

# Mammal diversity in the geothermal power plants, West Java, Indonesia

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Manuscript received: 22 November 2023. Revision accepted: 2 February 2024.

**Abstract.** Husodo T, Megantara EN, Wulandari I, Mustikasari IA, Febrianto P, Pujianto MP, Maulana NP, Yuansah. 2024. Mammal diversity in the geothermal power plants, West Java, Indonesia. *Nusantara Bioscience* 16: 81-88. Geothermal energy is a critical renewable resource to address global energy demands. West Java, Indonesia, in particular, stands out with six geothermal power plants, including Kamojang, Gunung Salak, and Darajat Geothermal Power Plants. However, developing geothermal potential in biodiverse highland ecosystems raises concerns about its negative impact on biodiversity, especially mammals, making it essential to monitor and manage these areas for environmental sustainability. In 2019, a comprehensive study on mammal species was conducted in three geothermal power plants: Kamojang, Darajat, and Gunung Salak, all located in West Java, Indonesia. These geothermal power plants are located within diverse natural landscapes. The study employed various methods such as direct encounters, sign surveys, collapsible trapping, camera traps, and interviews with local communities. The mammal diversity study around the Kamojang, Darajat, and Gunung Salak Geothermal Power Plant areas revealed 32 mammal species from 18 families. Gunung Salak had the highest diversity with 22 species, primarily Sciuridae, primates, and some Carnivora species. Conversely, Kamojang had 20 species dominated by Muridae, and Darajat had 19 species with a similar dominance of Muridae, highlighting different characteristics among these geothermal power plant locations. Conservation status analysis identified species of high conservation concern, emphasizing the importance of preserving these habitats for biodiversity conservation.

**Keywords:** Darajat, Halimun-Salak National Park, Kamojang, mammals

**Abbreviations:** PLTP: Geothermal Power Plant

## INTRODUCTION

The geothermal energy is one of the renewable resources that provides an alternative solution to meet the growing global energy demand. Indonesia is the largest geothermal producer worldwide, having 29.5 Gigawatt electrical potential (Pambudi and Ulfa 2023). West Java has the largest geothermal potency than other provinces, with six geothermal power plants in Indonesia (Setiawan et al. 2018). The top three geothermal power plants with more than 200 MWe capacity are Kamojang, Gunung Salak, and Darajat Geothermal (Setiawan et al. 2018).

Geothermal systems are associated with volcanic structures situated in subduction zones along the edges of continental plates. Most geothermal heat sources are higher along the volcanic belt (Pambudi and Ulfa 2023). Many of these locations are still covered by forests and are integrated into Indonesia's protected area network for conservation purposes. Furthermore, 57% of the geothermal areas are located in forest areas, 22% in conservation forest areas, and others in protection and

production forest areas (Meijaard et al. 2019).

In contrast to the high potential of geothermal as a renewable energy source, the increasing development of geothermal potential negatively impacts habitats and species in the geothermal potential location. The decline in biodiversity will significantly impact the environment (Rehbein et al. 2020). The expansion of operational areas for geothermal power plants significantly impacts mammal populations by diminishing the available comfortable and suitable habitats. Therefore, the increased operational footprint disrupts the natural habitat of mammals, potentially leading to ecological imbalances, altered species dynamics, and challenges sustaining a healthy and diverse mammal population. The effects of geothermal activity in forested regions are manifested through expected consequences like fragmentation, disturbance to wildlife and their distribution, poaching, and illegal logging (Meijaard et al. 2019). Geothermal operations contribute to ecosystem disruptions, posing biodiversity and wildlife behavior challenges. The biological characteristics of an ecosystem are usually seen in its biodiversity, as well as the

existence of important fauna and flora (endemic, rare, and endangered), such as mammals. Mammals are considered bioindicators within terrestrial ecosystems due to their role in conserving other species and upholding ecosystem balance (Udy et al. 2021). The mammal species' roles include the dispersal of vegetation seeds, playing a significant role in maintaining the balance of the rainforest ecosystem (Lacher et al. 2019).

