Environmental and Social Impact Assessment Report (ESIA) – Appendix 9

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FINAL REPORT OF STUDY OF ENDANGERED SPECIES AT RANTAU DEDAP

PT SUPREME ENERGY RANTAU DEDAP (SERD)

Muara Enim Regency and Pagar Alam City,

South Sumatra Province

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STUDY OF ENDANGERED AT RANTAU DEDAP

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EXECUTIVE SUMMARY

Natural habitats in and around the Project site of PT Supreme Energy Rantau Dedap (SERD) are dominated by forest on undulating terrain at altitude ranges from 1,600 m to 2,600 m Above Mean Sea Level (AMSL). The Project site is part of the Bukit Barisan Mountains, with vegetation associations divided into sub montane forest and montane forest ecosystems. Sub montane forest is found at altitudes above 1,700 m AMSL; this ecosystem is dominated by Puspa (*Schima wallichii*), Pasang groups (*Quercus* sp.), Medang (*Litsea* sp.) and Kebe elang (*Aglaia* sp.). Upper montane forests, at altitudes above 2,200 m AMSL, are dominated by *Taxus sumatrana* and *Dacrycarpus imbricatus*.

Several findings have confirmed the presence of key target species in the study area. Findings have been confirmed existence of Sumatran Tiger (*Panthera tigris sumatrae*), while the Sumatran Elephant (*Elephas maximus sumatranus*) is no longer exists. Among the primates groups in project area are Siamang (*Symphalangus syndactylus*) and Surili (*Presbytis melalophos*), whereas Agile gibbon (*Hylobates agilis*) is a primate species that certainly does not inhabit at the study area. The survey has proved of the existence of Sunda Pangolin (*Manis javanica*) which is Critically Endangered and Ajag or the Dhole (*Cuon alpinus*) which is Endangered according to IUCN red list status. The survey did not find any evidence of the existence of Smoky Flying Squirrel (*Pteromyscus pulverulentus*) which is assumed inhabit the study area. The lack of secondary data and research information makes it difficult to prove the existence of the species.

In addition to the target species, the survey also found some other threatened species, such as Sumatran serow (*Capricornis sumatraensis*, Vulnerable), Malayan sun bear (*Helarctos malayanus*, Vulnerable) and Malayan tapir (*Tapirus indicus*, Endagered). These species were found to be distributed fairly evenly across the study area.

Statement of Limitations

This report has been prepared in accordance with the agreement between PT SUPREME ENERGY RANTAU DEDAP (SERD) and Greencap Indonesia.

Within the limitations of the agreed-upon scope of services, this work has been undertaken and performed in a professional manner, in accordance with generally accepted practices, using a degree of skill and care ordinarily exercised by members of the consulting profession. No other warranty, expressed or implied, is made.

This report is solely for the use of SERD and any reliance on this report by third parties shall be at such parties' sole risk, and this document may not contain sufficient information for purposes of other parties or for other uses. This report shall only be presented in full and may not be used to support any objectives other than those set out in the report, except where specific written approval with comments are provided by Greencap.

STUDY OF ENDANGERED SPECIES AT RANTAU DEDAP

PT SUPREME ENERGY RANTAU DEDAP (SERD)

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CHAPTER 1 INTRODUCTION

The Rantau Dedap Geothermal Power Plant Project (**Map 1-1**) (the Project), located in the Province of South Sumatra, proposes development of a geothermal power plant. PT Supreme Energy Rantau Dedap (the 'Client' or SERD), as owner of the Rantau Dedap Project, will enter into project financing agreements with commercial banks during the geothermal exploration stage. Based on the ADB Safeguard Requirements for the assessment of critical habitats, various mammal species known or believed resident in the Project region have been identified as endangered according to the IUCN Red list. ADB has requested that SERD ensure the Project to be financed is socially and environmentally responsible.

ADB reviewed data from the World Database on Protected Areas, which reveals 65 species on the IUCN Red List of Threatened Species having ranges that overlap the boundaries of Gunung Patah Protection Forest, within or adjacent to the Project region. Given suitable habitat, these species may be found close to the Project site. Some of the key endangered species are listed below.

Table 1-1 Target Species and Conservation Status

English	Indonesia	Scientific Name	IUCN	CITES	Indonesia
Dhole	Ajag	*Cuon alpinus*	EN	II	P
Sumatran Tiger	Harimau Sumatra	*Panthera tigris* sumatrae	EN	I	P
Asian Elephant	Gajah Sumatra	*Elephas maximus*	EN	I	P
Sunda Pangolin	Trenggiling	*Manis javanica*	CR	II	P
Smoky Flying Squirrel		*Pteromyscus pulverulentus*	EN		
Agile Gibbon	Ungko	*Hylobates agilis*	EN	II	P
Sumatran Surili	Surili	*Presbytis melalophos*	EN		P
Siamang	Siamang	*Symphalangus syndactylus*	EN	I	P

Note: IUCN: EN = Endangered, CR = Critical Endangered, CITES: I = Appendix I, II = Appendix II, Indonesia: P = Protected

SERD requested PT Greencap Indonesia to address potential deficiencies that may prevent compliance with international and national regulations as identified by the ADB team. Greencap's understanding is that two of the four wellpads and the road construction during the exploration stage will negatively impact on the identified endangered species. However, Greencap also considered the vicinities of the other wellpads and planned power plant site in

the survey, although these areas have been used for agricultural purposes and therefore the probability of being habitats for the target endangered species is low.

1.1. Project Objectives

- Confirm presence or absence of target species in study area and identify their habitats;
- Identify other threatened species in study area.

1.2. Project Scope

- Field survey, together with use of camera traps for a fixed time period;
- Interviews with local people to assess actual presence/absence in the Project area;
- Consultation with the regional and local Ministry of Forestry offices, local specialist, and prior targeted surveys to confirm actual presence of species and conservation significance of the Project area, and
- Partner as possible with an NGO/university to assist with the studies.

1.3. Study Area

The study area is the extent of geographical space required to appropriately assess impacts to biodiversity values as a result of the Project.

The study area was extended to Wellpads B, C, E, D, I and Puyang Lake area, situated deep within the forest (**Map 1-1**).

Map 1-1 Area of Endangered Species Study

CHAPTER 2 METHODOLOGY

2.1. Review and Compilation of Secondary Data

Secondary data will be gathered from relevant agencies from available relevant reference journals, reports and documents that describe the existing conditions in the project area and describe the existing environmental conditions in the project area (where possible and where information is available). Secondary data also include previous UKL and UPL report, Baseline study for ANDAL, RKL and RPL and recent high-level biodiversity report if available. Data and information will also be collected from the Forestry Office in South Sumatera and other offices concerned.

2.2. Line Transect

Line transect methods were used to observe animals; transects were constructed at some sites and every site was surveyed for two days. Four transects, each 1 kilometre in length, were developed. Observations in the field were carried out from 6.30 to 17.30. When surveyors detected animals or their signs or vocalizations, times of detection were noted, as well as numbers of individuals, and the direct distance between observer and animal. The vocalization recording method was specifically used for siamang and gibbon, which ”promote” their territory almost every morning. Siamang and agile gibbon groups produce their vocalization for territorial advertisement on average 15.9 minutes and 14.4 minutes, respectively (Raemakers, 1977; Gittins, 1977). The farthest distance between source of vocalization and the observer was estimated at 2 km.

The survey was also recorded information on habitat characteristics of target species including its potential food sources. The geographical positions of the findings were noted by using GPS. Means of detecting the species have been categorized into direct or indirect, including animal’s signs such as foot prints, faeces (scat), feathers, tree markings, and nesting sites. The primate food trees and fruit drops along the path were recorded. Planning for transect is illustrated in **Figure 2-1**.

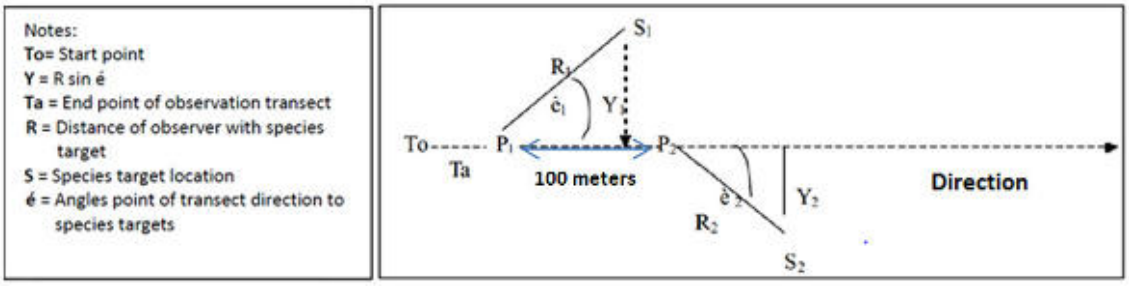


Figure 2-1 Line Transect to Primate Observation

The strip width of line transect was estimated at 50 m (Willson and Willson, 1972). This is due to the vegetation of montane forest habitat in survey area was not too dense.

2.3. Mist net

Mist net is net-shaped fauna trap. Mist net is generally used for birds and small mammals, such as bats. Mist net has a variety of sizes depend on target species. Mist nets are used to catch a flying squirrel. Mist net length ranges between 3-18 meters with a width of 2.5 meters. Survey will installed 2 – 5 of camera traps on study area.

2.4. Camera Trapping

Camera traps are very useful for wildlife monitoring, and have become a standard method. Seven Bushnell camera traps model 119537C and 119437C have been installed in this study. Camera traps could provide visual data of target species and would record continuously in real-time and intermittently at specific times (limited by battery lifetime). To maximize results, the camera trap placed in appropriately selected locations. The installation of camera traps is thus adapted to the target species and the habitat terrain. Camera traps targeted to get information of large mammals. The camera is placed in the path of movement of large mammals that determined by marks or other signs of animals' present.

Figure 2-2 Bushnell Camera Traps Model 119537C and 119437C

2.5. Rapid Observation

Rapid observation is a non-transect method of data collection with route. Survey route follows the movement of the target species. In addition to line transects, surveyors also followed the existing foot trails in the forest. Basically, this technique is the same as the line transect, differing in the use of the existing trails on ridges or along streams, as well as along the borders between plantations and forest. In total, surveyors walked 20 kilometres along both line transects and existing foot trails.

For large mammals, survey has been focused on ridges and hills. Ridges are commonly used by animals as movement routes. For primate species, the routes were followed its food trees in the forest and the edge of forest bordering plantation areas. The information of habitat use were derived from direct findings and information from local residents and project's worker.

Locations of transects, observation routes, and camera traps are shown on **Map 3-2** and **Map 3-3**.

2.6. Community Interview

Large portions of the study area in the lower altitudes have been converted into villages and coffee plantations. Surveyors surveyed the remaining forest adjacent to the plantations where people still find Leaf monkeys (*P. melalophos*). In the villages, interviews with people have been conducted specifically on their experiences with wildlife that still exists in the area. Residents were questioned on whether they have seen specific animals in recent years (up to 3 years back). People are also asked whether they hunt animals or they have experienced threats from wildlife during their residence in the village. These interviewed villages have been identified based on the results of previous reconnaissance trip.

2.7. Habitat Modelling

Habitat analysis used the Maximum Entropy (MaxEnt) Model. MaxEnt is a general purpose algorithm for estimating a target probability distribution by findings of the probability distribution of maximum entropy. The model for a species is determined from a set of environmental layers (or "coverage") in a landscape, together with a set of sample locations where the species has been observed. The model expresses the suitability of each grid cell as a function of the environmental variables at that grid cell. A high value of the function at a particular grid cell indicates that the grid cell is predicted to have suitable conditions for that species. The computed model is a probability distribution over all the grid cells. The

distribution chosen is the one that has maximum entropy, subject to some constraints: it must have the same expectation for each feature (derived from the environmental layers) as the average over sample locations.

The model considers five environmental variables (**Table 2-1**) as potential predictors of habitat potential of Sumatran Tiger's prey. These variables are chosen based on their biological relevance to species distribution. The environmental variables map is presented in **Appendix III**.

Table 2-1 Environmental Variables

No	Environmental Variable	Code	Type	Data
1	Elevation	Dem	Continues	ASTER Digital Elevation Model
2	Land cover	Landcove_	Categorical	Data interpreted from Landsat 8 with acquisition on June 2014
3	Distance from water sources	rivdist_class	Continues	Distance buffer from water sources in study analysis area, such as river and lake.
4	Slope	Slopeclass	Continues	Analysis using Digital Elevation Model data, slope in degree.
5	Topography position	Topopositin	Categorical	input Digital Elevation model data and analysis using land facet toolbox

The landscape boundaries for analysis use water catchments as units of analysis. The boundaries were extended to include the water catchment area of Puyang Lake, as presented on **Map 2-1**.

Map 2-1

STUDY AREA OF HABITAT MODELING

ENDANGERED SPECIES STUDY OF SUPREME ENERGY RANTAU DEDAP MUARA ENIM, LAHAT, DAN KOTA PAGAR ALAM - SOUTH SUMATERA PROVINCE

Scale

0 1.25 2.5 5 Km

Scale 1 : 100,000

Proyeksi : UTM Zona 48 S
Spheroid : WGS 84
Datum : WGS 84

U

Legend

- Province Boundary
- Regency Boundary
- Collector Road
- Local Road
- Road Proposed
- River
- Settlement
- Water Body
- Project Facility
- Wellpad
- Camera traps
- Study Area of Habitat Modeling

Map Source

- Peta Atlas Provinsi Sumatera Selatan, Bakosurtanal
- Batas Administrasi dari Peta RTRW Provinsi Tahun 2012-2032 Perda Sumsel No. 14 tahun 2006
- PT Supreme Energy
- Overal Site Layout, Kota Agung Site Location, SKM, Jan 2012
- Elevasi Diperoleh dari Aster DEM, Resolusi 30 meter
- Landsat 8, August 08, 2013
- Google Earth
- Field Survey, October 2014

CHAPTER 3 THE FINDINGS

3.1. Vegetation and Ecosystem

The sampling locations for the flora study and map of ecosystem types is presented on **Map 3-1**. Floral specimens are identified on the Bogor Laboratory of LIPI (Lembaga Ilmu Pengetahuan Indonesia/Indonesian Institute of Sciences). Complete findings of the flora component are presented in the **Appendix IV**.

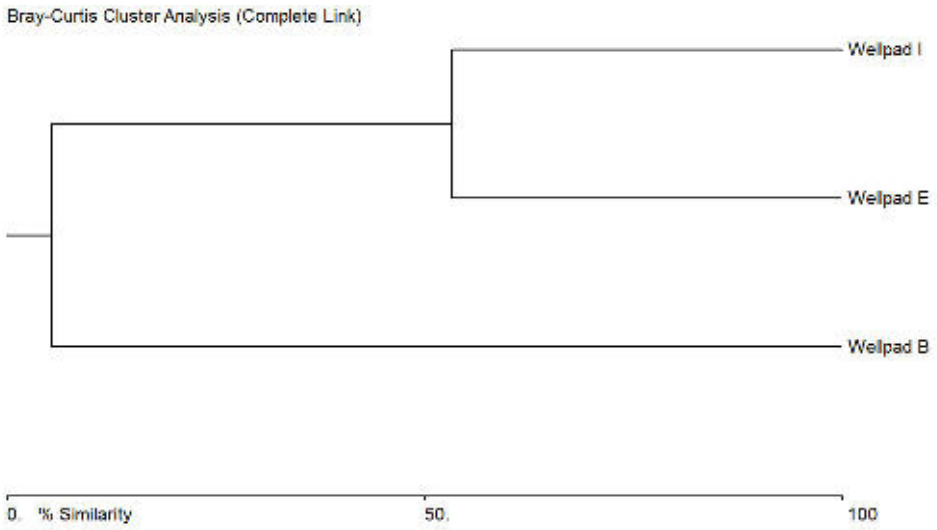


Figure 3-1 Cluster Analysis of Vegetation Data

In general, the study area is a montane ecosystem. The results of cluster analysis showed that high similarity found between the vegetation types of Wellpad E and Wellpad I. In the meantime, the species composition in Wellpad B was very different. This might be due to the altitude of Wellpad B is somewhat lower than the other two. The altitude of Wellpad B is lower than 2,000 m AMSL (Above Mean Sea Level). To simplify, the vegetation types of montane habitat in the study area could be categorized into two types of ecosystem i.e. lower montane and montane.

Wellpad B (1,700 m AMSL.)

Wellpad B is representative of the Sub-montane forest ecosystem. The observation of trees in the growth stage with a diameter over 60 cm was recorded consist of Puspa (*Schima wallichii*), Pasang (*Quercus* sp.), Medang (*Litsea* sp.), and Kebe elang (*Aglaia* sp.). Undergrowth plants, among others, were composed of Kelat groups (*Syzygium* sp.), Baso (*Caryota mitis*), and Kekawi (*Lasianthus* sp.) On the forest floor were found species such as *Begonia isoptera*, *Begonia muricata*, and *Begonia multangula*. Also recorded was *Balanophora* sp., a parasitic

plant that roots on trees of *Quercus* sp. Some pioneer plants were found, including Sepat (*Ficus* sp.) and Jelatang (*Laportea stimulant*).

A secondary mountain plant species found to be quite dominant is Maleuleu (*Litsea cubeba*). Palm groups, especially species of rattan, are rarely found, because elevation factors in the study area do not support growth of these species. The species distribution caused by altitude (elevation effect) factors is *Vaccinium varingiaefolium* (epiphyte species). Another common plant is edelweiss (*Anaphalis longifolia*). Plant species mentioned are common species found in the mountain forests of Java as well as Sumatra.

Wellpad E (2,000 m AMSL.)

Wellpad E is in the sub-montane forest ecosystem, with the dominant flora including Lengkedai (*Dacrycarpus imbricatus*) and Lengkedai daun (*Taxus sumatranus*). Both trees are commonly used for building material by local communities. Lengkedai daun, endemic to Sumatra, here is was found quite dominant and abundant in the hilly areas. This plant became famous because of its alleged potential as cancer drug, but this factor is still in research. Other tree species recorded are *Syzygium* sp., Medang, Cihu (*Schima wallichii*) and *Litsea cubeba*. In the second canopy layer are found *Syzygium lineatum* with elliptical leaves, *Neolitsea* sp., *Evodia latifolia*, and *Litsea* sp. On the forest floor was recorded *Sarcandra glabra*, *Argostemma montanum*, *Begonia muricata* as dominant species, as well as *Sonerilla* sp., *Medinilla speciosa*, *Polygonum* sp., and *Ficus* sp.

