *Syzygium* sp., *Melicope confusa*, *Knema* sp., *Buchanania arborea*, *Polyalthia* sp., *Leucosyke capitellata*, *Macaranga tanarius*, *Vitex pinnata*, *Pterocarpum macrocarpum*, *Paranephelium* sp., *Sindora beccariana*, *Popowia* sp., *Dimocarpus longan*,

Microcos crassifolia, *Ixora grandifolia*, *Artocarpus anisophyllus* and *Heriteira* sp.

The secondary freshwater swamp forest in the central portion of Block B was recovering from the effects of fire. The ground is covered with sedge, grasses (e.g. *Melastoma malabatricum*), fern (e.g. *Lygodium* sp. and *Stenochlaena palustris*), *Pandanus* sp. and *Uncaria* sp. Mean canopy height was about 4 m. The most common species were *Vitex pinnata*, *Glochidion* sp. and *Mallotus mollisimus*. Other species present were *Syzygium* sp., *Ptenandra* sp., *Dillenia excelsa* and *Octomeles sumatrana*

The Block C on the Pin Supu Forest Reserve area is previously part of a larger Sg. Pin FR and is mainly covered with secondary MDF in the hills side and secondary seasonal freshwater swamp forest in the lowland areas. The secondary MDF is a result of previous logging operations. Mean canopy height is 15-20 m high. Dipterocarp and other large trees as primary species were not common in the area. *Macaranga gigantea* was the most common species and most were sized between 20-29 cm DBH. Other species were *Scaphium longipetiolatum*, *Prunus* sp., *Enicoxanthum* sp., *Ficus treubii*, *Macaranga hypoleuca*, *Vernonia arborea*, *Barringtonia sarcostchys*, *Macaranga personii*, *Carallia brachiata*, *Barringtonia lanceolata*, *Macaranga mollisimus*, *Drypetes* sp., *Ptenandra* sp., *Glochidion rubrum*, *Gluta wallichii*, *Adinandra myrioneura* and *Dialium indum*. Large trees (>60 cm DBH) found were *Scaphium longipetiolatum*, *Dipterocarpus acutangulus*, *Shorea smithiana* (> 90 DBH), *Dipterocarpus kerrii*, *Eusideroxylon zwagerii*, *Irvingia malayana*, *Mesua micrantha*, *Shorea argentifolia* (>90 cm DBH) and *Durio zibethinus*. Other smaller-sized dipterocarps were *Shorea macroptera*, *Shorea foxworthii*, *Shorea multiflora*, *Shorea smithiana* and *Dipterocarpus acutangulus*.

The secondary seasonal freshwater swamp forest in Block C was heavily degraded. The terrain is flat. Mean canopy height was about 15 m, with some areas in the north at 3 m. All trees recorded were below 40 cm DBH. There was no species that was common. Species included were *Vitex pinnata*, *Cubilia cibili*, *Aglaiia* sp., *Madhuca* sp., *Paranephelium xesthophyllum*, *Diospyros* sp., *Dillenia excelsa*, *Neolamarkia cadamba*, *Dehaasia* sp., *Nauclea subdita*, *Diospyros elliptifolia*, *Cryptocarya griffithiana*, *Mangifera foetida*, *Walsura pinnata*, *Canarium denticulatum*, *Pleiocarpidia* sp., *Dimocarpus longan*, *Pterospermum elongatum*, *Myristica* sp., *Koordersiodendron pinnatum*, *Macaranga hypoleuca* and *Mallotus cunifera*.

4.2.5 Native Fauna

While the overall Kinabatangan floodplain has been relatively well studied, few studies have concentrated solely on the Pin supu forest Reserve. Given the proximity, and similarity of habitats it can be assumed that all birds and large mammals identified in the Lower Kinabatangan have the potential to be found in Pin Supu FR.

The existing species lists for Kinabatangan consist of some 208 bird species, 90 fish species (Vaz, 1998).

Similar species are expected to be found in the current Project Site, though the rarer or migratory species might not be recorded during a the short survey period.

Given the proximity of fertilised agricultural land, and nutrient poor sandstone hills of the Project Site, it is expected that many birds and animals will travel from forest areas into surrounding farms to feed, and return to the forest for shelter and nesting sites.

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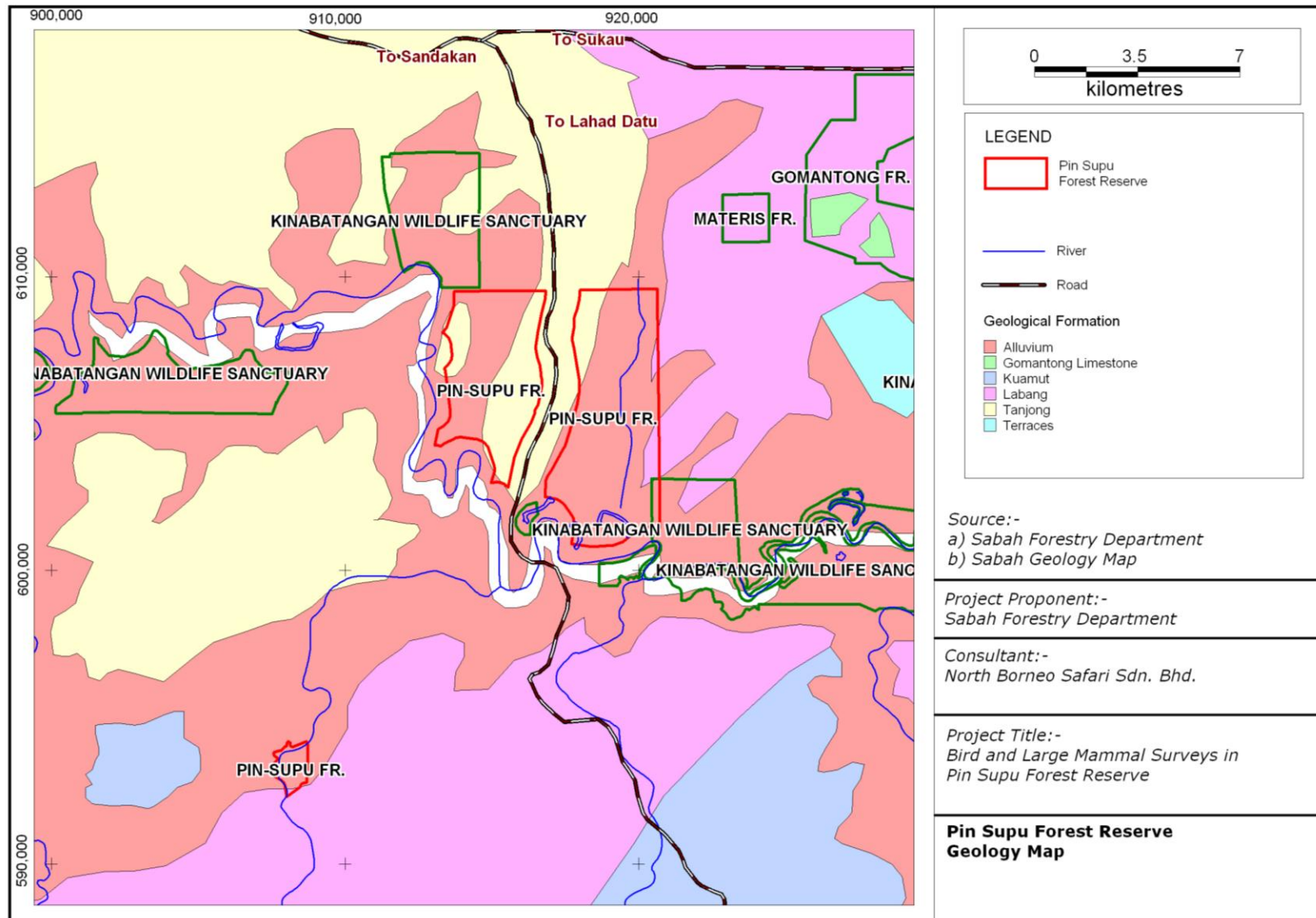


