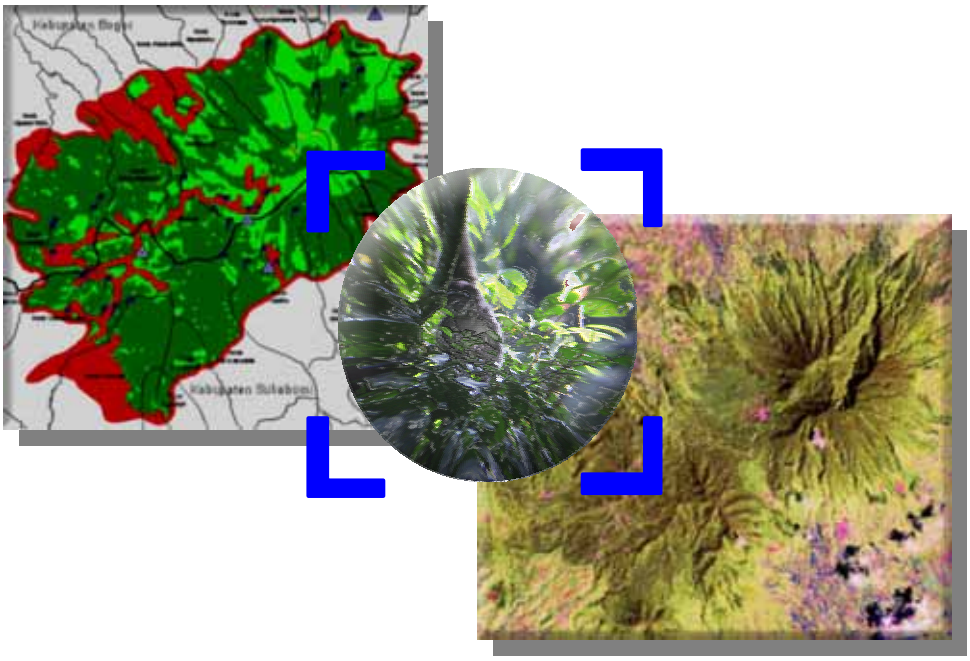
Javan Gibbon (*Hylobates moloch*) Habitat Suitability Survey and Mapping in Mt. Salak Area of Gunung Halimun-Salak National Park



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EXECUTIVE SUMMARY

The objectives of this project are to provide spatial information on javan gibbon habitat suitability and distribution in Mt. Salak area for Management Authority of Mt. Halimun-Salak National Park. This information will be useful for developing new park zonation since the extension of the former Mt. Halimun National into Mt. Salak area, and as a scientific basis for implementation of strategic action plan for javan gibbon conservation.

The information on javan gibbon distribution was collected through a number of survey during December 2005 to June 2006 in three places of Mt Salak area, i.e.: Kawah Ratu (Parakan Salak, Sukabumi) and Pondok Wisata Cangkuang – (Cidahu, Sukabumi) and Bobojong village (Bogor). There are 22 groups were identified using direct counting and triangle count method from over 47 identified positions. This survey is also proved that both methods were very useful and flexible to be used concurrently when the observer is moving.

There were ten variables (criterion) used to formulate habitat suitability model, i.e. the area of primary forest, the area of low-land forest, the area of submontane forest, the area of slope 0-15%, the area of slope 15-45%, the area of slope > 45 %, distance to river/water body, distance to settlement, and distance to road. GIS-based SAW technique combining with *Principal Component Analysis*, were used to construct the model. Based on the suitability model (grouped by 5 classes), Mt. Salak area consists of 59.10% (7,847.65 ha) and 23.03% (3,058.69) for high-suitable and suitable level subsequently, from total area of 13279.55 ha. It is larger than the less and low suitable level which have a portion of 16.81% and 0.11% subsequently from the whole area.

Based on the superimposition of 29 javan gibbon distinct groups upon habitat suitability map, it is shown that 10 groups are located on low suitable habitat, and 4 groups in suitable habitat and 15 groups are living in high suitable habitat. This information can be used as preliminary warning to immediately develop monitoring plan for gibbon groups which living in the low suitable habitat.

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I. INTRODUCTION

A. Background

The consciousness of the importance and values of biodiversity has been used as a motive to find out the way to conserve the remaining land in the earth, especially of that containing high biodiversity. One well-known approach is through the conservation area establishment (Primack *et al*., 1998).

Wildlife information, constitutes of habitat and population aspects, is often used as standard criteria to select the certain land to be assigned as conservation areas. Some area is established as wildlife sanctuary (suaka margasatwa) based on the uniqueness wildlife community within and/or its capability to support the survivalness of this wildlife (Republik Indonesia, 1998). In an established park, such as Gunung Halimun National Park (recently expanded and renamed as Gunung Halimun-Salak National Park), it has been used to formulate action plan (LIPI *et al*., 2003).

In the park management which primarily focused on keystone species management approach, the accumulated information on wildlife-habitat relationship probably the most important wildlife information to be considered into management practices. Wildlife-habitat relationship is alleged by many ecologists in providing scientific basis and framework for conservation area management to formulate management plan and make decision (De La Ville *et al*., 1998; Morrison *et al*., 1992). Although it has not been applied yet, every park in Indonesia has to complementarily acquire this framework for determining management zonation (Republik Indonesia, 1998).

This research took javan gibbon (*Hylobates moloch*) in Gunung (Mt.) Salak as a case study or an assessment. The conservation status of javan gibbon is *critically endangered* (Eudey and MPSG2000, 2004). It means that this species will extinct in the immediate times and require urgent actions to inhibit extinction process and promote its survivalness. Reintroduction was arising for one option and hence need assessment to the relatively large habitat, where Mt. Salak is included in the list (Supriatna *et al*., 1994; LIPI *et al*., 2003). Besides having large natural areas, this area still has been connected by a corridor to mountainous

landscape of Mt Halimun and commend as the extended area for Gunung Halimun National Park. Hence, it is urgent to provide information for developing new park zonation.

B. Objectives

The objectives of this project are to provide the spatial information on javan gibbon distribution and suitable habitat in Gunung Salak area. The information obtained by this project is intended to be used further by Management Authority of Gunung Halimun-Salak National Park as the complementary information for park zonation development. It will also beneficial for the strategic action implementation recommended by The Working Group of Javan Gibbon and Langur Population in The Habitat Viability Analysis Workshop (1994) and The Action Plan for the Endangered Species Conservation in Gunung Halimun-Salak National Park (2003).

II. METHODOLOGY

A. Time and Location

The preliminary field survey was conducted in the late December 2005 to earlier January 2006. In January to February 2006 and May to June 2006 the main survey was carried out at three places of Mt Salak Area, i.e.: Kawah Ratu (Parakan Salak, Sukabumi) and Pondok Wisata Cangkuang – (Cidahu, Sukabumi) and Bobojong village (Bogor). The location of study area is shown in the figures below.

Figure 1. The Study Area, Mt Salak in West Java (bounded by green curve)

B. Human Resources

Beside the main researcher and field assistant, this project involved diploma student from Bogor Agricultural University (1 person), local people (2 persons) for field guide and porter as a part of survey team.

