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Short Communication: The existence of Javan Leopard (*Panthera pardus melas* Cuvier, 1809) in the non-conservation forest areas of Cisokan, Cianjur, West Java, Indonesia

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Abstract. *Shanidah SS, Partasasmita P, Hudoso T. Parikesit, Febriato P, Meganatara EN. 2018. Short Communication: The existence of Javan Leopard (*Panthera pardus melas *Cuvier, 1809) in the non-conservation forest areas of Cisokan, Cianjur, West Java, Indonesia. Biodiversitas 19: 42-46.* There is no accurate data about the number of individual leopards in Java Island in both conservation and non-conservation areas. In West Java, deforestation for plantations and agriculture is widespread, although it is unknown if leopard uses these human-altered habitats. Therefore, it is important to research the existence of leopards in Non-Conservation Forest Area (NCFA) in western Java, Indonesia. The aim of this research is to investigate: (i) evidence of leopard's existence (ii) encounter rate of leopard's existence; and (iii) estimation of individual leopards in NCFA, Cisokan, Cianjur, and West Java. Indirect data were obtained from sign surveys for feces, scrapes, footprints, and residual prey. We also obtained direct data with camera traps. We found 13 footprints, 2 feces, 4 scrapes, and 2 direct encounters by observers. The camera trap data recorded 12 independent leopard events and 8 leopard photos/100 trap days. Estimated number of leopards in Cisokan ranged 1-3 individuals.

Keyword: Existence, *Panthera pardus melas*

INTRODUCTION

Indonesia has a high diversity of endangered and protected species in the world, and it also has high extinction threat level. One of the endangered species in Indonesia is the Javan leopard (*Panthera pardus melas* Cuvier, 1809) (MoF 2013) which is endemic to Java Island and surrounding small islands. Javan leopard is found only in Java Island, Kangean Island, and Nusakambangan Island (Directorate of Nature Protection and Conservation 1978), in Bodogol areas, Gunung Gede Pangrango National Park (Ario 2006, 2009; Rustiadi and Prihatini 2015), in the Mount Salak Forest Area, Mount Halimun-Salak National Park (Ario 2017), and in the fragmented forest near the village of Girimukti, District of Sukabumi (Partasasmita et al. 2016). Javan leopard is an apex predator which has an important role in the ecosystem, as their predation on prey species helps to balance the ecosystem. Its presence in nature is highly dependent on habitat and prey abundance, especially ungulate species such as muntjac and wild pig. The decrease of Javan leopard is caused mainly by habitat loss, which also affects the natural processes that have been going on in the island for thousands of years (MoF 2013).

Habitat alteration of Javan leopard and the decrease of its prey due to the increased of human activity reduce the number of Javan leopard. The loss of natural habitat creates opportunities for Javan leopard to search for prey in human-altered habitat. This causes Javan leopard to enter villages and prey on livestock and create conflict with humans that have recently occurred on the island (MoF 2013).

There has not been much research on Javan leopards, and there is no accurate data about the number of individuals in Java Island in both conservation and non-conservation areas. In fact, the Javan leopard has been included in the list of Appendix I of CITES and is classified as Critically Endangered by the IUCN Red List. If the conservation of Javan leopard is not taken seriously, then these endemic animals will become extinct, following the extinction of Javan tiger (*Panthera tigris sondaicus*) in the 1970s (Gunawan and Alikodra 2013).

This research was carried out in Cisokan because this region has non-protected forests that may be important for Javan Leopard. The region has widespread urban and rural developments with no conservation areas, therefore there is no natural habitat for such species as Javan leopard. Rustiadi and Prihatini (2015) said that habitat loss and prey loss due to human activities are important factors that threaten leopard populations. Habitat and prey loss can also lead to human-leopard conflicts. Therefore, it is important to research on the existence of Javan leopard in the non-conservation forest areas (NCFA), Cisokan, Cianjur, West

Java. The aim of this research is to determine: (i) the evidence of leopard's existence; (ii) the encounter rate of leopards; and (iii) the number of leopard individuals.

MATERIALS AND METHODS

Study area

This research was carried out in Non-Conservation Forest Area (NCFA), Cisokan, Cianjur, West Java, Indonesia, include Batu Nagok, Batununggul, Cigintung, Cilengkong, Cileungsing, Cipanas, Cisuren, Pasir Bedil, Pasir Laja, Pasir Nangka, Pasir Taman, and Sarongge (Figure 1). This research was carried out for one month, in February-March 2017.