The various impacts generated by geothermal power plants must be managed to preserve forests and biodiversity and their ecological functions. The geothermal power plant developments aim to provide clean and green electrical energy. The company is responsible for protecting natural resource balance and preventing environmental damage based on state regulation Number 5 of 1984 about industrial. Therefore, it strives to provide the latest information about biotic environmental components, such as mammal diversity. Then, the information will be used as a reference in managing biodiversity in the future.

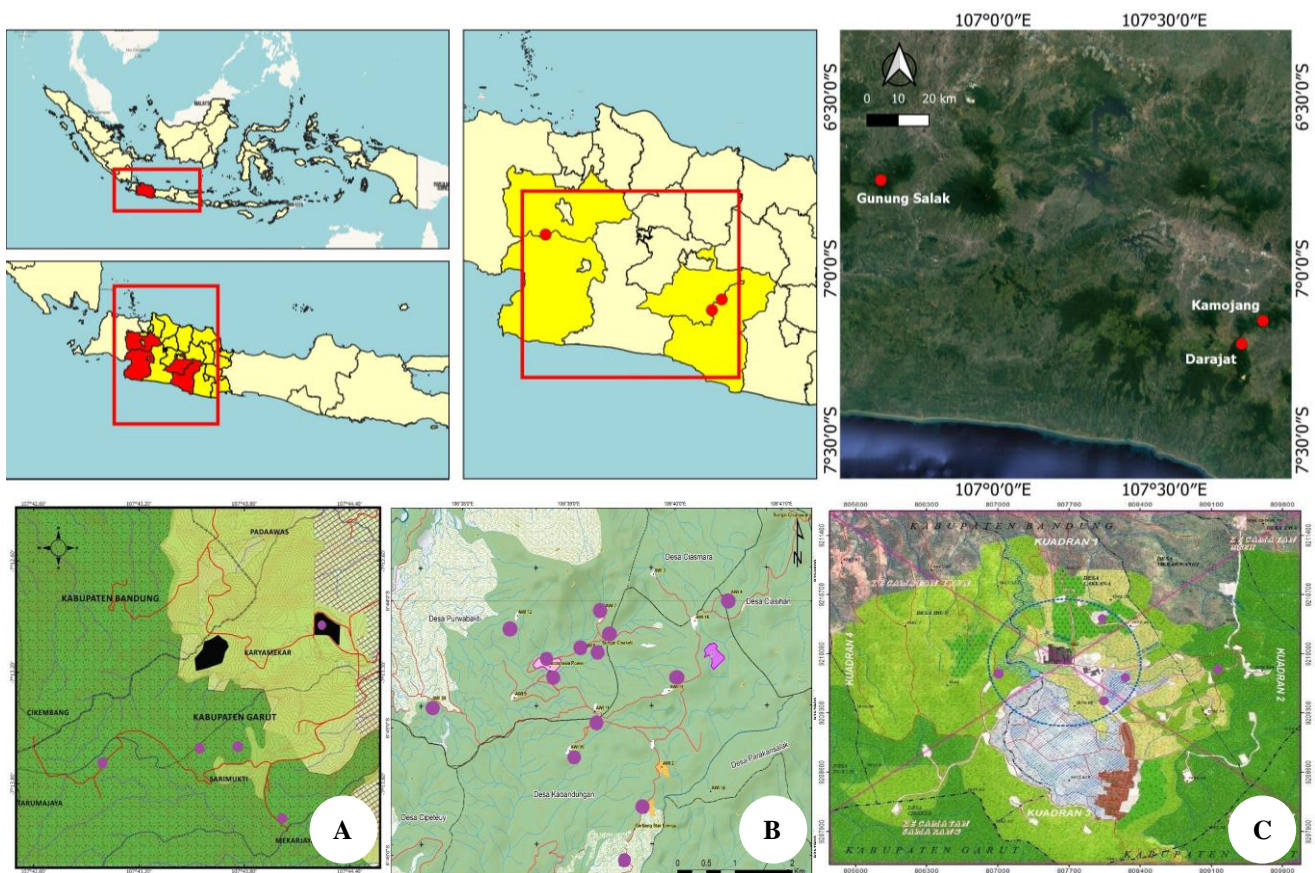
A previous study showed that 54 species of mammals are distributed from lowland to highland in several sites of West Java (Husodo et al. 2019). Some high-risk conservation species were recorded in West Java, such as the Javan leopard (*Panthera pardus* subsp. *Melas* Cuvier, 1809), Javan gibbon (*Hylobates moloch* Audebert, 1798), Javan pangolin (*Manis javanica* Desmarest, 1822), Javan slow loris (*Nycticebus javanicus* E. Geoffroy, 1812), lesser mouse-deer (*Tragulus javanicus* Osbeck, 1765), and small-

