ECOLOGICAL STUDY
HALIMUN-SALAK CORRIDOR
MOUNT HALIMUN-SALAK NATIONAL PARK

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INTRODUCTION

Background

Halimun-Salak corridor stretched from west to east, connecting Mount Halimun with Mount Salak area. Attention to this corridor is very important since it become part of Mount Halimun-Salak National Park (GHSNP) management area in accordance Minister of Forestry Decree No. 175/Kpts-II/2003[1] established on 10 June 2003. The corridor is functioning as connector between two ecosystem of Mount Halimun and Mount Salak. Therefore, this corridor is very important to make sure genetic flow is happening for the conservation of biodiversity and the function of this area as life support system. The inclusion of Mount Salak forest area into Mount Salak National Park (GSNP), has made GSNP management area that previously 40,000 ha extended into 113,357 ha.

Today, Halimun-Salak corridor has fragmented due to community activities and the presence of building and roads, agricultural land, and other activities that converting forest in this area. Illegal logging, illegal mining (stone), and encroachment also still occurred in this area. These conditions are much related to the long history of the park management.

Based on satellite image classification in 1990 and 2001, there has been fragmentation and forest degradation in the corridor. Within 11 years, the corridor's forest degraded about 347,523 ha from the total forest area of 666,508 ha (1990) and it declined into 318,985 ha (2001) with corridor width of 1.4 km (1990) into 0.7 km (2001) (Cahyadi 2003).

The Mount Halimun-Salak corridor at the moment needs management that able to improve its function for the better future. The future corridor management is expected to be more direct and focus, both for the importance of national park area and the wide community especially in **ecological function protection aspect as life support and conservation of genetic natural resources**. In GHSNP management, in particular, the corridor is expected to become one of priority area on the park management. Therefore, result and information from ecological studies in corridor area can become foundation and support for formulation of GHSNP management priority effort in general and the corridor in particular.

Description of Halimun-Salak Corridor

Corridor is a 'linear habitat remnants' or remaining habitat that supporting the survival and regeneration of wildlife and become wildlife movement path that connecting sufficient/available habitats (Sieving et al., 2000).

Information on wildlife diversity in Halimun-Salak corridor is not yet many. Previous studies have recorded the existence of 11 mammals and 52 birds (cahyadi 2003, Harahap et al., 2004, Prawiradilagal & Marakarman, 2003; 2004). The important mammals found from those studies are Javan Gibbon (*Hylobates moloch*), Ebony Leaf Monkey (*Trachypithecus auratus*), Javan Leaf Monkey (*Presbytis comate*), Leopard Cat (*Felis bengalensis*), Leopard *(Panthera pardus melas*), Asian Palm Civet *(Paradoxurus hermaproditus),* Black Giany Squirrel *(Ratufa bicolor)* and Wild boar *(Sus scrofa).* Studies using camera trap method recorded there

[1] a*bout* Determination of Mount Halimun-Salak National Park area and function changes of protected forest, permanent production forest, limited production forest, in Mount Halimun and Mount Salak forest block of ±113,357 ha in West Java and Banten Province into Mount Halimun-Salak National Park

are at least three individual of leopard that protected by law (Harahap S.A. et al., 2004). Important bird species recorded in this area are; Javan Hawk-eagle (*Spizaetus bartelsii*), Crested Serpent-eagle (*Spilornis cheela),* Red-billed Partridge (*Arborophila javanica*).

Based on administrative authority, the Halimun-Salak corridor is located in two districts, Sukabumi and Bogor District. The northern part of the corridor is included in Bogor District with area of 1,662.76 ha, while the southern part is Sukabumi District with area of 2,533 ha. The boundary of these districts is stretched from West to East at the highest altitude of the corridor. The Halimun-Salak corridor area is under management of GHSNP authority that located in two management resort, which are: the southern part of Mount Kendeng resort and northern part of Mount Butak resort.

The corridor within Bogor District covers two villages under two sub district administrations, which are Purasari Village (Leuwiliang Sub District) and Purwabakti Village (Pamijahan Sub District). Whilst the corridor in Sukabumi District covers three villages under one sub district, which are Cihamerang, Cipeuteuy and Kabandungan Village of Kabandungan Sub District. Administration of Halimun-Salak corridor area in complete is presented in **Figure 1.** of administrative boundary of Halimun-Salak Corridor of GHSNP.

Table 1. Administration Area of Halimun-Salak Corridor

Province	**District**	**Village**	**Sub District**	**Area(ha)**
West Java	Sukabumi	Cihamerang	Kabandungan	67,11
		Cipeuteuy	Kabandungan	1.931,21
		Kabandungan	Kabandungan	534,68
	Bogor	Purasari	Leuwiliang	296,32
		Purwabakti	Pamijahan	1.366,46
			Total	4.195,78

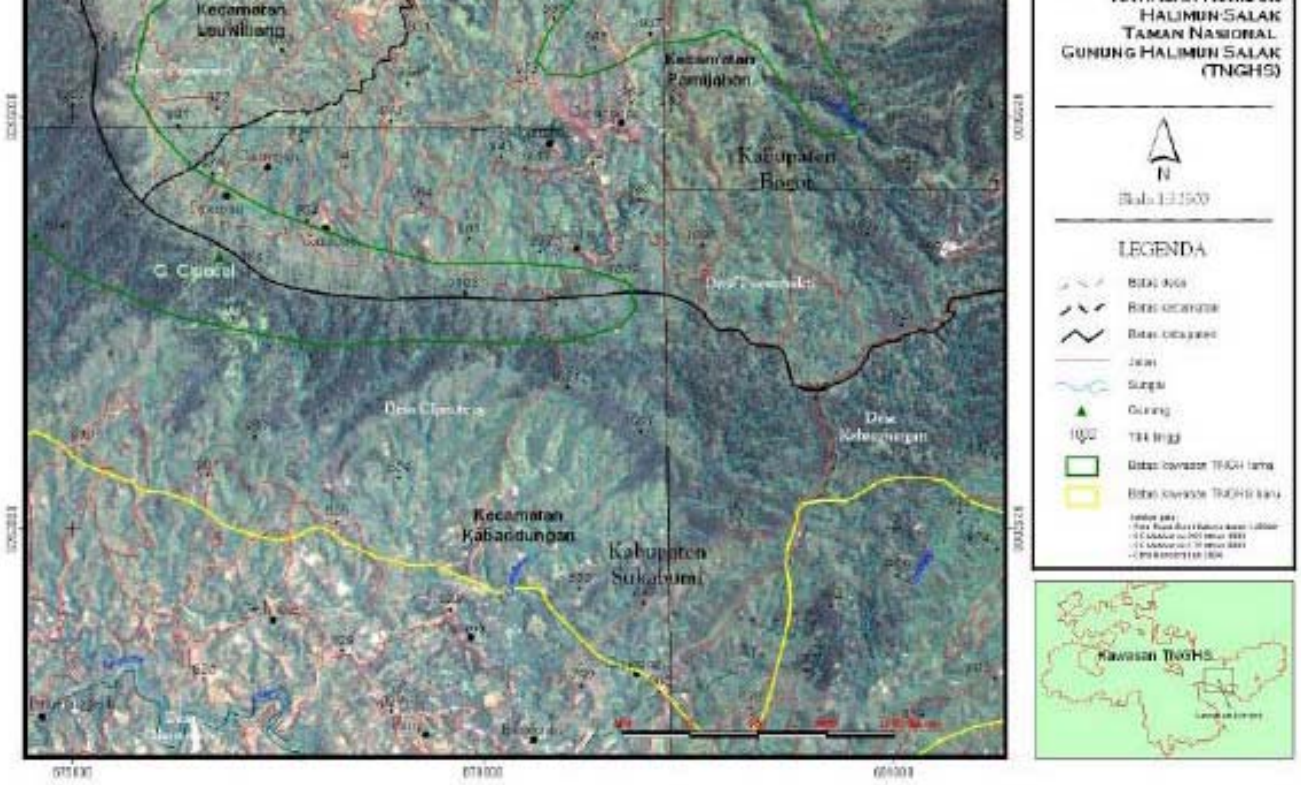


Figure 1. Map of administrative boundary of Halimun-Salak Corridor of GHSNP

HISTORY OF MOUNT HALIMUN-SALAK NATIONAL PARK AREA

In the Colonial period (1924-1934), the Mount Halimun area determined as protected forest with area of 39,941 ha under management of Netherlands Government. In the period of 1935-1961, Mount Halimun protected forest status was changed into the status of Natural Reserve under management of Netherlands Government and then the Republic of Indonesia cq. West Java Forestry Agency. Until February 1978, the Mount Halimun Natural Reserve management is conducted by Perum Perhutani where within the time period all forest in West Java was under management of Perum Perhutani.