Figure 4; Pin Supu Forest Reserve Geology Map

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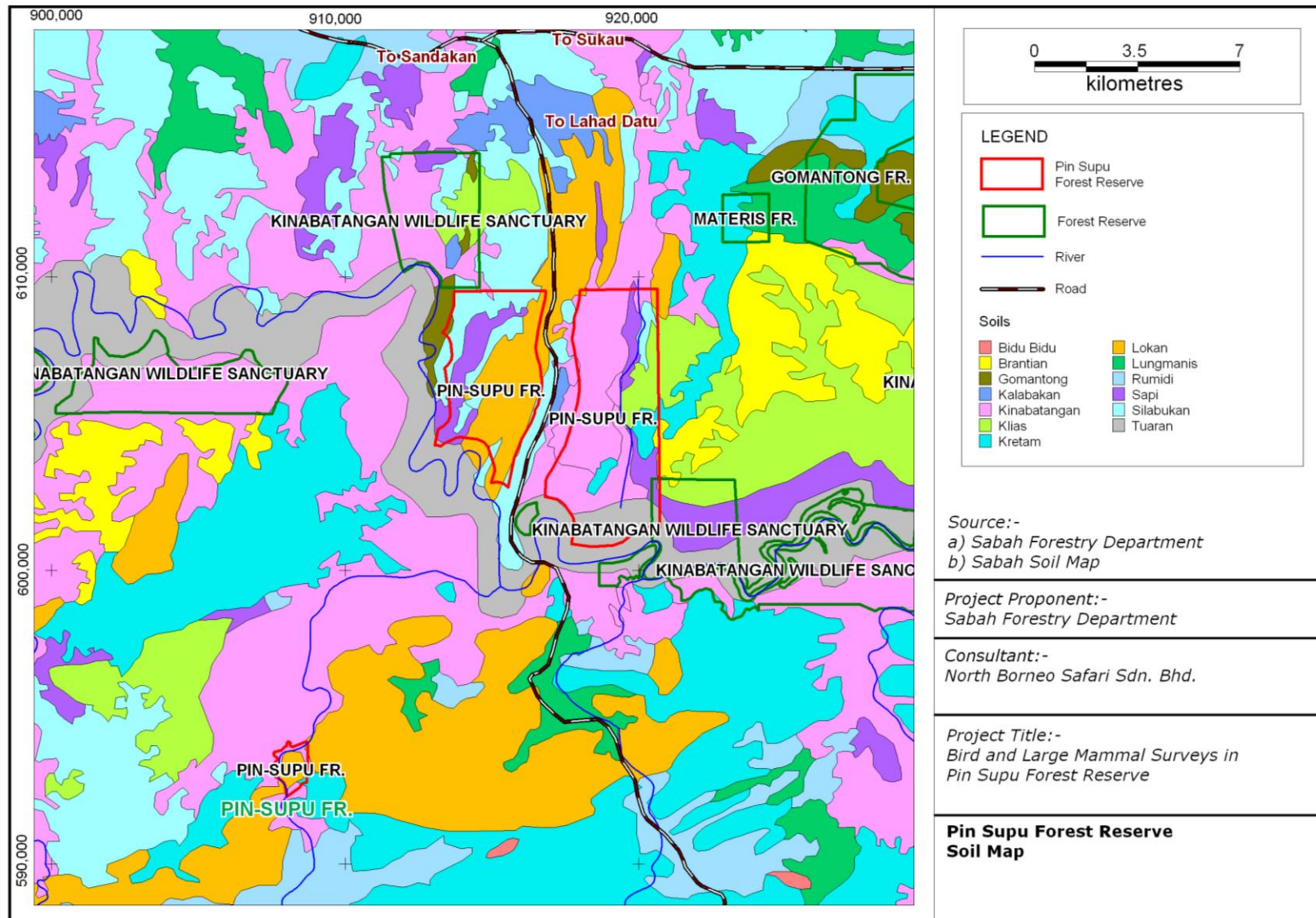


Figure 5; Pin Supu Forest Reserve Soil Map

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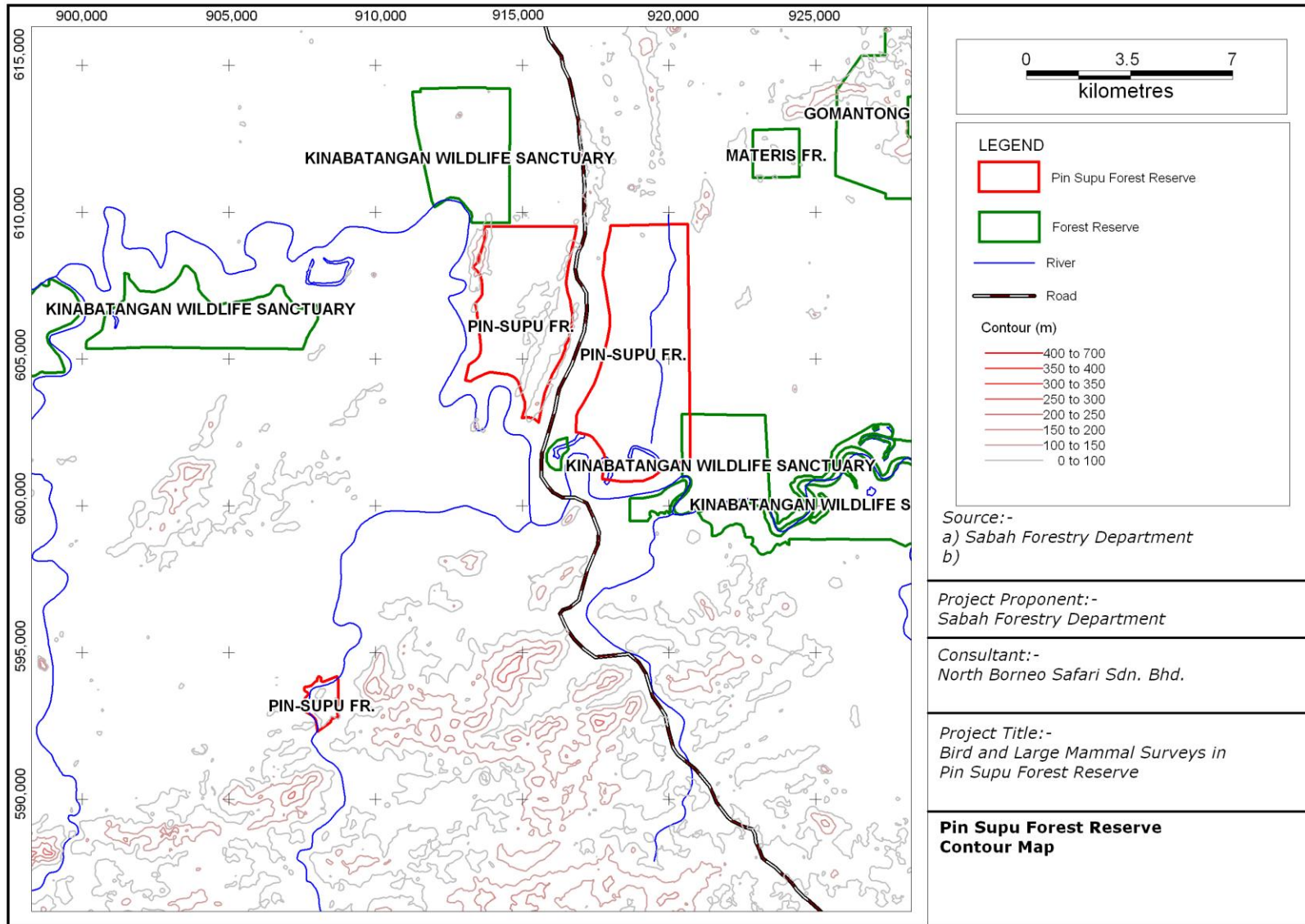