clawed otter (*Aonyx cinereus* Illiger, 1815) (Husodo et al. 2019). This research aims to determine the latest condition of mammal diversity, including its conservation in the geothermal power plants in West Java, Indonesia, i.e., Kamojang, Gunung Salak, and Darajat Geothermal Power Plants.

## MATERIALS AND METHODS

### Study area

The study was conducted in the Kamojang (April 2019), Gunung Salak (June 2019), and Darajat (September 2019) Geothermal Power Plant area, West Java, Indonesia (Figure 1). Administratively, Kamojang-Darajat Geothermal Power Plants covered 45,380 ha in Bandung and Garut Districts, while Gunung Salak is in the western of Gunung Salak, Bogor and Sukabumi Districts, West Java. The Gunung Salak Geothermal area is an area of 10,000 ha, including 228 ha of Perhutani Land (Meijaard et al. 2019). In Kamojang, the study area covered with production forests, shrubs, secondary forests, mixed gardens, riparian, swamps, and artificial parks. In Darajat, the study area covered with built-up area (Indonesia Power Office), craters, riparian, secondary forests, and lake. In Gunung Salak, the study area covered with secondary forests, riparian, tea plantation, and built-up areas.



**Figure 1.** Study areas at Geothermal Power Plants in West Java, Indonesia. A. Darajat Geothermal Power Plant (48 M, 800811.68 m E 9200549.76 m S); B. Gunung Salak Geothermal Power Plant (48 M, 683756.00 m E 9255797.00 m S); and C. Kamojang Geothermal Power Plant (48 M, 808381.73 m E 9209763.04 m S) (●: Sample areas)

## Procedures

The data were collected through a qualitative approach by combining several methods, such as unstructured interviews, sign surveys, direct observation, camera trapping, and collapsible traps. Each site was studied for five days.

### *Unstructured interviews*

The interviews were conducted to identify potential habitats and the presence of mammal species. The interview was conducted with guidelines made previously and could be developed during the interview. The informants were patrol workers, security officers, and local people. Those informants were encountered during observation. We assume that those informants had experiences in mammal discovery during day and night. The species recorded were those discovered by the informants in the last six months.

### *Sign surveys*

Sign surveys were conducted to encounter the mammal tracks, such as feces, footprints, scratches on the ground or trees, hairs, and leftovers. Two observers survey in the sampled areas (Figure 1) at 06.00 a.m. - 11.00 a.m. and 03.00 p.m. - 05.00 p.m. Indirect evidence is beneficial for surveying mammals, such as carnivores, that are elusive, rare, found in low densities, and challenging to capture repeatedly. The presence of medium and large mammals was also precisely indicated using indirect evidence, such as sounds, spines, burrows, and feces (Campos et al. 2013; Borges et al. 2014; Dereje et al. 2015). References of mammals track used a guidebook of van Strien (1983).