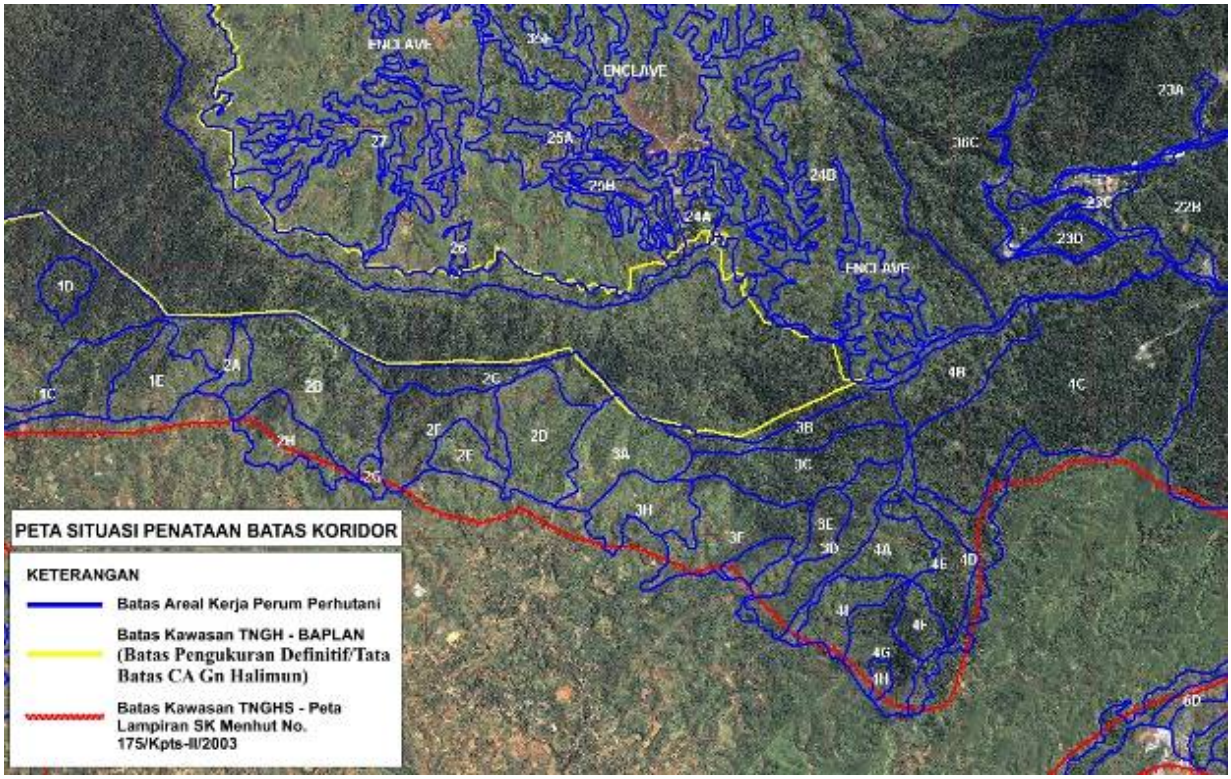
Before, in 1977, it was proposed and approved by the governor of West Java that all protected areas in West Java should be under the care of PPA, (it was then changed into PHPA). However, at that time, it was not happened. The temporary proposal was to establish a natural reserve with area exceeding 40,000 ha in Mount Halimun area that proposed by PPA in 1977. The proposal included all existing protected forest and excluding production forest based on Planology Brigade map. However, several parts of protected areas have been converted into agricultural land and settlement, while some of production forest was still primary forest. In 1979, the area extended into 40,000 ha under management of PPA.

In 26 February 1992, the area determined as national park with Minister of Forestry Decree No 282/Kpts-II/1992. Management and responsibility of the national park establishment was temporarily given to Mount Gede Pangrango National Park authority on 26 May 1992 based on DG PHPA Decree No. 1544/DJ-VI/TN/1992.

The independent management of Mount Halimun National Park authority was began in February 2007 with Minister of Forestry Decree No. 185/Kpts-II/1997. The Mount Halimun National Park is divided into three sub section of conservation area, which are South Mount Halimun, North Mount Halimun, and Mount Sanggabuana Conservation Area Sub Section.

Particularly for corridor area, before the national park is extended into two management area, the western part of corridor area (part of Mount Halimun) was managed by national park, while the eastern part (Mount Salak and surrounding) was managed by Perum Perhutani. The area that managed by national park was determined as core zone and other area outside this area is national park buffer zone. For buffer zone, most of the area is managed by Perum Perhutani and the northern part is managed by Cianten tea plantation.

Decision to merged Mount Halimun and Mount Salak area (with area of 113,357 ha) into one management was determined by Minister of Forestry Decree No. 175/Kpts-II/2003 on 10 June 2003 that all corridor area and area that previously managed by Perum Perhutani become part of Mount Halimun-Salak National Park (GHSNP) authority.



--Figure 2. Map of boundary arrangement situation in Halimun-Salak Corridor area

CONDITION OF HALIMUN-SALAK CORRIDOR

General Condition of Mount Halimun-Salak Corridor

1. Slope

The slope of Halimun-Salak corridor area varies from flat to steep. The dominant slope class in the corridor is 15-25% with slight topography covering area of 1,292.89 ha. Along the northern corridor, the topography is very steep with slope > 40%. The corridor on Mount Salak side (eastern part) the slope is more flat compare to those in Mount Halimun (western part).

The map of the corridor slope is obtained from digital contour data of Bakosurtanal Earth Surface map within the interval of 12.5 meters that converted into DEM (Digital Elevation Model). The DEM data was then converted into slope map.

Based on slope map of Halimun-Salak corridor area and Table 3, it is appear that the Halimun-Salak corridor has varies topography.

Table 2. Class of slope in corridor area

No	Class	Note	Area (ha)
1	0 - 8 %	flat	417.99
2	15 - 25 %	slight	1,292.89
3	25 - 40 %	quite steep	1,133.51
4	8 - 15 %	steep	674.53
5	> 40 %	very steep	676.84
			4,195.76

Source: analysis of contour digital data from Bakosurtanal Earth Surface Map with interval of 12.5 m

2. Type of Soil

Soil type at the corridor is dominated by Association Reddish-Brown Latosol and Brown Latosol with area of 1,811.78 ha, included in Mediteran soil type, the type has moderate sensitivity to erosion. For more clear information on area of each soil type at the corridor, please refer to **Figure 4.** The soil type of Halimun-Salak corridor and Table 4.

Table 3. Type of soil at corridor area

No	Soil Class	Soil Type	Note	Area (ha)
1	Mediteran	Association of Brown Latosol and Greyish Pegoso	sensitive moderate	15.49
2	Mediteran	Association of Reddish-Brown Latosol and Brown Latosol	sensitive moderate	1,811.78
3	Andosol	Brown-Yellowish Andosol	sensitive	27.91
4	Mediteran	Brown Latosol	sensitive moderate	2,340.58
				4,195.76

Source: Digital map data of soil type at corridor area (PIKA)

3. Rainfall Intensity

Based on rainfall map, the Halimun-Salak corridor (**Figure 5**) is divided into 2 average annual rainfall intensity areas, which are moderate (4,000-4,500 mm/year) and high (4,500-5,000 mm/year). The corridor with high annual rainfall intensity is located at north which most of the area are under administration of Bogor District, while corridor area with moderate annual rainfall intensity is with Sukabumi District.

Table 4. Average annual rainfall intensity in corridor area

No	Average annual rainfall intensity	Note	Area (ha)
1	4,000 – 4,500 mm	Moderate	2,491.47
2	4,500 – 5,000 mm	High	1,704.28
			4,195.76

Source: Java-Madura Rainfall Map Book 1973 (50 years)

4. Land Coverage

Based on Ikonos images interpretation (acquisition date 24 August 2004) of Halimun-Salak corridor, there are 19 land cover types that included in 5 major categories, which are: natural vegetation, secondary vegetation, artificial vegetation, natural non-vegetation and artificial non-vegetation.

The vastest land covers type in Halimun-Salak corridor (Figure 2. Class of slope in corridor area), which is shrubs of around 1,484.53 ha (35.29%) and the second is secondary forest with area of 759,06 ha (18.05%). For more detail area of each land cover type is presented at Table 2.

Result of Ikonos interpretation shows that secondary forest in Halimun-Salak area is fragmented by shrubs and caliandra stretch from South to North. In several spots there are montane shrubs and fernland, at the northern part is Cianten tea plantation and the southern is Cisarua and Cipeuteuy settlement, where those areas are directly bordered with corridor area that managed by community around the corridor for farm, agricultural land, paddy field, etc.

Table 5. Width of each land cover in Halimun-Salak Corridor area

No	Land Cover Type	Category	Area (ha)	Percentage
1	Primary Forest	Natural Vegetation	268,56	6.38
2	Secondary Forest	Secondary Vegetation	759,06	18.05
3	Mixed farm	Artificial Vegetation	185,13	4.4
4	Plantation Forest	Artificial Vegetation	42,05	1
5	Agathis	Artificial Vegetation	0,19	0
6	Pinus	Artificial Vegetation	28,30	0.67
7	Dry agriculture	Artificial Vegetation	512,48	12.18
8	Tea plantation	Artificial Vegetation	514,63	12.24
9	Settlement	Artificial non	24,90	0.59

No	Land Cover Type	Category	Area (ha)	Percentage
10	Fernland	Natural Vegetation	10,12	0.24
11	Grassland	Natural Vegetation	8,73	0.21
12	Road	Artificial non	29,64	0.7
13	Paddy Field	Artificial Vegetation	234,13	5.57
14	Pond	Natural non Vegetation	1,45	0.03
15	River	Natural non Vegetation	13,76	0.33
16	Cleared land	Artificial non	54,96	1.31
17	Shrubs	Artificial Vegetation	1.484,53	35.29
18	Shrubs	Natural Vegetation	32,14	0.76
19	Mining	Artificial	1,43	0.03
			4.206,18	100

Source: Ikonos Image interpretation 24 August 2000

WILDLIFE BIODIVERSITY

1. Flora biodiversity

Based on field data, the whole forest in corridor area has been disturbed. Observation in four main sites show that species biodiversity at corridor area is high, even tough most recorded species is generally secondary species. This is related with increasing deforestation rate and forest canopy open that only pioneer and secondary species that can adapt themselves in such condition. The remaining primary species is generally existed only in areas with steep slope.