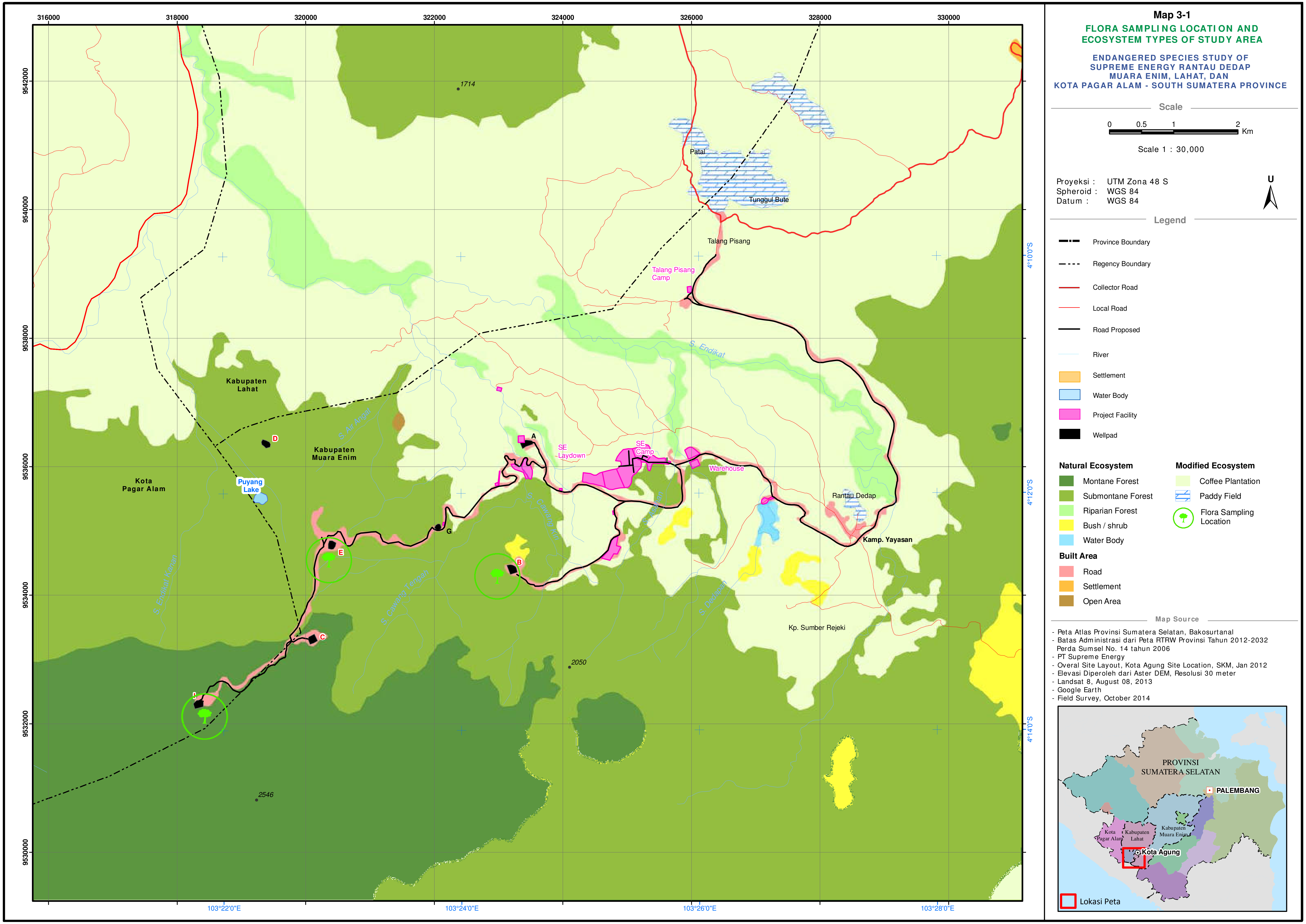
Wellpad I (2,200 m AMSL)

This area is in the montane moss forest ecosystem; generally, tree roots are covered by moss. The composition of the forest is dominated by *Taxus sumatrana* and *Dacrycarpus imbricatus*. Common species found are *Weinmania* sp., *Liquidambar* sp. *Cinnamomum* sp., *Syzygium* sp., and Cihu (*Schima wallichii*). in the lower forest canopy are found *Lasianthus* sp., *Litsea* sp, *Acer laurinum*, *Symplocos* sp., and Proteaceae family species. Liana plants are rare, except *Rubus* sp. and *Lasianthus* sp., indicating the forest is still in good condition. On the forest floor were found *Sonnerila* sp., *Elatostemma* sp., *Impatiens* sp 3 which is also believed to be an endemic species not previously recorded.

Impatien sp groups

Taxus sumatrana

Figure 3-2 Species Findings of Vegetation Study


Map 3-1
FLORA SAMPLING LOCATION AND
ECOSYSTEM TYPES OF STUDY AREA
ENDANGERED SPECIES STUDY OF
SUPREME ENERGY RANTAU DEDAP
MUARA ENIM, LAHAT, DAN
KOTA PAGAR ALAM - SOUTH SUMATERA PROVINCE
Scale
0
0.5
1
2
Km
Scale 1 : 30,000
Proyeksi : UTM Zona 48 S
Spheroid : WGS 84
Datum : WGS 84
U
Legend
Province Boundary
Regency Boundary
Collector Road
Local Road
Road Proposed
River
Settlement
Water Body
Project Facility
Wellpad
Natural Ecosystem
Montane Forest
Submontane Forest
Riparian Forest
Bush / shrub
Water Body
Built Area
Road
Settlement
Open Area
Modified Ecosystem
Coffee Plantation
Paddy Field
Flora Sampling Location
Map Source
- Peta Atlas Provinsi Sumatera Selatan, Bakosurtanal
- Batas Administrasi dari Peta RTRW Provinsi Tahun 2012-2032
Perda Sumsel No. 14 tahun 2006
- PT Supreme Energy
- Overal Site Layout, Kota Agung Site Location, SKM, Jan 2012
- Elevasi Diperoleh dari Aster DEM, Resolusi 30 meter
- Landsat 8, August 08, 2013
- Google Earth
- Field Survey, October 2014
PROVINSI
SUMATERA SELATAN
PALEMBANG
Kota Pagar Alam
Kabupaten Lahat
Kabupaten Muara Enim
Kota Agung
Lokasi Peta
316000
318000
320000
322000
324000
326000
328000
330000
9542000
9540000
9538000
9536000
9534000
9532000
9530000
103°22'0"E
103°24'0"E
103°26'0"E
103°28'0"E
4°10'0"S
4°12'0"S
4°14'0"S
1714
Patal
Tunggul Bute
Talang Pisang
Talang Pisang
Camp
S. Endikat
Kabupaten
Lahat
Kabupaten
Muara Enim
Kota
Pagar Alam
Puyang
Lake
A
B
C
D
E
G
SE
Laydown
SE
Camp
Warehouse
Rantau Dedap
Kamp. Yayasan
Kp. Sumber Rejeki
2050
2546

3.2. Species Targets

3.2.1. Primates

Siamang (*Symphalangus syndactylus*) and Agile gibbon (*Hylobates agilis*)

In total, the survey covered 20 km length which consists of both line and natural foot trail walks. The habitats in the Project areas are sub montane and montane forests. The lowest altitude is around 1,300 m and the highest about 2,000 m AMSL. With the maximum observation distance about 50 meters to either side, surveyors covered an area of 200 ha. During the survey, only Siamang were found and no agile gibbons could be detected nor heard. However, data collected mostly did not result from direct encounters with species, but through their vocalization. The sources of vocalization were traced using triangulation. Only six groups were noted from direct encounters with the animals. The remaining 10 groups were detected from the territorial songs produced almost every morning.

Figure 3-3 Photos of *Symphalangus syndactilus* that encountered at the border between forests and coffee plantations (Left) and the forest near the Cawang Tengah river (Right)

The number of individuals in the groups encountered varied from 2 up to 5, consisting normally of an adult couple alone or with up to one adolescent and two juveniles. All six groups were encountered at high elevation, with five groups in montane habitat between 1,500 and 2,000 m AMSL. Only one group occupied territory in the sub-montane forest habitat with altitude below 1,500 meters AMSL. This is because most forest areas below 1,500 m AMSL have been converted to coffee plantations

Appendix I showed direct encounters and vocalizations of siamang groups that were recorded. Six groups were obtained from line transects, occupying 200 ha. The average home range size for groups of siamang in this area was 33.4 ha, slightly larger than siamang groups studied in

the Kuala Lompat forest, Malaysia, which utilize 32 ha of forest habitat (Chivers, 1984). The availability of food trees particularly with fleshy fruit is reduced with increasing altitude. This was clearly shown by a study of habitat quality of two sympatric gibbons on montane habitat on the Malay Peninsula (Caldecott, 1980). Because of climate, soil, and drainage, the supply of fruit to agile gibbons decreases in abundance with elevation. This renders highland areas less favourable to agile gibbon than to siamang, which is less frugivorous (Raemakers, 1984). The only fleshy fruit bearing trees which are a dominant species in the study area are *Syzygium* spp. This is one of the explanation why the Agile gibbon (*Hylobates agilis*) could not be found in the study area.

O'Brien et.al (2004) found in Bukit Barisan Selatan National Park that Agile gibbon and Siamang density are negatively correlated, with agile gibbon most abundant in mid-elevation forests (400 – 600 m AMSL) and Siamang most abundant in lowland (< 400 m AMSL) and sub-montane (1,000 – 1,500 m AMSL) forests. In this study, the agile gibbon (*Hylobates agilis*) was neither encountered nor heard of its vocalization. Since the Project area consists of high elevation montane forest habitat, only a few groups of siamang exist.

Observer has discovered Siamang in the plantation near the forest edge. When it overlays with land cover, the results indicate that the Siamang group was trapped on small forest. This was due to the impact of forest fragmentation. This group of Siamang has been trapped in the "forest island". If it is not well manage the group becomes threatened. Observer has estimated five individuals of Siamang.

The coverage area was calculated based on the radius of the farthest distance between observer and source of vocalization which is estimated at 2 km length. There is 16 groups of siamang has been documented within 48 km^2 forest area. Therefore, only 0.3 group/km^2 occur in the survey area. This number is much lower than the density of siamang in Gunung Tujuh (2,100 m AMSL) in Kerinci Seblat National Park, west Sumatra which is 2.7 groups/km^2 (Wood, et.al., 1996). The total number of tree stands with diameter more than 30 cm is less than 200 trees/ha. This number was obtained from 50 plots each 200 m^2 (range 2–7 trees/plot). In the last 10 years in south Sumatra of Barisan Montane range, illegal deforestation has increased up to the sub-montane forest habitat (1,000–1,400 m AMSL.). Currently, the forest in this region has been converted to coffee plantation and the encroachment went up to montane forest as seen in the map of Project area. **Map 3-2** showed the distribution of Siamang in the Project area is dispersed in the forest surroundings Wellpad A through E and Wellpad I.

Sumatran Surili (*Presbytis melalophos*)

All leaf monkeys (*Presbytis melalophos*) encountered during the survey were in groups of 3 to 10 individuals. All encounters were situated in forest areas bordering coffee plantations. They inhabit peripheral forest at elevations 1,500 m to 1,700 m AMSL. In the Bukit Barisan Selatan Park which is situated in the southeast of the Project area, the Sumatran surili is abundant and it was occurred in the forest habitats that have been converted into plantation. It occurs mainly in the lowlands, and its density is related to the existence of shrub, coffee, and forest patches (Nurcahyo, 2009).

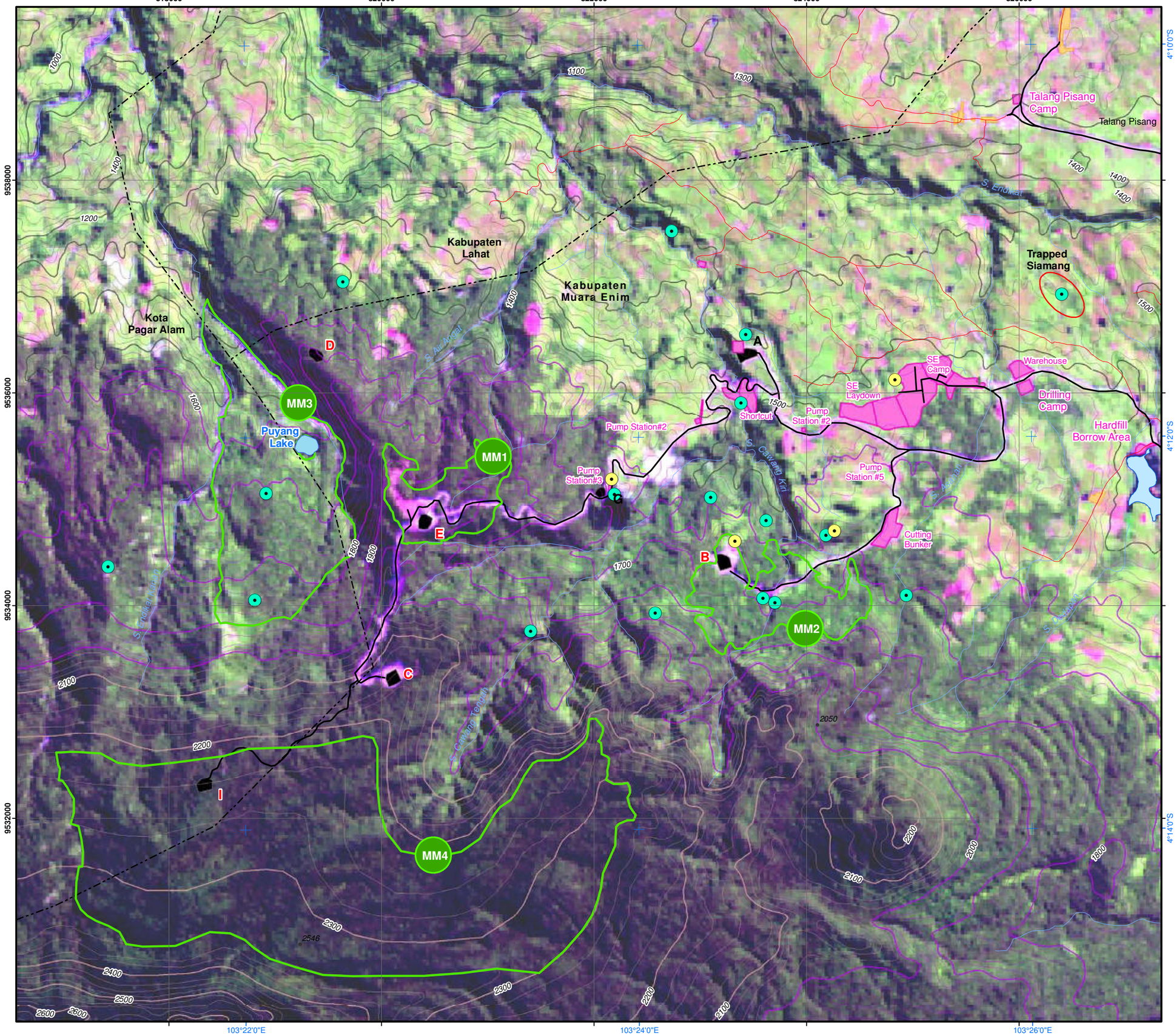
In contrast, the density of Sumatran Surili based on this survey was only 2 groups/km^2. This might be due to the forest cover in these area remains 75 percent, whereas coffee plantations occupy about 25 percent of the total Project area. Further, it has been indicated by Nurcahyo (2009) that the Sumatran surili was not present in the proportion of forest with cover between 50 and 75%, but had an extremely high density in forest cover between 26 and 50% at more than 19 groups/km^2. Therefore, this species is hardly seen in the moist forest within the project area. The distribution of Sumatran Surili was found to be dispersed in the vicinity of Wellpads A and B, which are close to coffee plantations.

Figure 3-4 Photos of Sumatran Surili on Adjacent Habitat between Plantation and Forest

Map 3-2

SURVEY LOCATION AND FINDING LOCATION OF PRIMATES GROUPS

ENDANGERED SPECIES STUDY OF SUPREME ENERGY RANTAU DEDAP MUARA ENIM, LAHAT, DAN KOTA PAGAR ALAM - SOUTH SUMATERA PROVINCE



Scale

0 0.5 1 2 Km

Scale 1 : 35,000

Proyeksi : UTM Zona 48 S
Spheroid : WGS 84
Datum : WGS 84

U

Legend

- Province Boundary
- Regency Boundary
- Collector Road
- Local Road
- Road Proposed
- River
- Settlement
- Water Body
- Project Facility
- Wellpad

Altitude (meters asl)

- 1000 - 1500
- 1500 - 2000
- 2000 - 2600

Sampling Location

Primates Species

- Siamang (Symphalangus syndactylus) (17 locations)
- Surili (Presbytis melalophos) (4 locations)

Survey location

- Observation route
- Transect
- Survey Area (MM1-MM4)

Map Source

- Peta Atlas Provinsi Sumatera Selatan, Bakosurtanal
- Batas Administrasi dari Peta RTRW Provinsi Tahun 2012-2032 Perda Sumsel No. 14 tahun 2006
- PT Supreme Energy
- Overal Site Layout, Kota Agung Site Location, SKM, Jan 2012
- Elevasi Diperoleh dari Aster DEM, Resolusi 30 meter
- Landsat 8, August 08, 2013
- Google Earth

3.2.2. Large Mammals

Appendix II shows the list of species that have been found during the survey either captured by camera trap or indirectly through their sign of foot-prints. Several foot prints of prey animals have been identified and it consists of Malayan tapir *(Tapirus indicus*), Red deer (*Muntiacus muntjak*), Serow (*Capricornis sumatrensis*), wild pig (*Sus scrofa*), Porcupine (*Hystrix brachyura*), and Sambar deer (*Cervus unicolor*). The prey species' foot prints are common in the well pad B. The highest numbers of encounter frequencies of species foot prints were in surroundings Wellpad B whereas; the least frequencies were in Wellpad E which is near the lake. This was calculated by using a formula which has been developed by Lancia et al. (1999). The most diverse of foot prints of large mammals have been found in these forest surroundings in the altitude between 1,400 and 1,500 m AMSL with the Malayan tapir is the most frequent. The area was located near the village or plantation where the survey team found many active traps and snares targeted for prey animals.

Tiger foot-print was found in the south of Wellpad B together with the Malayan Tapir, Small Cats, and Malayan Sunbear. Among the small cats which are captured by camera were the Asian Golden Cat (*Catopuma temminckii*) and the Marbled Cat (*Pardofelix marmorata).* Considering the existence of high varieties of prey species in these areas, it is assumed that the population of predator species including the Sumatran tiger and the other cat species are living in a good quality of forest habitat. Therefore, the most important management intervention is controlling the area from the threat of hunting pressure. This is very crucial part of the management task in addition to the protection of the tiger itself. Hunting can drive big cat population into rapid extinction only if it exceeds threshold levels set by habitat quality and reproductive potential of the species (Martin and de Maulenaer, 1988).

The prediction of prey species habitat in the Project area and surroundings is discussed below in the **Habitat Modelling** chapter.

Figure 3-5 Footprint of Small Cat's (*Polymesoda bengalensis*) (left) and Serow (*Capricornis sumatrensis*) (Right)

Sumatran Tiger (*Panthera tigris* sumatrae)

The vertical distribution of Sumatran tigers ranges from sea level to 2,000 m AMSL (O'Brien et al. 2003) but on occasion they are found up to altitudes of more than 2,400 m AMSL (Linkie et al. 2003). There were 33 out of 38 forest patches of tiger habitat have been evaluated and the project area is included one of the patches of forest that have not been evaluated yet (Wibisono and Pusparini, 2010). This study's results would be useful to fill the gap of data of current tiger forest patches. Surveyors found evidence of Sumatran tiger existence in the vicinities of Wellpads B, C, and D.