### *Direct observation*

Observations were conducted on mammals, except bats. Surveys in the sample areas (Figure 1) were performed three times a day: 06.00 a.m. - 11.00 a.m. and 03.00 p.m. - 05.00 p.m., when most mammals were more active in the study area (Meseret and Solomon 2014; Dereje et al. 2015), and at night (07.00 p.m. - 10.00 p.m.). During data collection, an observer walks on foot along each transect and directly counts all the individuals sighted with their respective species using unaided eyes and binoculars. Information like species, the number of individuals, location, habitat type, sex, and age were recorded (Campos et al. 2013). Signs of the mammal's existence that need to be considered included the movement of tree branches and branches and sounds.

### *Camera trapping*

Camera traps are widely used in Southeast Asia for conservation and research, particularly for the inventory of ground-dwelling mammals within conservation landscapes (Moo et al. 2017). Camera trap installation is used to optimize the sampling time for 24 hours. Five camera traps were installed in 6-7 days using hybrid mode (one unit) and photo mode (four units). The camera trap installation determination was based on the local people's recommendations, the mammal tracks, and previous research (Husodo et al. 2019). Cameras were placed

between 30 and 50 cm above and perpendicular to the ground. All photographs were checked manually, and encounters were identified to species by the author (Gray 2018). According to Sollmann et al. (2013), the primary survey area's camera traps were set along active or abandoned logging roads, but the others were set randomly within the forest. We recorded each camera's installation period and retrieval and calculated the total trap days (Debata and Kedar 2018).

### *Collapsible trap*

The traps used are the Collapsible Sherman Trap and Collapsible Wire Trap. The Sherman Trap measured 30 cm × 10 cm × 12 cm, and the Wire Trap measured 30 cm × 20 cm × 15 cm. The number of traps set was ten each, placed on the ground at a distance of 5 m each. Trap installation was carried out for one day at each predetermined sampling location. In this monitoring, the bait used to capture small mammals was oatmeal flavored with peanut butter (Hoffmann et al. 2010). This collapsible trap is set in several hotspots for overnight. Traps should be set as late in the afternoon as possible (around sunset) and opened as early as possible (sunrise) (Machtinger and Williams 2020). The bait used was a mix of peanut butter and oats wrapped in gauze (Hoffmann et al. 2010; Husodo et al. 2019).

## Data analysis

The data obtained by unstructured interviews, camera trapping, collapsible trapping, and sign surveys were entried using Ms. Excel. Each species encountered was recorded based on conservation status, referring to the Environment and Forestry Ministry of the Republic of Indonesia Regulation No. P 106 of 2018 concerning the protected plant and animal species, IUCN (International Union for Conservation of Nature) Red List, and CITES (Convention on International Trade of Endangered Species).

## RESULTS AND DISCUSSION

A total of 32 species of 18 families (Table 1; Figure 2) were encountered in the geothermal power plants and its surroundings. Almost 78% of mammals were found directly with direct encounter and collapsible trap methods, and the others were discovered indirectly with sign surveys, camera traps, or local people interviews. Gunung Salak Geothermal Power Plant was found the most with 22 species; about 68% of species are found directly, especially the Sciuridae family, Primate family, and some species of Carnivore orders. Twenty species was encountered in the Kamojang Geothermal Power Plant following the Gunung Salak Geothermal Power Plant. 80% of species of mammals are encountered directly, and the most commonly found species are from the Muridae family. And lastly, Darajat Geothermal Power Plant has 19 species, with 74% encountered directly. This location has the exact most commonly found species, the Muridae family.