C. Data Requirement

The required data to construct habitat suitability model is described in the following:

1) Digital topographic map (topomap) on Mt Halimun Salak National Park scale 1:25.000. This map is the special and newest version of topographical situation on Mt Halimun Salak National Park, produced by the National Coordinator Agency on Survey and Mapping (BAKOSURTANAL) consultant for Mt Halimun Salak National Park Management. Landsat ETM+ year 2003 was used to describe the latest land cover condition. The other topographic features (such as road, river, settlement, countur lines) were already extracted (in the self-theme). These features will be further processed by this system to derive the ecological geographical (ecogeographical) factor and to determine habitat suitability.
2) Javan gibbon distribution data in Mt Salak. This data were collected during field survey and some data came from previous research (Djanubudiman *et al*., 2003). This data was also used by SUITSTAT system (special GIS application) to determine javan gibbon habitat suitability.

D. Field Data Collection Method

Javan gibbon distribution data were collected by using triangle count and direct count along the available track in the study area. This method is appropriate to be applied on gibbon population counting and positioning (Rinaldi, 1992). The method is working based on the intersection between two (imaginary) lines, which each line was created by observer position (measured by GPS) and the measured compass bearing (azimuth) of observer to the source of sound. These two points should be in a quite distant to prevent the occurrence of parallel lines. After the species position was determined by drawing lines upon the map, the observer went to that position to verify the species existence. Some record list

in the tally sheet were marked, when the species was found. The design of the tally sheet can be seen in the Appendix 1.

E. Data Preparation

Data preparation was carried out for some reasons, i.e.:

1) To generate needed data, such as elevation class, slope class and forest ecosystem. DEM (Digital Elevation Model) data, which created from countur lines data, was used to generate these data. The generated elevation class data was used to produce elevation-based forest ecosystem data.
2) To adjust the attribute (especially on categorical spatial data, such as land cover, forest ecosystem, etc.) so that fit when they were inputted and processed by SUITSTAT system. This adjustment is intended to provide coding system which represents the available feature class in the data.

The work flow of data preparation is shown in the Figure 2.

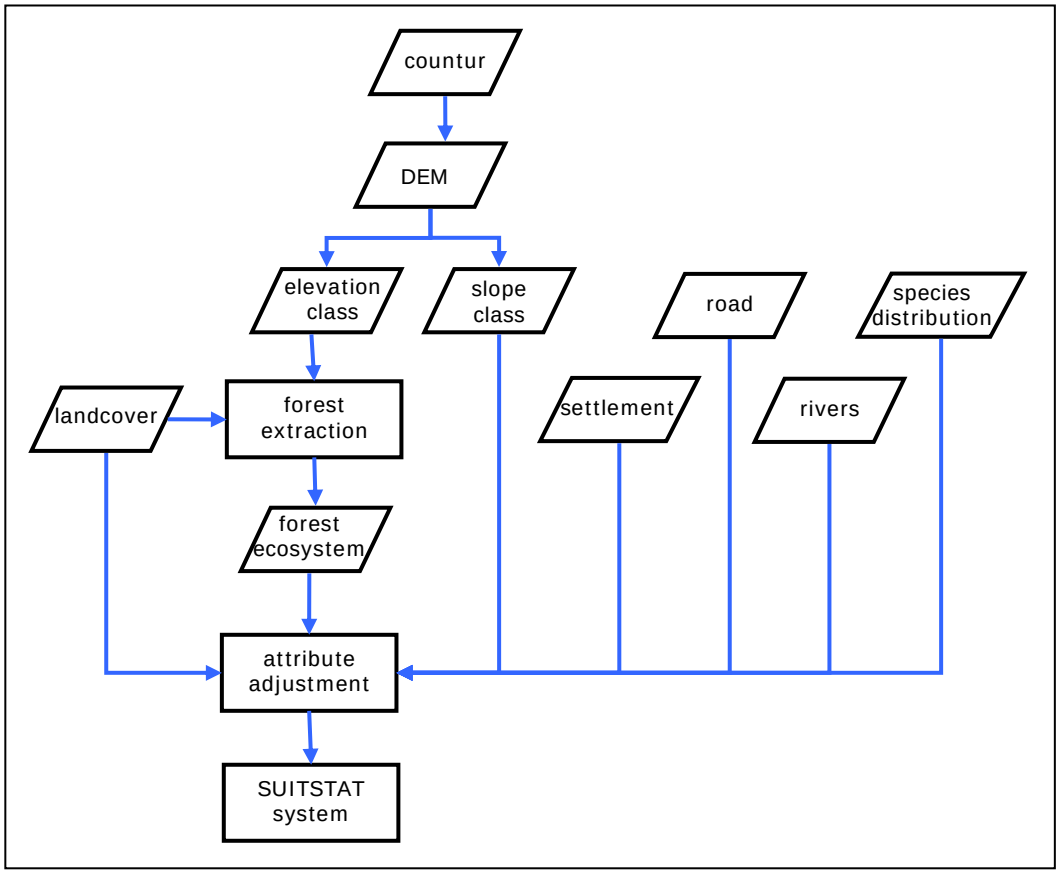

Figure 2. Data Preparation Work Flow

F. Data Analysis and Model Formulation

There two types of analysis method were used, i.e. descriptive statistics and GIS-based Simple Additive Weighting (SAW) method. The distribution data was statistically described to see the general pattern of gibbon distribution to habitat factor. The second analysis method is used to determine the habitat suitability of Mt Salak area for javan gibbon.

Suitability model is approximate using GIS-based decision rules, i.e.: Simple Additive Weighting (SAW) method. The suitability model outcome (decision outcome) is represented by suitability score which reflects the suitability level (the higher score, the higher suitability level). The model considers habitat factors, such as biotic, abiotic and human factor as decision criteria. Habitat factors are represented by available spatial data, such as land cover, river/water body, roads, settlement, slopes, and elevation-based forest ecosystem. From these factor, ten eco-geographic (spatial) variables were 'extracted', i.e.: the area of primary forest; the area of low-land forest; the area of submontane forest; the area of slope 0-15%, the area of slope 15-45%, the area of slope > 45 %, distance to river/water body; distance to settlement, and distance to road.

Almost of all variables are related to gibbon behavior and hence its survival. The variables were selected through rationalizing knowledge specifically on javan gibbon and generally on wildlife. Javan gibbon is a brachiated monkey which primarily depends on the forest structure (Napier and Napier, 1985; Kappeler, 1984a). Therefore, forest maturity (which derived from land cover data) should be considered as a cue to habitat suitability. The existing of built area (such as road/track and settlement) gives influence to the health of habitat which discussed in the concept of edge effect and fragmentation (Morrison *et. al.*, 1992; Primack *et al*., 1998). Tobing (1999) noted this factor influence to javan gibbon alert behavior. The existence of rivers or water body is vital for wildlife survival. Seeing that javan gibbon rarely came down from top forest canopy, this factor seems unimportant. However, this factor was included into the model consider to the possible relationship of this factor to community structures in javan gibbon habitat.

The decision constraints were also included. The constraints are considered due to the existence of a factor in the land entity that is not livable for gibbon and vigilant distance. The model constraint is determined on the area within 20 m from roads and settlement based on Tobing (1999) observation on javan gibbon alert behavior. Another constraint is area which contains a non-habitat land.