Figure 3-6 Evidence of Sumatran Tiger: Claw (Left) and Footprint (Right)

The elevation of the study area is between 1,400 m and 2,500 m AMSL. Camera traps were deployed opportunistically in the forest. Wellpads where tigers are predicted to pass, especially on trails below a ridgeline, trails near water, and passages between hills. During the survey, surveyors never directly encountered the tiger. However, prey animal signs such as footprints, as well as tiger prints were found in the forest surrounding Wellpad D with elevations of 1,800 m up to 2,000 m AMSL.

Figure 3-7 Camera Trap Result: Malayan Sunbear (*Helarctos malayanus*) (Left) and Masked Palm Civet (*Paguma larvata*) (Right)

Figure 3-7 shows photographs of species captured by camera trap, Malayan sun bear (*Helarctos malayanus*) and Masked palm civet (*Paguma larvata*) with the status of Vulnerable and Near Threatened, respectively.

Table 3-1 Installation of Camera Trap

No	Location	Coordinate		Date	
		South	East	Start	Stop
1	Wellpad D Route (D1)	4.20012°	103.3781°	17-10-2014	29-01-2015
2	Adjacent of Plantation and Forest (PL1)	4.20713°	103.4137°	21-10-2014	29-01-2015
3	Wellpad I-1 (I1)	4.23598°	103. 3593°	13-10-2014	29-01-2015
4	Wellpad I-2 (I2)	4.24240°	103.3663°	15-10-2014	18-12-2014
5	Wellpad B-1 (B1)	4.22214°	103.3991°	14-10-2014	29-01-2015
6	Wellpad B-2 (B2)	4.21791°	103.4184°	17-10-2014	29-01-2015
7	Wellpad E	4.20702°	103.3800°	16-10-2014	19-10-2014
8	Wellpad C (C1)	4.21733°	103.3837°	20-10-2014	29-01-2015
9	Route to Puyang (P2)	4.21943°	103.3709°	19-12-2014	29-01-2015
10	Wellpad E (E1)	4.20702°	103.3800°	25-12-2014	29-01-2015

Sumatran Elephant (*Elephas maximus* sumatranus)

The Sumatran elephant (*Elephas maximus sumatranus*) was not encountered during this study, either directly or indirectly (through tracks or scat). Perhaps it is locally extinct due to human pressure over the past 10 years. This has been indicated by villagers resident in the Project area questioned during the survey. A decade ago, the forest habitat in the

survey area was included on the list of small fragmented forest where Sumatran elephants could be found (Soehartono et al., 2007). According to the Sumatran Elephant Conservation Action Plan and Strategies, the population for the whole island was estimated at 2,400 to 2,800 individual wild elephants (excluding elephants in camps), in 25 fragmented populations (Soehartono *et al.* 2007). Most of these populations are living in the lowland areas. People kill elephants for its tusk.

Illegal killing of elephants by villagers, commonly by poisoning, as retaliation for conflicts with elephants is also considered a serious problem and contributed to the declining elephant populations (Hedges *et al*. 2005; Uryu *et al*. 2008). Results of surveys by the Wildlife Crimes Unit to the owner of protected species stuffs in Lampung province were shown that the stuffs of Sumatran elephant and Sumatran tiger were the most common found (Soehartono et al., 2007).

Sunda Pangolin (*Manis javanica*)

The survey has proved the existence of Sunda pangolin (*Manis javanica*) by camera trapped (**Figure 3-8**), although the results of interviews with local residents indicate that they have never seen pangolin in the study area. The species was captured by camera trap on Wellpad D and Wellpad C.

It has been recorded in Bukit Barisan Selatan National Park at 900 m AMSL. (Wirdateti et al., 2013). It is a nocturnal species and specialist feeder foraging only on ants and termites. Major threats include loss and degradation of available habitat and also due to hunting for trade (Semiadi et al., 2009).

Figure 3-8 Sunda pangolin that have been captured by camera trap

The finding of Sunda pangolin in the 1,910 m AMSL in the project area was the highest record in terms of altitude where the species has ever found.

Dhole (*Cuon alpinus*)

The survey has proved on the existence of Ajag or Dhole (*Cuon alpinus*) by camera trapped. The species can be found in primary of lowland habitat up to 1,200 m AMSL.

Figure 3-9 Dhole or Ajag that captured by camera trap in route to Wellpad D (left) and Wellpad B (right)

Camera traps that have been installed on Wellpad I and Wellpad D captured photographs of Dholes. On monitoring data, the Dhole was captured several times with different date. It indicates the area is part of main home-range of this species. The photographs show the species lives solitary. Based on literature, Dholes live in the mountain and lowland forests; they commonly make nests in caves and holes. Two subspecies of dholes are endemic to Indonesia, inhabiting the islands of Sumatra and Java, namely *Cuon alpinus* javanicus and C. *alpinus* sumatrensis. Dholes typically live in groups consisting of 5 to 12 individuals, even up to 30 individuals. However, in certain situations, dholes can live in solitary conditions, as found in Gunung Leuser National Park (Aceh) and Way Kambas National Park (Lampung) as well as in this study area.

Smoky Flying Squirrel (*Pteromyscus pulverulentus*)

The survey team did not find any evidence or signs of Smoky Flying Squirrel (*Pteromyscus pulverulentus*), directly or indirectly. Smoky Flying Squirrel (*Pteromyscus pulverulentus)* is the most difficult species target to prove its existence at study area. The species is solitary, nocturnal and lives in tree hollows 3 to 4 m above the ground in tall undisturbed lowland primary forest (Payne et. al. 1985; Niethammer, 1988). It is less common in higher elevations up to 1,000 m (Nowak and Walker, 1999). A threat to the population is habitat loss. It feeds mostly fruits, nuts and fungi found on nocturnal forays through the trees. Local people have never seen this species, although it has been explained the species target is a flying squirrel. They only noticed a common squirrel species.

3.3. Other Target Species

This chapter discusses the findings of threatened species others than the targets. The survey has been noted and confirmed two threatened species i.e., Malayan Sunbear (Endangered), Tapir (Endangered) and one species which still need a more detailed evidence other than just footprint, such a picture i.e., the Serow (*Capricornis sumatrensis,* Endangered)

3.3.1. Large Mammals

Malayan Sunbear (*Helarctos malayanus*)

Secondary evidence of Malayan Sunbear was recorded during field survey, such as scratches and footprint on surrounding of Wellpad I, Wellpad B, Wellpad D and Puyang Lake area. Camera traps captured photograph of Malayan Sunbear on Wellpad B, Wellpad D, Wellpad I and forest edge habitat at plantation area.

Figure 3-10 Malayan Sunbear that captured by Camera traps on Edge Habitat (left) and Wellpad D (right)

The Sunbear lives in the primary forest, secondary forest and occasionally in the plantation near the forest. This species could climb trees up to seven meters high for nesting.

They spread throughout tropical forest in Southeast Asia from Myanmar, South of China, Indochina, Sumatra and Borneo. This species has been listed by IUCN as vulnerable and has been included on the CITES list Appendix I since 1979.

Malayan Tapir (*Tapirus Indicus*)

The Malayan Tapir is a nocturnal species (Holden et al. 2003; Novarino et al. 2005). The distribution of this species in the Southeast Asia includes south of Myanmar, south of Thailand, the Malay Peninsula and Indonesia. **Figure 3-11** shows the distribution of Tapir in Indonesia. In Indonesia the species can be found in Sumatra from southern part of Toba Lake down to Lampung. There is only one record of Tapir in the north of Toba Lake, in Pangkalan Brandan

(Meijard & van Strien 2003). However, this record did not get any supports from others. Although the habitat in Aceh looks suitable for this species but, it has never been seen in the area (Whitten et al. 1984). Usually, the species occupies lowland forest, however, it can be detected in the elevation 2,000 m AMSL in Gunung Tujuh, Kerinci National Park (Holden et al., 2003). It can be found in the secondary forest habitat as well as plantations bordering the forest (Santiapilai & Ramono 1990; Novarino 2005; Maddox et al. 2007).

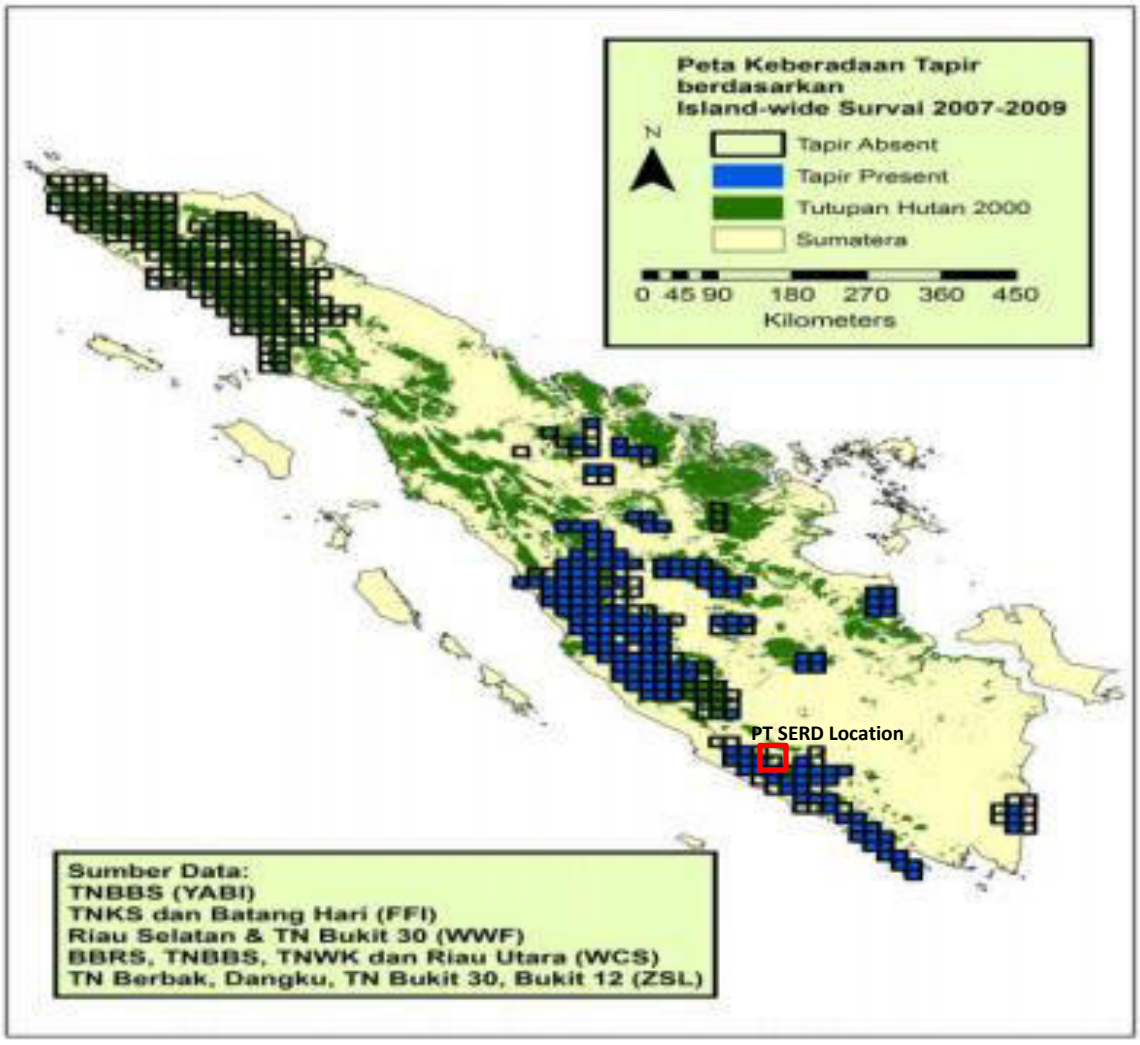


Figure 3-11 Distribution of *Tapirus indicus* (Pusparini et al. 2011)

The Malayan Tapir is one of the four species available in the world. In comparison to other Tapir species, the Malayan Tapir is the biggest. The IUCN has considered the status of Malayan Tapir Endangered (EN). In Indonesia, Tapir is protected by Government of Indonesia Regulation's (PP) Number 7 Year 1999. In the Project location, the Tapir was found around Wellpad B and Wellpad I. Camera trap has captured existence of this species of Northern part of Wellpad I.

Figure 3-12 Malayan Tapir

Sumatran Serow (*Capricornis sumatraensis*)

The Sumatran Serow becomes rare in the wild and its population is declining due to habitat destruction. The IUCN has categorized the species in vulnerable status. However, the GoI (Government of Indonesia) has included the Sumatran Serow on the list of protected species based on the Government Regulation of Indonesia Number 7 year 1999.

The habitat of Sumatran Serow consists of montane forest like the Rantau Dedap forest habitat. The population has also been recorded in the montane forest habitat of Kerinci Seblat National Park which covers four provinces in the southern Sumatra i.e., West Sumatra, Jambi, Bengkulu, and South Sumatra. In addition, this species has also been found in the montane forest habitat of Batang Gadis National Park and Gunung Leuser National Park. Both Parks are in the northern Sumatra. There are only three major concentration zones of distribution for this species i.e., Aceh highlands, Kerinci highlands and Barisan Selatan highlands (Santiapilai and Widodo, 1989). The populations of Sumatran Serow in Indonesia are limited and distributed along with the volcanic mountain chain of the Barisan Montane ranges from North to the South of Sumatra. It is also found scattered through Peninsular (West) Malaysia, but concentrated in the northern states, especially Kelantan, Perlis and Perak. The species has been recorded in 50 areas in Peninsular Malaysia, but in each area, the number of animals is estimated to be only between 10 to 15 individuals (Grubb, 2005). It inhabits steep mountain slopes between 200 and 3,000 m (van der Zon, 1979), covered by both primary and secondary forests. The serow is predominantly a browser (Santiapillai and Widodo, 1989). It is usually

solitary in nature, but small groups of up to seven have been observed (Nowak, 1991). It may occupy seasonal ranges and use well marked trails that often run along ridges of steep hills. Information on its reproduction is not available. Despite their wide spread distribution in the Barisan Montane Ranges, the report on the existence of the species are lacking since the last decade.

3.4. Biodiversity Threat

The forest habitat in the SERD Project area becomes easily accessible. Local people could enter the forest area from many places despite active control by SERD security staff. Very wide forest area might increase the threat of wildlife hunting and forest encroachment in the Project area as indicated by active animal traps found in the forest area during the survey.

3.4.1. Hunting Pressure

Hunting activity by local people is quite common in the Project area. Local people use several techniques of hunting. They were setting up an active trap and using the soft gun with the assistance of well-trained hunting dogs. The species target for hunting consists of deer, mouse deer, serow, and birds.

Rapid assessment through the interview with villagers living in surroundings Project area has shown that the reason for hunting was for meat requirement. The people who live in the immediate adjacent to the Project area are mostly agriculturist. Their daily income based on the selling of coffee beans. They have to enter the forest to collect forest resources due to the long-cycle period of coffee beans harvest. This phenomenon should be anticipated by the SERD management in order to maintain biodiversity in the Project area.

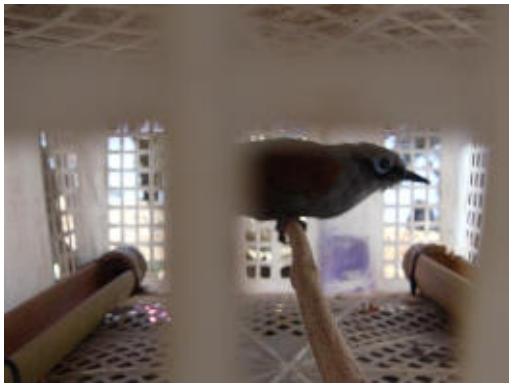


Figure 3-13 Poaching Activity Found in Project Area

3.4.2. Deforestation

Deforestation means of changing of land coverage from forest into non-forest land. In this context the deforestation in the study area was caused by activities of the people living in the surroundings Project area and the need for the Project itself. SERD has opened the forest for their geothermal development including construction of infrastructure and wellpad establishment whereas, the local people has converted the forest for their agricultural land. The direct impacts of these activities would cast out the wildlife habitat and creates fragmented habitat. This survey has found one group of Siamang which has been trapped in a small forest surrounded by the Project's access road and coffee plantation. A special attention should be given to this Siamang group to safe this endangered species. **Map 3-2** shows the location where the Siamang trapped in the "forest island".

Figure 3-14 Deforestation Activities by Local Farmers in the Project Area by Trees Cutting and Burn Method

3.5. Habitat Modeling

A total of 82 species from the existence data available are consist of the Sumatran Tiger's prey. These are separated into 75% for training data (62 locations) and 25% for testing data (20 locations). Several large mammals that identified as tiger prey are deer, red muntjak, wild boar, serow, and tapir.

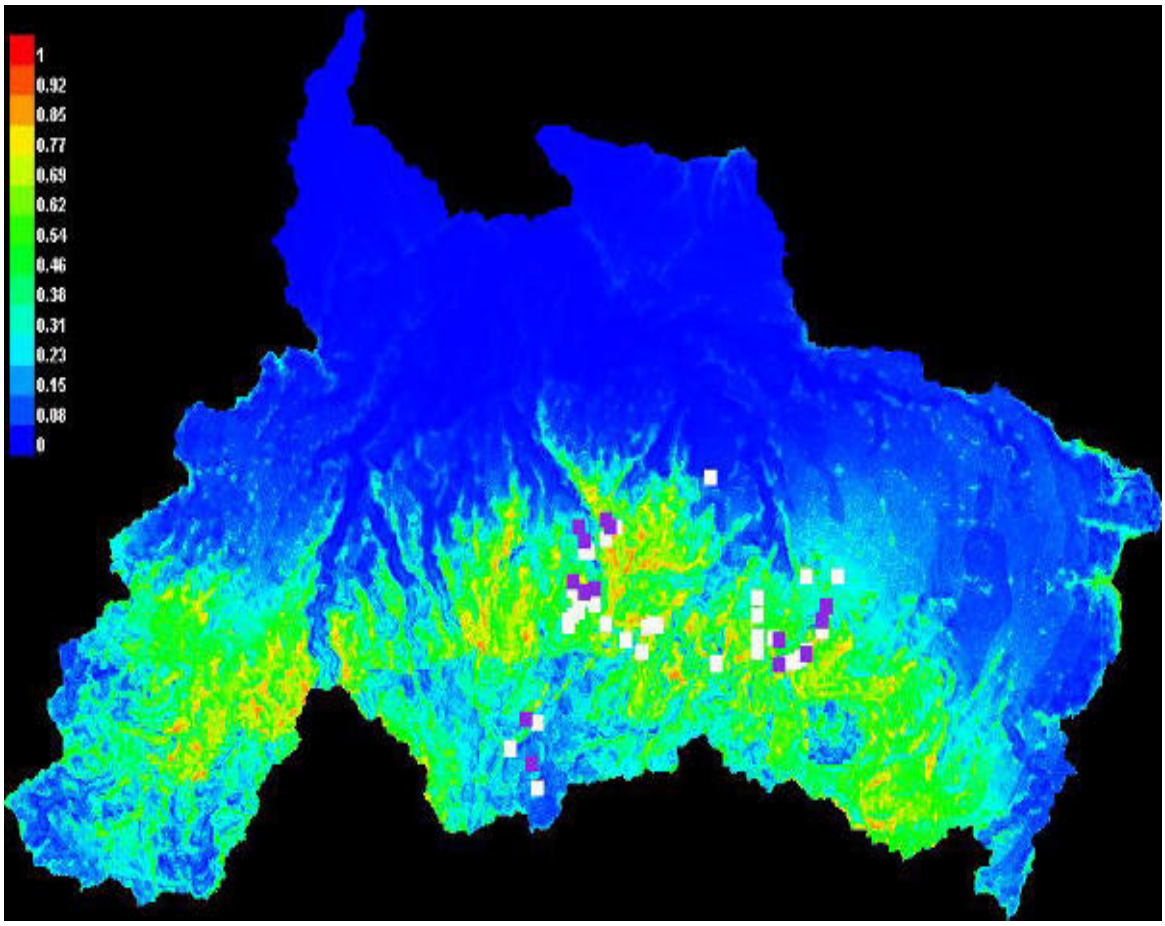


Figure 3-15 Output of Maxent Software

The purple grid points (dots) are testing location and white grid points are training data. Dots image uses colors to indicate predicted probability that conditions are suitable habitat and the red one indicates high probability of suitable conditions for the species. Green color indicates typical conditions of those where the tiger prey species were found, and lighter shades of blue indicate low predicted probabilities of suitable conditions. The result of potential habitat for tiger prey species is presented in **Map 3-4**.