**Table 1.** Mammals diversity in the geothermal power plants, West Java, Indonesia

Ordo   Family   Species	Common Name	Study Areas			Conservation Status		
		KMJ	DRJ	GS	P106	IUCN	CITES
<b>Artiodactyla</b>							
Cervidae							
<i>Muntiacus muntjak</i> (Zimmermann, 1780)	Southern Red Muntjak		S,I	S, I	✓	LC	
Suidae							
<i>Sus scrofa</i> (Linnaeus, 1786)	Wildboar	S,I	S	S		LC	
Tragulidae							
<i>Tragulus javanicus</i> (Osbeck, 1765)	Lesser Mouse-Deer			S	✓	DD	
<b>Carnivore</b>							
Felidae							
<i>Panthera pardus melas</i> (Cuvier, 1809)	Javan Leopard	I	S	S, I	✓	CR	I
<i>Prionailurus bengalensis</i> (Kerr, 1782)	Leopard Cat	S, I	S, CT	I	✓	LC	II
Herpestidae							
<i>Herpestes javanicus</i> (E. Geoffroy Saint-Hilaire, 1818)	Javan Mongoose	I	S	DE		LC	III
Mephitidae							
<i>Mydaus javanensis</i> (Desmarest, 1820)	Sunda Stink Badger			DE		LC	
Mustelidae							
<i>Melogale orientalis</i> (Horsfield, 1821)	Javan Ferret-badger		DE			LC	
Prionodontidae							
<i>Prionodon linsang</i> (Hardwicke, 1821)	Banded Linsang			S, I	✓	LC	II
Viverridae							
<i>Paradoxurus hermaphroditus</i> (Pallas, 1777)	Asian Palm Civet	DE	DE	DE		LC	III
<b>Chiroptera</b>							
Pteropodidae							
<i>Rousettus amplexicaudatus</i> (E. Geoffroy Saint-Hilaire, 1810)	Geoffroy's Rousette			DE		LC	
<b>Eulipotyphla</b>							
Soricidae							
<i>Suncus murinus</i> (Linnaeus, 1758)	Asian House Shrew	T				LC	
<b>Pholidota</b>							
Manidae							
<i>Manis javanica</i> (Desmarest, 1822)	Sunda Pangolin			S, I	✓	CR	I
<b>Primate</b>							
Cercopithecidae							
<i>Macaca fascicularis</i> (Raffles, 1821)	Long-tailed Macaque			DE		EN	II
<i>Presbytis comata</i> (Desmarest, 1822)	Grizzled Leaf Monkey	DE	DE	DE	✓	VU	II
<i>Trachypithecus auratus</i> (E. Geoffroy, 1822)	Javan Langur	DE	DE	DE	✓	VU	II
Hylobatidae							
<i>Hylobates moloch</i> (Audebert, 1798)	Silvery Gibbon			DE	✓	EN	I
Lorisidae							
<i>Nycticebus javanicus</i> (E. Geoffroy, 1812)	Javan Slow Loris	DE		DE	✓	CR	I
<b>Rodentia</b>							
Sciuridae							
<i>Callosciurus nigrovittatus</i> (Horsfield, 1823)	Black-striped Squirrel	DE	DE	DE		NT	
<i>Callosciurus notatus</i> (Boddaert, 1785)	Plantain Squirrel			DE		LC	
<i>Petaurista petaurista</i> (Pallas, 1766)	Red Giant Flying Squirrel	DE	DE	DE		LC	
<i>Ratufa bicolor</i> (Sparman, 1778)	Black Giant Squirrel			DE		NT	II
Muridae							
<i>Chiropodomys gliroides</i> (Blyth, 1856)	Pencil-tailed Tree Mouse	T	T			LC	
<i>Hylomys suillus</i> (Muller, 1840)	Short-tailed Gymnure	T	T			LC	
<i>Maxomys surifer</i> (Miller, 1900)	Red Spiny Rat	T	T			LC	
<i>Rattus exulans</i> (Peale, 1848)	Polynesian Rat	T	T			LC	
<i>Rattus tiomanicus jalorensis</i> (Bonhote, 1903)	Malayan Field Rat	T	T			LC	
<i>Rattus norvegicus</i> (Berkenhout, 1769)	Brown Rat		T			LC	
<i>Rattus rattus</i> (Linnaeus, 1758)	House Rat	T				LC	
<i>Rattus tiomanicus sabae</i> (Miller, 1900)	Malayan Wood Rat	T	T	T		LC	
<b>Scandentia</b>							
Tupaiaidae							
<i>Tupaia glis</i> (Diard & Duvaucel, 1820)	Common Tree Shrew	DE				LC	II
<i>Tupaia javanica</i> (Horsfield, 1822)	Javan Tree Shrew	DE	DE	DE		LC	II