Generally, flora community at four observation sites are (1) Halimun patch is *Castanopsis acuminatissima – Schima wallichii* community, (2) Western Corridor patch is *Schima wallichii – Maesopsis eminii* community, (3) Eastern Corridor patch is *Quercus gemmeliflora – Schima wallichii* community, and (4) *Salak* patch is *Euodia latifolia – Schima wallichii* community.

The effect of altitude (from 1000-1400 m asl.) to flora species variation is not very visible. Some parts of corridor have many shrubs such as *paku andam* (*Dicranopteris linearis*), *tepus* (*Etlingera punicea*), *nampong* (*Clibadium surinamensis*) and several other species. At the forest that intact/less disturbed around slope of mountain/hill, high primary species such as *kihujan* (*Engelhardtia serrata*), *Castanopsis spp., Quercus sp., Lithocarpus spp. Litsea spp.* and several *jambu-jambuan* (Myrtaceae) can often be found. Species of tree level has already rare to found among other are *palahlar* (*Dipterocarpus hasseltii*), *Cyathea contaminans* (*paku tiang*), *Cinnamomum spp., Schizostachyum sp.*(*awi sengkol*) and *Altingia excelsa* (*rasamala*). It is estimated that many more natural forest species is in critical existence.

Number of flora found in the study comprises of ± 280 species of 197 family and 80 class that in detail: 123 tree species (44%), 61 small tree species (21.8%), 97 *perdu, terna* and epifit species (34.6%). When classified by species, shrubs and secondary species dominated the corridor area (± 70%) compared to the primary species (± 27%). In the heavier destructed level, almost 80% is occupied by grasses such as *alang-alang* (*Imperata cylindrica*) and *kirenyuh* (*Eupatorium inulifolium*). In the deeper area, there is change of plant composition with many finding of *Macaranga spp.*, and *Ficus spp.*, while the ground vegetation is *cangkore* (*Dinochloa scandens*), *Calamus manan, Begonia sp.* And *Cyrtandra sp.*

Existing primary forest that found many in both mountains are of types *puspa* (*Schima wallichii*), *kimerak* (*Weinmannia blumei*), *paku siuer* (*Cyathea junghuniana*), and several Fagaceae such as *Quercus gemelliflora*, *Castanopsis argentea* and Lauraceae (*Cryptocarya mentek, Litsea robusta*). In the research site, there is tree individuals with diameter >50 cm. The condition reflecting that deforestation rate is quite high that recorded trees are those from regeneration. The fact is also supported by species composition that most are secondary plant such as several main species from Euphorbiaceae and Moraceae. The most general species representing Euphorbiaceae is *Macaranga triloba, M, tanarius, Aporosa frutescens, Mallotus paniculatus* and *Homalanthus populneus* while Moraceae is represented by various *Ficus* such as *Ficus grossuloides, F., sinuata, F., fistulosa, F. hirta* and *F. Padana*. Those species are of secondary forest species that common to grow in disturbed forest that having significant pressure from community.

The characteristic of disturbed forest also appear from tree height class that most only in range of 10 – 15 meters. Species that dominant in this small diameter and height is from Euphorbiaceae, Symplocaceae, Melastomataceae and Cyatheaceae while Fagaceae, Juglandaceae, Lauraceae and Theaceae generally in diameter class > 30 cm. Species with relatively big diameter class and height class is represent by *Lithocarpus sp., Quercus gemelliflora, Egelhardia serrata, Schima wallichii* and *Altingia excelsa*. From tree height, it is apparent that most trees cannot reach A layer (height >30m) and many in B layer (height 20-30m) and C (height <20m). Tree recorded to regenerate from seedling is actually several primary tree species that ready to replace secondary species such Lauraceae, Fagaceae, Cyatheaceae, Myrtaceae and Elaeocarpaceae. During observation, there area remaining big trees but it was not at flowering time.

The open of forest canopy because of destruction has stimulated growth of several forest ground vegetation for example is herbs such as *Eupatorium inulifolium* (*kirenyuh*), *Clibadium surinamensis* (*nampong*) and *Clidemia hirta* (*nunut*). In addition, there are several rattan and bamboo that also grow because of forest canopy opening. In the contrary, in several sites with closed canopy, such as in steep slope area, with dominant species such as *Begonia* spp. Maranthaceae and *keladi hutan* (*Colocasia esculenta*) whereas rattan is hardly found.

Remaining forest is having many rattan manau (*Calamus manan*) with age of ± 5 years. Because of forest canopy opening, the rattan manau can grow very well. Other potential in the forest on this corridor is also source of food for wildlife, such as bat and other small mammals and several plants that potential as decorative plant.

There are several important species that need to be considered, especially *palahlar* (*Dipterocarpus hasselthii* Bl.) and species from Fagaceae family such as *saninten* (*Castanopsis* spp. and *pasang* (*Lithocarpus* spp), and from Lauraceae such as *kilimo* (*Litsea cubeba*) and *kimanis* (*Cinnamomum* sp.).
In belta level, there are record of 110 belta species that included into 81 families and 41 class. Belta species among other are *Ficus* sp., *Prunus arborea*, *Psychotria viridiflora* and *Symplocos* sp.

Based on important value category, dominancy and frequency of tree, belta and seedling on 4 study sites in the corridor is various among others: *Castanopsis acuminatissima, Schima wallichii, Maesopsis eminii, Quercus gemmeliflora, Euodia latifolia* (Tabel 6).

Table 6. Important value of tree level, Belta and Seedling in 4 pilot sites in Halimun-Salak Corridor

Part of Corridor	Tree level	Belta	Seedling
Halimun	*Castanopsis acuminatissima* (65,54 %) *Schima wallichii* (55,75 %), *Altingia excelsa* (19,42 %), *Prunus arborea* (15,52 %) *Quercus gemmeliflora* (13,32 %)	*Castanopsis acuminatissima* (25,80 %), *Quercus gemmeliflora* (15,51 %) *Garcinia sinuata* (14,15 %) *Lasianthus* sp (14,03 %) *Cryptocarya* sp (14,02 %)	*Syzygium lineatum,* *Symplocos* sp. *Psychotria viridiflora,* *Lithocarpus* sp *Quercus gemmeliflora*

Part of Corridor	Tree level	Belta	Seedling
West Corridor	*Schima wallichii* (39,90 %) *Maesopsis eminii* (21,91 %) *Caliandra calothyrsus* (19,19 %) *Castanopsis* sp (18,69 %) *Euodia latifolia* (17,77 %)	*Macaranga triloba* (26,60 %) *Caliandra calothyrsus* (25,49 %) *Symplocos* sp (18,19 %) *Antidesma neurocarpum* (15,86 %) *Litsea robusta* (13,34 %)	*Macaranga triloba*, *Euodia latifolia*, *Psychotria viridiflora*, *Prunus arborea* *Kibara coriacea*
East Corridor	*Quercus gemmeliflora* (48,20%) *Schima wallichii* (31,94 %) *Euodia latifolia* (20,31 %) *Quercus* sp. (16,43 %) *Prunus arborea* (15,50 %)	*Urophyllum* sp (19,61 %) *Schima wallichii* (16,76 %) *Macaranga tanarius* (15,81 %) *Garcinia* sp (14,18 %) *Quercus gemmeliflora* (12,90 %)	*Quercus gemmeliflora*, *Schima wallichii*, *Euodia latifolia*, *Macaranga* sp *Symplocos* sp
Salak	*Euodia latifolia* (28,62 %) *Schima wallichii* (26,41 %) *Vernonia arborea* (21,73 %) *Castanopsis tungurut* (14,19 %) *Syzygium* sp (13,80 %)	*Urophyllum* sp (79,27 %) *Macaranga triloba* (39,32 %) *Quercus gemmeliflora* (17,63 %) *Symplocos* sp (11,63 %) *Psychotria viridiflora* (9,80 %)	*Syzygium* sp. *Urophyllum* sp. *Goniothalamus macrophyllus*, *Symplocos* sp. *Ardisia* sp

Tree level genus's that have quite high diversity are Euphorbiaceae (9 species and 6 families), Lauraceae (9 species and 5 families) and Fagaceae (6 species and 3 families).

Tree and belta richness index are: Patch Mount Halimun (2.70 and 4.02), West Corridor Island (3.35 and 4.59), East Corridor Island (3.94 and 4.64) and Patch Mount Salak (3.65 and 3.35). Index value on Table 6. shows that Halimun-Salak Corridor have quite high species richness level.

