

The protection effort of leopard cats (*Prionailurus bengalensis* Kerr, 1792) in the Upper Cisokan Pumped Storage, West Java, Indonesia

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Abstract. Husodo T, Megantara EN, Mutaqin AZ, Kendarto DR, Wulandari I, Shanida SS. 2024. The protection effort of leopard cats (*Prionailurus bengalensis* Kerr, 1792) in the Upper Cisokan Pumped Storage, West Java, Indonesia. *Biodiversitas* 25: 169-176. Humans develop various infrastructures to meet electricity needs so that it is to improve human welfare besides the increasing population. Hydropower development cannot be separated from land clearing, which damages and eliminates the habitats of wild animals, including leopard cats (*Prionailurus bengalensis* Kerr, 1792). Humans also cleared land as agricultural land to fulfill their needs. Fulfilling the needs of electricity and agriculture is necessary to improve human welfare. Besides, leopard cats need a suitable habitat to meet their needs. Therefore, protection effort is required to fulfill leopard cats' and humans' needs. The study aims to reveal the protection efforts in the Upper Cisokan Pumped Storage, West Java, Indonesia. A qualitative approach was applied through literature reviews. The protection effort of leopard cats was conducted through stakeholder participation in the UCPS area. As the initiator, Indonesia Hydropower Company (PT. PLN) involves various stakeholders related to the construction of the UCPS hydropower plant, including Perum Perhutani, contractors, and the local people. Indonesia Hydropower Company (PT. PLN) protects leopard cats by managing the impacts produced by the UCPS hydropower plant and biodiversity.

Keywords: Anthropogenic disturbance, harmonization, stakeholder participation

Abbreviations: BIA: Biodiversity Important Area; BKPH: Forest Management Unit Section; C-ESMP: Construction-Environmental and Social Management Plan; ESMP: Environmental and Social Management Plan; FPF: Forest Partnership Framework; KPH: Forest Management Unit; Perhutani: The state forestry company; PT. PLN (Persero): The state hydropower company; PT. PLN UIP JBT: Hydropower Company-Central Java Development Main Unit; REEPS: Rare, Endangered, Endemic, and Protected Species; UCPS: Upper Cisokan Pumped Storage

INTRODUCTION

The Upper Cisokan Pumped Storage (UCPS) has entered the construction stage with various land use changes. The construction stage has an impact on the loss or decline in the quality of wildlife habitat, such as leopard cats (*Prionailurus bengalensis* Kerr, 1792), which have been categorized as Least Concern by The International Union for Conservation of Nature (IUCN) Red List (Ghimirey et al. 2022), Appendix II by Convention on International Trade of Endangered Species (CITES). It is also protected by the Environment and Forestry Ministry of the Republic of Indonesia No. P.106 concerning Protected Plants and Animals Species. Besides, in the UCPS area, agriculture is dominated by slash-and-burn farming because the sloping topography ranges from 20-40°. This farming is the primary source of livelihood for local people. The land is cleared of trees, shrubs, and others. Then, the land is planted with crops and annual plants. After 1-2 years of planting crops, the land is fallowed. The

farmers leave the farmland with annual plants to restore soil nutrients and vegetation. Besides, farmers clear land in other areas similarly (Weinstock 2015). After 2-3 years of the fallow period, shrubs dominated the former farmland, and annual plants may be harvested, so the land is reopened to be planted with crops again (Choir et al. 2018). Directly, slash-and-burn farming affects the leopard cats's habitat. Land clearing involves clearing undergrowth, cutting and burning shrubs and trees, eliminating hunting habitats for leopard cats, and negatively impacting the ecosystem. However, the construction of the UCPS is needed to meet electricity needs on the islands of Java and Bali. Then, farming was also required by local people as their main livelihood.

Those anthropogenic disturbances will potentially impact the leopard cats' habitat. In Malaysia, leopard cats experience conflict with humans, such as roadkill (Laton et al. 2017). Most roadkill cases occur on major roads near oil palm, rubber, and bush plantations (Laton et al. 2017). These cases occurred because of a roadway in plantations

and bushes, which are habitats for leopard cats as a place to shelter and breed. They can cross from one habitat to another. This conflict between leopard cats and humans can potentially reduce the leopard cat population in nature (Laton et al. 2017).