Figure 6; Pin Supu Forest Reserve Topography

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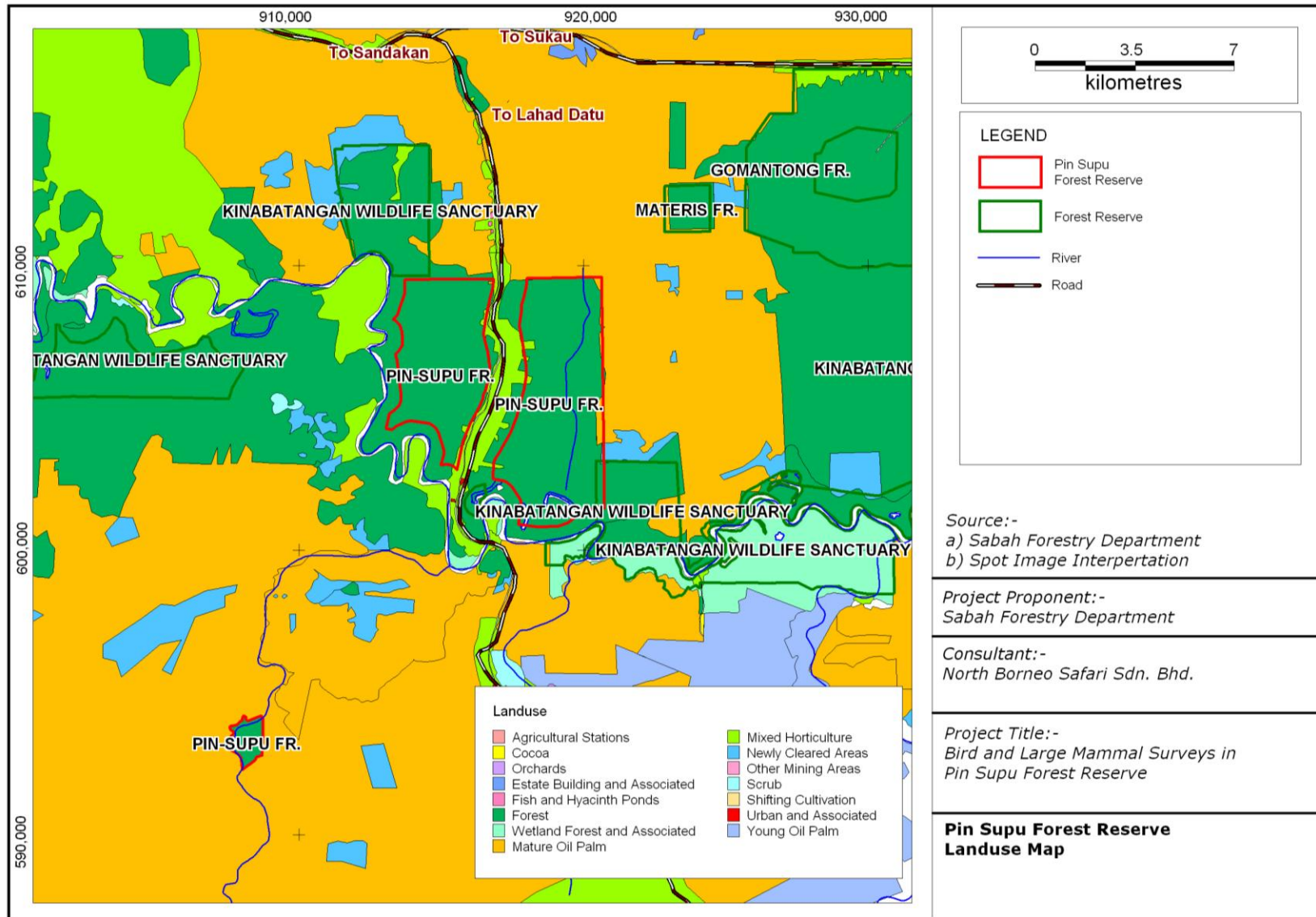


Figure 7; Pin Supu Forest Reserve surrounding Landuse Map

5.0 Survey Methodology

Due to the need to rapidly establish as comprehensive a species list as possible, a variety of methods have been utilised to assess the Study Area. Time spent in the field, and undertaking aerial surveys has also given a greater understanding of past, present and future threats. Survey locations are indicated in Figure 14.



Figure 8; Forest edge surveys using boat



Figure 9; Surveys in areas bordering along the river

Forest Edge Surveys

Using agricultural roads through surrounding areas, forest edge environments have been surveyed by drive through, and stationary surveys. Suitable locations for surveys were found at the interface between forest and agricultural landuses to allow identification of birds in the forest edge, and birds and mammals passing between forest and farmland.

Surveys were undertaken during the day, and at dawn and dusk.

Bordering Plantations

Surveys through plantations where food is plentiful (oil palm, fruit orchards, rice fields, etc.), and the terrain is more open have helped to identify biota present in the wider area. Species identified in agricultural areas are expected to also be found in nearby forests.

Surveys were undertaken during the day, and at dawn and dusk.

Under-Canopy Surveys

Surveys within forests were undertaken to look for forest birds such as pittas and Great Argus. Mammal species such as mouse deer, maroon langurs, pangolins and gibbons were targeted.

Where required, survey lines were cleared in advance to aid the survey team in accessing the forest, especially at night when looking for nocturnal mammals.

Viewpoint Scoping

The Forest Reserves of the Project Site are fragmented but not over large distances. Many birds have been observed travelling between forest reserves. Viewpoints were therefore established in locations with a good vantage point to see birds moving between Forest Reserves. During survey periods, the forest canopy was also investigated with telescopes to assist in locating features such as Orang Utan nests.



Figure 10; Viewpoint scoping for bird overflights and forest canopy

Interviews

Informal interviews with local residents were conducted with local residents in the Kinabatangan area to clarify the past and current presence of large characteristic mammals such as elephants, tembadau and rhinoceros, as well as cryptic species such as nocturnal mammals.

Hunting is known to be a common activity in the Kinabatangan area; ascertaining the scale and location of hunting activities, and impacts on rare or protected animal species is important in preserving the wildlife resource of the area for sustainable multiple use.



Figure 11; Community surveys for additional information

Informal surveys of local markets and stalls indicated the level of hunting, and demand for wildmeat in the local area.

During the survey, surveyors will record any bird and large mammal detected either by direct sighting, sound, footprints, or other physical evidence. Photographs were taken where possible to provide a record of the area, and allow preparation of a field guide for monitoring use in the future.

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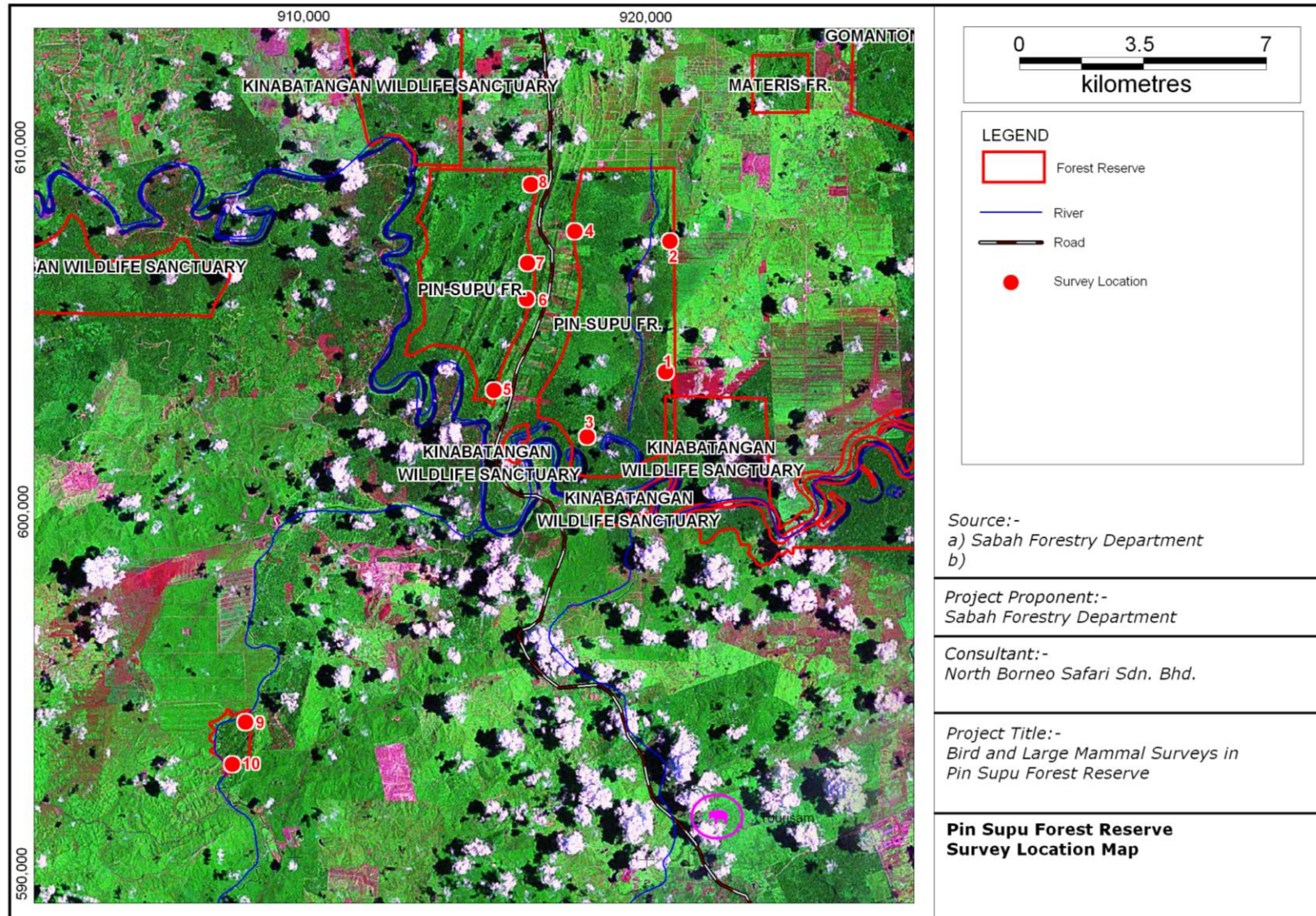


Figure 12; Bird and Large Mammal Field Survey Locations

6.0 Survey Results

6.1 Fauna Surveys

Land and river surveys have been conducted through the Forest Reserve during November and December

Surveys at some locations were repeated several times on different days, and at different times of day.