Procedures

Indirect data were collected by survey on the signs of feces, scrapes, footprints, and prey species. We identified leopard footprints using a guidebook (van Strien 1983). We identified leopard feces using a guidebook (Bang and Dahlstrom 2001). Direct data were collected from camera traps, which were placed near leopard sign. Five camera traps were used, with 4 cameras taking photographs and 1 camera taking videos. Camera traps were set for a period of 2 weeks. Camera traps are mounted on tree trunks at a height of 30-40 cm above the ground at a distance of 2.5 to 3 meters from the path (Ancrenaz et al. 2012). Identification of the animals caught during the installation period was carried out using mammals field guide (Francis 2001).

Data analysis

Number of Javan leopard

The number of individual leopards was based on the camera trap images and the amount and spacing of leopard sign. When determining the number of leopards, the home-range size of leopards and physical barriers to movements were taken into account. From the camera-trap photographs, individual leopards were identified based on their spot patterns. Photographs were considered independent events if they occurred >30 min apart.

Encounter rate of Javan leopard

The encounter rate (number of independent photos/100 trap days) is calculated from total number of independent photos divided by total number of days that cameras were operational, multiplied by 100 (O'Brien et al. 2003).

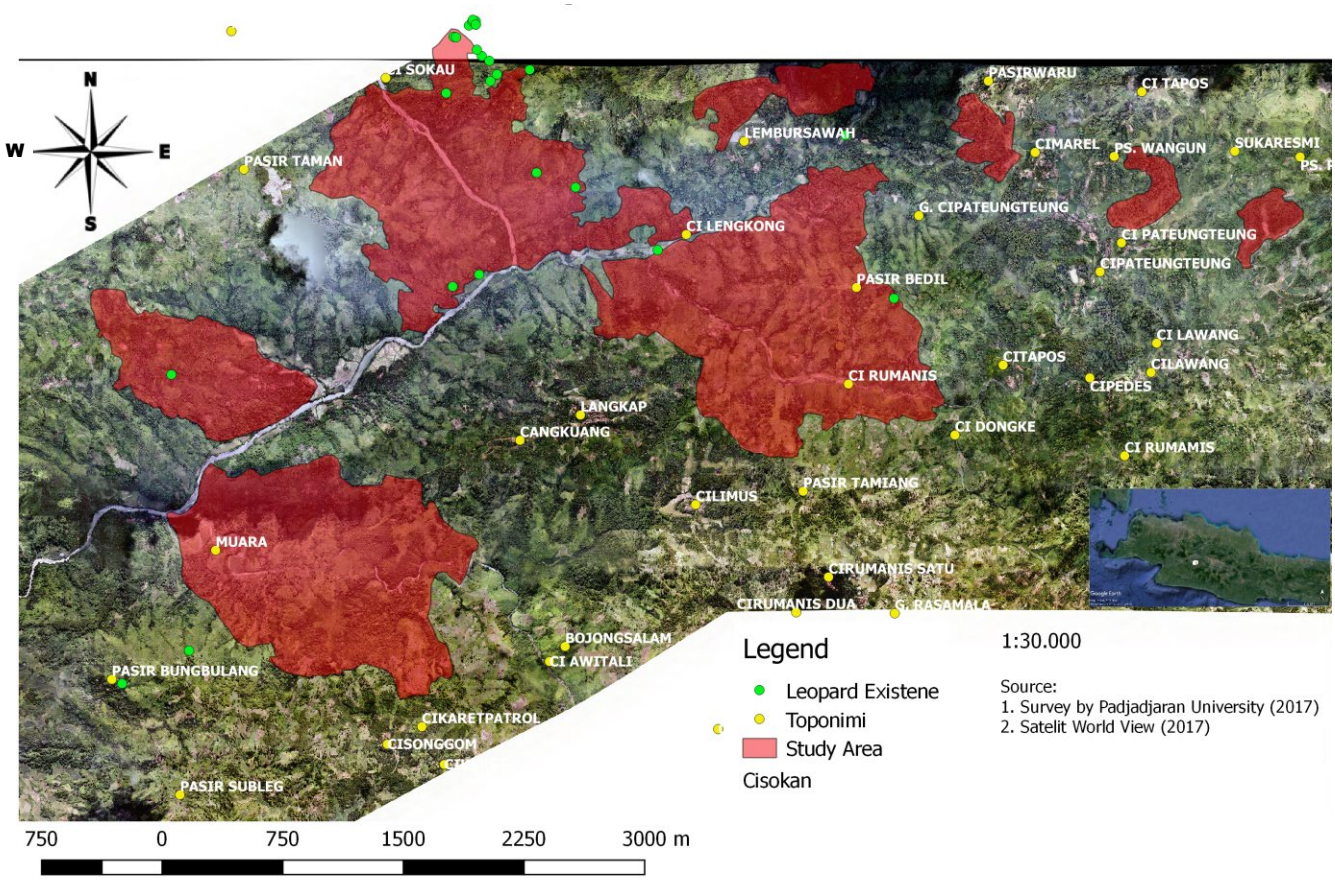

Figure 1. Location of study area (48 M 747041.23 m E 9231361.70 m S in Cisokan, Cianjur, West Java, Indonesia

$$\sum ER = \frac{\sum f}{\sum d} . 100$$

Note:
ΣER : Encounter Rate
Σf : Total number of independent photos obtained
Σd : Total number of days that cameras were operational

RESULTS AND DISCUSSION

The existence of Javan leopard

The direct and indirect leopard data are shown in Table 1. The indirect data include 13 footprints, 2 feces, and 4 scrapes (Table 1; Figure 2). The direct data included 2 observations by researchers (a reflection of green eye light) and 12 independent photographs from camera traps. Most leopard signs were found at Batu Nagok and surrounding areas (Pasir Laja and Sarongge), indicating the leopard uses the habitat in these areas to carry out most of its activities.

Table 1. Javan leopard data collected from direct and indirect methods

No.	Location	Time	Data type	Number of individual
1	Pasir Nangka	02/11/2017	Ob	1
2		02/18/2017	Ob	
3	Pasir Laja	03/07/2017	Scr	
4			Scr	
5			Tr	
6		03/11/2017	Tr	
7			Tr	
8	Sarongge	03/12/2017	Fc	
9			Tr	
10			Tr, Scr	
11		03/13/2017	Tr	
12		03/14/2017	CT	
13		03/15/2017	Fc, CT	