The tree and belta community uniformity index can be described as the following:
1. Patch Mount Halimun-West Corridor Island (20.26% and 23.14%)
2. West Corridor Island-East Corridor Island (29.64% and 26.31 %)
3. East Corridor Island -Patch Mount Salak (34.05% and 31.68 %)
4. Patch Mount Halimun-East Corridor Island (37.13 % and 30.32 %)
5. Patch Mount Halimun- Patch Mount Salak (24.37% and 23.0 %), and
6. West Corridor Island -Patch Mount Salak (31.29% and 34.56%),

Tree and belta community among areas that form Halimun-Salak Corridor have small uniformity (< 40%)

Considering the corridor area has many disturbances and occupied by shrubs, the outstanding potential for the area is fruit plants for birds, small mammals or primates, such as *Ficus spp.*, Melastomataceae, *Rubus spp.*

2. Fauna Diversity

Primates

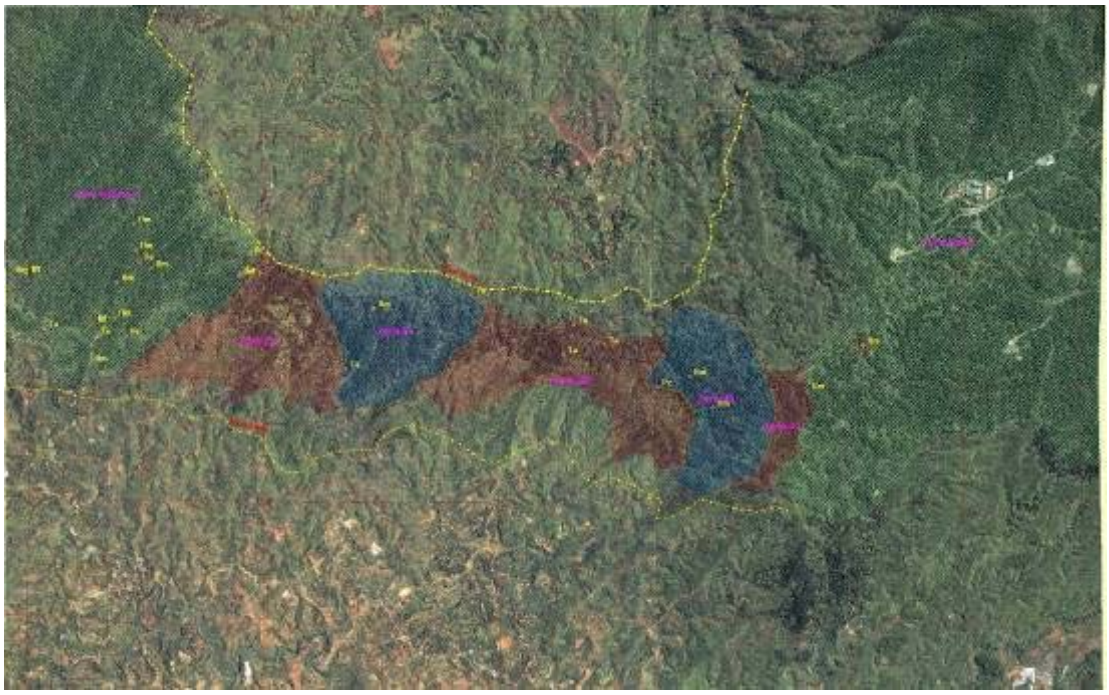
Primate is one of wildlife group that can be used as ecological indicator of a forest by determining the group's distribution and condition that provide useful information for corridor management and rehabilitation.

From eight main survey path that cuts through forest corridor between Mount Halimun and Mount Salak (Figure 7) the survey found direct contact and recorded the sound of 11 Javan gibbon groups (*Hylobates moloch*), 4 groups of Javan Leaf Monkey (*Presbytis comata*), 8 groups of Ebony Leaf Monkey (*Trachypithecus auratus)* and 1 group of Macaque (*Macaca fascicularis)* (Table 7) and recorder several information from community.

Table 7. Distribution of primates found directly in Halimun- Salak corridor forest

Nomor	Koordinat UTM		Altitude (m dpl,)	Jenis	
	X	Y			
1	673925	9253720	920	Hylobates moloch	
2	673925	9253720	920	Hylobates moloch	
3	674545	9253104	929	Hylobates moloch	
4	674545	9253104	929	Hylobates moloch	
5	674545	9253104	929	Hylobates moloch	
6	679394	9252646	959	Hylobates moloch	
7	679083	9252802	1017	Hylobates moloch	
8	680990	9253408	1041	Hylobates moloch	
9	674913	9254278	1066	Hylobates moloch	
10	675804	9253838	1121	Hylobates moloch	
11	676911	9253718	1137	Hylobates moloch	
12	674841	9253332	937	Presbytis comata	
13	679088	9252760	1016	Presbytis comata	
14	675019	9254434	1064	Presbytis comata	
15	675893	9254016	1149	Presbytis comata	
16	674151	9253392	892	Trachypithecus auratus	
17	678565	9253170	900	Trachypithecus auratus	
18	674589	9253332	942	Trachypithecus auratus	
19	676714	9253050	964	Trachypithecus auratus	
20	678912	9253250	1024	Trachypithecus auratus	
21	678651	9253428	1057	Trachypithecus auratus	
22	677781	9253678	1116	Trachypithecus auratus	
23	675823	9253858	1137	Trachypithecus auratus	
24				Macaca fascicularis	

Figure 3. Distribution of primates in Halimun-Salak Corridor area



Primates

Javan Gibbon (*Hylobates moloch*)
Javan Gibbon in Mount Halimun zone still showing good breeding capacity since from observation, there is still Javan gibbon group with very well age class structure and by solitary individual that was still weaning. In zone 2, there was no Javan gibbon that found in good and complete group that shows the quality of habitat for good breeding has been declined.

Figure 4. Javan Gibbon (*Hylobathes moloch*)

Ebony Leaf Monkey (*Trachypithecus auratus*)
Ebony Leaf Monkey can almost be found in the entire corridor area and seems to be adapted to the fragmented habitat condition, especially in zone 2. This is possible due to better accessibility compare to Javan gibbon, where each group can move from one area to other area. This is due to its semi-terrestrial nature.

However, based on number of individual in each group the small, relatively, that only consist of 1-8 individuals (normally it is around 8-12 individuals/group), showing decline habitat.

Figure 5. Ebony Leaf Monkey (*Trachipithecus auratus*)

Javan Leaf Monkey (*Presbytis comata*)
Javan Leaf Monkey, as Ebony Leaf Monkey, can also adapt to fragmented habitat, but Javan Leaf Monkey is very rare to found and the group is smaller than Ebony Leaf Monkey.

Based on observation at several sites in Mount Halimun-Salak National Park, Javan Leaf Monkey needs special treatment on its conservation since its sensitivity and rarity.


Figure 6, Javan Leaf Monkey (*Presbytis comata)*

Long-tailed Macaque (*Macaca fascicularis*)
During observation, there is only one direct contact with long tailed monkey group in Mount Halimun zone. However, based on interview with community who open an agricultural land/paddy field near forest, the long-tailed monkey seems to be adapted with low quality habitat.

According to community, long-tailed monkey is generally found in forest side and along small rivers that reported as community as disturbing their agricultural land.

2.2. Mammals

The existence of mammals other than primates

Based on survey, there is record of 9 mammal's species beside primates that categorized into 8 families in study area (Table 8). Identification of the species is based on indirect field finding or based on existed signs.

Table 8. List of mammals beside primates identified during survey

No	Family	Species	Scientific Name
1	Viverridae	Asian Palm Civet	*Paradoxurus hermaproditus*
2	Suidae	Wild Boar	*Sus scrofa*
3		Squirrel	-
4	Mustalidae	Javanese Stink Badger	*Mydaus javanensis*
5	Manidae	Pangolin	*Manis javanica*
6	Felidae	Leopard Cat	*Prionailurus bengalensis*
7	Felidae	Leopard	*Panthera pardus melas*
8	Cervidae	Barking Deer	*Muntiacus muntjak*
9		Beavers	-

Based on the analysis of trail or field finding spots using animal movement kernel, it is appearing that the available habitat seems to form habitat islands in Halimun-Salak corridor

area. The condition is the same with other mammals, such as wild boar, barking deer, pangolin and asian palm civet (Figure 7.).

Figure 7. Tiger habitat use pattern in Halimun-Salak Corridor

Gambar 8. Sebaran Penggunaan Kawasan oleh Jenis-jenis Satwa

Figure 8. Distribution of area allocation used by wildlife 1

2.3. Birds

Number of bird species in Halimun – Salak Corridor is 56 birds. Of all recorded birds, 16 are protected birds (Government Regulation PP No, 7/ 1999) and six species are in Appendix 2 of CITES that protecting the bird from trade (Table 9) and Javan Hawk-agle is included as endangered according to IUCN.