6.2 Birds

Throughout the surveys, a total of 79 birds have been identified and are listed in the Table 3 below.

Table 1; List of birds identified during field survey.

No.	Species	Direct Sighting
	Crows, Magpies and Bristleheads	
1	Slender-billed Crow	Direct Sighting
2	Thick-billed Crow	Direct Sighting
	Egrets, Heron & Bitterns	
3	Great Egret	Direct Sighting
4	Little Egret	
5	Cattle Egret	Direct Sighting
6	Striated Heron	Direct Sighting
7	Black-crowned Night-Heron	Direct Sighting
8	Purple Heron	Direct Sighting
	Swallows & Shrikes	
9	Pacific Swallow	Direct Sighting
10	Barn Swallow	Direct Sighting
	Kingfishers	
11	Stork-billed Kingfisher	Direct Sighting
12	Blue-eared Kingfisher	Direct Sighting
13	Banded Kingfisher	
	Hornbills	
14	Bushy-crested Hornbill	
15	Oriental Pied Hornbill	Direct Sighting
16	Black Hornbill	Direct Sighting
17	White-crowned Hornbill	
18	Wrinkled Hornbill	
	Pittas	
19	Hooded Pitta	
20	Black and Crimson Pitta	
21	Blue-headed Pitta	
	Babblers	
22	Ferruginous Babbler	Direct Sighting
23	Chestnut-winged Babbler	Direct Sighting
24	Fluffy-backed Tit Babbler	
25	Chestnut-rumped Babbler	

No.	Species	Direct Sighting
26	Abott's Babbler	
27	Sooty-capped Babbler	
28	White-chested Babbler	
29	Black-capped Babbler	Direct Sighting
30	Scaly-crowned Babbler	Direct Sighting
31	Stripe Wren-Babbler	Direct Sighting
	Pigeons & Doves	
32	Emerald Dove	
33	Little Green Pigeon	Direct Sighting
34	Green Imperial Pigeon	Direct Sighting
	Partridges & Pheasants	
35	Crested Fireback	
36	Chestnut Necklaced Partridge	
37	White-breasted Waterhen	Direct Sighting
38	Great Argus	
	Broadbills	
39	Black-and-yellow Broadbill	
40	Black-and-red Broadbill	
	Robins, Forktails & Thrushes	
41	Magpie Robin	Direct Sighting
42	White-crowned Shama	
	Tailorbirds & Warblers	
43	Dark-necked Tailorbird	
44	Ashy Tailorbird	
	Barbets	
45	Blue-eared Barbet	
46	Brown Barbet	Direct Sighting
47	Red-throated Barbet	Direct Sighting
	Plovers & Sandpiper	
48	Common Sandpiper	Direct Sighting
	Darter	
49	Oriental Darter	Direct Sighting
	Birds of preys	
50	Changeable Hawk Eagle	Direct Sighting
51	White-bellied Sea Eagle	
52	Lesser Fish Eagle	Direct Sighting
53	Brahminy Kite	Direct Sighting
54	Crested Goshawk	Direct Sighting
55	Crested Serpent Eagle	Direct Sighting
56	Wallace's Hawk-eagle	Direct Sighting
57	Jerdon's Baza	Direct Sighting
	Bee-Eaters & Rollers	
58	Blue-throated Bee-Eater	Direct Sighting
59	Dollarbird	Direct Sighting
	Bulbuls	
60	Yellow-vented Bulbul	
61	Red-eyed Bulbul	Direct Sighting
62	Grey-cheeked Bulbul	Direct Sighting
63	Hairy-backed Bulbul	Direct Sighting

No.	Species	Direct Sighting
	Flowerpeckers	
64	Flowerpecker SPP	
	Cuckoos, Coucal & Malkohas	
65	Cuckoo SP	
66	Plaintive Cuckoo	Direct Sighting
67	Greater Coucal	Direct Sighting
68	Raffle's Malkoha	Direct Sighting
	Flycatchers	
69	Pied Fantail	Direct Sighting
70	Asian Paradise Flycatcher	Direct Sighting
71	Black-naped Monarch	Direct Sighting
	Woodpeckers	
72	White-bellied Woodpecker	Direct Sighting
73	Orange-bellied Flowerpecker	Direct Sighting
74	Buff-rumped Woodpecker	Direct Sighting
	Wagtails & Pipits	
75	Yellow Wagtail	Direct Sighting
	Trogons	
76	Scarlet-rumped Trogon	Direct Sighting
	Terns	
77	White-wing Tern	Direct Sighting
	Spiderhunters & Sunbirds	
78	Little Spiderhunter	Direct Sighting
	Leafbirds, loras & Woodswallows	
79	Lesser Green Leafbird	Direct Sighting

6.3 Large Mammals

During the field survey, the recent presence of some 24 large mammals have been confirmed either by direct observation, recent tracks or physical signs, or from community reports.

Most have been identified by direct sighting and some identified by foot print, signs, sounds or nests. The list of the identified large mammal can be seen in Table 4.

Table 2; List of large mammal identified during field survey

No.	Species	Track, Mud rubbing, Scratch, Sound	Direct Sighting
	Primates		
1	Long-tailed Macaque		Direct Sighting
2	Pig-tailed Macaque		Direct Sighting
3	Proboscis Monkey		Direct Sighting
4	Orang Utan	15 nest sighting	
5	Bornean Gibbon	Sound	
6	Silvered Langur		Direct Sighting
7	Maroon Langur		Direct Sighting

No.	Species	Track, Mud rubbing, Scratch, Sound	Direct Sighting
	Pig		
8	Bearded Pig	T/M	Direct Sighting
	Deer		
9	Sambar Deer	T	
10	Lesser Mouse Deer		Direct Sighting
11	Greater Mouse Deer		Direct Sighting
	Civet		
12	Mask Palm Civet		Direct Sighting
13	Malay Civet		Direct Sighting
	Elephant		
14	Bornean elephant	T/M	
	Cat		
15	Leopard Cat		Direct Sighting
16	Clouded leopard	Interview	
	Tarsier		
17	Western Tarsier	Interview	
	Loris		
18	Slow Loris	Interview	
	Squirrel		
19	Prevost's Squirrel		Direct Sighting
20	Pointed Nose Squirrel		Direct Sighting
21	Plantain Squirrel		Direct Sighting
	Bat		
22	Flying Fox		Direct Sighting
	Otter		
23	Smooth otter		Direct Sighting
	Bear		
24	Malayan sunbear	Scratch marks	

During the community interviews, a larger number of mammals have been mentioned by local people as present in the Forest Reserve.

6.4 Protected Species Recorded

During the surveys, several of the species identified are present on State and International lists of rare and protected animals. In particular, the Wildlife

Conservation Enactment (1997) and the IUCN Red List (2008) have been referred to in compiling this list of rare and protected animals.

Table 3; Protected Species identified during surveys

No.	Name	IUCN Category	WCE Status
1	Pig Tailed Macaque	VU	Protected Species (Schedule 2)
2	Proboscis Monkey	EN	Totally Protected Species (Schedule 1)
3	Bornean Gibbon	EN	Protected Species (Schedule 2)
4	Orang Utan	EN	Totally Protected Species (Schedule 1)
5	Bearded Pig	VU	Protected Species (Schedule 3)
6	Malayan Sun Bear	VU	Totally Protected Species (Schedule 1)
7	Sambar deer	VU	Protected Species (Schedule 3)
8	Smooth Otter	VU	Protected Species (Schedule 2)
9	Bornean Pygmy Elephant	EN	Protected Species (Schedule 2)
10	Western Tarsier	VU	Protected Species (Schedule 2)
11	Slow Loris	VU	Protected Species (Schedule 2)
12	Clouded Leopard	VU	Totally Protected Species (Schedule 1)

N.B. EN – Endangered; VU – Vulnerable (IUCN, 2008)



Figure 13; Orang Utan (*Pongo pygmaeus*)

6.5 Limitations of Results

It is noted that while considerable effort has been made to identify as many species as possible, some isolated areas of the FR could not be accessed with the available time and logistics.