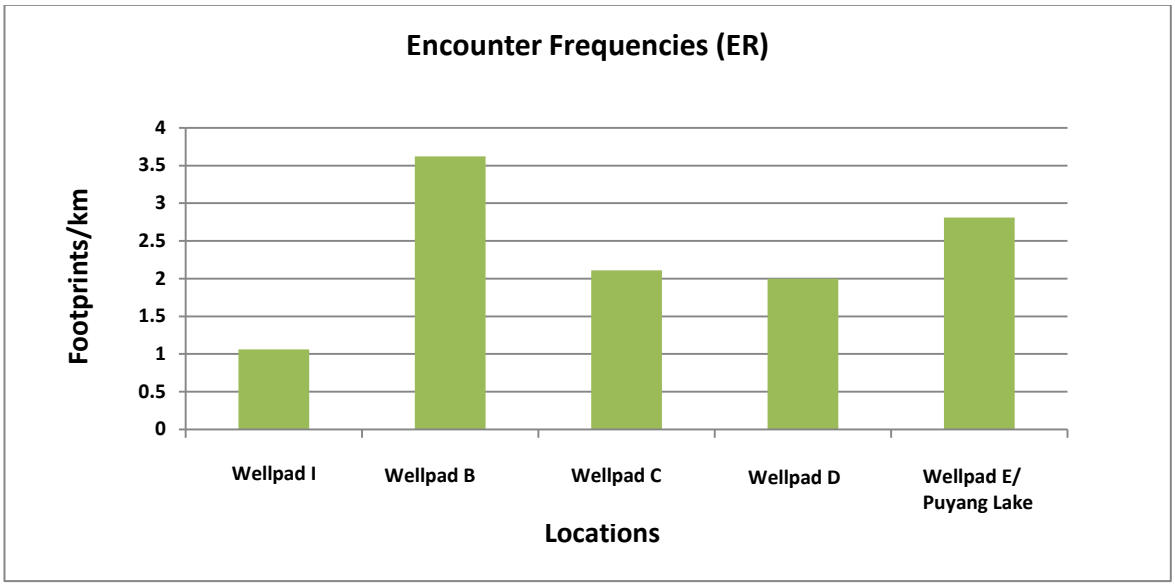


Figure 3-16 **Encounter Frequencies of Footprints of Big Mammals**

Prey species distribution is mostly affected by the elevation variable. Analytic results show elevation accounts for 50% of species distribution, followed by the land cover variable (21%), water source distances and topographic position (each 12%), and the least significant is slope, which affects only 6% of target species distribution (see **Figure 3-16**; DEM is digital elevation model).

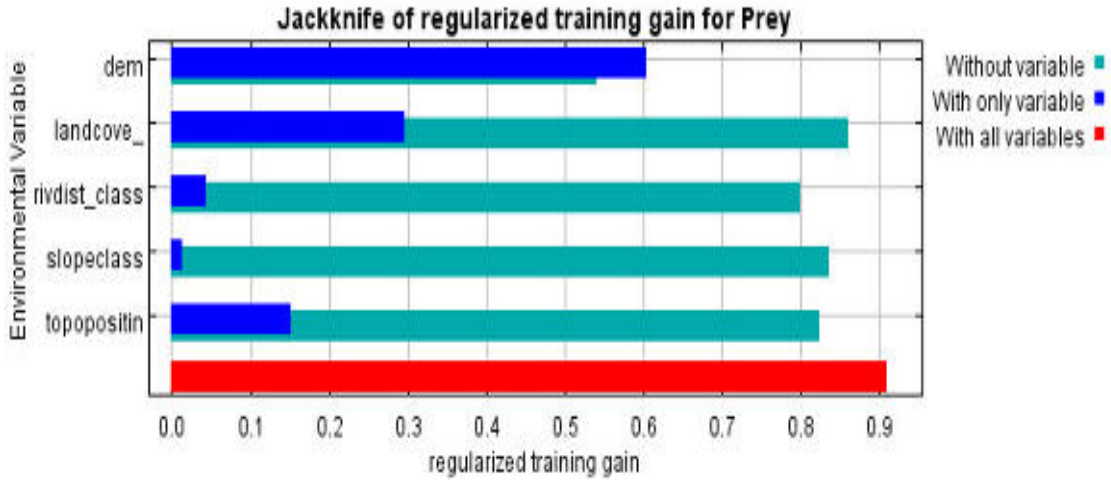


Figure 3-17 **Result of Jackknife Evaluations of Relative Importance of Predictor Variable for Tiger's Prey Habitat Model**

Figure 3-17 is a graph of the response of each environmental variable for distribution of prey species in the study area. At variable altitudes, species tend to use habitats most at altitudes of 1,700 to 1,900 m AMSL, and becomes less at higher locations. By using land cover variable,

sub-montane forest (class 2) is the forest cover category which the most frequently used; the next is class 10, built-up area.

If the slope variable was used, then the species prefer to use flat rather than high slope areas. Prey species use areas with less than 25 degrees in slope. The probability of finding the species was higher, in the topographic position variable, on ridge tops.

Map 3-3

SURVEY LOCATION AND FINDING LOCATION OF LARGE MAMMALS GROUPS

ENDANGERED SPECIES STUDY OF
SUPREME ENERGY RANTAU DEDAP
MUARA ENIM, LAHAT, DAN
KOTA PAGAR ALAM - SOUTH SUMATERA PROVINCE

Scale

0 0.25 0.5 1 Km

Scale 1 : 30,000

Proyeksi : UTM Zona 48 S
Spheroid : WGS 84
Datum : WGS 84

U

Legend

- Province Boundary
- Regency Boundary
- Collector Road
- Local Road
- Road Proposed
- River
- Settlement
- Water Body
- Project Facility
- Wellpad

Altitude (meters asl)

- 1000 - 1500
- 1500 - 2000
- 2000 - 2600

Sampling Location

- Camera traps
- Asian leopard cat, Panthera bengalensis
- Cat??,
- Rusa, Cervus spp.
- Sumatran tapir, Tapirus indicus
- Sumatran tiger, Panthera tigris
- Sun Bear, Helarctos malayanus
- Observation Route
- Survey Area (MM1-MM4)

Map Source

- Peta Atlas Provinsi Sumatera Selatan, Bakosurtanal
- Batas Administrasi dari Peta RTRW Provinsi Tahun 2012-2032 Perda Sumsel No. 14 tahun 2006
- PT Supreme Energy
- Overal Site Layout, Kota Agung Site Location, SKM, Jan 2012
- Elevasi Diperoleh dari Aster DEM, Resolusi 30 meter
- Landsat 8, August 08, 2013
- Google Earth
- Field Survey, October 2014

Map 3-4

PREDICTION OF THE HABITAT OF SUMATRAN TIGER PREY (MAXENT MODEL RESULT)

ENDANGERED SPECIES STUDY OF SUPREME ENERGY RANTAU DEDAP MUARA ENIM, LAHAT, DAN KOTA PAGAR ALAM - SOUTH SUMATERA PROVINCE

Scale

0 1.25 2.5 5 Km

Scale 1 : 30,000

Proyeksi : UTM Zona 48 S
Spheroid : WGS 84
Datum : WGS 84

U

Legend

- Province Boundary
- Regency Boundary
- Collector Road
- Local Road
- Road Proposed
- River
- Settlement
- Water Body
- Project Facility
- WellPad
- Wilayah Kerja Pertambangan (WKP)
- Study Area of Habitat Modeling

Prediction of Habitat Preference (%)

- 0 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 90

Map Source

- Peta Atlas Provinsi Sumatera Selatan, Bakosurtanal
- Batas Administrasi dari Peta RTRW Provinsi Tahun 2012-2032 Perda Sumsel No. 14 tahun 2006
- PT Supreme Energy
- Overal Site Layout, Kota Agung Site Location, SKM, Jan 2012
- Elevasi Diperoleh dari Aster DEM, Resolusi 30 meter
- Landsat 8, August 08, 2013
- Google Earth
- Field Survey, October 2014

CHAPTER 4 CRITICAL HABITAT ASSESSMENT AND BIODIVERSITY CONSERVATION

4.1. Performance Standard 6

Performance Standard 6 recognizes that protecting and conserving biodiversity - the variety of life in all its forms, including genetic, species and ecosystem diversity and its ability to change and evolve is fundamental to sustainable development. The components of biodiversity, as defined in the Convention on Biological Diversity, include ecosystems and habitats, species and communities, and genes and genomes, all of which have social, economic, cultural and scientific importance. This Performance Standard reflects the objectives of the Convention on Biological Diversity to conserve biological diversity and promote use of renewable natural resources in a sustainable manner. This Performance Standard addresses how clients can avoid or mitigate threats to biodiversity arising from their operations as well as sustainably manage renewable natural resources.

4.1.1. Objectives

- To protect and conserve biodiversity
- To promote the sustainable management and use of natural resources through the adoption of practices that integrate conservation needs and development priorities

4.1.2. Protection and Conservation of Biodiversity

In order to avoid or minimize adverse impacts to biodiversity in the project's area of influence (*see Performance Standard 1, paragraph 5*), the client will assess the significance of project impacts on all levels of biodiversity as an integral part of the Social and Environmental Assessment process. The Assessment will take into account the differing values attached to biodiversity by specific stakeholders. The Assessment will focus on the major threats to Endangered /Critically Endangered biodiversity, which include habitat destruction and invasive alien species. When requirements of paragraphs 9, 10, or 11 apply, SERD will retain qualified and experienced either internal or external experts to assist in conducting the Assessment.

4.1.3. Habitat

Habitat destruction is recognized as the major threat to the maintenance of biodiversity. Habitats can be divided into natural habitats (which are land and water areas where the biological communities are formed largely by native plant and animal species, and where human activity has not essentially modified the area's primary ecological functions) and

modified habitats (where there has been apparent alteration of the natural habitat, often with the introduction of alien species of plants and animals, such as agricultural areas). Both types of habitat can support important biodiversity at all levels, including endemic or threatened species.

- Modified Habitat

In areas of modified habitat, the client will exercise care to minimize any conversion or degradation of such habitat, and will, depending on the nature and scale of the project, identify opportunities to enhance habitat and protect and conserve biodiversity as part of their operations.

- Natural Habitat
  - In areas of natural habitat, the client will not significantly convert or degrade such habitat, unless the following conditions are met:
    - There are no technically and financially feasible alternatives
    - The overall benefits of the project outweigh the costs, including those to the environment and biodiversity
    - Any conversion or degradation is appropriately mitigated
  - Mitigation measures will be designed to achieve no net loss of biodiversity where feasible, and may include a combination of actions, such as:
    - Post-operation restoration of habitats
    - Offset of losses through the creation of ecologically comparable area(s) that is managed for biodiversity
    - Compensation to direct users of biodiversity

4.1.4. Critical Habitat

- Critical habitat is a subset of both natural and modified habitat that deserves particular attention. Critical habitat includes areas with high biodiversity value, including habitat required for the survival of critically endangered or endangered species; areas having special significance for endemic or restricted-range species; sites that are critical for the survival of migratory species; areas supporting globally significant concentrations or numbers of individuals of congregatory species; areas with unique assemblages of species or which are associated with key evolutionary processes or provide key

ecosystem services; and areas having biodiversity of significant social, economic or cultural importance to local communities.

- In areas of critical habitat, the client will not implement any project activities unless the following requirements are met:
  - There are no measurable adverse impacts on the ability of the critical habitat to support the established population of species described in paragraph 9 or the functions of the critical habitat described in paragraph 9.
  - There is no reduction in the population of any recognized critically endangered or endangered species
  - Any lesser impacts are mitigated in accordance with paragraph 8
- Critical Habitat Determination

Critical Habitat is triggered if the requirements of any one of these seven Criteria are met. Quantitative thresholds have been set for Criteria 1-3 (species), for the purposes of guiding Critical Habitat assessments; qualitative thresholds exist for Criteria 4-7 (habitats, functions, processes and ecosystem services) but depend on quantitative assessment, and expert and participatory judgement.

The identification of IFC Critical Habitat is based on five criteria (IFC, 2012a, 2012b):

1. C1: Critically endangered and/or endangered species;
2. C2: Endemic and/or restricted-range species;
3. C3: Concentrations of migratory and congregatory species;
4. C4: Highly-threatened and unique ecosystems; and
5. C5: Key evolutionary processes

In addition to the above five biological criteria, the IFC Guidance Note 6 (IFC, 2012b) clarifies further circumstances in which an area may be recognized as Critical Habitat. The additional criteria that are relevant to this project include:

6. C6: Legally Protected Areas in IUCN Categories I-II; and
7. C7: Internationally Recognised Areas.

Table 4-1 Quantitative Thresholds for Tiers 1 and 2 of Critical Habitat Criteria 1 Through 3

Criteria	Tier 1	Tier 2
1. Critically Endangered/ Endangered	a) Habitat required to sustain ≥ 10 percent of the global population of an IUCN Red-listed CR or EN species where there are known, regular occurrences of the species and where that habitat could be considered a discrete management unit for that species. b) Habitat with known, regular occurrences of CR or EN species where that habitat is one of 10 or fewer discrete management sites globally for that species.	c) Habitat that supports the regular occurrence of a single individual of an IUCN Red-listed CR species and/or habitat containing regionally-important concentrations of an IUCN Red-listed EN species where that habitat could be considered a discrete management unit for that species. d) Habitat of significant importance to CR or EN species that are wide-ranging and/or whose population distribution is not well understood and where the loss of such a habitat could potentially impact the long-term survivability of the species. e) As appropriate, habitat containing nationally/regionally-important concentrations of an EN, CR or equivalent national/regional listing.
Endemic/ restricted range	a) Habitat known to sustain ≥ 95 percent of the global population of an endemic or restricted-range species/ subspecies where that habitat could be considered a discrete management unit for that species/subspecies (e.g., a single-site endemic).	b) Habitat known to sustain ≥ 1 percent but < 95 percent of the global population of an endemic or restricted-range species/subspecies where that habitat could be considered a discrete management unit for that species/subspecies, where data are available and/or based on expert judgment.
3. Migratory/ Congregatory Species	a) Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 95 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle where that habitat could be considered a discrete management unit for that species.	b) Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent but < 95 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle and where that habitat could be considered a discrete management unit for that species, where adequate data are available and/or based on expert judgment. c) For birds, habitat that meets BirdLife International's Criterion A4 for congregations and/or Ramsar Criteria 5 or 6 for Identifying Wetlands of International Importance. d) For species with large but clumped distributions, a provisional threshold is set at ≥5 percent of the global population for both terrestrial and marine species. e) Source sites that contribute ≥ 1 percent of the global population of recruits.

4.1.5. Legally Protected Areas

- In circumstances where a proposed project is located within a legally protected area, SERD, in addition to the applicable requirements of paragraph 10 above, will meet the following requirements:
  - Act in a manner consistent with defined protected area management plans
  - Consult protected area sponsors and managers, local communities, and other key stakeholders on the proposed project
  - Implement additional programs, as appropriate, to promote and enhance the conservation aims of the protected area

4.1.6. Invasive Alien Species

- Intentional or accidental introduction of alien, or non-native, species of flora and fauna into areas where they are not normally found can be a significant threat to biodiversity, since some alien species can become invasive, spreading rapidly and out-competing native species.
- SERD will not intentionally introduce any new alien species (not currently established in the country or region of the project) unless this is carried out in accordance with the existing regulatory framework for such introduction, if such framework is present, or is subject to a risk assessment (as part of the SERD's Social and Environmental Assessment) to determine the potential for invasive behavior. SERD will not deliberately introduce any alien species with a high risk of invasive behavior or any known invasive species, and will exercise diligence to prevent accidental or unintended introductions.

4.1.7. Mitigation Hierarchy

The conservation actions have been established with the aim of achieving 'no net loss' to biodiversity in accordance with IFC PS6 (IFC, 2012a, 2012b). IFC PS6 requires evidence that the mitigation hierarchy has been applied, that avoidance is prioritized, and that offsets are measurable and only applied as a last resort where residual impacts are unavoidable.

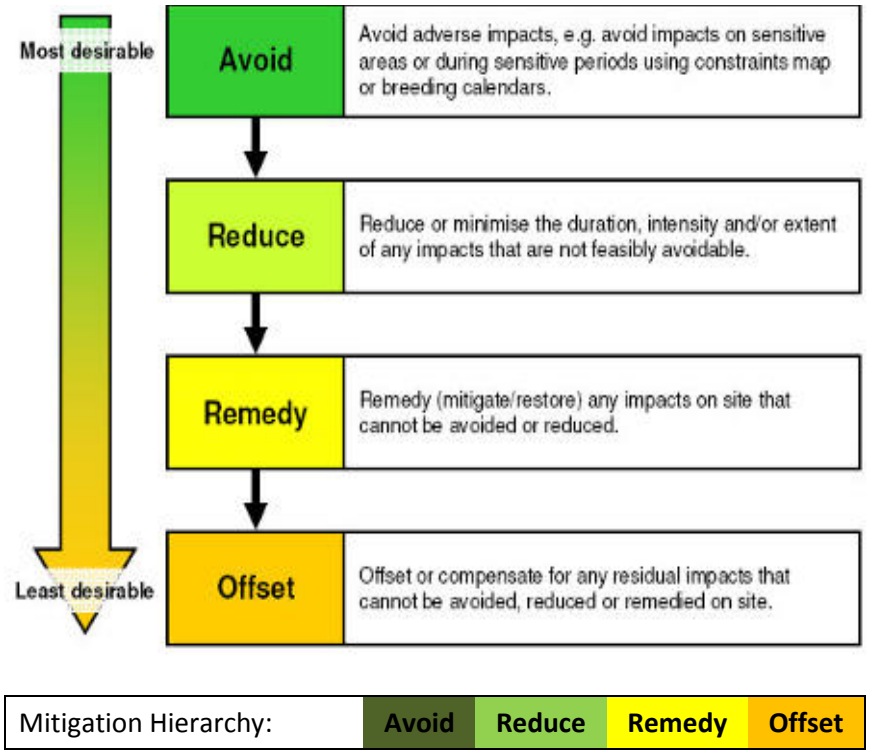


Figure 4-1 Mitigation Hierarchy

4.2. Project Description

PT Supreme Energy Rantau Dedap (SERD) plans to conduct "Geothermal Development for Rantau Dedap Geothermal Power Plant (PLTP) in Muara Enim Regency and Pagar Alam City, South Sumatra Province. This activity is expected to address the crisis of electrical energy in Indonesia and in particular in South Sumatra, to support the Indonesian government's policy of energy diversification and reduction in the consumption of fuel oil (BBM), reduction of electricity and fuel subsidies, as well as utilization of geothermal resources, which have high economic potential in Rantau Dedap.