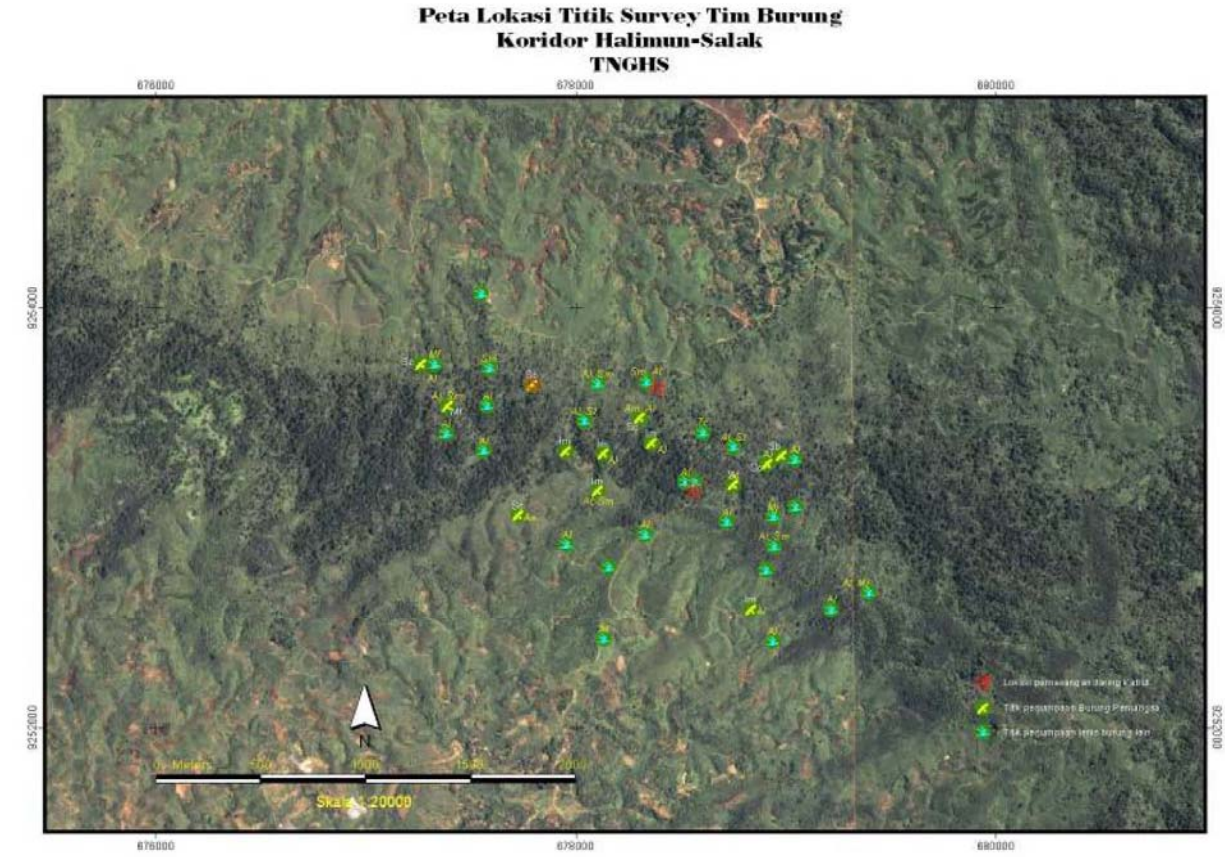
Capture by using *jaring kabut* successfully recording 16 bird species with the highest species number in Cisalada 1 with 11 species and followed by Taneuh Beureum with 10 species and the lowest is in Bivak with only 7 species. There are four birds species, *Srigunting Kelabu* (*Dicrurus leucophaeus*), Horsfield's Babbler (*Malacocincla sepiarium*), *Tepus pipi perak* (*Stachyris melanothorax*) and *Pijantung kecil* (*Arachnothera longirostra*) that are common species on those all three disturbed forest location.

From observation by using point counts method, the observation shows that 32nd points has the highest bird species uniformity (9 species) and 34th points have the highest number of protected bird species (4 species). From vegetation type, both points are located in natural forest.

The whole statistical analysis from point counts shows that no significant different of species richness and relative abundance between three vegetation type (ANOVA, p>0,05). However, there is trend of different species composition between those three vegetation types. Natural and disturbed forest have the same composition of around 40%, natural forest and cleared land shared bird species of around 31%, and disturbed forest and cleared land have 21% of the same bird.

Habitat that used by birds is not limited to only one type. Some birds can use more than one type of habitat. Two habitat types, used by most birds are natural and disturbed forest with 10 species using the habitats. Bird that can use all habitat type is 6 species, namely *Cacomantis merulinus*, *Dicrurus leucophaeus*, *Alophoixus bres*, *Orthotomus sepium*, *Dicaeum trigonostigma* and *Arachnothera longirostra*. Number of bird, found to use only one habitat is 9 species in natural forest, 3 species in disturbed forest and 7 species in cleared land.

Birds that only found in natural forest are *Spizaetus bartelsi*, *Todirhampus chloris*, *Chloropsis chochinensis*, *Dicrurus paradiseus*, *Ficedula westermanii*, *Hypothymis azurea*, *Pellorneum capistratum*, *Pomatorinus montanus* and *Dicaeum sanguilentum*. Birds found in disturbed forest and none in other forest type are *Microhierax fringilarius*, *Aegithina tiphia*, and *Lonchura leucogastroides*. Birds found in cleared land and none in other habitat are *Ciconia episcopus*, *Gallus g. bankiva*, *Streptopelia chinensis*, *Lanius schach*, *Phaenicophaeus* sp., *Pycnonotus aurigaster* and *P. goiavier*, diurnal raptor birds, recorded in the study consist of four species, which are Crested Serpent-eagle (*Spilornis cheela*), indian-black eagle (*Ictinaetus malayensis*), Javan Hawk-eagle (*Spizaetus bartelsi*) and *Alap-alap capung* (*Microchierax fringillarius*). Javan Hawk-eagle was found in two sites, in natural forest of Salak corridor and in natural forest in Halimun corridor that found in a valley with the 3rd jaring kabut located (Bivak).



Gambar 9. Peta Lokasi Survey Tim Burung Koridor Halimun – Salak TNGHS

Figure 9. Location map of Bird team survey in Halimun-Salak Corridor

Table 10. List of birds in Halimun-Salak south corridor in Cipeutey-Cisalada Block

Nomor	Jenis Burung	Nama Indonesia	Status Perlindungan
1	*Ciconia episcopus*	Bangau Sandang lawe	Dilindungi
2	*Pernis ptilorhynchus*	Elang Sikep madu	Dilindungi, CITES Lamp,2
3	*Accipiter soloensis*	Alap-alap cina	Dilindungi, CITES Lamp,2
4	*Spilornis cheela*	Elang ular bido	Dilindungi, CITES Lamp,2
5	*Ictinaetus malayensis*	Elang hitam	Dilindungi, CITES Lamp,2
6	*Spizaetus bartelsi*	Elang Jawa	Dilindungi, CITES Lamp,2
7	*Microchierax fringillarius*	Alap-alap capung	Dilindungi, CITES Lamp,2
8	*Gallus g, bankiva*	Ayam merah	Tidak dilindungi
9	*Turnix suscitator*	Gemak loreng	Tidak dilindungi
10	*Streptopelia chinensis*	Tekukur totol	Tidak dilindungi
11	*Cacomantis sonneratii*	Wiwik lurik	Tidak dilindungi
12	*Cacomantis merulinus*	Wiwik kelabu	Tidak dilindungi
13	*Surniculus lugubris*	Kedasi hitam	Tidak dilindungi
14	*Phaenicophaeus* sp.	Kadalan	Tidak dilindungi
15	*Centropus bengalensis*	Bubut alang-alang	Tidak dilindungi
16	*Otus* sp.	Celepuk	Tidak dilindungi
17	*Batrachostomus javensis*	Paruh kodok Jawa	Tidak dilindungi
18	*Alcedo meninting*	Raja udang meninting	Dilindungi

Nomor	Jenis Burung	Nama Indonesia	Status Perlindungan
19	*Todirhamphus chloris*	Cekakak sungai	Dilindungi
20	*Megalaima javensis*	Tulung tumpuk	Dilindungi
21	*Sasia abnormis*	Tukik tikus	Tidak dilindungi
22	*Celeus brachyurus*	Pelatuk kijang	Tidak dilindungi
23	*Eurylaimus javanicus*	Sempur hujan	Tidak dilindungi
24	*Hirundo rustica*	Layang-layang api	Tidak dilindungi
25	*Aegithina tiphia*	Cipoh kacat	Tidak dilindungi
26	*Chloropsis cochinchinensis*	Cica daun sayap biru	Tidak dilindungi
27	*Pycnonotus aurigaster*	Cucak kutilang	Tidak dilindungi
28	*Pycnonotus goiavier*	Merbah cerucuk	Tidak dilindungi
29	*Alophoixus bres*	Empuloh janggut	Tidak dilindungi
30	*Dicrurus leucophaeus*	Srigunting kelabu	Tidak dilindungi
31	*Brachypteryx leucophrys*	Cingcoang coklat	Tidak dilindungi
32	*Malacocincla sepiarium*	Pelanduk semak	Tidak dilindungi
33	*Pomatorhinus montanus*	Cica kopi Melayu	Tidak dilindungi
34	*Napothera epilepidota*	Berencet berkening	Tidak dilindungi
35	*Pnoepyga pusilla*	Berencet kerdil	Tidak dilindungi
36	*Stachyris melanothorax*	Tepus pipi perak	Dilindungi
37	*Stachyris thoracica*	Tepus leher putih	Dilindungi
38	*Enicurus leschenaulti*	Meninting besar	Tidak dilindungi
39	*Megalurus palustris*	Cica koreng Jawa	Tidak dilindungi
40	*Orthotomus sepium*	Cinenen Jawa	Tidak dilindungi
41	*Rhinomyias olivacea*	Sikatan rimba	Tidak dilindungi
42	*Ficedula dumetoria*	Sikatan dada merah	Tidak dilindungi
43	*Ficedula westermanni*	Sikatan belang	Tidak dilindungi
44	*Cyornis banyumas*	Sikatan cacing	Tidak dilindungi
45	*Hypothymis azurea*	Kehicap ranting	Tidak dilindungi
46	*Terpsiphone paradisi*	Seriwang Asia	Tidak dilindungi
47	*Lanius schah*	Bentet kelabu	Tidak dilindungi
48	*Anthreptes singalensis*	Burung madu belukar	Dilindungi
49	*Nectarinia sperata*	Burung madu pengantin	Dilindungi
50	*Aethopyga siparaja*	Br. madu sepah raja	Dilindungi
51	*Arachnothera longirostra*	Pijantung kecil	Dilindungi
52	*Prionochilus percussus*	Pentis pelangi	Tidak dilindungi
53	*Dicaeum trigonostigma*	Cabai bunga api	Tidak dilindungi
54	*Dicaeum sanguinolentum*	Cabai gunung	Tidak dilindungi
55	*Zosterops palpebrosus*	Kacamata biasa	Tidak dilindungi
56	*Lonchura leucogastroides*	Bondol Jawa	Tidak dilindungi

Ictinaetus malayensis + sarang

Ictinaetus malayensis + sarang

Sasia abnormis

Cacomantis merulinus

Dicrurus leucophaeus

Malacocincla sepiarium

Stachyris melanothorax

Stachyris thoracica

Alophoixus bres

Ficedula dumetoria

Napothera epilepidota

Rhinomyias olivacea

Dicaeum trigonostigma

Prionochilus percussus

Arachnothera longirostra

Nectarinia sperata

Figure 10. Bird species in Halimun-Salak Corridor

DISCUSSION

Area use is identified from level of wildlife sign finding in study area. Field signs with high frequency indicate that the area used with high intensity by the species.