This means that, in particular, the presence of migratory birds and winter visitors has not been included in this survey and report.

In addition, as with all rapid surveys, it is not expected that the list included here is complete; additional species were identified on almost all days indicating that many more species remain to be found and confirmed within the FR. However, the list does include the primary rare and protected species expected to be found in the FR.



Figure 14; Oriental Darter (*Anhinga melanogaster*)

7.0 Threats

7.1 *Illegal Logging*

Illegal logging has been a persistent threat to forests in Sabah for several decades. Some evidence of log extraction is evident from the borders of the FR, though this is more likely to be related to agricultural encroachment, and domestic extraction for building materials.

In the future, domestic extraction is likely to remain a threat. Liaison with local community leaders, and an increased patrolling presence will decrease this pressure on the FR.



Figure 15; Logs being transported along Sg. Kinabatangan (image dated ~2007)

7.2 *Encroachment*

As with many forest reserves close to inhabited areas, Pin-Supu has suffered from encroachment. As an isolated forest reserve, the FR has a long boundary with respect to its area and the FR is surrounded by agriculture.

The encroachments are primarily for agriculture, and no permanent structures have been reported in the Pin-Supu Forest Reserve.



Figure 16; Encroachment into Pin supu FR

7.3 Hunting

While the residents of Lower Kinabatangan are primarily Muslim and as such do not hunt for pigs or monkeys, many outsiders enter the estates and forested areas to hunt; as such, hunting is considered to remain as a significant pressure on wildlife in the Lower Kinabatangan. With a cultural history of utilising river and forest products, hunting is considered to be equally cultural as economic.

Hunting can be categorised as hunting meat for personal consumption and small scale sale at markets, hunting for commercial sale and processing (barbequed, smoked, etc.) and hunting for animal products such as pangolin scales, largely for the TCM (Traditional Chinese Medicine) market.

Of the reported hunting activities in Pin-Supu, most fall into the first category,, though capture of pangolins has also been reported. Target species include pig and deer. The activities of the local villages in tourism and conservation has presumably decreased hunting pressure in the area.

Hunting is undertaken either directly using shotguns, homemade firearms (bakakuk), possibly spears, or with traps. Increasing controls on the availability of bullets (shotgun cartridges) has decreased the amount of hunting with guns. One unfortunate side effect of this has been the rise of small 'bombs' used to disable and dismember pigs. This inhumane method of hunting has found limited support due to the high personal danger of handling these.

This aside, the decreased availability of bullets, and the relative difficulty of using spears and blowpipes, will increase reliance on traps as a means of catching wildmeat. Fortunately, this is the easiest method to prevent through regular patrols as the trap must be left in place for some time before it catches

anything. Patrols along trails will be effective in locating and dismantling traps, or preparing ambushes to catch the perpetrators.

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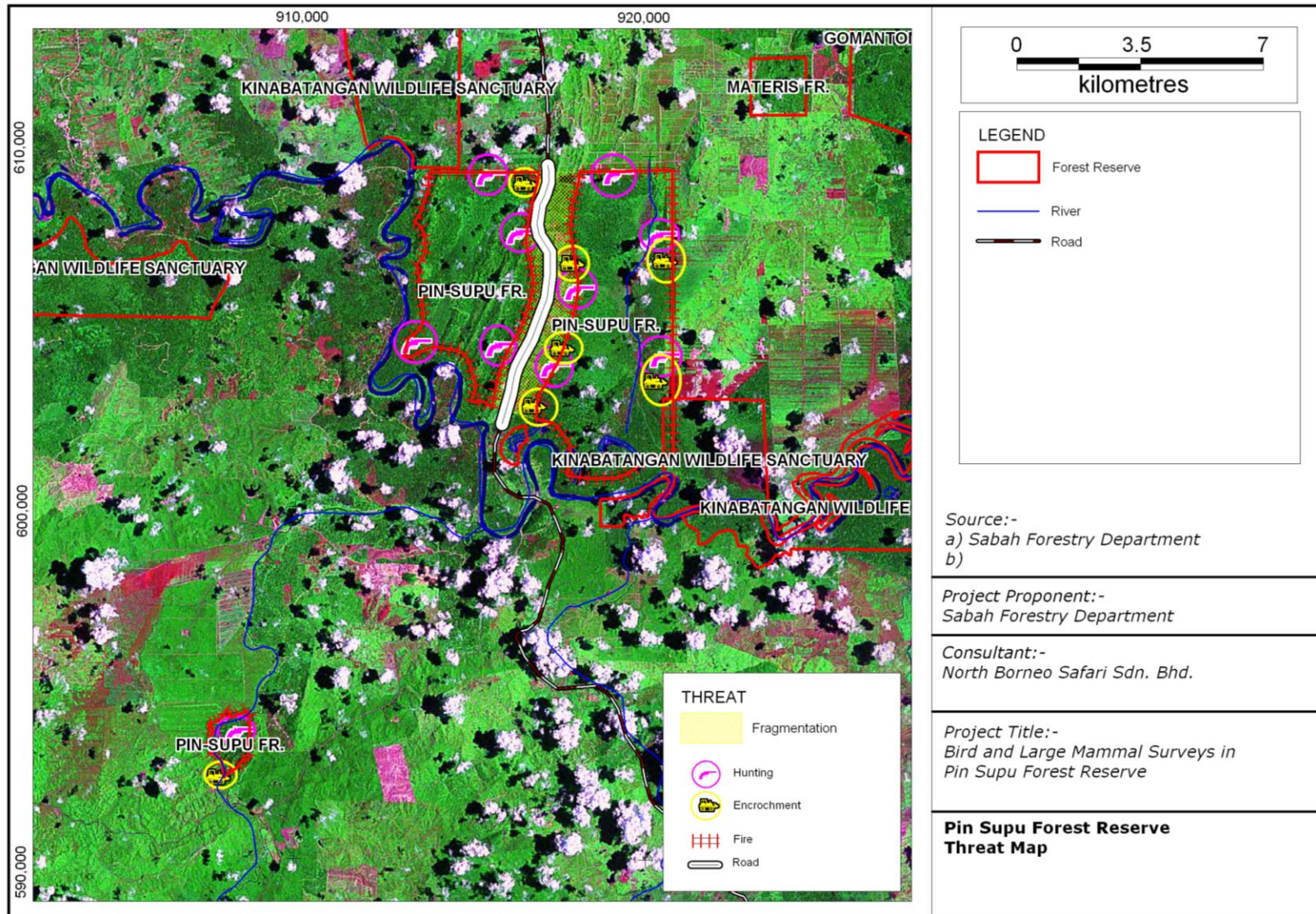


Figure 17; Pin Supu Forest Reserve Threat Map

7.4 Fragmentation

Pin Supu FR consists of three blocks of land separated by highway and rivers, as well as considerable distance. In the mosaic landscape of the Kinabatangan, Blocks A and B border onto forested lands protected as Wildlife Sanctuary, though Block C is completely isolated being surrounded by Oil Palm.

The fragmentation of the original forested landscape over the past three decades had resulted in isolation as well as reduction of populations of animals: and as the area available reduces, so too does the number of individuals, and the genetic diversity they contain. Over time, increased incidences of consanguine breeding will degrade the genepool, and likely lead to increases in birth defects and susceptibility to disease. Of particular concern for this are animals such as orang utans and gibbons, which normally do not move between forest blocks on non-forested land. The lack of connectivity also limits escape options in case of forest fires or increased hunting pressure.



Figure 18; Aerial photo of the Pin Supu showing agriculture and the highway between separating the forested areas

The close proximity of Blocks A and B – with a very major but spatially narrow barrier - indicate that reconnection may be feasible, and of benefit, not only to birds and mammals in both blocks, but also – and most significantly – for ecological continuity from Kuala Kinabatangan to Kuala Lokan. Block C is considered as entirely isolated with no real prospect for connection with other forest blocks.