The decline in the leopard cat population will increase in prey, especially rats. In agricultural ecosystems, rats act as pests while leopard cats act as predators, so indirectly, leopard cats control agricultural pest populations and support local people's livelihood. Fernandez et al. (2018) state that certain predators, such as leopard cats, are keystone species because they can control the prey population in the ecosystem at the top of the food chain. Apex predators can be ideal indicator species, as they represent changes in food webs (Ramirez et al. 2014).

Conservation efforts are needed to protect leopard cats in the UCPS area and to minimize disturbance to leopard cats due to the UCPS construction and farming activities. Using natural resources such as leopard cats' habitat, agricultural land, and infrastructure development requires better management to harmonize leopard cats and humans in the ecosystem. Previous studies have been conducted on leopard cats, specifically on the Java Island. Leopard cats ecology has been studied in the UCPS area by Meijaard and Ferguson (2014); Shanida et al. (2018b); Husodo et al. (2019a); Husodo et al. (2019b); Husodo et al. (2019c); Megantara et al. (2019); CESS (2020) unpublished; Husodo et al. (2022); and Shanida et al. (2023). Most studies are limited to the ecological aspects of leopard cats, while others have revealed conservation strategies for endangered animals. However, no information regarding the management of natural resources supports it precisely at the species level, specifically for the leopard cats (*P. bengalensis*). Based on those studies, there has been no research on leopard cats focused on protection efforts to harmonize between leopard cats and humans, so it is a

novelty of this study. The study aims to reveal the protection efforts in the Upper Cisokan Pumped Storage, West Java, Indonesia.

MATERIALS AND METHODS

Study area

Administratively, the UCPS area (Figure 1) and its infrastructure cover an area of 775.64 ha, located in two districts, namely West Bandung District (Cipongkor and Rongga Sub-districts) and Cianjur District (Bojongpicung, Cempaka, and Cibeber Sub-districts). The UCPS area is in the upper catchment area of the Cisokan River, as a tributary of the Citarum River, which flows from south to north, leading to the Java Sea. The UCPS consists of two dams and a reservoir, transmission line, power station, access road, quarry, and other facilities, estimated to require an area of ± 723.15 ha. This area consists of a community area of ± 337.89 ha and a forest area of ± 385.25 ha in West Bandung and Cianjur Districts. The UCPS area is at an altitude of 400-900 masl with a slope of 20-40°. Based on the land ownership map of Perum Perhutani III, the UCPS plan area is in the production forests that Perhutani Unit III manages in the Forest Management Unit/ *Kesatuan Pengelolaan Hutan* (KPH) South Bandung and Cianjur. According to the satellite imagery, the UCPS area is in the Forest Management Unit Section/ *Bagian Kesatuan Pengelolaan Hutan* (BKPH) South Ciranjang Selatan and North Sukanagara of KPH Cianjur, while BKPH Gunung Halu is in KPH South Bandung. The area comprises seven land uses: secondary forests/remnant forests, production forests (including *Pinus* spp., *Tectona grandis* L. f.), irrigated rice fields, slash-and-burn farmings, shrubs, mixed gardens, and settlements.