Mammals

Based on direct meet with primates and its habitat condition, the forest of Halimun-Salak corridor can be divided into three zones (Figure 6).

Most primate distribution, especially Javan gibbon and Ebony Leaf Monkey, found in Halimun area (Halimun Zone) that having relatively better forest structure compared to middle corridor, even illegal logging and new conversion for agricultural land/paddy field. In Mount Salak zone, the research found not much primates, even tough based on information/interview, there is still many primates. This is suspected because of the high community activity in Mount Salak, especially road construction, of natural gas Company, conducted in the area during this study.

For the forest in the middle of corridor, it can be divided into 2 primate distribution zones. Zone 2 is area where Javan gibbon can still be found and habitat condition can still be inhabit by primates, even tough the forest area already fragmented and limited only in valleys while most of trees in hill back is not longer existed.

In zone 3, forest has already very fragmented and there was no finding of Javan gibbon, there was only Ebony Leaf Monkey and some remaining habitat only existed in valleys with other habitat is forest ex-logging/agricultural land and bushes.

Mammal's existence from survey indicates corridor area is habitat for, at least, 9 mammal's species. With identification of panther that still using the area, it indicates that the area is still good as other mammal's habitat. The indication shows that panther prey still dwelling the area as habitat and supported by prey such as wild boar that use the area as breeding area, protection, and to find food.

Several signs, especially panther indicates that the area is area used as its territory.

From habitat use pattern by the leopard, it indicates that habitat fragmentation start to happen. If the current area condition continues to decline in quality, it is expected that the habitat islands will be reduced and separated one another, that Halimun and Salak forest area will be separated.

When the survey result is combined with other research, number of mammals (not including small mammals) inhabitant the corridor will reach around 11 species. This number is 15% of all mammals species in GHSNP.

Almost all area within the corridor is used by mammals. The level of area use varies. Based on land use pattern, there is two concentration of landuse in the corridor. Both corridor area is part of Halimun and Salak forest area. The middle part of the corridor has rarely used.

From the survey, the land is mostly used by leopard and wild boar. This fact is apparent on sign distribution map found in field. (Figure 11)

Habitat Condition
Halimun-Salak corridor condition is very poor with very rare primary trees and almost all area is secondary forest and shrubs. The condition indicates high pressure to the area by human activity. Many human activities has caused habitat quality in the area is lower, especially by logging. The major concern for the future is if area protection and management is not improved soon enough, the area function might not be able to support nature preservation.

From the survey, there are finding on habitat destruction. This is marked by finding on illegal logging activities in Halimun-Salak corridor area. Many illegal logging activities located in Salak area and only some in Halimun.

Necessary habitat condition
From the survey, with today mammal distribution and assuming the mammals have interaction among others or there is relationship between Halimun and Salak forest, the habitat condition in Halimun-Salak corridor will not be described as islands of habitat. At least the illustration give the idea of the area that is important to present's mammals condition.

Community perspective toward wildlife
Information and perception from local community on mammals in area of study is conducted by interview. The interview was focused on identification of mammals has been seen and the frequency and species that considered by the local community as disturbing wildlife.

Interview method was not very much conducted since survey is focused on information collection of mammals existence signs in survey location based on field findings. Data from interview will be verified with field findings.

From the interview, species that identified by community are Wild Boar, Asian Palm Civet, Skunk, Barking Deer, Leopard Cat. For Leopard, only small number of people claims its existence in the area. However, it can be concluded from interview result that community also believe that there leopard still exist in Halimun-Salak corridor area.

Wildlife that often seen by local community are: Wild Boar, Civet, and Skunk. And wildlife that sometime or rarely found are: deer and skunk and that seldom found are leopard cat and leopard.

Wildlife that considered as disturbing are: wild boar and civet that disturbing paddy field and farm.

Discussion on Bird
Forest condition in Halimun-Salak corridor, mainly in Cipeutey-Cisarua-Cisalada and around experiencing many damage. Beside farming and agricultural activity around the forest, timber extraction is still big factor for destruction and at the moment is still happening. There is connecting road between settlement in Northern and Southern area that adding destruction risk to be worsen since people are having more access for activity inside the forest with loose monitoring.

The existence of wide road and cut through the corridor become barrier for some birds, especially ground bird to move from west corridor to east and vice versa. Therefore, the road can become factor that cut gene flow between Halimun-Salak.

Vegetation type can be reflected from the existing bird community. Most birds found is bushes and secondary forest birds such as *Stachyris* sp., *Orthotomus* sp and *Arachnothera* sp, while the remaining natural forest bird is only *Eurylaimus javanicus*. There is no more evidence of Trogonidae, Bucerotidae and only two species of Picidae (*Sasia abnormis* dan *Celeus brachyurus*) that this is indicator of forest destruction in the area.

Beside those three bird genus, that being indicator of old forest, forest ecosystem health can also indicated by top predator. Halimun-Salak corridor have potential to become predatory bird habitat. The presence of four resident diurnal raptor species, which are Elang Ular Bido (*Spilornis cheela*), Elang hitam (*Ictinaetus malayensis*), Javan Hawk-eagle (*Spizaetus bartelsi*) and Alap-alap capung (*Microchierax fringillarius*) indicates that the area has sufficient resources to support their life. Elang hitam is recorded to use disturbed forest that bordered with farm as their nest (please refer to Figure 2). There is also possibility of other species used the corridor as breeding site. Corridor area is used as raptor migration path since there are 4 migratory birds using the corridor during observation, which are Alap-alap Cina (*Accipiter soloensis*) and Elang Sikep madu (*Pernis ptilorhynchus*) (Table 9) and two other unidentified species.

The corridor between Halimun and Salak is very important for bird and other wildlife. The presence corridor quality needs to be improved by implementing close monitoring from national park authority. Community involvement in maintaining and protecting national park area and corridor should also be improved.

Land use by local community

Understanding on forest conservation has not yet become concern of local community that logging of economical species increased, for example are: pakis tiang, palahlar, Lauraceae and Fagaceae. Local community income, beside from farming and agriculture, also come from forest utilization, especially fuel wood. Local community is very rare to use other forest product for their daily use such medicine, food and craft. Local community use more wood for fuel wood and construction. Community land that planted by various agricultural plant such as vegetables, banana, etc and paddy field is located closely to the forest, relatively, and the settlement is spread around the forest. This condition has caused the forest to reduce so quickly and threatening the existence of wildlife inside.

Wood utilization from remaining trees is also other potential that need to be concerned. Generally soft wood tree such as mara (*Macaranga sp*), manii (*Maesopsis manii*) and teureup (*Artocarpus elasticus*). Local community that living around the forest, in using forest plants for fuel wood usually use fast growing and flammable species. Other potential is medicinal plant, decorative plant and craft that based on information seems to be not preferred, where local community prefer to be farmer and tea leaf picker.

Other farming and agricultural activity around the forest is timber extraction that become big destructive factor and at the moment is still happening. Connecting road between settlement in the north and south part of national park increase risk for worse destruction. This is due to easy access for people to have activity inside forest if without close monitoring.

THREATS FOR HALIMUN - SALAK CORRIDOR

A. Habitat Degradation and Fragmentation

The presence of infrastructures such as high voltage electrical line, road facilities, farm land and other activities that convert forest into another function will affect on habitat degradation and fragmentation in the corridor.

An example of disturbance case is timber cutting in corridor area that makes open spaces within the corridor. The open space will requires time to recover before it getting to its early condition as primary forest. Moreover, pioneer and secondary vegetation regenerate faster at open area (no tolerance to shades), which is in contrast with primary species that difficult to regenerate at open area (the primary species is tolerance to shades). Such condition harder the natural succession process of primary forest because the domination of secondary species.

B. Exotic and Invasive Species

The origin of *Maesopsis eminii* (Family of Rhamnaceae) is East Africa. This is pioneer species and grow quick (recalcitract seed) and the seed is tolerance to shades. At the stage of belta and trees (average height is 15-25 m) this species needs light and reach the canopy if it grows in big gaps such as former cutting area.

The dispersal of Maesopsis seeds was helped by fruit eating bird, rodent and monkey. This species planted in Sumatra, Java and Kalimantan for its timber (Binggeli 1989), its value as agroforestry plantation and as ornamental plant.

Maesopsis eminii is exotic and aggressive species, it needs to be controlled even though it did not disturb the native seedling plant. This species can live up to 50-1800 masl altitude and start to flowering and fruits at 4-6 years of age. If the Halimun-Salak corridor is going toward restored condition, the core of the corridor needs to be cleared from *M. eminii* and replaced with native West Java highland species.