The occurrence of gibbon group is meant as proxy (indication) of suitable habitat. The concerned habitat variable are measured according those gibbon distribution (over 29 distinct groups) and analyze with *Principal Component Analysis* (PCA). Considers that principal component loading value indicates the contribution of a variable to variance explained by correspond principal component (eigenvalues), the maximum of principal component loading of the interpretable component suggest level of importance of variable in determining suitable habitat. Subsequently, it is used to calculate weight of each variable weight. *Broken Stick Distribution* is used to determine how many components were interpretable (McGarigal *et al*., 2000). The scheme of this method can be seen in the figure below.

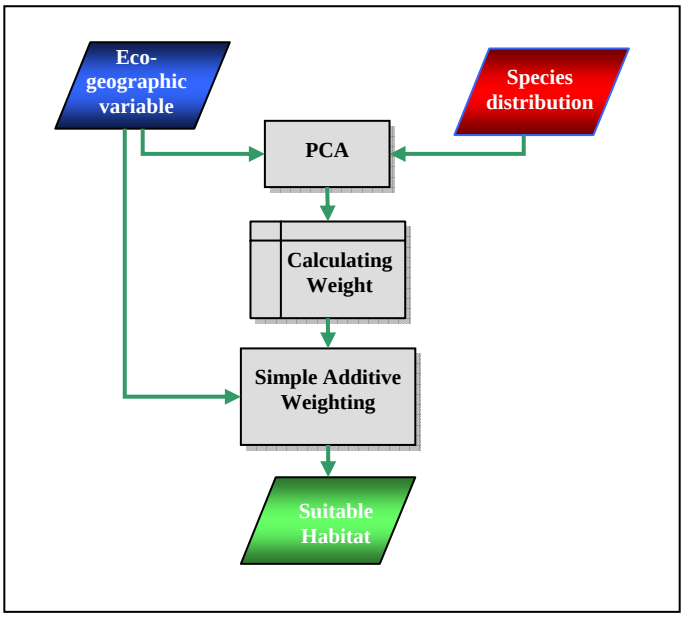

Figure 3. GIS-Based Analysis with PCA and SAW Method

The process of GIS-Based SAW Method was performed by SUITSTAT system (specially developed for this project and hopefully can be used for another species) which adopts Malczewski's (1999) procedure. This application could be used also to another species.

III. RESULT AND DISCUSSION

A. Javan Gibbon Distribution

Field survey was successful to record over 47 positions of identified javan gibbon through direct count method (visually) and triangle count method from whole study location. In each location, the measurement was conducted several times to ensure the distinction of java gibbon group to another. From these recorded locations, only 22 groups were identified as distinct groups. Specifically 10, 8, and 4 distinct groups were found in Bobojong, Cangkuang, and Kawah Ratu. Notes that only five groups from total of ten gibbons group at Bobojong site were included into analysis since there is no data on land cover type (covered up by cloud) in topographic map 2003 over these groups.

For the analysis purpose, the distribution data was enriched by previous research. Hence, there are 29 groups were used for analysis. The distribution data from field survey for analysis is provided in Appendix 2 (tabular format) and Appendix 3 (spatial format).

Most of the distinct groups were recorded through visual count method. However, triangle count method is helpful to be applied in gibbon count, which 13 points were recorded, and the rest was recorded visually. The extreme topographic condition is very challenging for verification of some positions which identified by triangle count method. Nevertheless, both methods were useful to be used concurrently by moving observer.

The number of groups identified through this survey is quite small, but it was successful to identified distinct group. Through SUISTAT system (special GIS Application which helping to map javan gibbon distribution using their positional data and construct habitat suitability) the distinct group could be checked and determined. Some positions which relatively close to its nearest position were determined as similar group. By using this procedure, distinct group misinterpretation is found to the previous study (Djanubudiman *et al.*, 2003). Additionally, consider to the forest damage around Kawah Ratu and extreme topographical condition which limiting the forest exploration in

Bobojong, the number of identified groups was optimal. The forest condition in Kawah Ratu study site can be seen in the figures below.

(a) (b)

Figure 4. Degraded Forest in Kawah Ratu: (a) forest condition near to the base camp, (b) forest condition along tracks

The distribution data obtained by this survey enrich the information of javan gibbon distribution data upon Mt. Salak. Previous research conducted by Djanubudiman *et al*. (2003) was focusing in western part of Mt. Salak, whereas this survey provides relatively in the central and north-eastern parts.

The general geographical pattern of distribution data is elucidated by summarizing the distribution data with the eco-geographic variables concerned, i.e. forest ecosystem (elevation based), land cover types, slopes, nearest distance to settlement, river (water body), and road. Since javan gibbons establish their exploiting area in the certain space as so called home range and/or territory, their position is represented with regular polygon (grid) as their home range entity. The summary is provided in the Table 1.

According to the summary, in the forest ecosystem, the data was distributed mostly in submontane forest and lowland forest. In average, gibbon range contains more submontane forest than lowland forest. The total area of submontane forest contained in the range is also higher than of lowland forest. In contrast, there is no any group found in montane forest. It is sensible because mostly javan gibbon diets are found in the lower ecosystem. Figure 5 show the landscape contains submontane primary forest.

Table 1. The Nature of Geographic Distribution of Javan Gibbon in Mt. Salak Based on 29 Observation Points

Variable	Freq	Total Area	Min	Max	Average	Std.Var.
HPR (ha)	28	423.423	0	16.646	14.600	4.503
HSE (ha)	9	52.787	0	15.960	1.820	4.400
HDR (ha)	18	229.629	0	16.646	7.919	7.947
HGB (ha)	19	252.411	0	16.646	8.704	7.973
HGA (ha)	0	0	0	0	0	0
SL1 (ha)	25	163.474	0	14.515	5.637	4.700
SL2 (ha)	28	291.050	0	16.002	10.036	4.700
SL3(ha)	8	9.185	0	3.301	0.317	0.813
RIV (m)*	28	-	0	2,747.617	979.488	826.489
PMK (m)	0	-	7.601	5,747.397	2531.521	1389.75
JL (m)*	12	-	0	2,153.779	428.919	567.654

Note: HPR=the area of primary forest; HSE=the area of low-land forest; HGB=the area of submontane forest contained in; SL1=The area of slope 0-15%; SL2=The area of slope 15-45%; SL3=The area of slope > 45 %; RIV=distance to river/waterbody; PMK=distance to settlement; JL=distance to road/tracks.

The geographical characteristic of the data is also examined based the forest maturity stage, i.e. primary forest and secondary forest, which shown that mostly they are distributed in primary forest, in number of occurrences or area possession in average. The gibbon distribution seems mostly spread to the area that has a low (0-15%) and medium slope area (15 – 45%). Even then, in average portion of area with the medium slope within gibbon's range is the highest. Almost all observations are distributed close to the river /small streams/ water body. This is related to the geographic situation in Mt Salak where river systems are so complex and closed to each other.

Figure 5. Primary Forest at Mt. Salak (viewed from Cangkuang)

B. Suitable Habitat of Javan Gibbon

The whole spatial variables were analyzed using PCA, except for the variable of montane forest area. This variable was omitted from calculation; because of the whole samples is zero which couldn't be used in PCA.

There is only five components are interpretable based on broken stick distribution, i.e. PC I to PC V. For each component has a percentage variance 35.32%, 23.86%, 14.90%, 11.35%, and 9.27% subsequently. Table 2 shows the loading of PC I to V, percent variance and broken stick distribution value.