Based on SERD Environmental Documents, Geothermal development plans generally include construction and operation of geothermal power plants, construction of supporting infrastructure, and electricity distribution. In ecology, these activities have potential to cause environmental impacts such as habitat loss, changes in land cover or habitat and increasing of poaching activity caused by better access road.

The project site is located in Gunung Patah Protection Forest. Protection forest is important habitat for hydrological function. Otherwise, Gunung Patah is a part of Barisan Montane

Ranges that is spread from north to the south of Sumatra and one of important habitat for the remaining endangered wildlife in Sumatra. Some protected species use this area as a habitat, one of which is the Sumatran Tiger.

GREENCAP (ENV) has conducted a study with background as described in the **INTRODUCTION** chapter. Stages of studies that have been done are literature review, field observation and monitoring using camera traps (October-January). From eight of the target species, five species have been proved for their existence in the project site. In addition, observations were also recorded three other threatened species. This wildlife study is focused on mammals.

The determination of critical habitat was only used five biological criteria. The unit analysis or focused area for this critical habitat assessment is defined based on impacted area of project.

The observation was using seven triggering species for project area which consist of two primates and five species of IUCN Red List threatened large mammals based on field observation. Siamang and Sumatran Surili are primate species, and Sunda Pangolin, Sumatran Tiger, Dhole, Malayan Sunbear, Malayan Tapir and Serow for large mammals.

4.3. Critical Habitat Assessment

In order to conduct a CHA, a discrete management unit (DMU) (i.e. the geographic area which is being investigated) must be defined with regard to criteria 1 to 3 (IFC, 2012b).

Spatial scope and unit analysis will use natural boundaries, which is hydrological catchment. Analysis focused on catchment that impacted by project. For the landscape, focused area is edge habitat of Bukit Barisan Landscape of Sumatera. The species that have been used for reference are consist of two Critical Endangered, four Endangered, and one Vulnerable based on the IUCN red list, but it has restricted range. All of them are mammals which are found in the Project area.

4.3.1. Criteria 1 and 2: Critically Endangered and Endangered Species; and Endemic and Restricted-range Species

Based on screening, detailed field survey and monitoring were recorded seven species as trigger of critical habitat under criterion 1 and/or 2. Table 4-2 is species that include on criteria 1 and/or 2 of critical habitat. **Table 4-2** is list of trigger species of Critical Habitat Assessment.

Critical habitat assessment conducted throughout the species triggered by determining the key species. That is because the focus area and the area impacted by project is not too widely. Based on expert judgment, Tiger is specified as key species of ecology. Potential habitat of

tiger is approached with the prey findings in the study area. Spatial analysis performed using the software MAXENT, it was presented in detail in Chapter **Habitat Modeling**. The result of spatial analysis is Critical Habitat Tier 2 of Project Area.

4.3.2. Criteria 3: Concentrations of Migratory and Congregatory Species;

Survey did not record of migratory species on project location. No trigger species of critical habitat at these criteria.

4.3.3. Criteria 4 and 5: Highly-threatened and Unique Ecosystems; and

Habitat and ecosystem as discussed on chapter **Vegetation and Ecosystem**. Most of focused area is Montane Forest Ecosystem. Project area included Sumatran montane rain forests eco region. Ecosystem types are quite common and can be found on Southern Sumatra Island.

It thus does not trigger Critical Habitat for Highly-threatened and unique ecosystems.

4.3.4. Criteria 5: Key Evolutionary Processes

This unit of analysis does not appear to have been the subject of the significant evolutionary processes required to meet this criterion. It is representative of a much broader and relatively homogenous landscape with low endemism. It thus does not trigger Critical Habitat for key evolutionary processes.

Table 4-2 Criteria 1 and 2 Candidate Species and Their Assessment Against Critical Habitat Criterion

English	Scientific Name	Criterion 1	Criterion 2	Tier 1	Tier 2	Rationale
Dhole	*Cuon alpinus*	EN			√	The species holds the status globally as Critical Endangered and it is Protected species in country. The number of population does not known both at national level and at the project site. Home range of the species is wide and focused area is relatively small part of the landscape.
Sumatran Tiger	*Panthera tigris* sumatrae	CR	The species is endemic of Sumatran Island		√	The species holds the status globally as Critical Endangered and it is Protected species in country. The population of the species is decreasing in the natural habitat. The focused area has been included in the national conservation action plan of species. The home rage size of the species is vast.
Sunda Pangolin	*Manis javanica*	CR			√	The species holds the status globally as Critical Endangered and it is Protected in country. The number of population is not known both at national level and at the project site. The trend of population is decrease in natural habitat.
Sumatran Surili	*Presbytis melalophos*	EN			√	The species holds the status globally as Endangered and it is protected in country. The number of population is not known both at national level and the project site. The feeding behaviour of this species is specific and only feed on leaves. The home range size is not big.
Siamang	*Symphalangus syndactylus*	EN			√	The species is strongly territorial. The territory size is not too big and very sensitive to disturbances because it's strong territoriality.
Malayan Tapir	*Tapirus indicus*	EN	The species is endemic of Sumatran Island		√	The species holds the status globally as Endangered and it is Protected in country. The population size is not known at national level and at the project site.

English	Scientific Name	Criterion 1	Criterion 2	Tier 1	Tier 2	Rationale
						The focused area is included on the national conservation action plan of the species. Species has wide home range.
Sumatran Serow	*Capricornis sumatraensis*		The species is endemic of Sumatran Island		√	The species holds the status globally as Vulnerable and it is Protected in country. The population size is not known both at national level and at the location of the project. The species has restricted home range and specific habitat. The trend of population is decrease in natural habitat because of poaching.

4.4. Priorities of Biodiversity Conservation

4.4.1. Selection Criteria

Based on literature review, detailed field survey and monitoring, GREENCAP has identified potential, challenge and threat for biodiversity, especially for mammals group. Biodiversity conservation need to be focused on habitat and species protection. The priorities of biodiversity conservation have been selected based on:

- Potential loss of EN/CR species and habitat on project area;
- Critical habitat trigger species and habitats; and
- Illegal activity issue that threaten of biodiversity conservation, such as poaching and illegal logging.

4.4.2. Habitat Priorities

GREENCAP has identified of habitat type on project area that have high biodiversity concentration. The following habitat types of high and medium conservation value have been selected as priorities for conservation:

- **Landscape of Puyang Lake area**. This landscape is predicted as refuges habitat. Puyang landscape area has flat topography with good condition of forest. This habitat prepare good water sources and feeding ground area for big mammals and primates group. Survey were recorded existence of Siamang and Malayan Tapir.
- **Wellpad B location area.** Forest area of Wellpad B is Sub-montane forest ecosystem. This area was core habitat for primates groups. Observer was found three groups of Siamang. In addition, several existences of big mammals and key species also was recorded on Wellpad B area.
- **Forest habitat on Wellpad D**. Observer was recorded of EN/CR species on this habitat. Tiger, Malayan Tapir, Dhole, Sumatran Golden Cat and Cat also were recorded on this area. Wellpad D is an area that is planned to be developed, but not yet done. Forest conditions in this area are still good. Easy access to this area might increase the threat to biodiversity.

Figure 4-2 Forest Condition on Wellpad D Area

4.4.3. Proposed Action Plan

Action 1: Develop of collaboration with Nature Conservation Agency (BKSDA) of Forestry and Environment Ministry

Timescale: During the activity, PT SERD should cooperate with BKSDA specifically for securing the species, such as increasing awareness to villagers and handling human-wildlife conflicts.

Intervention:

- Routine patrol together to prevent illegal activities that threaten Biodiversity.
- Promote public awareness on the importance of biodiversity and the legal aspects of activities which against the existing regulations.

Mitigation Hierarchy: **Avoid** **Reduce** **Remedy** **Offset**

Action 2: Increase Biodiversity Awareness for PT SERD Staff and Contractor

Timescale: During Project Activity.

Intervention:

- Incorporating biodiversity in the induction program material.
- Prohibit the killing and capturing of wildlife with its penalty

Mitigation Hierarchy: **Avoid** **Reduce** **Remedy** **Offset**

Action 3: Manage wildlife which has been trapped in fragmented habitats around the Coffee Plantation.

Timescale: Pre-construction

Intervention:

- Cooperation with BKSDA on the monitoring and remedial plans.

Mitigation Hierarchy: **Avoid** **Reduce** **Remedy** **Offset**

Action 4: Monitoring of EN/CR and restricted range species on Project Area

Timescale: During project activity

Intervention:

- Installation of camera traps on target area.
- Monitoring and patrolling the accessibility to the project area

Mitigation Hierarchy: **Avoid** **Reduce** **Remedy** **Offset**

Map 4-1

HABITAT PRIORITIES

ENDANGERED SPECIES STUDY OF SUPREME ENERGY RANTAU DEDAP MUARA ENIM, LAHAT, DAN KOTA PAGAR ALAM - SOUTH SUMATERA PROVINCE

315103 317603 320103 322603 325103 327603

9539996 9537496 9534996 9532496 9529996 9527496

4°10'0"S 4°11'0"S 4°12'0"S 4°13'0"S 4°14'0"S 4°15'0"S 4°16'0"S

103°20'0"E 103°21'0"E 103°22'0"E 103°23'0"E 103°24'0"E 103°25'0"E 103°26'0"E 103°27'0"E

Kabupaten Lahat

Kota Pagar Alam

Kabupaten Muara Enim

Puyang Lake

Tunggul Bute

Talang Pisang

Rantau Dedap

Kamp. Yaya

Kp. Sumber Rejeki

S. Endikat

S. Air Angat

S. Endikat Kanan

S. Cawang Tengah

S. Asahan

S. Dedapan

A B C D E

1216 2546 2272 2050 1991

Scale

0 0.5 1 2 Km

Scale 1 : 50,000

Proyeksi : UTM Zona 48 S
Spheroid : WGS 84
Datum : WGS 84

U

Legend

- Province Boundary
- Regency Boundary
- Collector Road
- Local Road
- Road Proposed
- River
- Settlement
- Water Body
- Project Facility
- Wellpad
- Contour
- Catchment Boundary

Habitat Priorities

- Puyang lake
- Puyang lake landscape
- Wellpad B area
- Wellpad D area

Point density (point/square km)

- < 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30
- 30 - 40
- 40 - 50
- 50 - 60

Primates Species

- Siamang (Symphalangus syndactylus)
- Surili (Presbytis melalophos)

Big Mammals

- Golden Cat
- Rusa, Cervus spp.
- Sumatran tapir, Tapirus indicus
- Sumatran tiger, Panthera tigris
- Sun Bear, Helarctos malayanus

Map Source

- Peta Atlas Provinsi Sumatera Selatan, Bakosurtanal
- Batas Administrasi dari Peta RTRW Provinsi Tahun 2012-2032 Perda Sumsel No. 14 tahun 2006
- PT Supreme Energy
- Overal Site Layout, Kota Agung Site Location, SKM, Jan 2012
- Elevasi Diperoleh dari Aster DEM, Resolusi 30 meter
- Landsat 8, August 08, 2013
- Google Earth
- Field Survey, October 2014

CHAPTER 5 CONCLUSIONS

Based on the results of the field study in the Project area, Greencap suggests some considerations and recommendations for actions to the SERD management.

1. Among the Critically Endangered and Endangered species found in the Project area are the Sumatran tiger, Sunda pangolin, Dhole, Malayan tapir, Siamang, and Sumatran surili. The finding of Sunda pangolin in the 1,910 m AMSL in the project area is the highest record in terms of altitude where the species has ever found.
2. The Sumatran tiger in this area could be one population with those dispersed in Bukit Barisan Selatan National Park (BBSNP). Male tigers can roam about three times farther than females. The average dispersal distance for males is 33 km, and the longest is 65 km, whereas female dispersal distances are less than 10 km, with the longest of 33 km (Smith, 1993).
3. The forest habitat in the Project region is situated in the northwest of the vast tiger habitat in BBSNP. BBSNP has been categorized as the Tiger Conservation Unit I (TCU I) based on the analysis of Wikramanyake, et al. (1999). The nearest distance to BBSNP is only 40 km towards southeast, separated by high montane forests.
4. The Project area is covering about 120 km^2. Only 91 hectares of the Project facility area is located in the protection forest of Bukit Jambul - Gunung Patah, with elevations of 1,500 to 2,600 m AMSL -- relatively small for tiger habitat
5. Using the available references on the priority areas for conservation of tigers in the wild, the forest habitat in the Project area is included to the TCU III (Wikramanayake, et al., 1999). This means that the area has been considered less important in terms of the size of the land area available for tigers. However, tigers can persist in relatively small protected area, provided their prey base is protected and maintained at an adequate density (Karanth and Stith, 1999). This might be the case with the tigers in the Project area.
6. The forest connection towards BBSNP might still function although very narrow. This forest strip should be maintained and secured, particularly to protect prey species.
7. A decade ago, the forest habitat of the study area was included on the list of small fragmented forest patches where Sumatran elephants could be found (Soehartono, et al., 2007). However, this species is no longer exist. This might be due to human pressure which caused to local extinction.
8. It has been shown by the data that a variety of prey species exist in the Project area such as deer, tapir, and pigs. These are the favourite prey species for tigers.

9. Active animal traps and snares were found in the forest. It is important for the management to work together with local conservation authority to develop monitoring activities for controlling animal hunting.
10. Currently, the local people have not yet experienced with human-wildlife conflicts. It indicates that the ecosystem chain of the forest habitat in the Project area is still relatively good.
11. The Project area situated in high elevation of the sub-montane and montane forest habitat. Among the gibbon species only Siamang is available in this type of habitat. Agile gibbon does not exist because, they are more frugivorous.
12. Siamang is a territorial species. They are hardly to move even its surroundings are disturbed. They will defend their territory until they are killed or captured. Since the management only open the forest limited to the site where it is needed and maintain the forest surroundings wellpad, control access road and other facilities secured, the species does not move far away. Most important is to provide arboreal path way connection at the certain points where the gaps less than 30 m available due to access road construction. The connection may use rope which is made from natural materials.
13. The Sumatran surili is folivorous and it survives with less fruits. They did not raid the coffee plantation adjacent to the forest area.
14. The Sumatran surili tends to live in the periphery forest habitat at lower elevation. It probably in order to find more insects and young leaves because, more light enters these spots which could produce many young leaves and attracts insects as well.
15. The Sumatran surili is not truly arboreal. They frequently move on the ground when crossing the gap of forest. This primate species has been considered prey animals for the big cats including the Sumatran tiger. Maintain this species is important in order to diversify prey animals in the Project area.

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STUDY OF ENDANGERED SPECIES AT RANTAU DEDAP

PT SUPREME ENERGY RANTAU DEDAP (SERD)

Muara Enim Regency and Pagar Alam City, South Sumatra Province

Appendix 1: Encounters and Vocalization Data of Siamang Groups (*Symphalangus syndactylus*) in Study Area during Field Survey

Species	Location	Altitudes (meters AMSL)	Findings
Siamangs	S 04 ° 12'59.3" E 103 ° 23'27.3"	1,963	Direct detection
Siamangs	S 04º12'49.3" E 103 ° 24'38.2"	1,691	Direct detection
Siamangs	S 04°12'49.3" E 103 ° 24'41.7"	1,688	Direct detection
Siamangs	S 04 ° 12'30.1" E 103 ° 24'57.4"	1,714	Direct detection bordering coffee plantation.
Siamangs	S 04 ° 11'48.2" E 103 ° 24'24.4"	1,445	Direct detection
Siamangs	S 04 ° 11'28.7" E 103 ° 24'33.0"	1,375	Direct detection bordering coffee plantation.
Siamangs	S 04 ° 12'25.6" E 103 ° 24'39.2"	1,601	Vocalization
Siamangs	S 04 ° 12'18.5" E 103 ° 24'22.3"	1,575	Vocalization
Siamangs	S 04 ° 12'53.9" E 103 ° 24'05.3"	1,743	Vocalization
Siamangs	S 04 ° 11'08.4" E 103 ° 24'04.6"	1,317	Vocalization
Siamangs	S 04 ° 11'08.4" E 103 ° 24'04.6"	1,449	Vocalization
Siamangs	S 04 ° 12'49.5" E 103 ° 22'03.1"	1,987	Vocalization
Siamangs	S 04 ° 12'39.2"	1,822	Vocalization

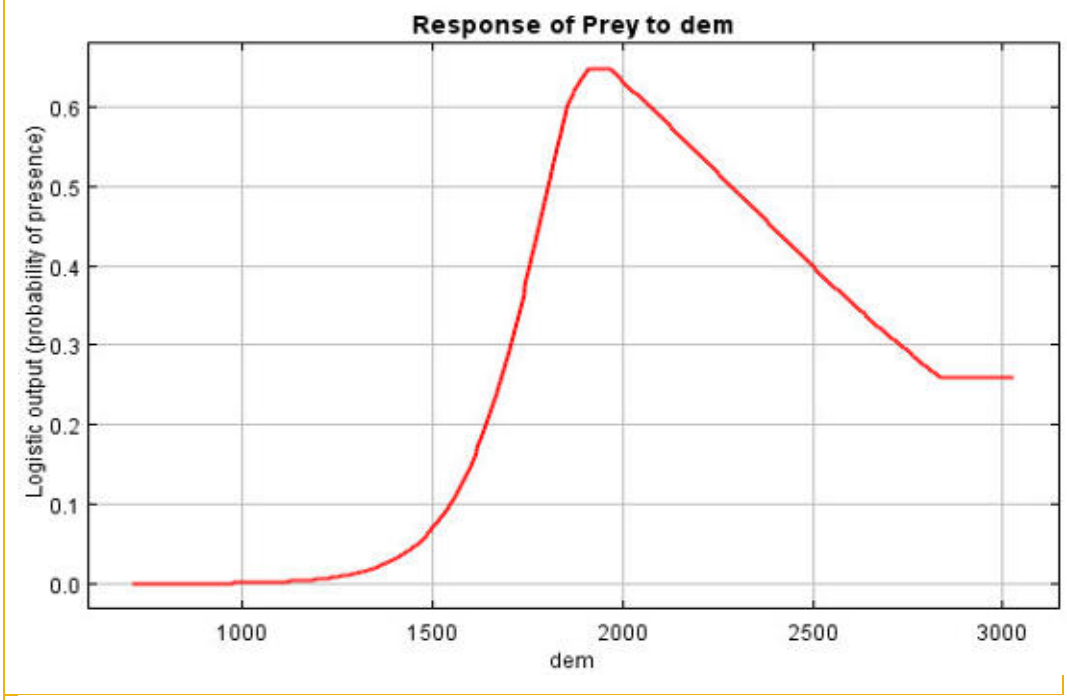
Species	Location	Altitudes (meters AMSL)	Findings
	E 103 ^{o} 21'18.4"		
Siamangs	S 04 ^{o} 12'17.0" E 103 ^{o} 22'06.6"	1,671	Vocalization
Siamangs	S 04 ^{o} 11'12.2" E 103 ^{o} 22'30.2"	1,263	Vocalization
Siamangs	S 04 ^{o} 12'48.5" E 103 ^{o} 25'21.9"	1,650	Vocalization