Note: Primary Data (2019); KMJ: Kamojang; DRJ: Darajat; and GS: Gunung Salak. Data Types = DE: Direct Encounter, I: Interview, T: Collapsible Trap, S: Sign, CT: Camera Trap; P106: Regulation of the Minister of Environment and Forestry of the Republic of Indonesia No. P 106 of 2018 on species of Protected Plants and Animals; IUCN = CR: Critically Endangered; EN: Endangered; VU: Vulnerable; NT: Near Threatened; DD: Data Deficient, CITES = I: Appendix I; Appendix II; Appendix III



**Figure 2.** Mammal species in Geothermal Power Plant, West Java, Indonesia. A. *Melogale orientalis*, B. *Trachypithecus auratus*, C. *Presbytis comata*, D. *Nycticebus javanicus*, E. *Hylobates moloch*, F. *Callosciurus notatus*, G. *Paradoxurus hermaphroditus*, H. *Roussettus amplexicaudatus*, I. *Petaurista petaurista*, J. *Panthera pardus* subsp. *melas*, K. *Prionailurus bengalensis*, L. *Sus scrofa*

Although these three sites are in the highlands, every site has different characteristics. Gunung Salak Geothermal Power Plant has the most diverse characteristics. In this location, the Sciuridae family has the highest number of species; this may indicate that no species dominates the presence. From 2018, there was no significant change in this family of black giant squirrels, which previously could not be found directly (Husodo et al. 2019); in June 2019, while monitoring, it was found directly. In this study, the family Muridae is rarely seen. It was only found in a disturbing forest community dominated by existing buildings. Family Muridae can adapt to highly damaged habitats; these rats could be found in highly damaged habitats, such as around settlements or urban areas (Amni et al. 2019). It was also recorded by Husodo et al. (2019) that only Malayan wood rat (*Rattus tiomanicus sabae* (Miller, 1900)) was found in the Gunung Salak Power Plant. Gunung Salak Power Plant has some species that are

only found in this power plant, such as lesser mouse-deer (*T. javanicus*), Sunda stink badger (*Mydaus javanensis* (Desmarest, 1820)), banded linsang (*Prionodon linsang* (Hardwicke, 1821)), geoffroy's rousette (*Roussettus amplexicaudatus* (E. Geoffroy Saint-Hilaire, 1810)), long-tailed macaque (*Macaca fascicularis* (Raffles, 1821)), Sunda pangolin (*M. javanica*), and silvery gibbon (*H. moloch*).

The *T. javanicus*, *M. javanensis*, *P. linsang*, and *R. amplexicaudatus* are lack information because their status conservation is still of the Least Concern and Data Deficient (IUCN 2023). In 2014, the previous study recorded that *T. javanicus*, *M. javanensis*, and *P. linsang* was encountered in Java by Rode-Margono et al. (2014). Moreover, that study explains there is no direct encounter or camera trap record of *M. javanensis* (Desmarest, 1820). In addition, *M. fascicularis*, *M. javanica*, and *H. moloch* are rare species also found in this location. As one of the

potential locations of mammals' habitat, the Gunung Salak Power Plant is located at the hill of Gunung Salak, so it is possible to find diverse mammals (Megantara et al. 2019). The *M. fascicularis* population is believed to have decreased by around 40% (42 years) over the last three generations (IUCN 2023). It makes the status conservation of *M. fascicularis* change, being Endangered (IUCN 2023). This species is observed to be abundant, especially in Java and the density of this species is around eight ind/ha (Hansen et al. 2020a). This species is in danger due to various threats, so it is necessary to study the population and range across Southeast Asia (Hansen et al. 2021).