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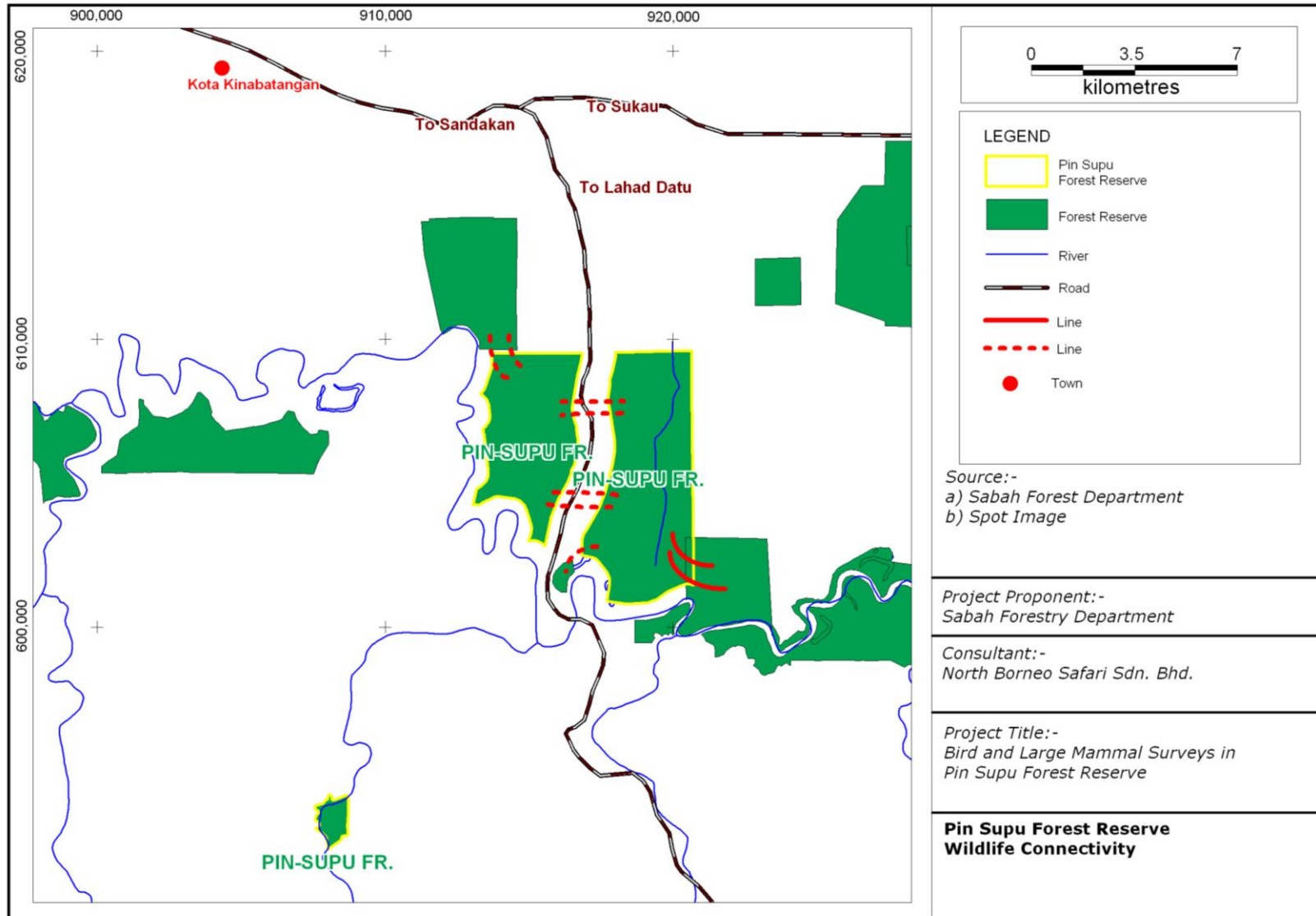


Figure 19; Wildlife connectivity in Pin Supu Forest Reserve

7.5 Landuse Conversion Pressure

As the population of the lower Kinabatangan increases, there will be additional pressure for land for agriculture and development. Although Class VI Virgin Forest Reserves cannot be used for agriculture, there will, in the future, be increased pressure to show economic value from Forest Reserves beyond altruistic, scientific and conservation goals.

However, it is noted that the steep sandstone hills, peat soils and flooded swamps of Pin Supu are unsuitable for agriculture, and it is unlikely that this pressure will be significant.

Increasing the economic value of the Forest Reserve as a source of tourism revenue for the local villages will give stronger justification (as well as conservation goals) in justifying retaining the area as forest.

7.6 Pollution

The presence of a Palm Oil Mill to the North of Block A means that treated Palm Oil effluent flows through the reserve. During low flows, the effluent is largely undiluted causing very poor water quality in Sg Kaboi.

The impacts on aquatic life, and forest life that depends on the aquatic resources (waterbirds, otters, etc.) may become severe during droughts if alternative clean wetlands are unavailable.

7.7 Fires

While the natural frequency and role of forest fires in Borneo has been much discussed (Beaman *et. al.*, 1985; Woods, 1989), there can be no doubt that they are extremely damaging in the short term. Significant fire damage has occurred in Pin Supu FR during both the 1983 and 1998 El Niño episodes.

Fires remain a significant threat to Pin Supu FR, and this risk has been exacerbated by drainage works in some areas of the Peat Swamp by neighbouring plantations and mills (North East of Block A) that have the effect of speeding up the peat drying out during droughts.

7.8 Archaeological Sites

As well as being home to a diverse array of flora and fauna, the FR also contains several sites of cultural and archaeological significance.

The limestone caves of Pin Supu block B are home to several caves that have been used for burials. Several coffins remain in the site, but there has been damage reported at some locations.

It is important to ensure that the caves are preserved for appropriate cataloguing and research before any visitation activities can be allowed.

8.0 Recommendations and Strategies

8.1 Demarcation

In the first instance, it is proposed that the FR be marked and signposted to indicate to local residents where the boundary is, and clearly identify any incidences of encroachment into the FR.

It is intended that this exercise (in conjunction with patrolling) will mark the end of encroachment into the FR. Any encroachers who willingly vacate their crops and agree to cease maintenance of the crops could be considered for release with a warning only.

Clear signage is required along the boundary to alert would-be intruders that the land is managed as a Forest Reserve.

It is recommended that the current practice of placing signs along the river bank (even where this is not the actual boundary) be continued.

The Pin Supu Forest Reserve boundary should conform with that shown on the 1:50,000 scale map used in conjunction with gazettelement of the Forest Reserve in 1984. It is expected that some dispute may occur with local farmer on the exact location of the boundary. Resolution of the boundary alignment will need to be done with the local community, therefore, bearing in mind the following point: (a) vegetation cover can be verified for some years prior to and after 1984, base on aerial photograph in the possession of Land and Survey Department (e.g. forest inventory photos), (b) a critical period is between 1982 (de-gazettelement of the original Pin Supu Forest Reserve), and March 1984 (gazettelement of Pin Supu Forest VJR), (c) although the route of the electricity pylons running approximately north-south along the western fringes of Block A has no legal bearing on the issue, it may be wise, as far as possible, to mesh this physical structure (and the zone of cleared vegetation along its route) with resolution of the FR boundary and encroachment (e.g. where feasible, the electricity pylon line could become the western boundary of block A of Pin Supu FR), and (d) interaction with the "local community should primarily be via formally recognized and appointed community leader for the recognized at and near Batu Putih.

8.2 Patrolling

An increased patrolling presence is proposed around the FR. JKR Roads, Kampong roads and Estate roads provide access around most of the FR, and multiple trails are available to allow foot access into the reserve for patrolling to prevent hunting, or remove structures and traps used for hunting.

Development of light vehicle tracks (motorbike or similar) to remote areas of the reserve could be considered if illegal access is a concern in these areas. However, construction of a patrol road may have the opposite effect of making

illegal access easier; this option should only be considered as a last resort in the face of ongoing encroachments.

8.3 Hunting Controls

The phenomenon of hunting using small bombs is disturbing as it is both lethal to wildlife, and extremely dangerous to non-target species and humans.

A series of posters advocating an immediate end to such methods is proposed incorporating blunt images and text such as shown below.

Figure 20; Possible content for community awareness poster to discourage hunting

Where traps, or hunting paraphernalia is found, and a capture or prosecution is not possible, the information should be forwarded to local Ketua Kampongs. This will ensure that community leaders are aware of illegal activities occurring within their area, and encourage them to dissuade illegal activities by their villagers, and within the area surrounding their village.

In addition, liaison with the police is required to ensure adequate controls on release of licenses for bullets to smallholders for 'pest control' on small farms.