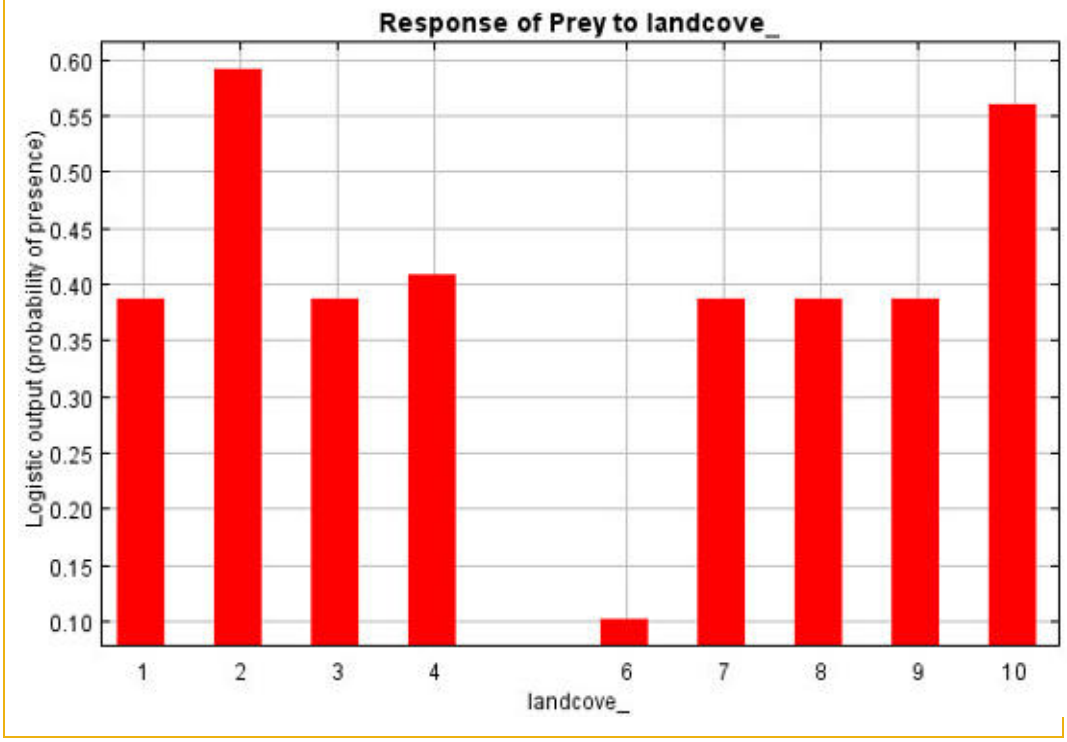
Appendix 2: Encounters with Big Mammals Group in Study Area during Field Survey

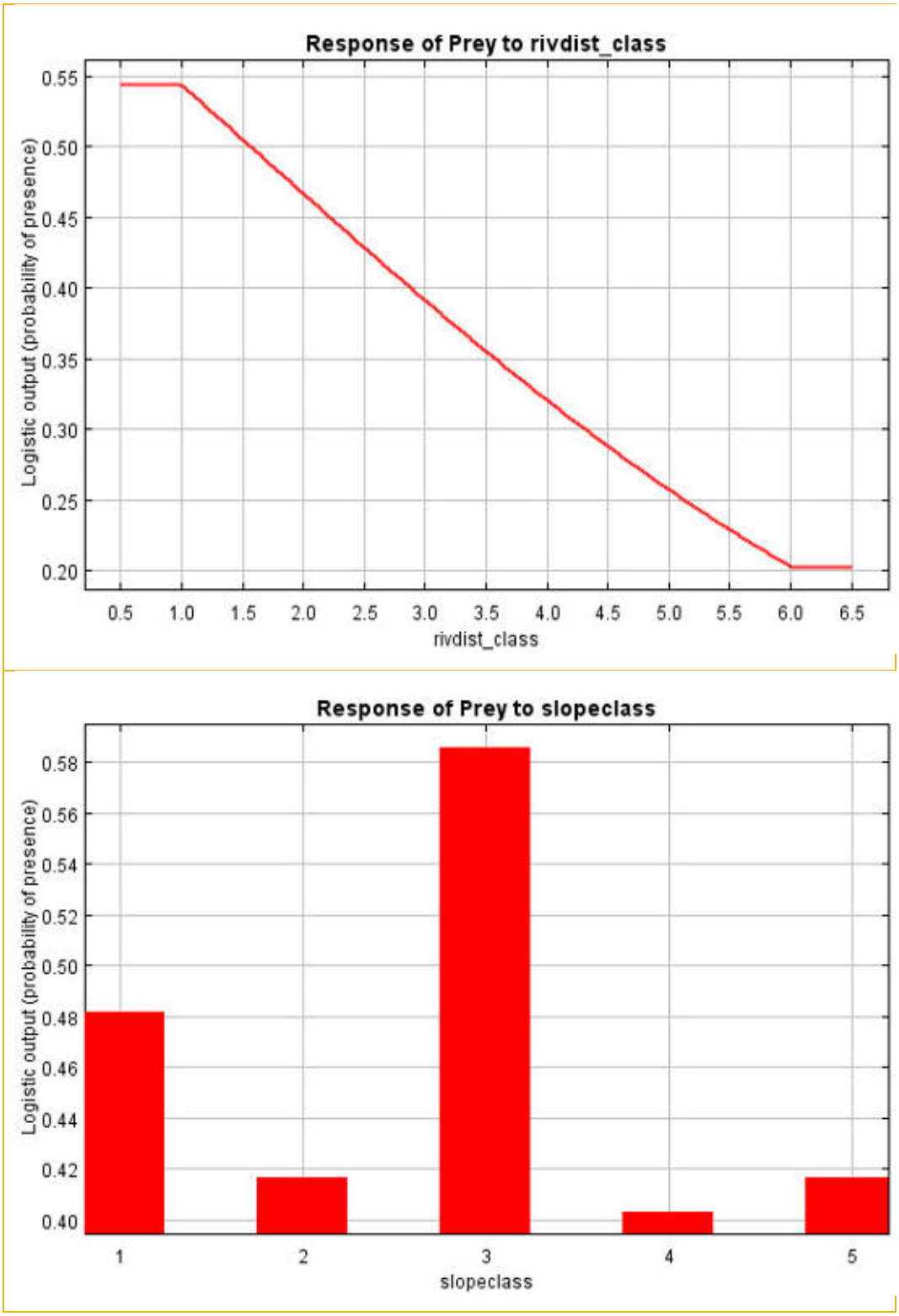
No	Locations	Common names	Latin names	Red list	Observation types
1	Wellpad D	Sumatran tiger	*Panthera tigris sumatrae*	Critically Endangered	Foot prints
		Malayan sun bear	*Helarctos malayanus*	Vulnerable	Foot prints and *camera trap*
2	Wellpad B	Sumatran tiger	*Panthera tigris sumatrae*	Critically Endangered	Foot prints
		Malayan sun bear	*Helarctos malayanus*	Vulnerable	Foot prints
		Wild pig	*Sus sucrosus*	N/A	Foot prints
		Red deer	*Muntiacus muntjak*	Least Concern	Foot prints
		Serow	*Capricornis sumatraensis*	Vulnerable	Foot prints
		Malayan tapir	*Tapirus indicus*	Endangered	Foot prints
3	Wellpad I	Malayan sun bear	*Helarctos malayanus*	Vulnerable	Foot prints
		Sambar deer	*Cervus unicolor*	Vulnerable	Foot prints
		Malayan tapir	*Tapirus indicus*	Endangered	Foot prints
4	Wellpad E	Malayan sun bear	*Helarctos malayanus*	Vulnerable	Foot prints
		Red deer	*Muntiacus muntjak*	Least Concern	Foot prints
		Malayan tapir	*Tapirus indicus*	Endangered	Foot prints
		Small cat	*P bengalensis*	Least Concern	Foot prints
		Civet		Near threatened	*camera trap*
5	Wellpad C	Malayan sun bear	*Helarctos malayanus*	Vulnerable	Foot prints
		Malayan tapir	*Tapirus indicus*	Endangered	Foot prints
6	Puyang Lake	Malayan tapir	*Tapirus indicus*	Endangered	Foot prints
		Wild pig	*Sus sucrofa*	N/A-	Foot prints

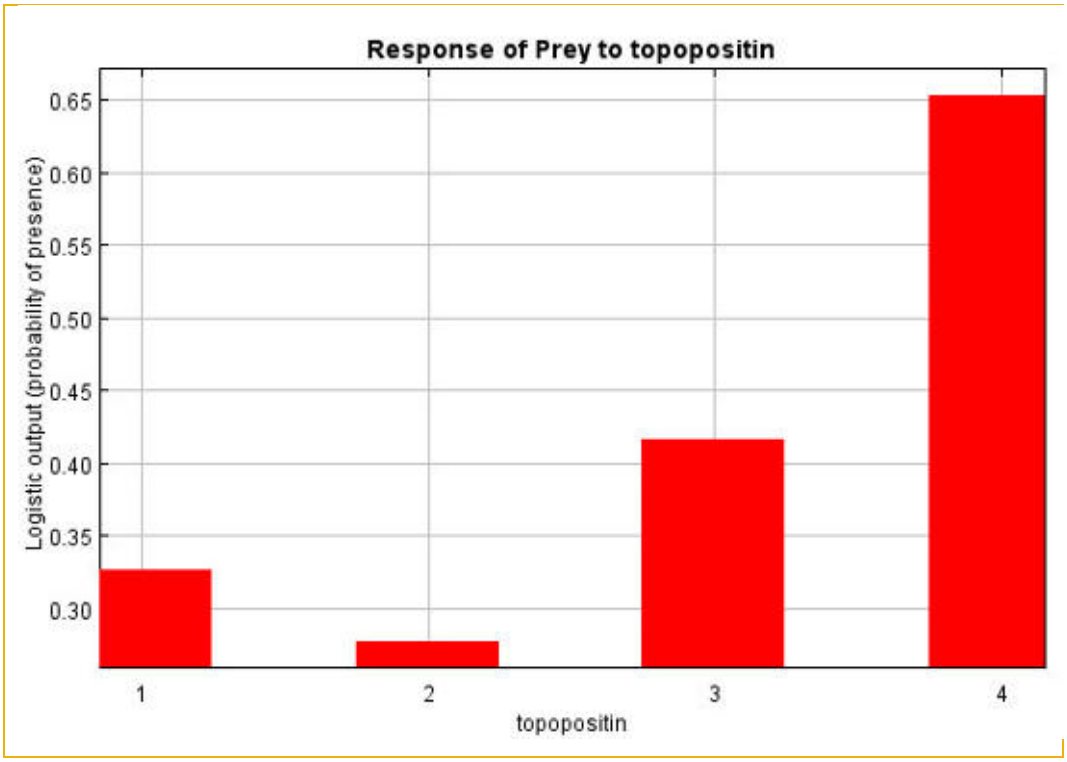
Appendix 3: Input Environmental Variable Data of MaxEnt Habitat Modeling

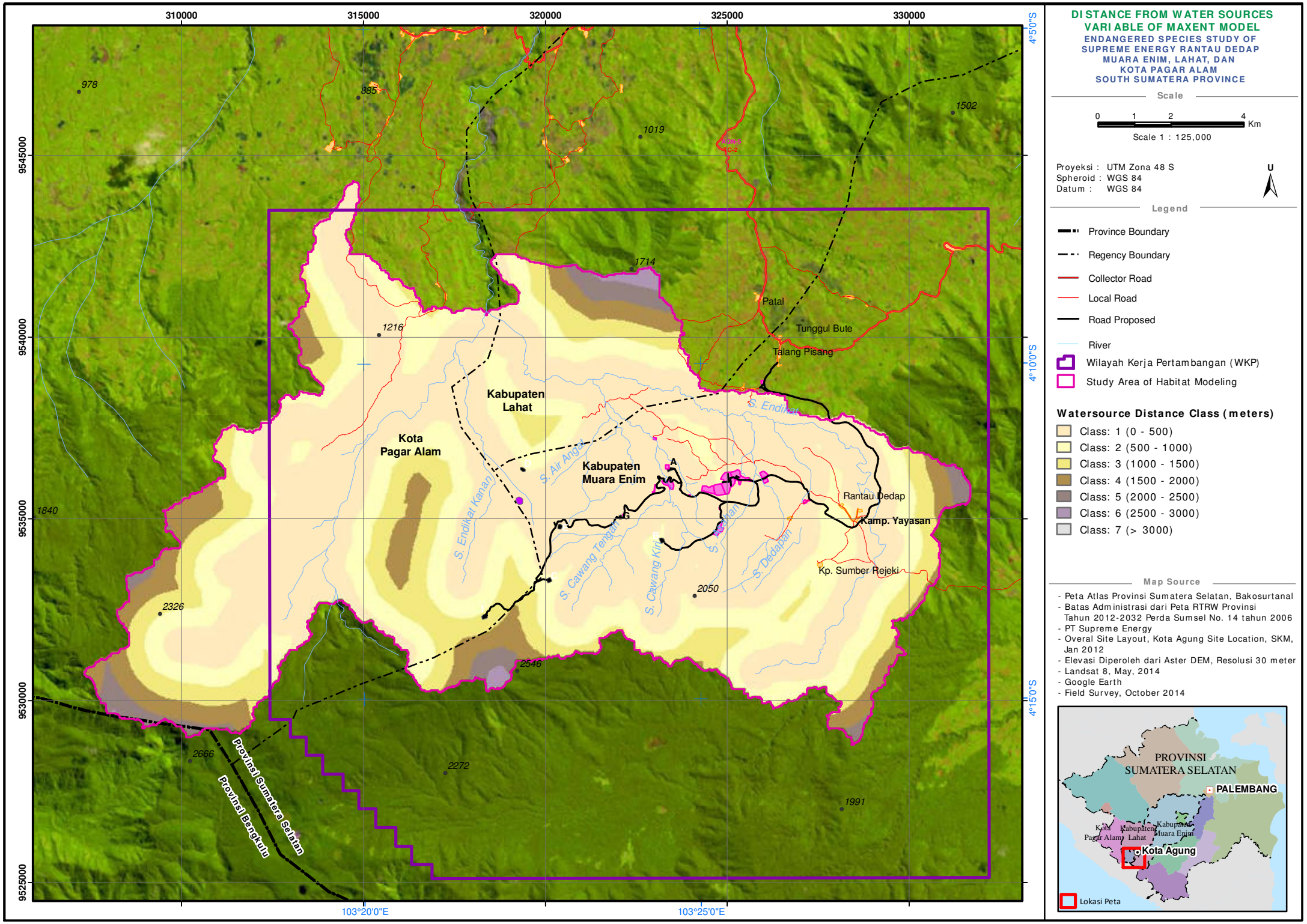
Response of Prey Species Distribution to Environmental Variables






Response of Prey to rivdist_class
Logistic output (probability of presence)
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
rivdist_class
Response of Prey to slopeclass
Logistic output (probability of presence)
0.58
0.56
0.54
0.52
0.50
0.48
0.46
0.44
0.42
0.40
1
2
3
4
5
slopeclass


Response of Prey to topopositin
Logistic output (probability of presence)
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
1
2
3
4
topopositin



DISTANCE FROM WATER SOURCES VARIABLE OF MAXENT MODEL

ENDANGERED SPECIES STUDY OF SUPREME ENERGY RANTAU DEDAP MUARA ENIM, LAHAT, DAN KOTA PAGAR ALAM SOUTH SUMATERA PROVINCE

Scale

0 1 2 4 Km

Scale 1 : 125,000

Proyeksi : UTM Zona 48 S
Spheroid : WGS 84
Datum : WGS 84

U

Legend

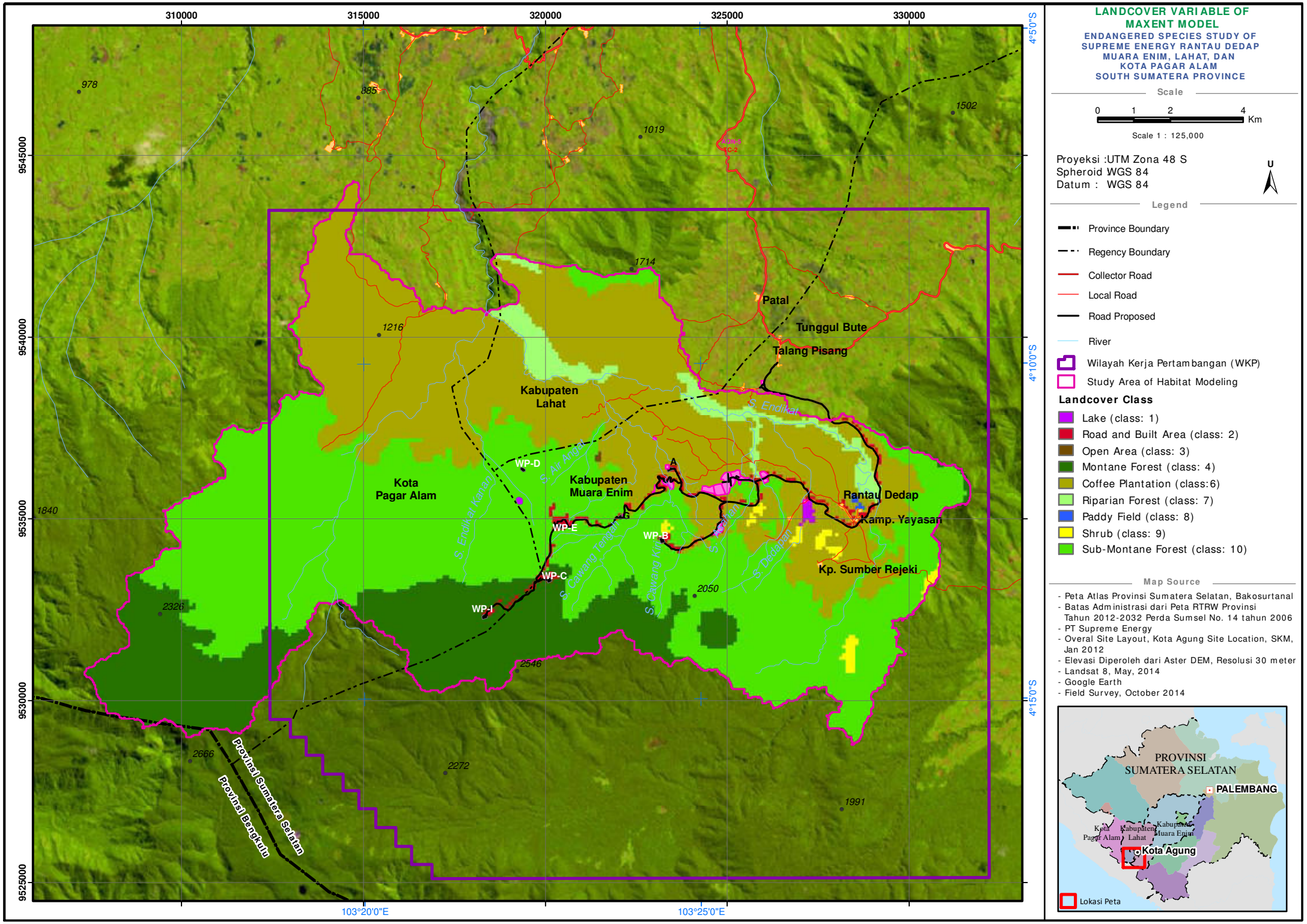
- Province Boundary
- Regency Boundary
- Collector Road
- Local Road
- Road Proposed
- River
- Wilayah Kerja Pertambangan (WKP)
- Study Area of Habitat Modeling