Table 2. Principal Component Loadings for Each Spatial Variable

Variable	PC I	PC II	PC III	PC IV	PC V
HPR	0.22437	-0.49666	0.26912	0.05566	0.35810
HSE	-0.26680	0.47381	-0.30900	-0.25607	-0.25067
HDR	-0.36678	0.28364	0.39306	-0.09930	0.30205
HGB	0.36883	-0.28621	-0.38874	0.10213	-0.29538
SL1	-0.36031	-0.33326	-0.01548	-0.40133	-0.10023
SL2	0.24657	0.31738	-0.02549	-0.02549	0.42547
SL3	0.38704	0.26082	0.03137	0.03137	0.00921
SU	0.25098	0.11421	-0.22964	-0.59959	0.46836
PMK	0.18818	0.05413	0.66842	-0.06141	-0.36542
JL	0.41121	0.26583	0.15842	-0.11582	-0.29393
Eigen Values	3.53180	2.38564	1.49005	1.13466	0.92738
Percent Variance (%)	35.32	23.86	14.90	11.35	9.27
Broken Stick Distribution (%)	29.29	19.29	14.29	10.96	8.46

Considering to the PC loadings, the first component is best describing slope > 45%, and road variables. Primary and secondary forest variables are described best by the second component. Lowland and sub-montane forest variables are best explained by the third component. The forth and fifth components are best describing consecutively slope 0 – 15% and rivers variables, and slope 15 – 45%.

The weight of each variable was further transformed into the range of value 0 – 1. The final weight calculation result can be seen in the Table 3.

Table 3. Calculated Weight of Each Habitat Factors

Variables	Maximum PC Loading	Weight
HPR	0.49666	0.104
HSE	0.47381	0.100
HDR	0.39306	0.083
HGB	0.38874	0.082
SL1	0.40133	0.084
SL2	0.42547	0.110
SL3	0.38704	0.084
SU	0.59959	0.126
PMK	0.66842	0.140
JL	0.41121	0.086

The weight of each variable given by the PCA shows the influence level to determine habitat suitability. From the table above, the subsequent highest weight is corresponding to the distance to settlement, distance to river/water body, slope, forest maturity, and so forth.

Analyzing this weight based on the variable family group seems to follow the ecological sense. For example, the weight of forest maturity is highest on primary forest, which is already known that primary forest is containing richer gibbon diets, providing more cover than secondary forest. The direct influence of water supply to the gibbons is questionable, since this species is very rare to come down from the tree canopy. The explanation of this fact might be put on the relation between the plant communities to the river, which has different composition and structure.

Based on the calculation and considered habitat factors, habitat with a low suitability shares fairly extent of whole area of Mt Salak. The largest portion of Mt Salak is dominated by high suitable and suitable level. The size of each suitability class area is provided in the Table 4 and Figure 7 (spatial format).

Table 4. Habitat Suitability Classes for Javan Gibbon in Mt. Salak

Suitability Class	Class Name	Area	
		(Ha)	(%)
Class 1	Low Suitable	2231.892	16.807
Class 2	Less Suitable	14.718	0.111
Class 3	Moderate Suitable	126.606	0.953
Class 4	Suitable	3058.689	23.033
Class 5	High Suitable	7847.647	59.096

The distribution data was superimposed into the habitat suitability class map to know the condition of available gibbon distribution from field survey. Figure 7 shows that from 29 gibbon groups, 10 groups are located on low suitable habitat, 4 groups in suitable habitat and 15 groups are living in high suitable habitat. There is no group living in the less and modest suitable.

Ten gibbon groups are living in low suitable habitat; even this area is still supporting their lives. It shows the influence of geographical factors to the model, which are not only considered to ecological factors. In this perspective, the suitability of the habitat entity is assumed low if located near to the inappropriate factors (built up area, such as road, settlement, and so forth) for survival.

Figure 6. A Male Gibbon Which Living in the Low-Suitable Habitat

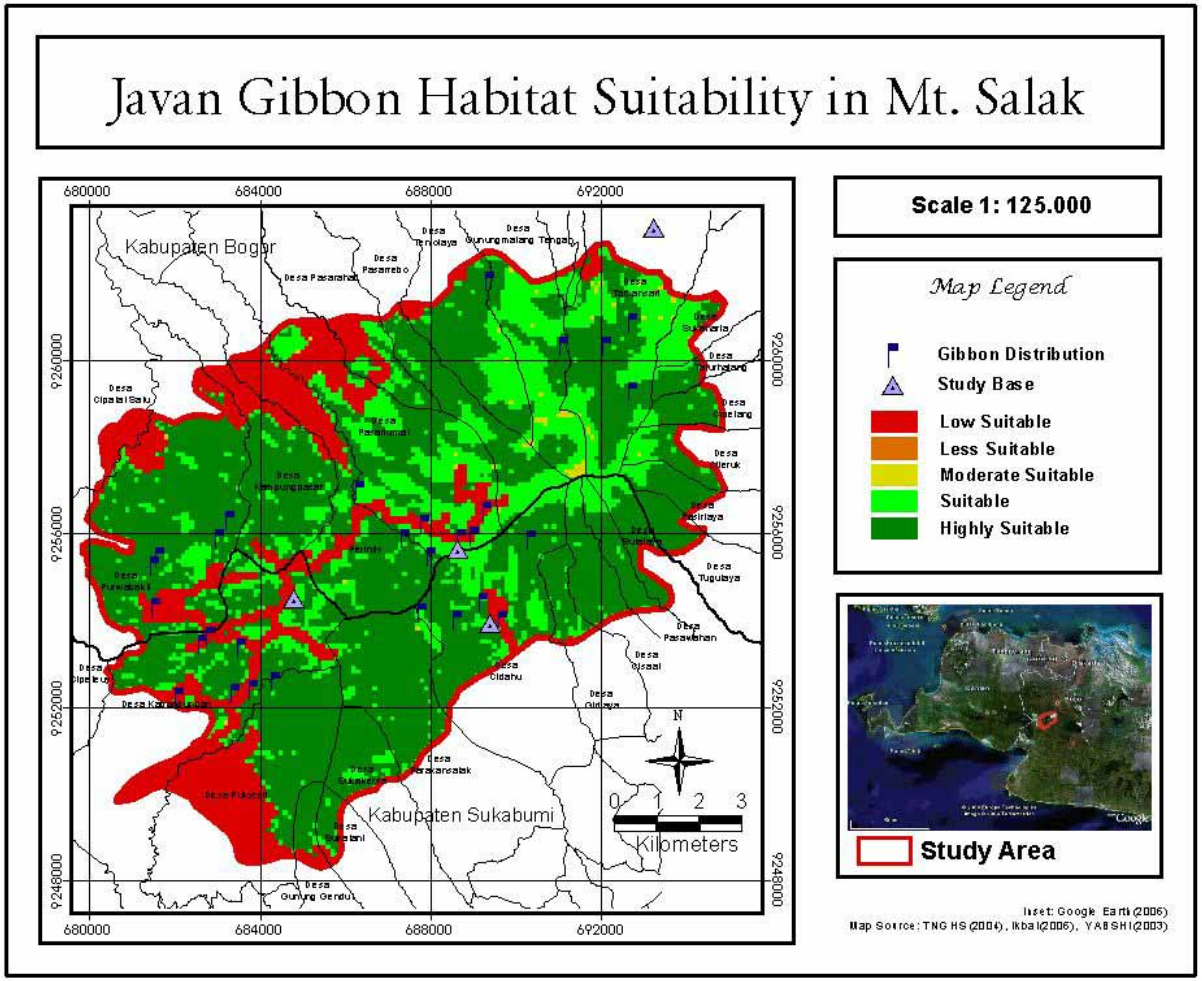

Figure 7. Map of Javan Gibbon Habitat Suitability in Mt. Salak

C. Conservation Setback and Recommendation

Based on the field observation, there is some disturbance facts to javan gibbon habitat were observed, such as: poaching, forest and non-forest extraction (such as fern, bamboos, etc.), encroachment, and so forth. Examining the current situation, we listed some possible problems through identifying the causes and symptoms, i.e.:

1) Lack of conservation management capability. There are some indications of this problem which are still occurred today:
   - Less coordination between adviser (Ministry of Forestry, Directorate General for Forest Protection and Nature Conservation) and the executor (Mt Halimun National Park Management Authority) which have made less responsibilities and less creativity atmosphere to take immediate action, and produced inefficient and ineffective area surveillance and control. The exposing of park enlargement issue has been very slow and grew the uncertainties among local peoples up. This condition has been motivated some irresponsible persons to take self-advantage by cutting down trees in the protected zones of PT Perhutani area.

Figure 8. One of Isolated Javan Gibbon Group near Cangkuang Base

- Lack of information and methodology to manage the integration of the habitat landscape. A fact that one group of javan gibbon (shown in the Figure 8) was isolated in small fragment of forest indicates that the integratedness of landscape habitat has not been considered in habitat management.

2) Lack of conservation enforcement and support. There is utilization (through concession scheme) other than conservation purpose (private company) inside Mt. Salak protected areas. Fragmentation inside Mt. Salak is not avoidable because of the development of built area or land cover change. Figure 9 shows the opened land after land concession was finished (more than 10 years ago).

Figure 9. Opened Land in the Ex-operational Area of Power Plant Private Company inside Mt. Salak Area

3) Highly economical dependency from local people to the resources in Mt. Salak area. In the origin most of local peoples are working as farmers. The depreciation of exchange value of agricultural products tends to make farmers to expand their agricultural area to conservation area, change their profession to another (such as labors or other informal occupation), or remain as a farmer. These choices are not complied with their daily needs. At last, they found that extracting forest or non-forest products is another alternative. It is obvious that the economical dependency to the forest has been developed without a reward to the forest health. The figure below shows the fact of forest extraction.

Figure 10. Fern Extraction

Beside the setbacks, some existing opportunities which favorable for Mt Salak conservation especially javan gibbon habitat are:

1) Communication between several holders in Mt. Salak has been maintained before the enlargement of Mt. Halimun National Park. For instance, the JK3GHS (Cooperation Network for Mt Halimun Salak Conservation) forum which initiated by local NGO (Biodiversity Conservation Indonesia).
2) Latest judgment on conservation status and enlargement of Mt Halimun National Park encourages finding optimum land utilization with more flexible ways than the previous Mt Salak management, i.e. protected area.
3) Close to the center of knowledge such as university, research institution, NGOs.

There are many range of possible recommendation and action could be developed to save javan gibbon habitat. The suggested goal of the strategy is to prevent the extension of low suitable habitat. The common strategy is how to hold up the setbacks and take maximum benefit from the opportunity. In the following are the identified recommendations:

1) Facilitate management of Mt Salak conservation. The management authority has to be more pro-active to enhance their own management program by develop partnership and support from university, research institution, and

NGOs, including program for technical practice in wildlife-habitat conservation, critical areas surveillance, and develop landscape rehabilitation. At the same time, they have to resolve their vertically internal problem.

2) Reducing fragmentation inside Mt. Salak area by developing well designed spatial-land utilization considering the linkage of javan gibbon habitat and habitat suitability.
3) Provide information on critical area by considering socio-economical factor and disturbances distribution in analysis. The result of this research could be used to develop this critical area information.
4) Intensify and revitalize the forum of communication or initiative of all holders in Mt. Salak, including local people, government (local and central government), private company, and so forth.
5) Promote and/or institutionalize the integrated natural resources management by establishing coordination among government department. This judgment is potential to resolve the overlapped or natural resources management conflicts and find the optimum land utilization for each natural resources management entity and increase the bargaining position of conservation areas over other type of land utilizations.

IV. FINANCIAL REPORT

This financial report used IDR (Indonesian Rupiah) currency since the exchange rate has been fluctuating. The fund is classified into two groups, i.e. administrative fund (used to manage or administer project, including management salaries, communication, and administration) and operational fund (used in real activities, such observation and data collection, data analysis, and reporting; including rent and purchasing equipment, field labor honor, rations and medicines, and transportation).

The total of fund given was Rp 87.235.819,- (*eighty seven millions, two hundred and thirty five thousands, eight hundreds and nineteen rupiahs*); almost 80% was used, i.e. 69.274.750,- (*sixty nine millions, two hundreds and seventy four thousands, seven hundreds and fifty rupiahs*) and remaining fund is Rp 17.961.069,- (*seventeen millions, nine hundred and sixty one thousands, sixty nine rupiahs*). In summary, the fund was used to rent and purchase equipment (35.90%), field labor honor/fee (15.48%), rations and medicines (14.78%), transportation (3.82%), salaries (24.68%), communication (4.33%), and administration (1.00%). More general, the fund was used to operational fund and administrative for 69.99% and 30.01% subsequently. More detailed of the fund utilization is provided in the table below on the next page.

Table 5. Fund Utilization

ITEM	Person	Quantity	Price/Unit	Total	Description
A. GRANT		1 package	87235819		
B. COSTS					
I. Endorsement administration					costs for fixed or regular item (during project)
1.1. Transportation Bogor-Bandung	1	2 times	130000	260000	
1.2. Transportation Bogor-Sukabumi	1	2 times	75000	150000	
1.3. Transportation Bogor-Cangkuang	1	2 times	50000	100000	
II. Preliminary survey					Cangkuang & Kawah Ratu (5 days) & Bobojong (3 days)
2.1. Transportation Bogor-Cangkuang	-	4 times	200000	800000	using rent car for bringing equipment, logistics, and team
2.2. Local Transportation	-	1 times	60500	60500	short distance, usually using motorcycle or public transportion
2.3. Ration	-	1 package	786000	786000	various food matters
2.4. Medicine	-	1 package	144750	144750	various medicines plus additional vitamin
2.5. Batteries	-	1 package	234000	234000	including batteries for GPS (A2 & A3), camera, lights
2.6. GPS (rent)	-	8 days	25000	200000	used to obtain earthly referenced position
2.7. Tent (rent)	-	8 days	15000	120000	used while staying overnight in the forest
2.8. Mono- and Binoculars (rent)		8 days	25000	200000	1 unit monocular and 2 units binocular, used in field observation
2.9. Additional equipment	-	1 package	182000	182000	including plastic sheets, cook set and others for tent
2.10. Equipment Maintenance	-	1 times	325000	325000	including tent and sleeping bag laundry
2.11. Honor Field Guide	1	4 days	50000	200000	Services fee in the field survey activity
2.12. Honor Porter	1	4 days	40000	160000	Services fee in the field survey activity
2.13. Honor Field Assistant	1	8 days	75000	600000	Services fee in the field survey activity
2.14. Residence		3 days	25000	75000	Fee for temporary stay overnight in the local people house