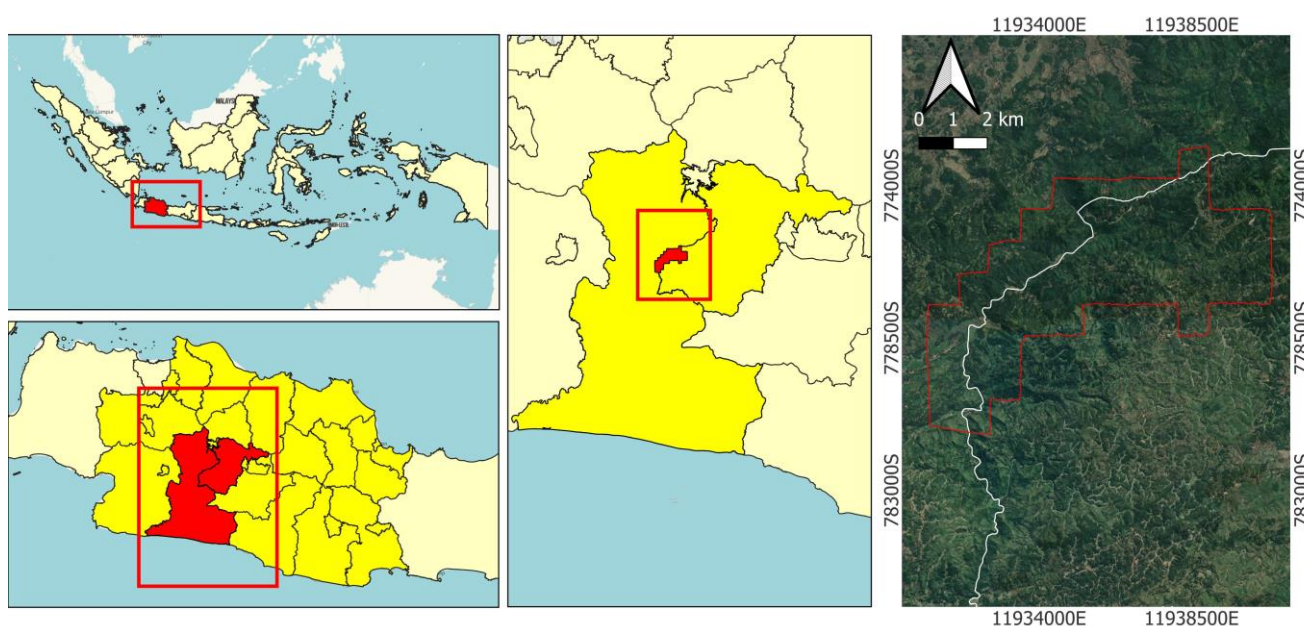


Figure 1. Hydropower plant development area, Cianjur District and West Bandung District, West Java (48M 746030.02 m E 9231551.58 m S)

Procedures

The study was conducted from August 2022 to July 2023. This study used a qualitative approach through literature reviews. The literature review was conducted through Researchgate with the keywords Cisokan, UCPS, leopard cats, *Prionailurus bengalensis*, the biodiversity management plan, and the forest partnership framework. We reviewed several research papers and technical reports, including Shanida et al. (2018b), Husodo et al. (2019b); CESS (2020) unpublished; CESS (2021); Husodo et al. (2022), and Shanida et al. (2023).

Data analysis

Data were collected in Ms. Excel and analyzed using cross-checking, summarizing, synthesizing, and narrative descriptions (Newing et al. 2011). Cross-checking data was conducted by triangulating the information collected.

RESULTS AND DISCUSSION

Overlapping leopard cats' habitat and UCPS area

According to Meijaard and Ferguson (2014), the construction of the permanent access road started in early 2014. Leopard cats have been encountered before construction since 2012. During construction, leopard cats were still encountered in the UCPS area in 2017 and 2022 (Husodo et al. 2022). Based on leopard cats' distribution from 2017 to 2022 (Figure 2), leopard cats' habitats overlap in the UCPS area. Of the 56 findings, 35 (63%) were found

within the UCPS area, such as in the lower dam, upper dam, permanent access road, temporary access road, and sliding gate (Shanida et al. 2018b; Husodo et al. 2022). Husodo et al. (2022) revealed that leopard cats still use the same areas as their habitat after 5-10 years, covering an area of 10 km² in the UCPS area. The leopard cats are considered a forest edge species that is predominantly found in human-dominated landscapes where habitat fragmentation and degradation, as well as direct and indirect anthropogenic disturbances, threaten the species' survival (Best and Pei 2020).