8.4 Monitoring of Key Wildlife Species

While the initial surveys reported here have highlighted a diverse list of species still present in Pin Supu FR, the number, and long term stability of the populations will require long term data to confirm. Sixteen species are proposed as indicator species for various aspects of landscape and faunal pressures.

Predator species (a healthy ecosystem normally has a small number of top predator species; the species suggested are easily distinguished by sighting and calls)

- Brown Wood Owl
- Scop's Owl
- Buffy Fish Owl

Waterbirds (both species suggested are currently quite common locally but are threatened and of restricted distribution globally, both are easily seen and identified)

- Oriental Darter
- Storm's Stork

Mid-storey forest birds (these taxonomic groups reflect good forest structure; they are readily identified by sight)

- Trogons
- Asian Fairy Bluebird
- Pigeons

Forest floor species (these taxonomic groups also reflect good forest structure; they are readily identified by sight and calls)

- Pittas

Upper storey species (all eight species known from lower Kinabatangan currently persist, although some are now very rare locally; it is believed that numbers of the large species are now limited by nesting sites, also occasional illegal hunting; all species are easily seen and identified)

- Hornbills

Hunting (it is believed that both species suggested are under chronic hunting pressure)

- Pangolins
- Mature Sambar Deer

Rare and Protected Species (records of the two suggested carnivore species will be very infrequent; it is likely that the Kinabatangan habitat may be insufficient to support breeding populations long term)

- Clouded Leopard
- Orang Utan (individuals or nests)
- Sun Bear (individuals or signs)

It is suggested that rangers or other suitable candidates who will be employed long term in the area be trained in identification of these species (See Appendix A) and that they spend 4 hours per week surveying through the forest for signs of these animals. Records of sightings should be maintained and compiled into monthly and annual statistics that will, in time, become a useful scientific record.

Sighting and records from the community, or during other types of patrol should also be logged, but recorded separately from the 4 hours of survey time dedicated for this purpose.

8.5 Translocation of Isolated Species

It is likely that the Orang Utans of Pin Supu FR Block C; with an estimated population of below 5 are facing immediate genetic pressure.

With a time limit of perhaps only a decade or two until the population perishes, translocation of individuals could be considered. Discussion and consideration of this measure is required as the costs of translocation (including feasibility study, genetic assessment, selection of target locations, capture, transportation and follow-up monitoring) may not be justified in the face of larger conservation issues elsewhere in the state.

8.6 Recreation and Tourism Development

With good access to high quality forests, attractive rivers and lakes, and impressive wildlife as well as interesting geological and archaeological sites, Pin Supu FR has a high potential for development of recreation activities.



Figure 21; Danau Tungog inside the Forest Reserve

The existing Batu Puteh/Kg. Menggaris homestay, and the recently opened Tungog Eco Camp are strong tourism products. Further expansion of these facilities may not be necessary in the short to medium term, but additional trails, and activities would enhance the experience and lengthen the stay of guests.



Figure 22; Tourism facilities at Tungog Eco-Camp

8.7 Forest Enhancement and Restoration

Pin Supu FR has an impressive record of forest restoration activities through work with the local community cooperative; KOPEL Bhd. Expansion and continuance of these activities is considered beneficial both to the environment, and to the breadth of activities available to tourists.



Figure 23; KOPEL Forest Restoration and Trees Planting in Pin Supu VJR Block A.

It is noted that some SFD restoration activities have occurred inside the Wildlife Sanctuary. These activities are undeniably beneficial, though it highlights the need for clear survey and marking of the boundary to clarify departmental jurisdictions.

It is recommended that Sabah Forestry Department continue to support the draft lower Kinabatangan habitat restoration plan, which prioritised location for restoration. This will help to bring some element regional perspective to an activity which to date has been rather ad hoc, and involved several NGOs as well as government.

8.8 Connectivity

As discussed in Section 7.4 above, there would be ecological benefits through the of establishment of wildlife corridors between Blocks A and B of Pin Supu FR. Elephants are known to approach the perimeter of Block A, but not enter the agricultural areas directly adjoining the road. Reforesting key lots of land next to the road could entice the elephants to approach the road and eventually pass into Block B. This expansion of available habitat would be beneficial to the growing population of elephants in the lower Kinabatangan.

From block B, the elephants would be able to pass into Lot 8 of the LKWS; another area of land suitable for elephants to graze. They could also cross Sg Kinabatangan to enter the Borneo Samudera land that has been reserved for conservation, and Lot 9 of the LKWS. From Lot 9, the elephants could access the Lokan Forest Reserve, and Deramakot where another population of elephants exists. Creating this linkage would free the elephants of the Lower Kinabatangan from the current genetic bottleneck.

Member of the local community have indicated that the most suitable location for this connection; where there are least houses, and land is still available for purchase and reforestation, is at the area known as Singgahmata. This passes close to the southern end of the hills and would give elephants access

to the flat land on both sides of the road, and directly across the river into the Borneo Samudera conservation area.

There are, however, two significant concerns with this measure. Enticing the elephants to cross the road could lead to accidents between elephants and vehicles; an occurrence that would likely be fatal to both parties. Adequate signage and traffic slowing measures would be essential if this is to be prevented. The second point of concern is that crossing the highway would bring elephants closer to Bukit Garam; one of the primary population centres of the Kinabatangan District. If elephants approached this area, there is an increased chance conflict and lethal measures being used by residents to protect their crops and houses from elephants. Careful consideration and community consultation is required to discuss benefits and possible concerns before such a measure is implemented.

Before any consultation with the local community on the identification of possible ecological connection between Block A and Block B, government needs to be appraised of the key issues and options. Firstly, it needs to be clear whether the concept is to provide a "corridor" via which elephant can pass from east to west; or whether a more general ecological connectivity is sought. For most species except elephant and orang-utans, occasional gene flow across the highway and/or Kinabatangan River will occur, irrespective of whether additional habitat is created or retained. Individual orang-utans could be translocated by human intervention at rare intervals to provide genetic exchange. Thus, the connection concept really concerns elephants. The entire zone between Pin Supu Block A and B (see Potential Connection Zone I, Map 1) has a steep sandstone hill range on the east side of Block B, acting as a physical barrier to elephant passage. It is unlikely that, even when this area was entirely under forest cover, elephant would have move east-west in this zone. Potential Connection Zone II (Map 1) offers a connection but from Pin Supu Block A to the forest conservation zone inside Borneo Samudera Pin Estate, not of Kinabatangan Rivers, if the goal is to allow elephants to move upstream toward Lokan and Deramakot. More significantly, there is no record of elephants having used this route at least since around 1992. Even if the connection were formalised (via compulsory purchase of land), it is quite possible that the route would never be used by elephants. The same point is true for Potential Connection Zone III, which relies on "riverine reserve" along the south bank of Kinabatangan River.

Overall, the opinion of this report is that the idea of a corridor between Pin Supu FR Block A and B does still merit further consideration, but on balance the risks may outweigh the potential benefit. Specifically, there are two risks: (i) elephants might not use any corridor that is established, or (b) elephant may, sooner or later start using the corridor, but this may lead to conflict at least on parts of the very long distance to Lokan, especially around Bukit Garam.