14		03/22/2017	CT	
15		03/23/2017	CT	
16			CT	
17			CT	
18		04/06/2017	CT	
19		04/08/2017	CT	
20	Batu Nagok	03/16/2017	Tr	
21		03/12/2017	Tr	
22			CT	
23	Pasir Taman	03/21/2017	CT	
24	Batununggul		CT	
25	Cilengkong	03/19/2017	CT	
26	Cisuren	03/13/2017	Tr	
27	Cigintung	02/15/2017	Tr	
28	Cileungsing		Tr	2
29			Scr	
30	Cipanas	02/13/2017	Tr	
31	Pasir Bedil	03/09/2017	Tr	

Note: Ob: Observation, Fc: Feces, Tr: Track, CT: Camera trap, Scr: Scrape

Leopard footprints were found in Pasir Nangka, Cigintung, and Cisuren located in North Cisokan. Other leopard footprints were found in Cilengkong, Pasir Bedil, Cipanas, and Cileungsing located in Southern Cisokan. This northern and southern part of Cisokan is separated by the Cisokan River. Regarding the number of footprints found in Pasir Bedil, Cigintung, and Cipanas, two footprints were found near the Cisuren River, and as many as three adjacent footprints were found at Cilengkong near the Cilengkong River. Two different size of leopard footprints were found in Cileungsing from as many as 7 sets of footprints. We assumed the two-different size footprints in Cileungsing were a mother with its cub. Leopard was observed directly based on the reflection of a green eye shining at night in Pasir Nangka at the same location on February 11 and February 18, 2017. Other evidence were feces found at Sarongge and 4 scrapes. Two of the four scrapes were found in Pasir Laja, Sarongge, and Cileungsing and they consisted of 2 different-size scrapes. The 2 different-size scrapes were found along with the footprints of presumed mother and its cub.

In addition to the two direct observations, other direct data came from photographs obtained from camera traps (CT). All 5 camera traps recorded leopard images, and the location of the camera traps was in Sarongge, Batu Nagok, Pasir Taman, and Batununggul. All photographs appeared to be coming from the same spotted female leopard (Figure 3).

We assumed that the female leopard recorded in the camera traps in Sarongge, Batu Nagok, Pasir Taman, and Batununggul was also the same leopard which footprints were recorded in Cigintung and Cisuren, where only single footprints were found. The home-range size of female leopards is 6-13 km^2 (Gunawan and Alikodra 2013). To fulfill the needs of food acquisition, the leopard requires a large roaming space as home range, and leopard can roam for 5-8.6 km in one day (Gray 2013). Based on footprints, a different female with a cub was assumed to occur in Cileungsing, Cipanas, and Pasir Bedil. We assumed this female was different from the female that was photographed on Cisokan River, a presumed barrier that separated those sites.