Meanwhile, Kamojang-Darajat, as an adjoining location, also has the same characteristics. In Kamojang-Darajat, small mammals from the Muridae family are the most dominating species because they are found in all monitoring locations. The genus *Rattus* dominates the Indonesia Power office area. The malayan field rat (*Rattus tiomanicus jalorensis* (Bonhote, 1903)) is the most common species in three sites. Rodents can be found in many land environment types, including farmland and local housing areas; the fields with high crop density could increase the density of rodents (Fischer et al. 2017). The condition of these four monitoring locations, which are adjacent to horticultural gardens and shrubs at specific points, is a supporting factor for the continued existence of rodent species, such as rats; as an individual rodent's ability to move around, its tolerance to different environmental conditions, and how it interacts with other species. Rodents play a crucial role in utilizing resources in their surroundings, especially in predation, competition, and environmental stress, which can hinder their access to essential resources (Royer et al. 2016).

Moreover, 11 species were found in all sites, such as wildboar (*Sus scrofa* (Linnaeus, 1786)), Javan leopard (*P. pardus* subsp. *melas*), leopard cats (*Prionailurus bengalensis* (Kerr, 1782)), Javan mongoose (*Herpestes javanicus* (E. Geoffroy Saint-Hilaire, 1818)), Asian palm civet (*Paradoxurus hermaphroditus* (Pallas, 1777)), grizzled leaf monkey (*Presbytis comata* (Desmaret, 1822)), Javan langur (*Trachypithecus auratus* (E. Geoffroy, 1822)), Black-striped squirrel (*Callosciurus nigrovittatus* (Horsfield, 1823)), red giant flying squirrel (*Petaurista petaurista* (Pallas, 1766)), malayan wood rat (*Rattus tiomanicus sabae* (Miller, 1900)), and Javan tree shrew (*Tupaia javanica* (Horsfield, 1822)). All those species were also encountered in the previous study by Husodo et al. (2019).

Javan leopard (*P. pardus* subsp. *melas*) and its population across various fragmented landscapes in Java land are more isolated than previously hypothesized. The three sites of the Geothermal power plants are identified as suitable for *P. pardus* subsp. *melas* habitat on the Indonesian island of Java (Wibisono et al. 2018). Only two primates exist in the Kamojang-Darajat location, including *P. comata* and *T. auratus*. The *P. comata* has an adaptive ability in a disturbed forest area with the availability of food and shelter, and it is recorded as nine meters away from the settlement and three meters from the road (Supartono et al. 2016). The *T. auratus* also exhibits

adaptability by thriving in various habitats, including dry habitats with disturbance without human conflict (Hansen et al. 2020b).

### Conservation status

Based on the Environment and Forestry Ministry Regulation P.106 of 2018, 10 out of 32 species are protected by the Kamojang-Darajat and Gunung Salak Geothermal Power Plants. Furthermore, 7 out of 10 species of mammals protected by the Minister Regulation have a high risk of extinction based on the IUCN. These species include *T. auratus*, *P. pardus* subsp. *melas*, *P. comata*, *H. moloch*, *M. javanica*, and Javan slow loris (*N. javanicus*). The other four species are southern red muntjak (*Muntiacus muntjak* (Zimmermann, 1780)), *P. bengalensis*, *P. linsang*, and *T. javanicus*. These four species are categorized as low risk of extinction, although in Indonesia, it is quite challenging to find them directly in nature. The rest is classified as low risk of extinction and also commonly easy to find.

Species considered the most traded internationally by CITES, so they are strictly prohibited for commercial use (AP. I) are *P. pardus* subsp. *melas*, *H. moloch*, *M. javanica*, and *N. javanicus*. Two of these four species are difficult to find directly at the monitoring site, such as *P. pardus melas* and *M. javanica*. The *N. javanicus* was found in the Kamojang and Gunung Salak sites, with only one individual on each site. As for the Javan gibbon species, up to three groups were observed. The Javan gibbon is challenging due to its high sensitivity to human disturbance and was only found in the Gunung Salak site.