Table 5. *Continued*

III. Main Survey					
3.1. Transportation	-	6 times	200000	1200000	
3.2. Local Transportation	-	1 package	79000	79000	
3.3. Ration	-	1 package	8707000	8707000	
3.4. Medicine	-	1 package	604500	604500	
3.5. Batteries	-	1 pairs	3539000	3539000	
3.6. GPS Rent	-	62 days	25000	1550000	
3.7. Tent Rent	-	62 days	15000	930000	
3.8. Mono- and Binoculars (rent)		62 days	25000	1550000	
3.9. Additional equipment	-	1 package	288000	288000	
3.10. Equipment Maintenance	-	3 times	185000	555000	
3.11. Honor Field Guide	1	56 days	50000	2800000	
3.12. Honor Porter	1	56 days	40000	2240000	
3.13. Honor Field Assistant	1	62 days	75000	4650000	
IV. Stationary					
4.1. Stationery	1	1 package	250000	250000	Materials and equipment used for writing and documenting
4.2. Analog Map (original and duplication)	1	5 sheets	35000	175000	Base map used in the field observation
4.3. Map container	1	1 unit	150000	150000	Map case for protecting maps from hazardous condition
4.4. Communication	1	12 months	250000	3000000	maintaining communication between team and related official
4.5. Day packs	-	2 units	275000	550000	complementary field equipment, especially used during observation
4.6. Sleeping bag	2	1 unit	150000	300000	complementary field equipment, especially used for tent
4.7. Rain coat	-	3 unit	75000	225000	complementary field equipment, especially used during observation
4.8. Flying sheet	-	2 unit	350000	700000	complementary field equipment, especially used for tent
4.9. Lights	-	2 units	35000	70000	complementary field equipment, especially used for tent
4.10. Notebook (secondhand)	-	1 unit	8500000	8500000	data storage, processing and analysis, data preparation
4.11. Printer	-	1 unit	400000	400000	Printing endorsement letters, report, references.
4.12. Print-cartridge	-	2 unit	200000	400000	printing equipment
4.13. External Hardisk (30 GB)	-	1 unit	950000	950000	portable storage
4.14. Flash Disk (256 MB)	-	1 unit	300000	300000	portable storage
4.15. Notebook peripherals	-	1 unit	75000	75000	including USB port extension and cables

Table 5. *Continued*

4.16. Digital Cammera (7 MB Resolution)	-	1 unit	2000000	2000000	used for documenting
4.17. Memory card (128 MB)	-	1 unit	150000	150000	used to store camera images
V. Salaries					
5.1. Project coordinator salary	1	12 months	700000	8400000	coordinating, liason, report preparation
5.2. Project assistant salary	1	12 months	600000	7200000	survey logistic, field data collection and data entry
5.1. GIS Application Developer Assistant	1	1 package	1500000	1500000	GIS application development for dynamic data processing
VI. Report distribution					
6.1. Report duplication	-	9 copies	35000	315000	
6.2. Report distribution/post delivery	-	5 units	75000	375000	
C. TOTAL COST (I – VI)				69274750	
D. REMAINING FUND (GRANT – TOTAL COST)				17961069	

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APPENDICES

Appendix 1. Tally Sheet for Gibbon Survey

Date					Base:								
Team					Started/Ended Time:								
Ind.	Pos.	Ctc.Type	Time	Observer Lat/Long	Az.	Dist.	Behav.	Age Classes					
								AM	AF	SM	SF	J	I
1	1a	(V,A)					(F,S,M,R)						
	1b												
2	2a												
	2b												
3	3x												
4													
5													

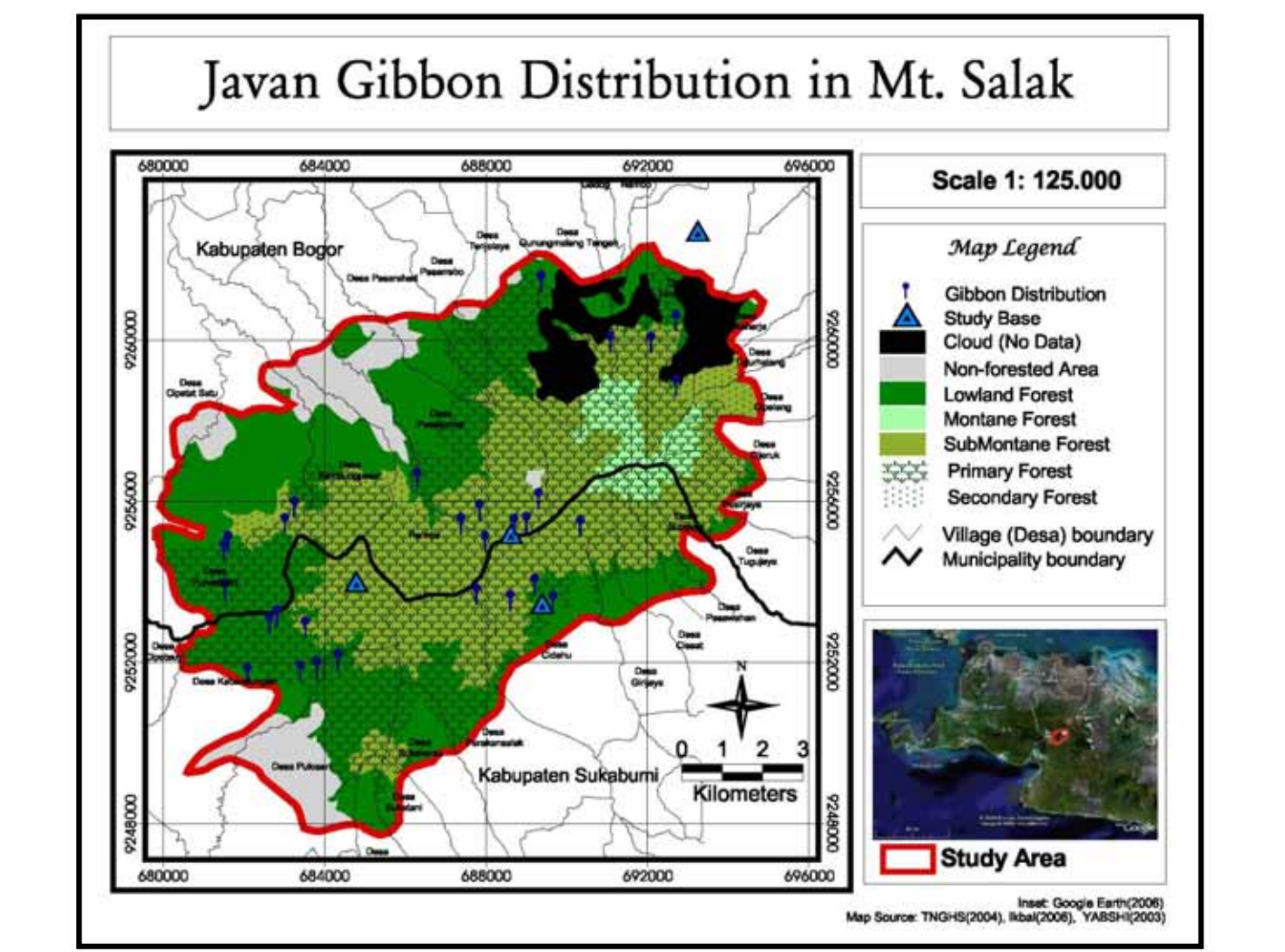
Coding details:

Ind.= gibbon individual code
Pos.= observer position code
Ctc.type= contact type (V: visual, A: audio)
Time= time of contact
Az.= azimuth/direction to source
Dist.= distance
Behav= behavior (F: feeding, S: socializing, M: moving, R: resting)
Age classes: individual found

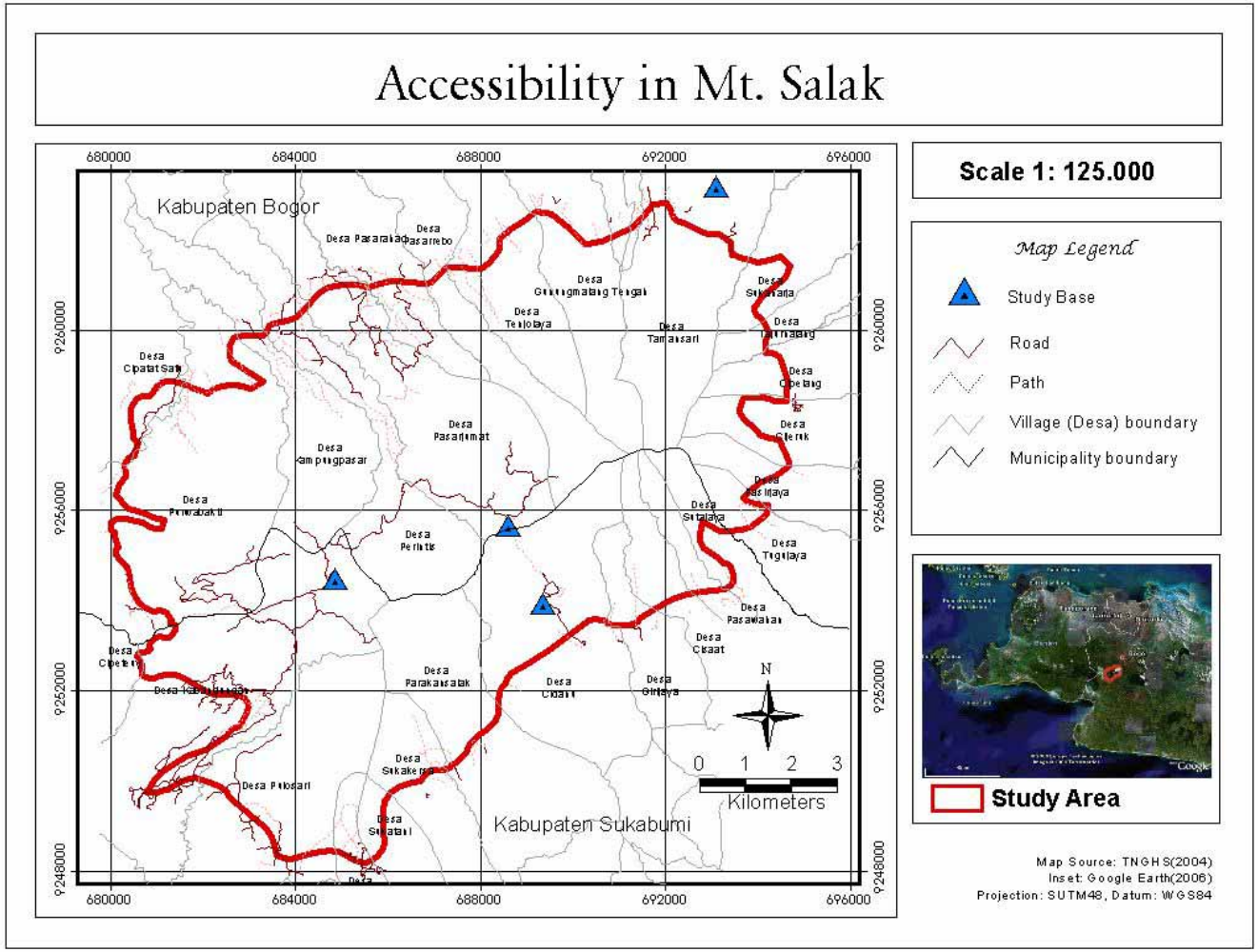
Appendix 2. Javan Gibbon Distribution Data in Mt. Salak Used in the Analysis

No	Date	Time	X	Y	Contact Type	Age Classes					
						AM	AF	SM	SF	J	I
1	13/06/06	10.45	689374.143	9261919.566	A	1					
2	02/06/06	14.14	691088.992	9260387.148	A	1					
3	03/06/06	10.15	692092.361	9260387.148	A	1					
4	29/05/06	09.09	692712.625	9260934.441	V	1	1				
5	07/06/06	11.09	692712.625	9259329.050	A	1					
6	31/01/06	12.47	690341.026	9255844.624	V	1					
7	01/02/06	8.3	689301.171	9256519.617	A	1					
8	01/02/06	12.02	689009.282	9255935.839	V	1					
9	31/01/06	8	688699.149	9255881.110	A	1					
10	25/02/06	8.3	687987.670	9255461.519	A	1					
11	08/04/03	09.52	687385.648	9255899.353	A	1					
12	26/02/06	11.03	687841.725	9256227.728	V	1	1				
13	08/04/03	09.52	686309.307	9257012.180	A	1					
14	12/03/06	09.50	689209.955	9254385.178	V	1	1				
15	03/02/06	15.3	689666.032	9253965.587	V	1	1			1	1
16	28/01/06	7.15	688607.934	9253983.830	A	1	1				
17	24/02/06	7.45	687768.753	9254148.018	A	1					
18	07/04/03	12.35	683262.714	9256300.700	V	1					
19	07/04/03	13.05	683025.554	9255899.353	V	1					
20	09/04/03	14.50	683536.360	9253345.323	V	1					
21	13/04/03	08.10	684339.055	9252524.384	A	1					
22	05/04/03	08.30	683810.006	9252341.954	V	1	1				
23	13/04/03	10.50	683408.658	9252250.738	V	1					
24	11/04/03	14.49	682095.157	9252177.766	V	1	1				1
25	11/04/03	07.35	682642.449	9253436.538	V	1	1			1	
26	04/04/03	11.11	682824.880	9253618.969	V	1	1				
27	12/04/03	10.30	681547.865	9254275.719	V	1					
28	04/04/03	16.50	681511.379	9255242.602	V	1	1				1
29	04/04/03	15.08	681620.837	9255461.519	A	1					