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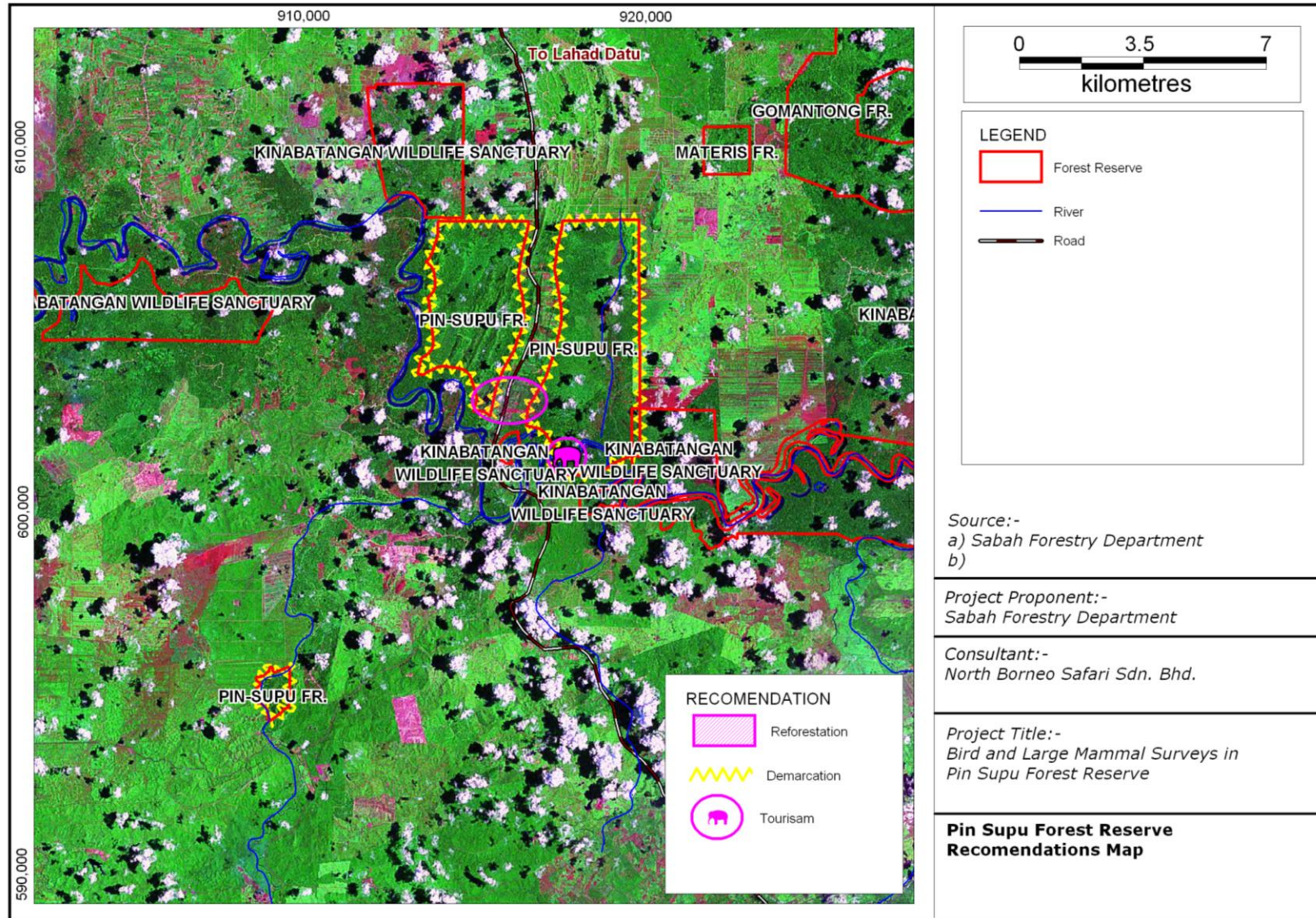


Figure 24; Pin Supu Forest Reserve Recommendations Map

9.0 Concluding Remarks

Against a background of reviews and reports on Kinabatangan, this survey has further highlighted that Pin Supu FR has a strong role as one of the core areas for biodiversity amongst the various forest fragments in the Lower Kinabatangan landscape. With a wide variety of forest and habitat types within a small and readily accessible area, Pin Supu FR represents much of what the Kinabatangan has to offer.

While the biodiversity of the Lower Kinabatangan ecosystem has been widely discussed, the importance of Pin-Supu FR as the focal point for connectivity should not be overlooked. The reconnection of wildlife habitat along the Kinabatangan river is a conservation goal that has been highlighted in the recent Kinabatangan Corridor of Life policy paper, and under the Sabah Development corridor. This reconnection can only occur through or very near to Pin Supu FR. However, some serious thinking is needed before proceeding with the idea of taking steps to identify and establish such a connection.

Some additional actions are required to strengthen the boundary, and commence patrolling to end and prevent further encroachment and hunting. Management over the next ten years should focus on increasing knowledge about these resources and reducing and managing immediate threats such as hunting and fires.

The current developments for tourism are to be praised as models of community and eco-tourism, and expansion of these low impact activities through the FR is compatible with the overall management objectives of the FR.

While the faunal surveys have not revealed the complete listing for the FR, they have highlighted the importance of Pin Supu FR at the centre of the Kinabatangan Corridor of Life.

10.0 Acknowledgements

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APPENDIX A

IUCN RED LIST BIRDS AND MAMMALS

**RED LIST BIRDS FROM
INTERNATIONAL UNION FOR CONSERVATION OF NATURE (IUCN)**

Species	Category	Sabah	Lowland	Montane
<u>Black Partridge <i>Melanoperdix niger</i></u>	VU	X	X	
<u>Crestless Fireback <i>Lophura erythrophthalma</i></u>	VU	X	X	
<u>Wattled Pheasant <i>Lophura bulweri</i></u>	VU	X		X
<u>Bornean Peacock-pheasant <i>Polyplectron schleiermacheri</i></u>	EN	X	X	
<u>Storm's Stork <i>Ciconia stormi</i></u>	EN	X	X	
<u>Lesser Adjutant <i>Leptoptilos javanicus</i></u>	VU	X	X	
<u>Chinese Egret <i>Egretta eulophotes</i></u>	VU	X	X	
<u>Mountain Serpent-eagle <i>Spilornis kinabaluensis</i></u>	VU	X		X
<u>Wallace's Hawk-eagle <i>Spizaetus nanus</i></u>	VU	X	X	
<u>Large Green-pigeon <i>Treron capellei</i></u>	VU	X	X	
<u>Grey Imperial-pigeon <i>Ducula pickeringii</i></u>	VU	X	X	
<u>Short-toed Coucal <i>Centropus rectunguis</i></u>	VU	X	X	
<u>Sunda Nightjar <i>Caprimulgus concretus</i></u>	VU	X	X	
<u>Blue-banded Kingfisher <i>Alcedo euryzona</i></u>	VU	X	X	
<u>Blue-headed Pitta <i>Pitta baudi</i></u>	VU	X	X	X
<u>Fairy Pitta <i>Pitta nympha</i></u>	VU	X	X	
<u>Straw-headed Bulbul <i>Pycnonotus zeylanicus</i></u>	VU	X	X	X
<u>Hook-billed Bulbul <i>Setornis criniger</i></u>	VU	X	X	
<u>Bornean Wren-babbler <i>Ptilocichla leucogrammica</i></u>	VU	X	X	
<u>Brown-chested Jungle-flycatcher <i>Rhinomyias brunneatus</i></u>	VU	X	X	
<u>Large-billed Blue-flycatcher <i>Cyornis caerulatus</i></u>	VU	X	X	

EN = Endangered

VU = Vulnerable

**RED LIST MAMMALS FROM
INTERNATIONAL UNION FOR CONSERVATION OF NATURE (IUCN)**

Genus	Species	Common names (Eng)	Red List status
Arctictis	binturong	Binturong	VU
Arctogalidia	trivirgata	Small-toothed Palm Civet	LC
Hemigalus	derbyanus	Banded Palm Civet	VU
Herpestes	semitorquatus	Collared Mongoose	DD
Martes	flavigula	Yellow-throated Marten	LC
Mustela	nudipes	Malay Weasel	LC
Mydaus	javanensis	Malay Badger Or Teledu,	LC
Neofelis	diardi	Clouded Leopard	VU
Paguma	larvata	Masked Palm Civet	LC
Paradoxurus	hermaphroditus	Common Palm Civet	LC
Pardofelis	badia	Bay Cat	EN
Pardofelis	marmorata	Marbled Cat	VU
Prionailurus	planiceps	Flat-headed Cat	EN
Prionodon	linsang	Banded Linsang	LC
Viverra	tangalunga	Malay Civet	LC
Bos	javanicus	Banteng, Tembadau	EN
Sus	barbatus	Bearded Pig	VU
Tragulus	javanicus	Lesser Mouse Deer	DD
Tragulus	napu	Greater Mousedeer	LC
Hylobates	muelleri	Bornean Gibbon	EN
Macaca	nemestrina	Pig-tailed Macaque	VU
Nasalis	larvatus	Proboscis Monkey	EN
Presbytis	hosei	Hose's Langur	VU
Presbytis	rubicunda	Maroon Langur	LC
Elephas	maximus	Bornean Pygmy Elephant	EN
Petaurista	elegans	Spotted Giant Flying Squirrel, Grey-headed Flying Squirrel	LC
Petaurista	petaurista	Common Giant Flying Squirrel, Red Giant Flying Squirrel	LC
Ratufa	affinis	Pale Giant Squirrel, Cream-coloured Giant Squirrel	NT
Rheithrosciurus	macrotis	Tufted Ground Squirrel	VU
Trichys	fasciculata	Long-tailed Porcupine	LC

EN = Endangered
VU = Vulnerable
NT = Near Threatened
LC = Least Concern
DD = Data Deficient

APPENDIX 4

STUDY TEAM

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