Red Caliandra (*Calliandra calothyrsus*) is part of Fabaceae family. The origin of this species is tropical America. This species is perdu plant with approximate 10 meters high and 20 cm of diameter, dense canopy and shallow to deep rooting system. Red Caliandra fruits all year long and produces approximate 14,000 – 14,500 seeds/kg (Vademecum Kehutanan 1976).

Red Caliandra could adapt to acid soil at the height of 150 – 1500 m above sea level and reach optimum growth with minimum 1,000 mm rainfall per year. This species planted in most area in Java Island as fuel wood, cattle food and conservation of marginal land.

Calliandra calothyrsus is fast growing exotic species and need to be controlled by putting them in the buffer zone. The location of red Caliandra in Halimun-Salak corridor is near to Mount Salak forest area and it need to be gradually replaced with native species, especially those that benefit as primates food.

C. Human Disturbance

The level of human activity within the corridor is quite high. This shows by the founding of many road paths, small or big, that linked the North and South corridor. These roads crossed the corridor of Halimun–Salak.

Activities within the corridor include timber cutting, fuel wood collecting, and farming. Some infrastructure such as roads, electrical line, high voltage electrical line, geothermal pipe and mining area are found along corridor area. The position of these infrastructures is cross cutting the corridor area.

The condition of forest in Halimun-Salak corridor, especially in Cipeteuy-Cisarua-Cisalda and its surrounding area is damaged. In addition to farming and agricultural activity around the forest, timber cutting also adds a quite proportion of forest destruction, and despite of the damage caused this activity is still being practiced. Roads that linked villages in Northern with those in Southern area adding the damage risk, because it allow easier access to the forest if not being watched carefully.

RECOMMENDATION FOR HALIMUN-SALAK CORRIDOR MANAGEMENT

A. Ecological Based Zoning System

1. Zonation based on protected area criteria

National Park is nature conservation area managed by zoning system, which automatically stated as protected area. To identify the zone within Halimun-Salak corridor, it will firstly classify based on Presidential Decree No.32 year 1999 on Protected Area Management.

Based on the analysis result of three physical factors determining the protected area, the total area of Halimun-Salak corridor is 793,45 ha. For detail, please refer to Figure 12. Map of Protected Area of Halimun-Salak Corridor and the following Table 10.

Table 10. The size of protected are in each administrative border of corridor area

No	Village	Sub District	District	Province	Area (ha)
1	Cihamerang	Kabandungan	Sukabumi	West Java	23,43
2	Cipeuteuy	Kabandungan	Sukabumi	West Java	319,63
3	Kabandungan	Kabandungan	Sukabumi	West Java	157,58
4	Purasari	Leuwiliang	Bogor	West Java	44,63
5	Purwabakti	Pamijahan	Bogor	West Java	248,17
793,45					

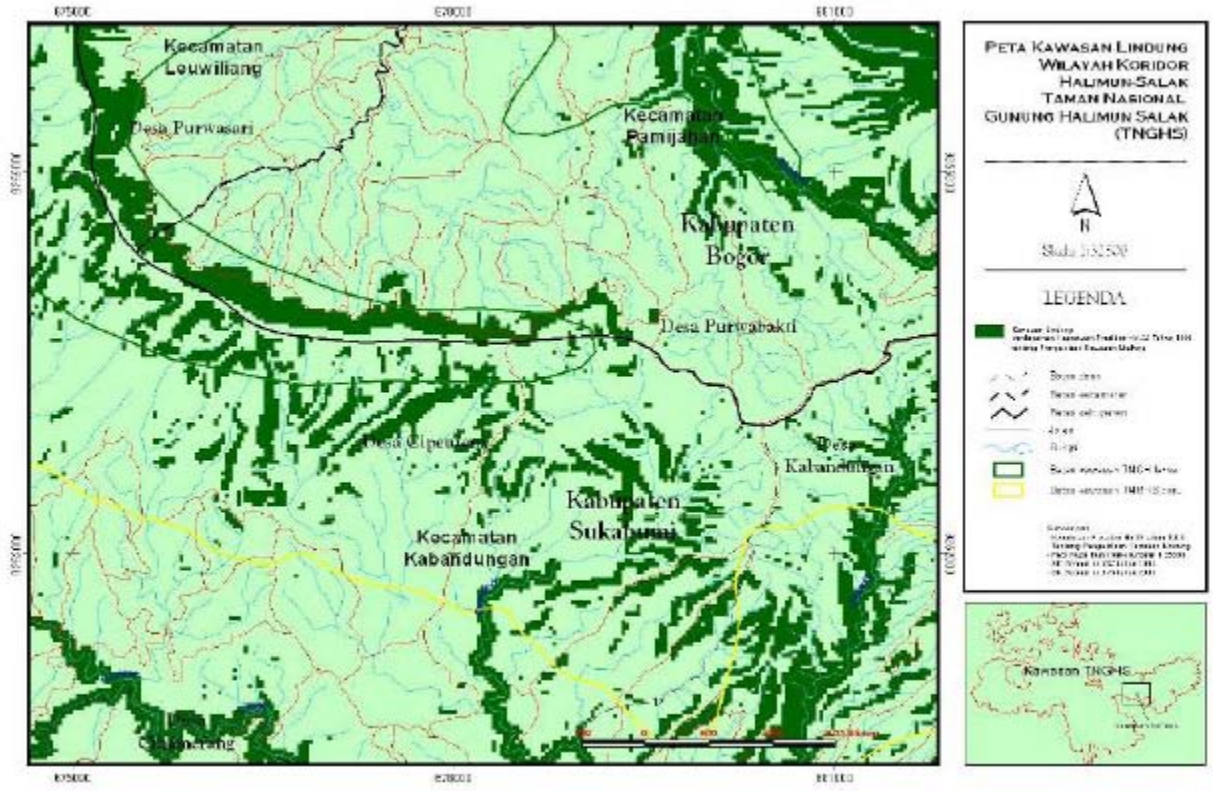


Figure 12. Map of Protected Area in Halimun-Salak Corridor

2. Zonation based on primates condition

Mt. Halimun Zone

Habitat condition in Mt. Halimun zone could be naturally recovered because the condition of the forest is relatively better than other zone.

Mt. Salak Zone

Habitat of primate in Mt. Salak zone is quite disturbed because of the road making activity of a gas company. This certainly cause fragmentation to the forest, however it seems that there is no environmental management to overcome the problem.

Zone 2

Zone in which there is population of javan gibbon and primary trees vegetation. In general, this zone is disturbed by illegal cutting.

Zone 3

This zone is damaged, shows by many open area dominated by one species of vegetation (Caliandra, *andam*, shrubs and *alang-alang*). In whole, this zone caused the corridor area fragmented.

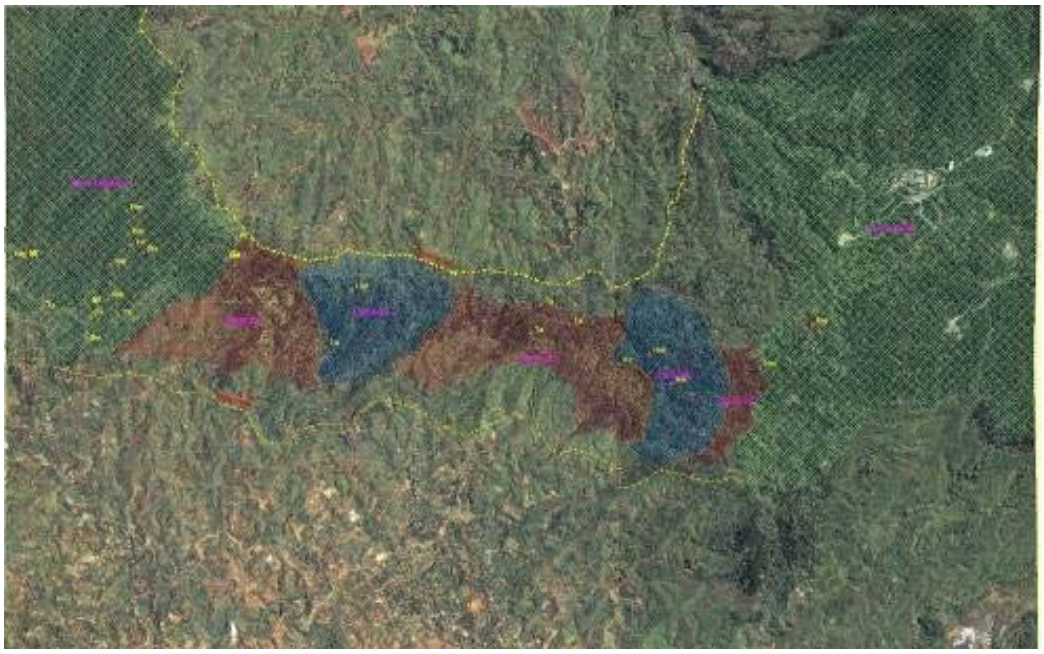


Figure 13. Zonation arrangement based on Javan Gibbon (*Hylobathes moloch*)

3. Zonation based on mammals aside of primates

Based on leopard home range, the corridor area are divide into islands of habitat (Figure 10). If that condition connected with habitat condition based on overall mammal distribution, by assumption that those mammals has interaction with each other, then the habitat needed will create a unity which connect the forest of Halimun and Salak. Thus, that zone will become the habitat needed by mammals in Halimun-Salak corridor (Figure 16).