Watersource Distance Class (meters)

- Class: 1 (0 - 500)
- Class: 2 (500 - 1000)
- Class: 3 (1000 - 1500)
- Class: 4 (1500 - 2000)
- Class: 5 (2000 - 2500)
- Class: 6 (2500 - 3000)
- Class: 7 (> 3000)

Map Source

- Peta Atlas Provinsi Sumatera Selatan, Bakosurtanal
- Batas Administrasi dari Peta RTRW Provinsi Tahun 2012-2032 Perda Sumsel No. 14 tahun 2006
- PT Supreme Energy
- Overal Site Layout, Kota Agung Site Location, SKM, Jan 2012
- Elevasi Diperoleh dari Aster DEM, Resolusi 30 meter
- Landsat 8, May, 2014
- Google Earth
- Field Survey, October 2014



LANDCOVER VARIABLE OF MAXENT MODEL

ENDANGERED SPECIES STUDY OF SUPREME ENERGY RANTAU DEDAP MUARA ENIM, LAHAT, DAN KOTA PAGAR ALAM SOUTH SUMATERA PROVINCE

Scale

0 1 2 4 Km

Scale 1 : 125,000

Proyeksi :UTM Zona 48 S
Spheroid WGS 84
Datum : WGS 84

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Legend

- Province Boundary
- Regency Boundary
- Collector Road
- Local Road
- Road Proposed
- River
- Wilayah Kerja Pertambangan (WKP)
- Study Area of Habitat Modeling

Landcover Class

- Lake (class: 1)
- Road and Built Area (class: 2)
- Open Area (class: 3)
- Montane Forest (class: 4)
- Coffee Plantation (class:6)
- Riparian Forest (class: 7)
- Paddy Field (class: 8)
- Shrub (class: 9)
- Sub-Montane Forest (class: 10)

Map Source

- Peta Atlas Provinsi Sumatera Selatan, Bakosurtanal
- Batas Administrasi dari Peta RTRW Provinsi Tahun 2012-2032 Perda Sumsel No. 14 tahun 2006
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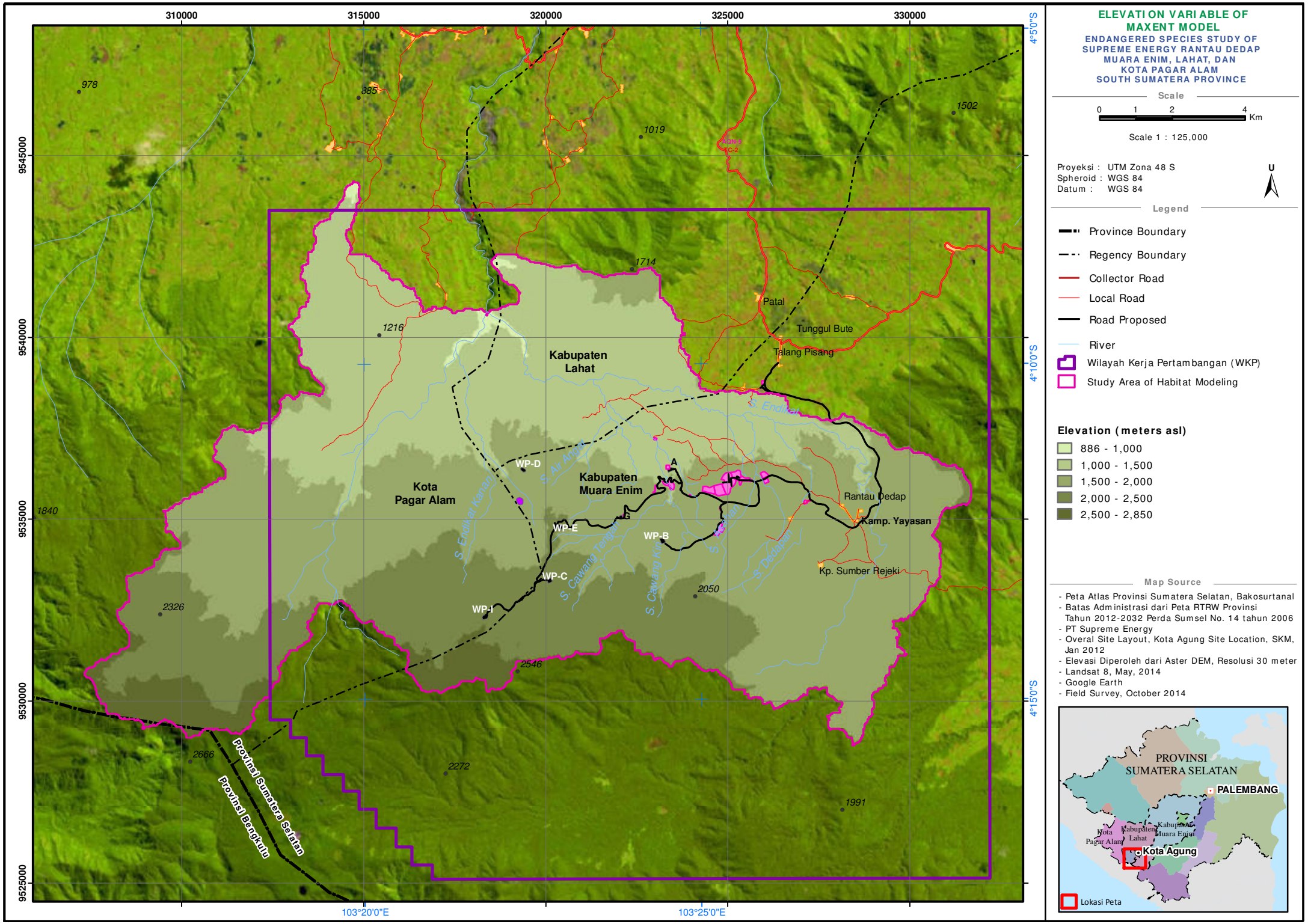

ELEVATION VARIABLE OF MAXENT MODEL

ENDANGERED SPECIES STUDY OF SUPREME ENERGY RANTAU DEDAP MUARA ENIM, LAHAT, DAN KOTA PAGAR ALAM SOUTH SUMATERA PROVINCE

Scale

0 1 2 4 Km

Scale 1 : 125,000

Proyeksi : UTM Zona 48 S
Spheroid : WGS 84
Datum : WGS 84

U

Legend

- Province Boundary
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- Study Area of Habitat Modeling

Elevation (meters asl)

- 886 - 1,000
- 1,000 - 1,500
- 1,500 - 2,000
- 2,000 - 2,500
- 2,500 - 2,850

Map Source

- Peta Atlas Provinsi Sumatera Selatan, Bakosurtanal
- Batas Administrasi dari Peta RTRW Provinsi Tahun 2012-2032 Perda Sumsel No. 14 tahun 2006
- PT Supreme Energy
- Overal Site Layout, Kota Agung Site Location, SKM, Jan 2012
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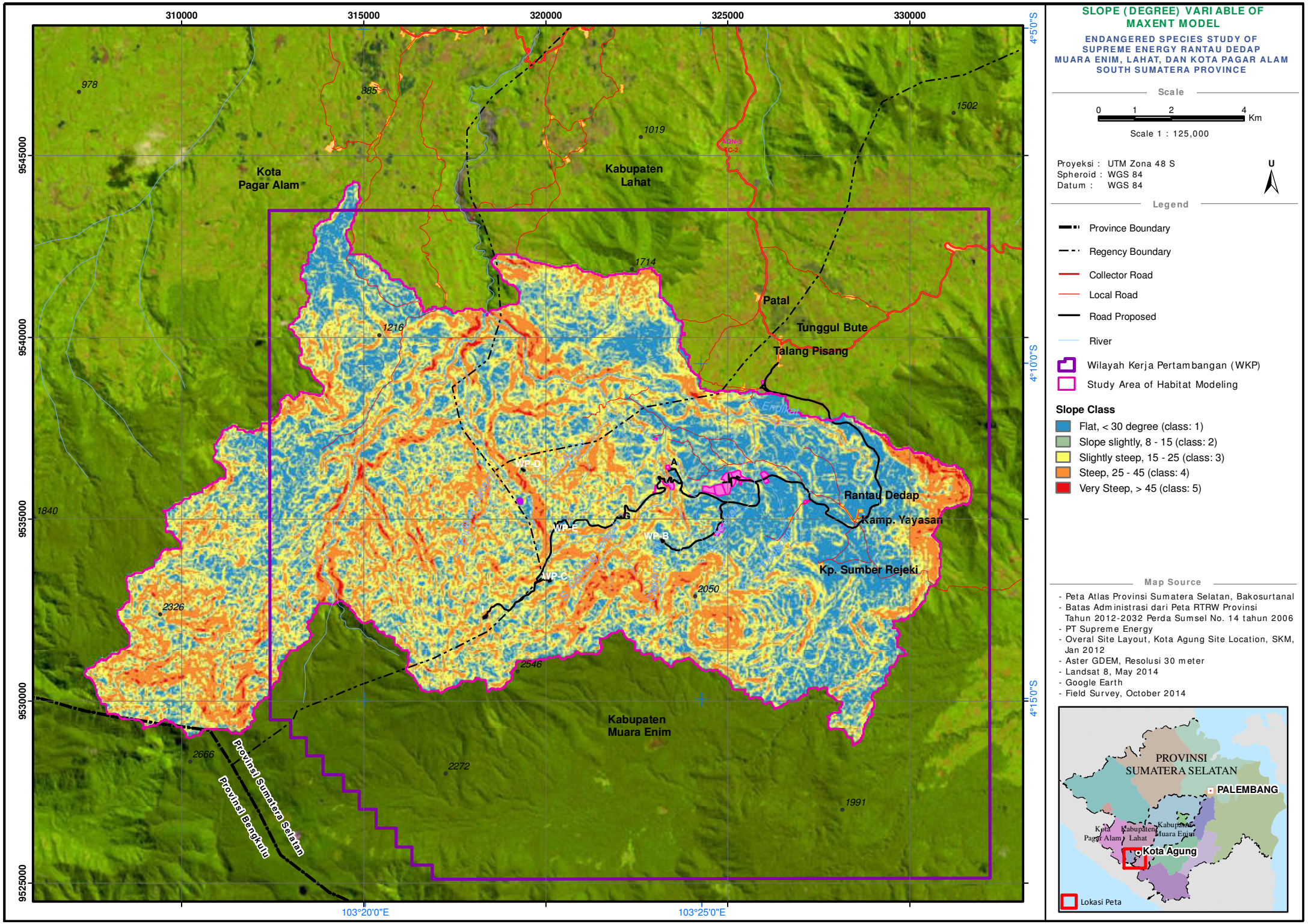

SLOPE (DEGREE) VARIABLE OF MAXENT MODEL

ENDANGERED SPECIES STUDY OF SUPREME ENERGY RANTAU DEDAP MUARA ENIM, LAHAT, DAN KOTA PAGAR ALAM SOUTH SUMATERA PROVINCE

Scale

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Proyeksi : UTM Zona 48 S
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- Province Boundary
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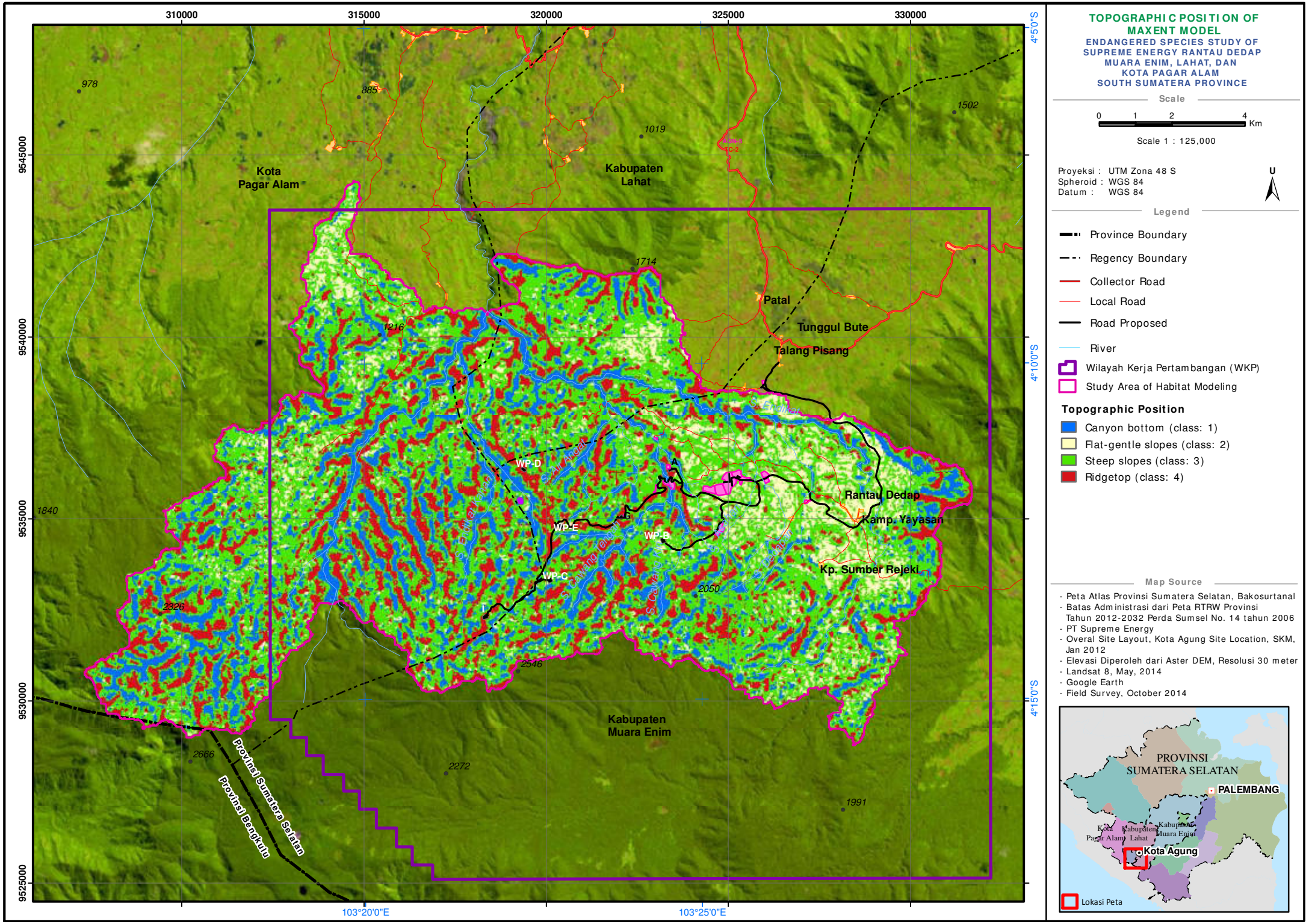
Slope Class

- Flat, < 30 degree (class: 1)
- Slope slightly, 8 - 15 (class: 2)
- Slightly steep, 15 - 25 (class: 3)
- Steep, 25 - 45 (class: 4)
- Very Steep, > 45 (class: 5)

Map Source

- Peta Atlas Provinsi Sumatera Selatan, Bakosurtanal
- Batas Administrasi dari Peta RTRW Provinsi Tahun 2012-2032 Perda Sumsel No. 14 tahun 2006
- PT Supreme Energy
- Overal Site Layout, Kota Agung Site Location, SKM, Jan 2012
- Aster GDEM, Resolusi 30 meter
- Landsat 8, May 2014
- Google Earth
- Field Survey, October 2014



TOPOGRAPHIC POSITION OF MAXENT MODEL

ENDANGERED SPECIES STUDY OF SUPREME ENERGY RANTAU DEDAP MUARA ENIM, LAHAT, DAN KOTA PAGAR ALAM SOUTH SUMATERA PROVINCE

Scale

0 1 2 4 Km

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- Local Road
- Road Proposed
- River
- Wilayah Kerja Pertambangan (WKP)
- Study Area of Habitat Modeling

Topographic Position

- Canyon bottom (class: 1)
- Flat-gentle slopes (class: 2)
- Steep slopes (class: 3)
- Ridgetop (class: 4)

Map Source

- Peta Atlas Provinsi Sumatera Selatan, Bakosurtanal
- Batas Administrasi dari Peta RTRW Provinsi Tahun 2012-2032 Perda Sumsel No. 14 tahun 2006
- PT Supreme Energy
- Overal Site Layout, Kota Agung Site Location, SKM, Jan 2012
- Elevasi Diperoleh dari Aster DEM, Resolusi 30 meter
- Landsat 8, May, 2014
- Google Earth
- Field Survey, October 2014

Appendix 4: Species Composition of Flora

No	Family	Species	Local name	Habit	Status	Wellpad B	Wellpad E	Wellpad I	Plantation
1	Annonaceae	*Uvaria sp.*		Climber			√		
2	Apocynaceae	*Alyxia reinwardtii Blume*		Climber			√		
3	Aristolochiaceae	*Aristolochia sp.*		Climber		√			
4	Gesneriaceae	*Aeschynanthus radicans Jack*		Climber		√	√		
5	Nepenthaceae	*Nephenthes sp.*		Climber	Endemic		√		
6	Schizandraceae	*Schisandra elongata (Bl.) Hook.f.&Thoms*		Climber		√			
7	Smilacaceae	*Smilax leucophylla Blume*		Climber			√		
8	Aspleniaceae	*Asplenium sp.*		Fern		√			
9	Lomariopsidaceae	*Elaptoglossum blumeanum*		Fern		√			
10	Lycopodiaceae	*Lycopodium serratum*		Fern			√		
11	Plagiogyria Group	*Plagiogyria glauca*		Fern		√			
12	Polypodiaceae	*Belvisia revoluta*		Fern		√	√		
13	Polypodiaceae	*Pyrrosia sp.*		Fern		√			
14	Asteraceae	*Anaphalis longifolia (Bl.) DC.*		Herb		√			
15	Balanophoraceae	*Balanophora elongata Blume*		Herb		√			
16	Balsaminaceae	*Impatiens sp 1*		Herb	Endemic			√	
17	Balsaminaceae	*Impatiens sp 2*		Herb	Endemic	√			
18	Begoniaceae	*Begonia areolata Miq.*		Herb			√		
19	Begoniaceae	*Begonia isoptera Dryand.*		Herb		√			
20	Begoniaceae	*Begonia muricata Blume*		Herb		√			
21	Begoniaceae	*Begonia robusta Blume*		Herb		√			
22	Commelinaceae	*Commelina sp.*		Herb		√	√		
23	Gesneriaceae	*Cyrtandra sp 1*		Herb		√			
24	Gesneriaceae	*Cyrtandra sp 2*		Herb		√			
25	Gesneriaceae	*Cyrtandra sp 3*		Herb		√			