When construction and agricultural activities occur, leopard cats will leave their habitat to other areas to adjust to the intensity of human activity. In a study by Husodo et al. (2022), leopard cats were found in certain areas in 2012-2017 but not in 2022. In 2022, observations were conducted during land clearing for farming using the slash-and-burn method. Because of that, leopard cats will not be found or leave their habitat during the land clearing. Leopard cats may return to their old habitat if the intensity of human activity decreases. Leopard cats adapt temporally to human activity within a narrow time niche (Sulaksono et al. 2023). Leopard cats adjusted their activity time to prevent coinciding with human activity (Sulaksono et al. 2023). Carnivores that persist in areas with high human-related risks have been shown to respond to anthropogenic threats through temporal and spatial behavioral adjustments, for example, by minimizing the risk of human encounters through fine-scaled habitat selection (Gehr et al. 2017; Belotti et al. 2018).

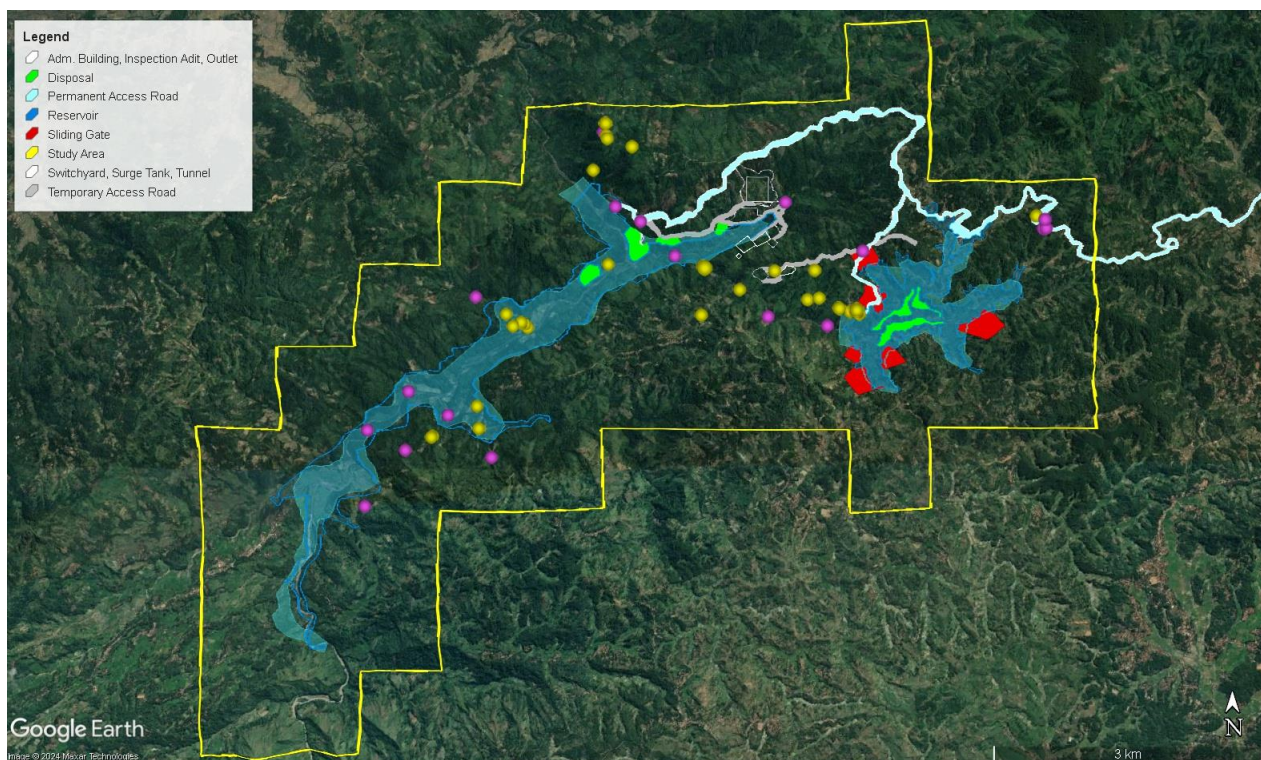


Figure 2. Overlapping the leopard cats' presence and the UCPS plan area. Notes: ● = Leopard cats presence in 2017 (Shanida et al. 2018b); ● = Leopard cats presence in 2022 (Husodo et al. 2022)