Based on the encounter rate analysis, the leopard in these areas has an ER value of 12 leopard photos/100 traps. From 2 camera traps, it can be seen that the leopard individual passes the Sarongge forest 7 times. This indicates that the leopard uses Sarongge forest intensively as its home range. In addition, the leopard passes Batu Nagok for as much as 3 times, and Pasir Taman and also Batununggul for as much as one time.

Leopard evidence based on land cover type

The direct and indirect data on leopard occurred in various types of vegetation, such as natural forest, production forest (pine), bush/fields, rice fields, and *talun*. Based on the data we collected, we estimated the number of individual leopards located in the different land cover types (Table 2).

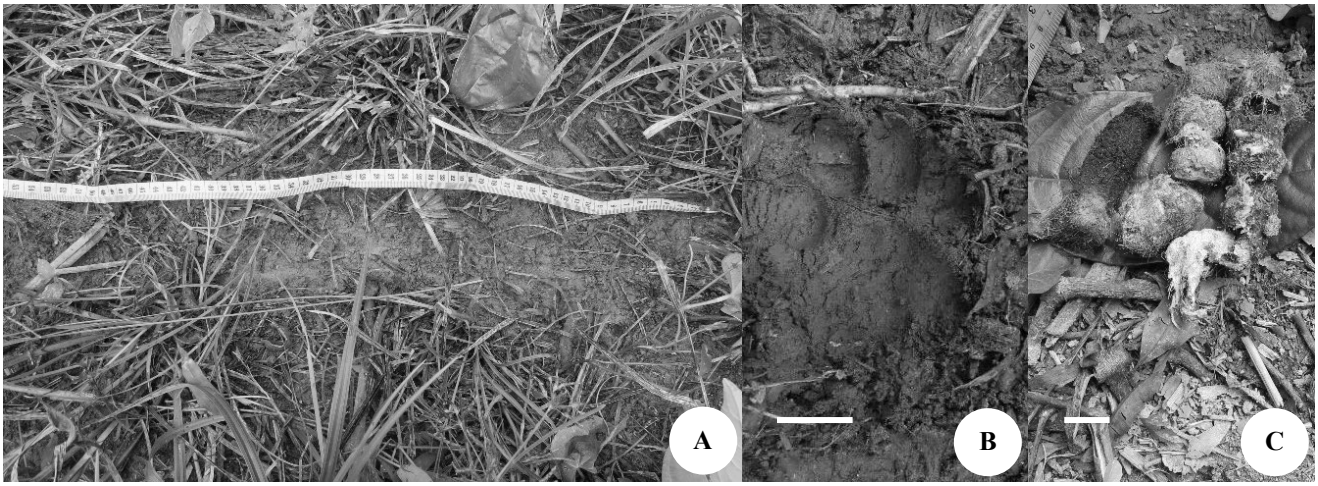

Figure 2. Example of Javan leopard sign found in Batu Nagok and surrounding areas. A. Scrape, B. Footprint, C. Feces. Bar = 2 cm