No	Family	Species	Local name	Habit	Status	Wellpad B	Wellpad E	Wellpad I	Plantation
26	Hypoxidaceae	*Curculigo orchimoides Gaertn.*		Herb			√		
27	Melastomataceae	*Sonerila tenuifolia Blume*		Herb			√		
28	Polygonaceae	*Polygonum chinense L.*		Herb			√		
29	Rubiaceae	*Argostemma borragineum DC.*		Herb			√		
30	Rubiaceae	*Argostemma montanun Bl. ex DC.*		Herb			√		
31	Rubiaceae	*Argostemma uniflorum Bl. ex DC.*		Herb		√		√	
32	Rubiaceae	*Ophiorrhiza junghuniana Miq.*		Herb		√		√	
33	Rubiaceae	*Ophiorrhiza longiflora Blume*		Herb			√		
34	Urticaceae	*Elatostema sinuatum (Bl.) Hassk.*		Herb			√		
35	Urticaceae	*Elatostema strigosum (Bl.) Hassk.*		Herb		√			
36	Vittariaceae	*Antrophyum caliifolium*		Herb		√			
37	Vittariaceae	*Antrophyum latifolium*		Herb		√			
38	Zingiberaceae	*Etlingera sp.*		Herb		√			
39	Orchidaceae	*Macodes javanica (Bl.) Hook.f.*		Orchid		√			
40	Orchidaceae	*Macodes petola Lindl.*		Orchid			√		
41	Orchidaceae	*Cryptostylis arachnites Hassk.*		Orchid			√		
42	Orchidaceae	*Dendrobium mutabile (Bl.) Lindl.*		Orchid			√		
43	Orchidaceae	*Gendup*		Orchid		√	√	√	
44	Musaceae	*Musa acuminata Colla*	Pisang hutan	Other		√			
45	Arecaceae	*Caryota mitis Lour.*	Basao	Palm		√			
46	Arecaceae	*Pinanga sp.*		Palm		√	√		
47	Arecaceae	*Calamus spp.*		Rattan		√			
48	Araliaceae	*Trevesia sundaica Miq.*		Shrub		√			
49	Chloranthaceae	*Sarcandra glabra*		Shrub			√		

No	Family	Species	Local name	Habit	Status	Wellpad B	Wellpad E	Wellpad I	Plantation
50	Ericaceae	*Gaultheria nummularioides D.Don*		Shrub		√			
51	Ericaceae	*Vaccinium varingiaefolium (Bl.) Miq.*		Shrub		√			
52	Ericaceae	*Rhododendron malayanum Jack*		Shrub		√			
53	Melastomataceae	*Medinilla speciosa (Reinw. ex Bl.) Blume*		Shrub			√		
54	Moraceae	*Ficus geophila*		Shrub		√			
55	Moraceae	*Ficus hirta Vahl*		Shrub			√		
56	Rosaceae	*Rubus lineatus Reinw. ex Blume*		Shrub				√	
57	Rosaceae	*Rubus rosaefolius J.E.Smith*		Shrub				√	
58	Rubiaceae	*Coffea arabica L.*		Shrub					√
59	Rubiaceae	*Lasianthus laevigata Blume*		Shrub		√	√		
60	Rubiaceae	*Lasianthus stercorarius Blume*		Shrub			√		
61	Rubiaceae	*Hypobathrum frutescens Blume*		Shrub			√		
62	Rubiaceae	*Pavetta montana Reinw. ex Blume*		Shrub			√		
63	Aceraceae	*Acer laurinum Hassk.*		Tree			√	√	
64	Actinidiaceae	*Saurauia sp 1*		Tree			√	√	
65	Actinidiaceae	*Saurauia sp 2*		Tree			√	√	
66	Aquifoliaceae	*Ilex pleiobrachiata Loes*		Tree			√	√	
67	Araliaceae	*Schefflera aromatica (Bl.) Harm.*		Tree			√		
68	Cunnoniaceae	*Weinmania blumei Planch.*		Tree			√	√	
69	Elaeocarpaceae	*Elaeocarpus griffithii A. Gray*		Tree			√		
70	Euphorbiaceae	*Macaranga sp.*	Sapot	Tree		√			
71	Fabaceae	*Albizia falcataria (L.) Forsberg*	Sengon	Tree					√
72	Fabaceae	*Erythrina subumbrans (Hassk.) Merr.*	Cangkring	Tree					√

No	Family	Species	Local name	Habit	Status	Wellpad B	Wellpad E	Wellpad I	Plantation
73	Fabaceae	*Leucaena leucocephala (Lmk) De Wit*	Lamtoro	Tree					√
74	Fagaceae	*Lithocarpus spp.*	Pasang	Tree		√	√	√	
75	Fagaceae	*Quercus spp.*	Pasang	Tree			√	√	
76	Flacourtiaceae	*Casearia sp.*		Tree			√		
77	Icacinaceae	*Platea excelsa Blume*		Tree			√	√	
78	Lauraceae	*Actinodaphne procera Nees*		Tree			√	√	
79	Lauraceae	*Cryptocarya ferrea Blume*	Medang	Tree			√	√	
80	Lauraceae	*Cryptocarya sp 1*		Tree			√	√	
81	Lauraceae	*Cryptocarya sp 2*		Tree			√	√	
82	Lauraceae	*Cryptocarya sp 3*		Tree			√		
83	Lauraceae	*Lindera bibracteata (Bl.) Boerl.*		Tree			√		
84	Lauraceae	*Litsea cubeba (Lour.) Pers.*		Tree			√		
85	Lauraceae	*Litsea elliptica*		Tree			√		
86	Lauraceae	*Litsea montana*		Tree			√	√	
87	Lauraceae	*Litsea sp 1*		Tree			√		
88	Magnoliaceae	*Magnolia candolii Noteboom*	Cempaka	Tree		√			
89	Meliaceae	*Aglaia sp 1*	Beke elang	Tree			√	√	
90	Meliaceae	*Aglaia sp 2*		Tree			√		
91	Meliaceae	*Aglaia sp 3*		Tree			√		
92	Meliaceae	*Aglaia sp 4*		Tree		√			
93	Myristicaceae	*Myristica sp.*	Getah merah	Tree		√			
94	Myrsinaceae	*Rapanea hasseltii Metz*		Tree			√		
95	Myrtaceae	*Syzygium lineatum Merr.& Perry*		Tree			√	√	
96	Myrtaceae	*Syzygium sp 1*	Kayu kelat	Tree			√	√	
97	Myrtaceae	*Syzygium sp 2*		Tree			√		
98	Nyssaceae	*Nyssa javanica (Bl.) Wang*		Tree			√		

No	Family	Species	Local name	Habit	Status	Wellpad B	Wellpad E	Wellpad I	Plantation
99	Oleaceae	*Chionanthus laxiflorus*		Tree			√	√	
100	Oleaceae	*Chionanthus montanus*		Tree			√	√	
101	Podocarpaceae	*Dacrycarpus imbricatus (Bl.) De Laub.*	Lengkedai	Tree			√	√	
102	Rhizophoraceae	*Gynothroches axillaris Blume*		Tree			√		
103	Rosaceae	*Prunus arborea (Bl.) Kalkman*		Tree			√	√	
104	Rosaceae	*Prunus gricea (C.Muell.) Kalkman*		Tree			√	√	
105	Rutaceae	*Euodia hemsleyi*		Tree			√		
106	Sabiaceae	*Meliosma sp 1*		Tree		√			
107	Sabiaceae	*Meliosma sp 2*		Tree			√		
108	Sapotaceae	*Gendup*	Balam	Tree		√			
109	Saxifragaceae	*Polyosma integrifolia Blume*	Marsawi	Tree				√	
110	Sterculiaceae	*Pterocymbium javanicum R.Br.*		Tree				√	
111	Taxacee	*Taxus sumatrana*		Tree	Endemic		√	√	
112	Theaceae	*Haemocharis integerima*	Cihu	Tree	Endemic		√	√	
113	Theaceae	*Ternstroemia sp*		Tree			√		
114	Cyatheaceae	*Cyathea sp 1*		Tree fern			√	√	
115	Cyatheaceae	*Cyathea sp 2*		Tree fern			√	√	

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MONITORING REPORT OF ENDANGERED SPECIES STUDY OF RANTAU DEDAP

SUPREME ENERGY RANTAU DEDAP (SERD)

Muara Enim Regency and Pagar Alam City, South Sumatra Province

January 2015

JI100114

February 2015

MONITORING REPORT OF ENDANGERED STUDY OF RANTAU DEDAP

PT SUPREME ENERGY RANTAU DEDAP (SERD)

Muara Enim Regency and Pagar Alam City, South Sumatra Province

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The camera traps was captured 15 species during 2 months. Two target species have been captured by camera trap during monitoring, they are pangolin and Dhole. Observation did not find the existence of Pangolin, both site exploration and interview approach. On literature, Pangolin can be found in primary lowland forest habitat up to 1200 m ASL. and has been recorded in Bukit Barisan National Park at 900 m ASL (Wirdateti et al., 2013). Camera trap has been captured Pangolin on route to Wellpad D at 22 November 2014 (20:07 WIB). Location of camera traps on route to wellpad D area has elevation about 1900 m ASL. This finding is the highest location of pangolin finding in Sumatra Island.

Dholes were captured fourth times on two locations, one times on route to wellpad D and three times on wellpad B area. The dhole is found in a wide variety of vegetation types, including: primary, secondary and degraded forms of tropical dry and moist deciduous forest; evergreen and semi-evergreen forests; dry thorn forests; grassland–scrub–forest mosaics; and alpine steppe (above 3,000 m). They are not recorded from desert regions (www.iucnredlist.org).

Dhole Photograps (www.brucekekule.com) Dhole photograph that capture by camera traps

Figure 1 Dhole (*Cuon alpinus*) photographs

Table 1 is distribution species finding of species and **Table 2** is the complete monitoring result. Malayan sun bear is threatened species that have wide spread in project area. This species has been captured by camera trap on three location, they are Route to Wellpad D, adjacent of forest and plantation and wellpad B area.

New record of finding of threatened species is Marble cat (*Pardofelis marmorata*). This species was captured on Wellpad I and Wellpad D. The marbled cat is found in tropical Indomalaya

westward along the Himalayan foothills westward into Nepal and eastward into southwest China, and on the islands of Sumatra and Borneo. There are few locality records of this species (Nowell and Jackson, 1996, Sunquist and Sunquist, 2002).

Table 1 Distribution Species Findings

No	Species	WP D Route	PL 1	WP I-1	WP I-2	WP B-2	WP B-1	WP C	P2
1	Banded Linsang (*Prionodon linsang*)		√						
2	Bird		√					√	
3	Bird 1					√			
4	Bird 3							√	
5	Dhole (*Cuon alpinus*)	√					√		
6	Golden cat (*Catopuma temminckii*)	√	√						
7	Malayan Porcupine (*Hystrix brachyura*)		√						
8	Malayan sun bear (*Helarctos malayanus*)	√	√				√		
9	Marbled Cat (*Pardofelis marmorata*)			√			√		
10	Masked Palm Civet (*Paguma larvata*)	√	√			√	√		
11	Muntjac (*Muntiacus muntjak*)			√		√			
12	Sunda pangolin (*Manis javanica*)	√							
13	Treeshrew			√					
14	Tupaia tana		√						
15	Yellow Throated Marten (*Martes flavigula*)							√	
16	Malayan Tapir								√

In the monitoring activities, the addition of camera performed in the area wellpad E (**E1**) and removal trap cameras that located on the I-1 (I1) to the location route to Puyang Lake (P2).

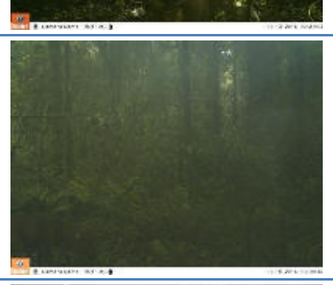
Table 2 Camera Trap Monitoring Result (17 – 21 December 2014 and 28 January – 1 February 2015)

No	Location	Species	Picture	Date/ Time	Coordinate		Date	
					South	East	Start	Stop
1	Wellpad D Route (**D1**)	Masked Palm Civet (*Paguma larvata*) Status: Least concern		24 October 2014/21.12 07 November 2014/15.15	S4.20011596°	E103.37811°	17 October 2014	29 January 2015
		Malayan sun bear (*Helarctos malayanus*) Status: Vulnerable	 	3 November 2014/00.37 9 November 2014/18.07 12 December 2014/05.23				
		Dhole (*Cuon alpinus*) Status: Endangered		4 November 2014/13.15				
		Golden cat (*Catopuma temminckii*) Status: Near threatened		03 November 2014/21.56 23 December 2015/17.29 17 January 2015/08.52 25 January 2015/10.03				

No	Location	Species	Picture	Date/ Time	Coordinate		Date	
					South	East	Start	Stop
		Sunda pangolin (*Manis javanica*) Status: Critical Endangered		22 November 2014/20.07				
2	Adjacent of Plantation and Forest (PL1)	Malayan sun bear (*Helarctos malayanus*) Status: Vulnerable		22 October 2014/06.27 12 December 2014/16.00	S4.20713°	E103.41365°	21 October 2014	29 January 2015
		Banded Linsang (*Prionodon linsang*) Status: Least concern	 	31 October 2014/19.22 9 November 2014/04.43 19 November 2014/20.43 3 December 2014/21.26 13 December 2014/23.23 16 December 2014/21.38				
		Bird		1 November 2014/06.46 27 November 2014/06.40 10 December 2014/16.24 11 December 2014/15.50 12 December 2014/15.26 13 December 2014/15.40 15 December 2014/08.21 20 December 2014/13.04 23 December 2014/07.19 24 December 2014/08.04 26 December 2014/12.42				

No	Location	Species	Picture	Date/ Time	Coordinate		Date	
					South	East	Start	Stop
								
		Masked Palm Civet (*Paguma larvata*) Status: Least concern		3 November 2014/03.18 13 November 2014/01.42 17 December 2014/00.41 8 January 2015/12.39				
		Golden cat (*Catopuma temminckii*) Status: Near threatened		6 November 2014/22.38				
		Malayan Porcupine (*Hystrix brachyura*) Status: Least concern		11 November 2014/22.25				
		Tupai tanah		21 November 2014/12.14				

No	Location	Species	Picture	Date/ Time	Coordinate		Date	
					South	East	Start	Stop
3	Wellpad I-1(I1)	Marbled Cat (*Pardofelis marmorata*) Status: Vulnerable		1 December 2014/10.51	S4.235978 °	E103.3593 °	13 October 2014	18 December 2014
		Muntjac (*Muntiacus muntjak*) Status: Least concern		23 October 2014/14.27				
		Tree shrew		25 October 2014/06.16				
4	Wellpad I-2 (**I2**)	-	-	-	S4.242395 °	E103.36629 °	15 October 2014	29 January 2015
5	Wellpad B-2 (**B2**)	Bird 1		3 November 2014 / 06.39	S.2179057 °	E103.41837 °		29 January 2015
		Muntjac (*Muntiacus muntjak*) Status: Least concern		11 November 2014/16.23				

No	Location	Species	Picture	Date/ Time	Coordinate		Date	
					South	East	Start	Stop
		Masked Palm Civet (*Paguma larvata*) Status: Least concern		26 November 2014/04.20				
6	Wellpad B-1 (**B1**)	Malayan sun bear (*Helarctos malayanus*) Status: Vulnerable		16 October 2014/08.52 22 October 20014/08.25 23 October 2014/11.31 28 October 2014/20.46	S4.222144 °	E103.3991 °	17 October 2014	29 January 2015
		Marbled Cat (*Pardofelis marmorata*) Status: Vulnerable		13 November 2014/09.31 30 November 2014/13.15				
		Dhole (*Cuon alpinus*) Status: Endangered		15 November 2014/10.19 18 November 2014/08.06 17 December 2014/13.15				
		Masked Palm Civet (*Paguma larvata*) Status: Least concern		20 November 2014/23.00				
7	Route to Punyang Lake (**P1**)				S4.2125184 °	E103.37148 °	16 October 2014	19 October 2014

No	Location	Species	Picture	Date/ Time	Coordinate		Date	
					South	East	Start	Stop
8	Wellpad C (**C1**)	Bird		28 October 2014/17.01	S4.217328°	E103.38370°	20 October 2014	29 January 2015
		Yellow Throated Marten (*Martes flavigula*) Status: Least concern		10 November 2014/07.48				
		Bird 3		20 October 2014/12.26 21 October 2014/06.42 22 October 2014/09.33 25 October 2014/07.51 25 October 2014/07.57 26 October 2014/07.03 26 October 2014/08.46 2 November 2014/09.12 2 November 2014/14.54 8 November 2014/07.01 10 November 2014/09.39 13 November 2013/13.33				
		Golden cat (*Catopuma temminckii*) Status: Near threatened		20 January 2015/03.11				

No	Location	Species	Picture	Date/ Time	Coordinate		Date	
					South	East	Start	Stop
		Sunda pangolin (*Manis javanica*) Status: Critical Endangered		25 December 2015/18.46				
9	Route to Puyang (**P2**)	Malayan Tapir Status: Endangered		7 January 2015/18.53	S4.21943 °	E103.37085 °	19 December 2014	29 January 2015
		Masked Palm Civet (*Paguma larvata*) Status: Least concern						
10	Wellpad E (**E1**)	Banded Linsang (*Prionodon linsang*) Status: Least concern		25 December 2015/02.31	S4.20702 °	E103.38000 °	19 December 2014	29 January 2015
		Masked Palm Civet (*Paguma larvata*) Status: Least concern		12 January 2015/02.53				

MAP 1
CAMERA TRAPS LOCATION

ENDANGERED SPECIES STUDY OF SUPREME ENERGY RANTAU DEDAP MUARA ENIM, LAHAT, DAN KOTA PAGAR ALAM - SOUTH SUMATERA PROVINCE

Skala/Scale

0 0.25 0.5 1 Km

Scale 1 : 30,000

Proyeksi : UTM Zona 48 S
Spheroid : WGS 84
Datum : WGS 84

U

Legenda/Legend

- Batas Provinsi *Province Boundary*
- Batas Kabupaten *Regency Boundary*
- Jalan Kolektor *Collector Road*
- Jalan Lokal *Local Road*
- Rencana Jalan Baru *Road Proposed*
- Sungai *River*
- Pemukiman *Settlement*
- Badan Air (Genangan) *Water Body*
- Fasilitas Proyek *Project Facility*
- Lokasi Sumur *Wellpad*

Altitude (meters asl)

- 1000 - 1500
- 1500 - 2000
- 2000 - 2600

Sampling Location

- Active - 8
- Not Active - 2
- Survey area

Sumber Peta/ Map Source

- Peta Atlas Provinsi Sumatera Selatan, Bakosurtanal
- Batas Administrasi dari Peta RTRW Provinsi Tahun 2012-2032 Perda Sumsel No. 14 tahun 2006
- PT Supreme Energy
- Overal Site Layout, Kota Agung Site Location, SKM, Jan 2012
- Elevasi Diperoleh dari Aster DEM, Resolusi 30 meter
- Landsat 8, August 08, 2013
- Google Earth
- Field Survey, October 2014