Protection effort of Hydropower Company

Indonesia Hydropower Company (PT. PLN) protects leopard cats in a broader scope by managing the impacts resulting from the construction of the UCPS hydropower plant. In its management, PT. PLN involves various stakeholders related to the construction. Involving stakeholders in environmental and biodiversity management efforts helps identify potential problems more precisely. It provides a deeper understanding of the positive and negative impacts on the construction of the UCPS hydropower plant. Stakeholder participation can promote the assessment of environmental risks and help restore and protect ecosystems (Cohen-Shacham et al. 2019; Gómez et al. 2020; Kiss et al. 2022; Kooijman et al. 2021). Stakeholder participation is also can help improve their understanding and trust of the decision-making process (Frantzeskaki et al. 2018) in order for them to provide constructive thoughts and recommendations that eventually improve the planning and encourage the decision's implementation (Nesshöver et al. 2017). Stakeholders involved in the UCPS hydropower area include PT. PLN, Perum Perhutani, contractors, and the community (Figure 3). These stakeholders have respective roles in managing environmental impacts and biodiversity in the UCPS area.

Hydropower development plan area is carried out in forest areas which have essential environmental functions. Government Regulation Republic of Indonesia No. 61 of 2012 concerning the Utilization of Forest Areas states that natural and production forests can be used for infrastructure development outside forestry activities with unavoidable purposes, including power plants. Power plants can be carried out without changing the primary function of forests by considering particular areas, time limits, and environmental sustainability.

This policy shows that land use resources such as UCPS hydropower can be carried out in forest areas by paying attention to the extent and time of impacts due to development. Impact management resulting from construction is needed to mitigate, minimize, and anticipate

various impacts. In this policy, environmental sustainability aims to maintain the function of forest areas, including their function as habitat for wild animals, such as leopard cats. This ecological sustainability is determined by installing power plants to harmonize the needs of humans and leopard cats.

According to Figure 3, PT. PLN has carried out several environmental impact studies on the construction under regulations set by the World Bank and the regulations in Indonesia. PT. PLN must prepare an Environmental Impact Assessment (EIA) as one of the requirements for an environmental feasibility study. The preparation of the EIA refers to the World Bank's international standards set out in the Environmental and Social Framework (ESF). EIA is used to evaluate the potential impact of hydropower development on the environment and society. Based on the results of the EIA assessment, PT. PLN must prepare an Environmental and Social Management Plan (ESMP) document based on social, economic, and environmental aspects. The ESMP explains the steps and strategies for managing negative impacts (identified in the EIA) on the environment and society. ESMP aims to ensure that hydropower development proceeds sustainably and responsibly.

Besides conducting EIA, through its regulations, the Indonesian Government requires PT. PLN to prepare an environmental impact analysis (AMDAL). Like the EIA, AMDAL is used to evaluate the potential impact of a development on the environment and society. After obtaining environmental permits, PT. PLN is required to prepare an Environmental Management Plan (RKL) and Environmental Monitoring Plan (RPL). Following the ESMP, the contractor prepared the C-ESMP document to focus on the environmental and social management plan. C-ESMP aims to ensure that all contractors and subcontractors involved in the construction understand and comply with PT. PLN's environmental and social requirements. C-ESMP ensures that construction operates well and achieves sustainable development goals.