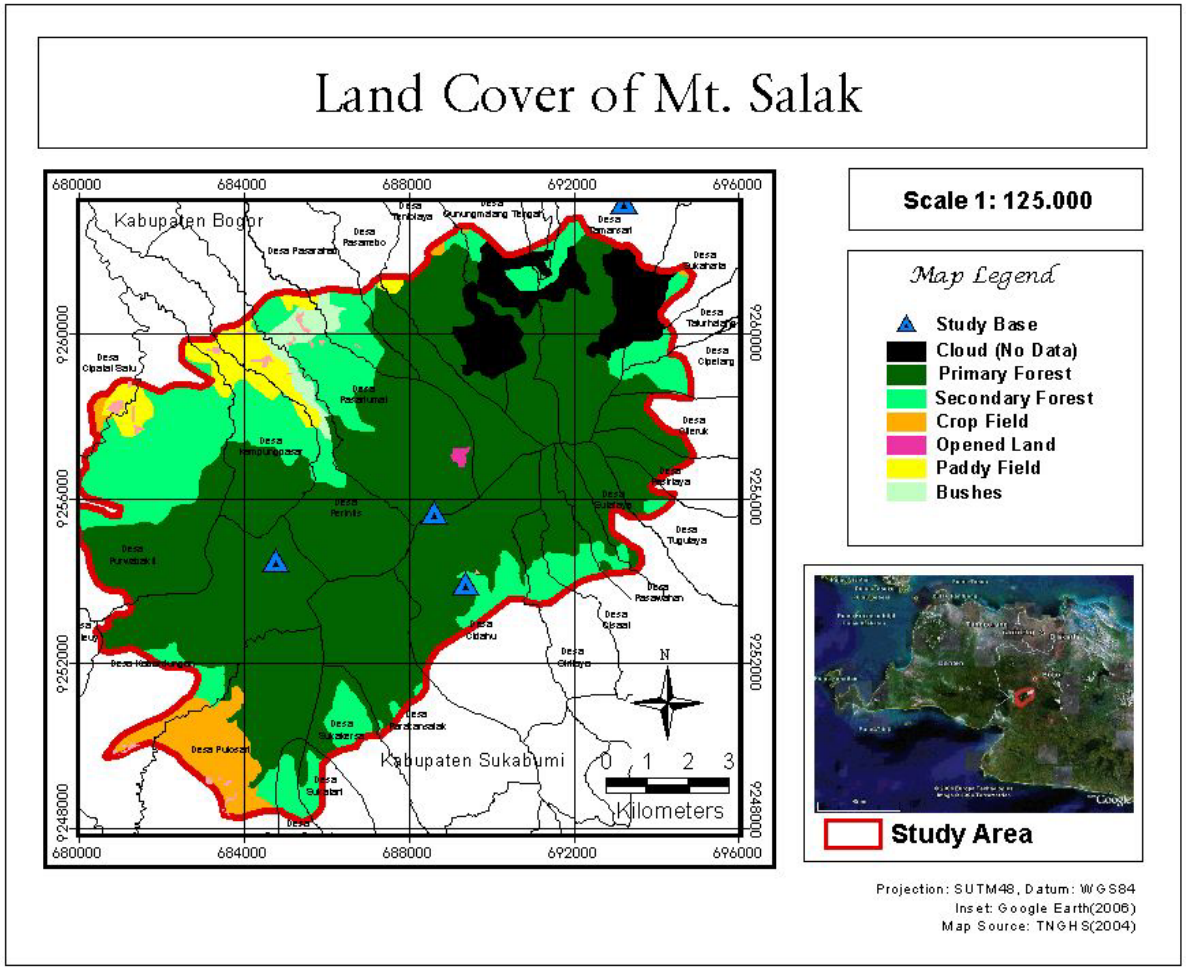
Appendix 3. Javan Gibbon Distribution Survey Map



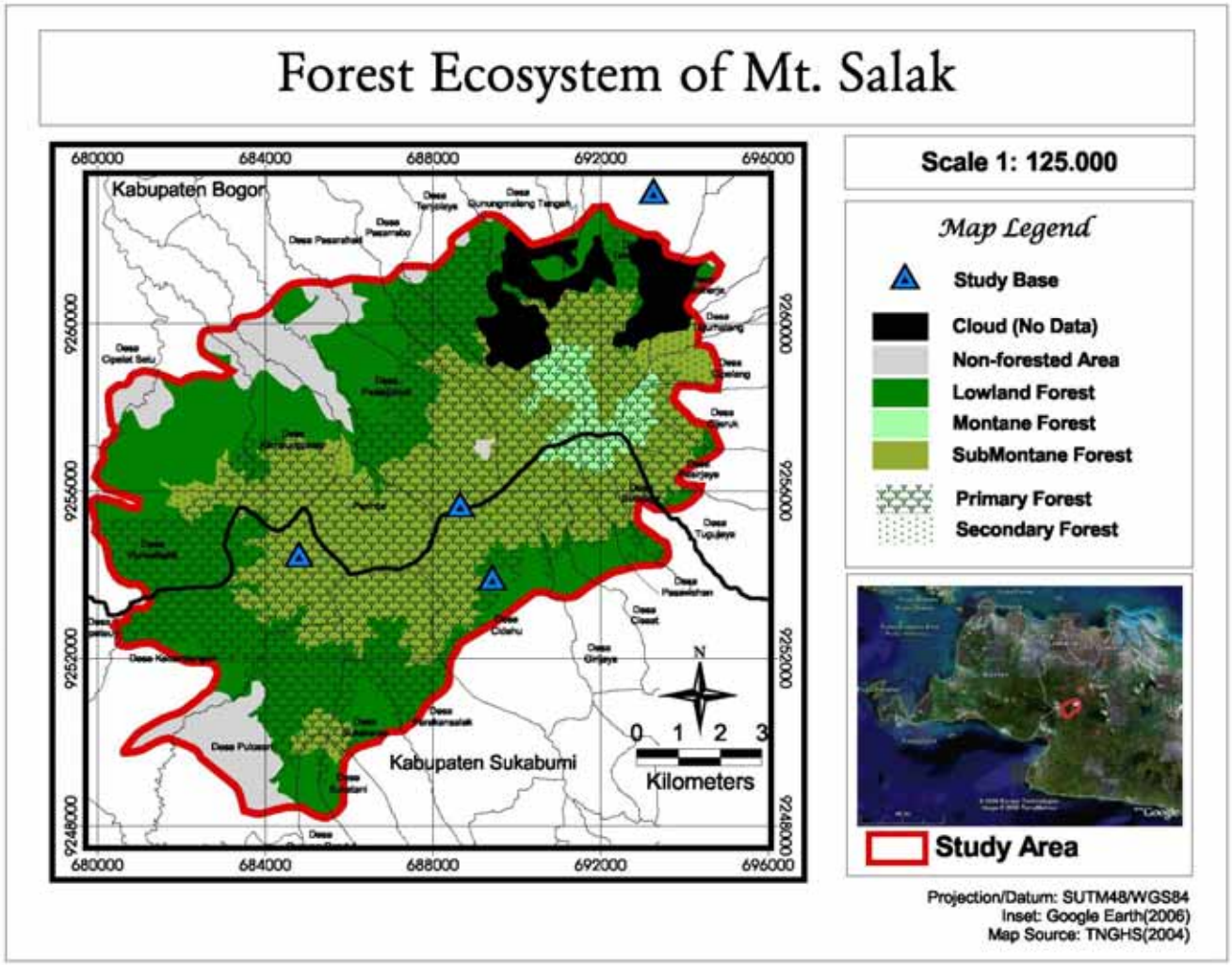
Appendix 4. Accessibility (road and track) in Mt. Salak



Appendix 5. Land Cover of Mt. Salak



Appendix 6. Forest Ecosystem (Elevation Based) in Mt. Salak



Appendix 7. Rivers in Mt. Salak Map