Figure 14. Habitat use pattern by mammals in Halimun-Salak Corridor

Note on figure:

The outer zone is mammals habitat in Halimun-Salak corridor (indicate by color of cream), whilst the inner habitat shows the use of habitat by many other mammals. At present condition, the most inner zone is the most important.

4. Integrated zone of the "Ecological Zone of Halimun Salak Corridor"

This zone is a compound of the identified zone, such as: protected area, primate based zoning system, zoning system based on mammal habitat other than primates, and information on flora and birds areas. The compound of these factors is described as area within the corridor

area that ecologically needed in order to connect the ecosystem of Halimun and Salak (Figure 15).

This area connect Halimun and Salak by 7,17 km long and approximate 1,99 km wide. From the condition of vegetation, contour, slope, soil type, rainfall and information on status of the flora and fauna, the area is separate into four (4) zone; Halimun zone of 245,71 ha area, Salak zone of 468,06 ha area, zone 2 (consist of two areas; 2a: 117,38 ha, 2b: 147,35 ha) and zone 3 (consist of three areas; 3a: 130,59 ha, 3b: 147,35 ha, 3c: 28,45 ha). This zoning system is based on primate zoning system.

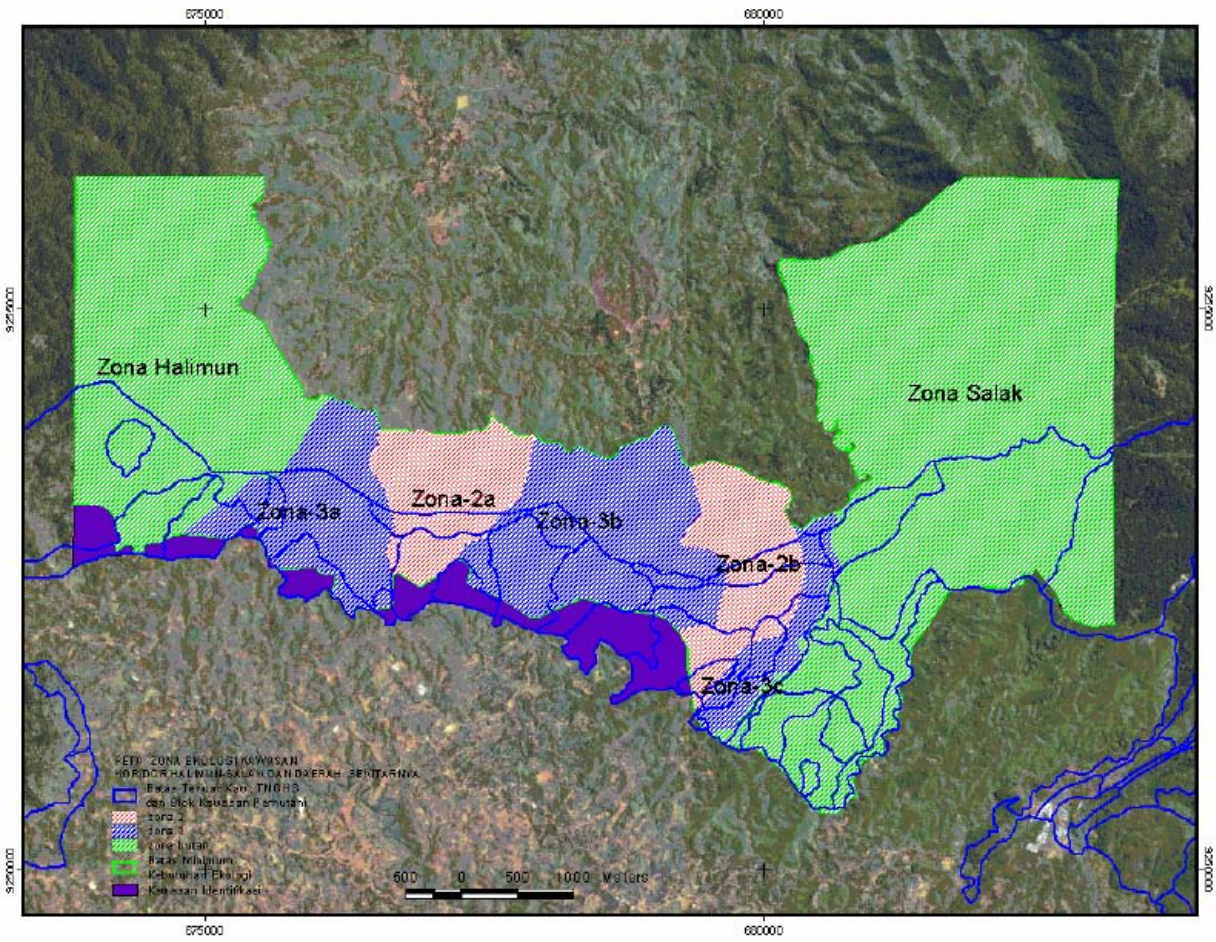


Figure 15. Map of Ecological Zone of Halimun-Salak Corridor and The Surrounding Areas

B. Corridor Management Based on Zonation

1. Identification of management action in each zone

Mt. Halimun Zone

- No restoration needed.
- Increase community understanding and awareness on the function of corridor.
- Increase forest security activity in corridor area.

Mt. Salak Zone

• No restoration needed.
• Increase community understanding and awareness on the function of corridor.
• Increase forest security activity in corridor area.
• Monitoring and evaluation on activities of Chevron.
• Establish wildlife crossing path on the road/facilities which cut the wildlife crossing path.
• Increase cooperation on environmental management.

Zone 2

• Stop illegal cutting and land opening.
• Restore the open areas.
• Increase community understanding and awareness on the function of corridor.
• Increase forest security activity.

Zone 3

• Area with main priority of restoration with native fast growing species (area dominated by caliandra, *andam*, *alang-alang*).
• Increase community understanding and awareness on the function of corridor.
• Increase forest security activity.
• Stop opening land activity for farm, paddy field, housing, etc.
• Recommended to build tower for corridor security as well as wildlife monitoring.

Several action recommendations on corridor management:

1. Areas in valleys and slope of hills, which relatively has natural forest because of its difficult access, must be maintain for these are the best habitat for Javan Hawk-eagle either for nesting or feeding ground (covered in Presidential Decree No. 32 on protected area).
2. Halimun and Salak zone with disturbed forests should be secured to allow them grow into natural forest because there are many seedlings of Saninten (*Castanopsis argentea*) and Puspa (*Schima wallichi*) been found.
3. Should the open area zone maintained, it must be carefully monitor to prevent further expansion. If restoration action is needed, it is best to plant local vegetation such as Saninten (*Castanopsis argentea*) or other Fagaceae and beringin (*Ficus* spp,) that support the life of birds and other small mammals.

2. Recommendation of species for rehabilitation

For trees regenerate by seedlings, there are records on several primary trees such as Lauraceae, Fagaceae, Cyatheaceae, Myrtaceae and Elaeocarpaceae to replace the secondary species.

Recommendations for rehabilitation of corridor area:

1. Allow the forest to regenerate naturally even though it takes more time and it is expected that the forest will have no longer disturbance.
2. Seedlings of primary trees can be use for forest rehabilitation.
3. Recommended species for forest rehabilitation especially of primary species which is high and has good canopy such as saninten, pasang and some Lauraceae family. Primary species need special treatment in nursery, for example is give them enough shades.
4. Secondary species, especially those for cattle food can be plant as shades for primary species seedling. Those species, among other, are *Ficus* spp., kipare (*Glochidion* sp), kiseueur (*Antidesma* sp), and harendong (Melastomataceae).
5. In area bordering the forest and citizen housing, it is better to plant forest trees that benefit the people such as saninten, kilimo, kimanis, and aren. Almost whole part of aren tree is useful, thus this species would hardly be invasive.

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2	Sadrah	(GHSNP)	Mammal B	
3	Ika	(GHSNP)	Flora I	
4	Koko	(GHSNP)	Flora I	
5	Momon	(GHSNP)	Flora II	
6	Endang	(GHSNP)	Flora II	
7	Nandang	(GHSNP)	Flora II	
8	Susanto	(GHSNP)	Flora II	
9	Sukiman	(GHSNP)	Bird	
10	Iwan	(GHSNP)	Bird	
11	Luki T	(GHSNP)	Bird	
12	Ismirza	(GHSNP)	Primate	
13	Iwan HP	(GHSNP)	Primate	
14	Undang	(GHSNP)	Primate	
15	Ibrahim	(GHSNP)	Flora I	
16	Ahmad SD	(GHSNP)	Mammal B	
17	Ojo	(GHSNP)	Mammal B	
18	Anda	(GHSNP)	Mammal B	
19	Nurfaizin	(GHSNP)	Mammal B	
20	Yusdi	(GHSNP)	Mammal B	
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22	.....	Assistant Researcher	Primate	IPB
23	Alwin Marakarma	Assistant Researcher	Bird	LIPI
24	S. Anhar H	Researcher	Mammal B	GHSNPMP-JICA
25	Ukad	Guide	Bird	
26	Hamim	Guide	Bird	
27	Ne'an	Guide	Flora I	
28	Apud	Guide	Flora II	
29	Sanam	Guide	Flora II	

No.	Name	Position	Team	Note
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31	Harry Wiriadinata/Purwaningsih	Main Researcher	Flora I	LIPI Herbarium Bogor
32	Edy Sambas	Main Researcher	Flora II	LIPI Herbarium Bogor
33	Dewi M. Prawiradilaga	Main Researcher	Bird	LIPI Zoology
34	Dones Rinaldi	Main Researcher	Primate	JKSH - IPB