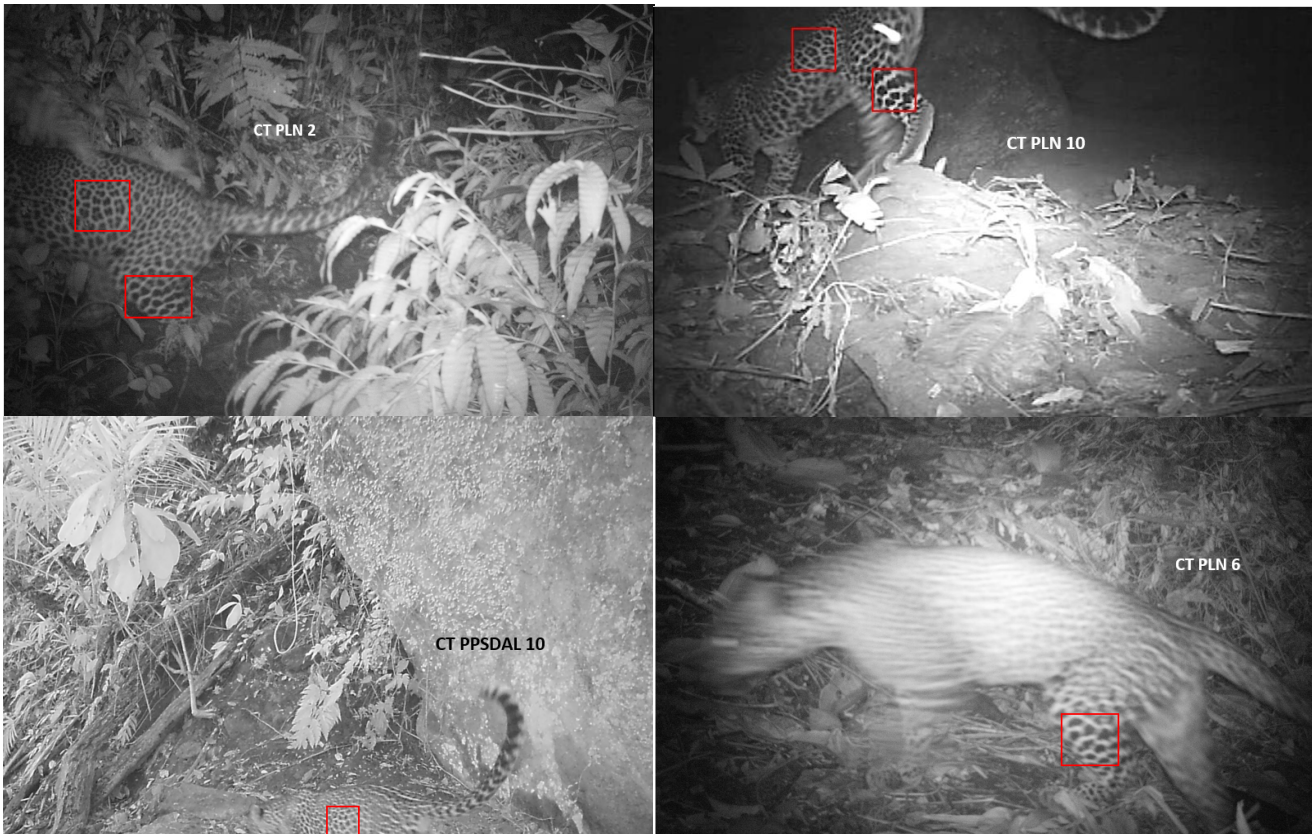

Figure 3. The leopard spotted pattern on photographs from camera traps showed one individual female

We assumed that the leopard mostly found in Batu Nagok and its surroundings because these areas contain natural forests, and leopard presumably uses natural forests intensively to carry out their main activities. In addition, the natural forests of Batu Nagok and Sarongge are far from human activities. The main habitat for Javan leopard consists of heavily vegetated forests that are difficult for humans to access, and also the areas have steep topography (> 40% slope) and remote areas such as deep valleys or high hills that are difficult to reach. Similarly, African leopard prefers thick bushes in rocky environments and riverside forests as their main habitat. Leopards are particularly fond of areas that have trees for shelter and lurking activities as they are strong climbers (Gunawan et al. 2012).

Table 2. Evidence of leopard's existence based on land cover type

Location	Cover land type (Estimation of Individual)				
	Natural forest	Production forest	Bush/ field	Rice field	Talun
Batu Nagok	1				
Batununggul				1	1
Cigintung					1
Cilengkong	1				
Cileungsing		1	2		
Cipanas			1		
Cisuren					1
Pasir Bedil		1			
Pasir Laja			1		
Pasir Nangka			1		
Pasir Taman					1
Sarongge	1				

Although Pasir Laja is dominated by shrubs with higher human activity, we also found evidence of leopard's existence there. This indicates that the leopards can overlap human activities and human settlements in West Java. Leopard also uses brushlands in Cipanas and Cileungsing as its home range.

Leopard's existence evidence was also found in natural forests in Cilengkong and around the Cilengkong River. Surprisingly, leopard's existence evidence was also found in a pine forest in Pasir Bedil, which had an open canopy, lots of human activity, and lots of coffee plants. According to Gunawan et al. (2012) the Javan leopard does not only use pine forests exclusively as its main habitat, but it also uses other types of vegetation for its daily activities, even it uses caves, rocky outcrops, and grooves or dried rivers as its shelter. In addition to pine forests, leopard's existence evidence was also found in *talun* near the Cisuren River, in Cigintung, and in Pasir Taman and Batununggul. We even found evidence of leopard's existence in rice fields although only in Batununggul. Our results suggest that leopards in West Java can use many different types of human-altered habitats, although their preference and main habitat appears to be natural forests with little human disturbance.

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