The findings of mammals in the Geothermal Power Plants show that habitat conditions are still maintained. Some mammals have been found to have a significant role in biodiversity conservation efforts. The *H. moloch* is generally categorized as an umbrella species; the leopard is charismatic, and the Javan slow loris are both flagship species. Flagship species are defined as memorable and iconic species in conservation efforts. Researchers define umbrella species as those with a wide home range and requiring special habitat conditions, which generally provide habitat protection for many other species. Charismatic species have several different definitions, especially in the standards set by researchers. A requirement for a species to be considered charismatic is potential information that can be investigated from the species. An alternative or complementary method for prioritizing conservation efforts may be necessary when dealing with range-limit species or those requiring specialized conservation measures to mitigate threats to their survival (Runge et al. 2019).

The flagship species in the mammal class and classified as a primate is the *N. javanicus*; this species was detected in the natural forest area around Kamojang and Gunung Salak sites. The number of individuals caught was only one, considering lorises are good hiding animals. Because they are nocturnal or primarily nocturnal, the possibility of direct encounters is also limited at night. The *N. javanicus* is also not a primate grouped in large numbers, such as langurs or monkeys. Although information circulating in

the community says lorises are slow primates, they can occasionally move quickly.

The umbrella species of mammals found in the Gunung Salak area is *H. moloch*, which belongs to the Hylobatidae family and is the only species of lesser apes found on the island of Java (endemic to Java). It inhabits lowland tropical rainforests to hills up to 1,500 meters above sea level. Gunung Halimun Salak National Park is classified as a highly suitable habitat for the Javan gibbon (Oktaviani et al. 2023). The study revealed that from three different locations in geothermal power plants, the Gunung Salak site has distinctive characteristics with pristine forest conditions characterized by the diversity of species from the Sciuridae family. In contrast, the Kamojang-Darajat site, dominated by the Muridae family, indicates high anthropogenic activities such as plantations and settlements. Based on the area's conservation status, the Gunung Salak is the national park. Meanwhile, Kamojang-Darajat has the status of a nature tourism park conservation area.

As stipulated in Law No. 5 of 1990, based on its utilization, the national park area is more protected because of the government's legal zoning system. The utilization of the area is restricted for the community, unlike Natural Tourist Parks, which, in its utilization, will have a high anthropogenic impact that affects the presence of various species of animals. This conservation helps maintain the mammals diversity because the existence of this conservation area can increase public awareness to preserve natural resources in this area (Angraini and Gunawan 2021).

In conclusion, the mammal diversity study around the Kamojang, Darajat, and Gunung Salak Geothermal Power Plant areas revealed 32 mammal species from 18 families. Gunung Salak had the highest diversity with 22 species, primarily Sciuridae, primates, and some Carnivora species. Conversely, Kamojang had 20 species dominated by Muridae, and Darajat had 19 species with a similar dominance of Muridae, highlighting different characteristics among these geothermal power plant locations. Conservation status analysis identified species of high conservation concern, emphasizing the importance of preserving these habitats for biodiversity conservation.

#### ACKNOWLEDGEMENTS

Acknowledgments were given to PT. Indonesia Power Kamojang Power Generation and O&M Services, PLTP Kamojang POMU Unit, PLTP Gunung Salak Unit, and Unit PLTP Darajat. We also thank to *Balai Konservasi Sumber Daya Alam* (BKSDA) Garut District, Gunung Halimun Salak National Park, Papandayan and Kamojang Natural Tourist Park. We also thank the *Pusat Unggulan IPTEK Perguruan Tinggi* Center of Environment and Sustainable Science (PUIPT CESS) Universitas Padjadjaran, Indonesia, the researcher team, the surveyor team, and the local community.

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