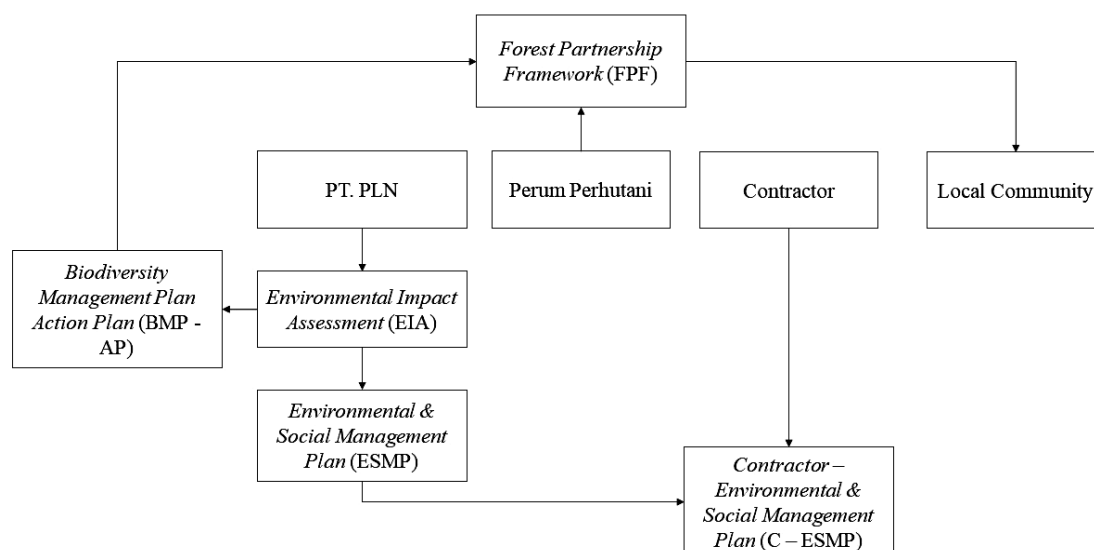


Figure 3. Stakeholder participation in the UCPS area

Based on EIA's assessment, PT. PLN must arrange a Biodiversity Management Plan (BMP) that focuses its management on the impact of the development on biodiversity (Husodo et al. 2019b). The BMP is also adjusted to regulations in Indonesia. The evaluation results from the EIA are the basis for preparing a BMP to manage the negative impacts of the construction on biodiversity so that the construction and the biodiversity can coexist sustainably. The BMP provides a strategy and Action Plan (AP) for biodiversity management across the project area of influence and has been developed within the context of a broader, integrated approach to catchment management. This document is used as a reference in preparing the C-ESMP. The contractor's work must follow the directions of biodiversity management recommendations set by the BMP to achieve the BMP's biodiversity management goals.

The BMP-AP shows how the community will be engaged to find alternatives to illegal hunting, poaching, and logging and explore cooperative forest management options. This action plan is also integrated with other safeguards responsibilities, such as resettlement of displaced people, construction-related impacts, watershed management, and environmental changes from hydropower operation. Based on the objectives of BMP-AP (Husodo et al. 2019b), the Action Plan includes five aspects that need to be implemented by PT. PLN, namely managing impacts related to construction, reforestation and forest management, wildlife management, stakeholder involvement, and community engagement. Indirectly, some of the Action Plans from the five aspects support efforts to protect leopard cats.

The BMP-AP focuses management on biodiversity problems that receive various impacts from the construction, especially on animals that are categorized as Rare, Endangered, Endemic, and Protected Species (REEPS), including the Javan leopard (*Panthera pardus melas* Cuvier, 1809), small-clawed otter (*Aonyx cinerea* Illiger, 1815), Javan gibbon (*Hylobates moloch* Audebert, 1798), grizzled leaf monkey (*Presbytis comata* Desmarest, 1822), Javan langur (*Trachypithecus auratus* É. Geoffroy Saint-Hilaire, 1812), Javan slow loris (*Nycticebus javanicus* Boddert, 1785), Javan mouse-deer (*Tragulus javanicus* Osbeck, 1765), Sunda porcupine (*Hystrix javanica* Cuvier, 1823), and Javan pangolins (*Manis javanica*, Desmarest, 1822) (Ayundari et al. 2017; Withaningsih et al. 2018; Shanida et al. 2018a; Shanida et al. 2018b; Husodo et al. 2019a; Husodo et al. 2019c; Megantara et al. 2019; Mustikasari et al. 2019; Dirgantara et al. 2021). Therefore, biodiversity management determined by BMP-AP is one of PT PLN's efforts to protect leopard cats.

Besides protecting species, PT. PLN also protects the area as a habitat for REEPS in the BMP-AP. Area protection is carried out by the designation of areas where various REEPS are known to be found, called Biodiversity Important Areas (BIA). BIA is a forest patch that has the potential to be used as a wildlife habitat, and the presence of wild animals has been recorded based on previous studies, resulting in a total of 15 BIA in the UCPS hydropower development area (Figure 4). Some leopard cats have been found in BIAs. Establishing a BIA can protect the leopard cats's habitat through area protection.

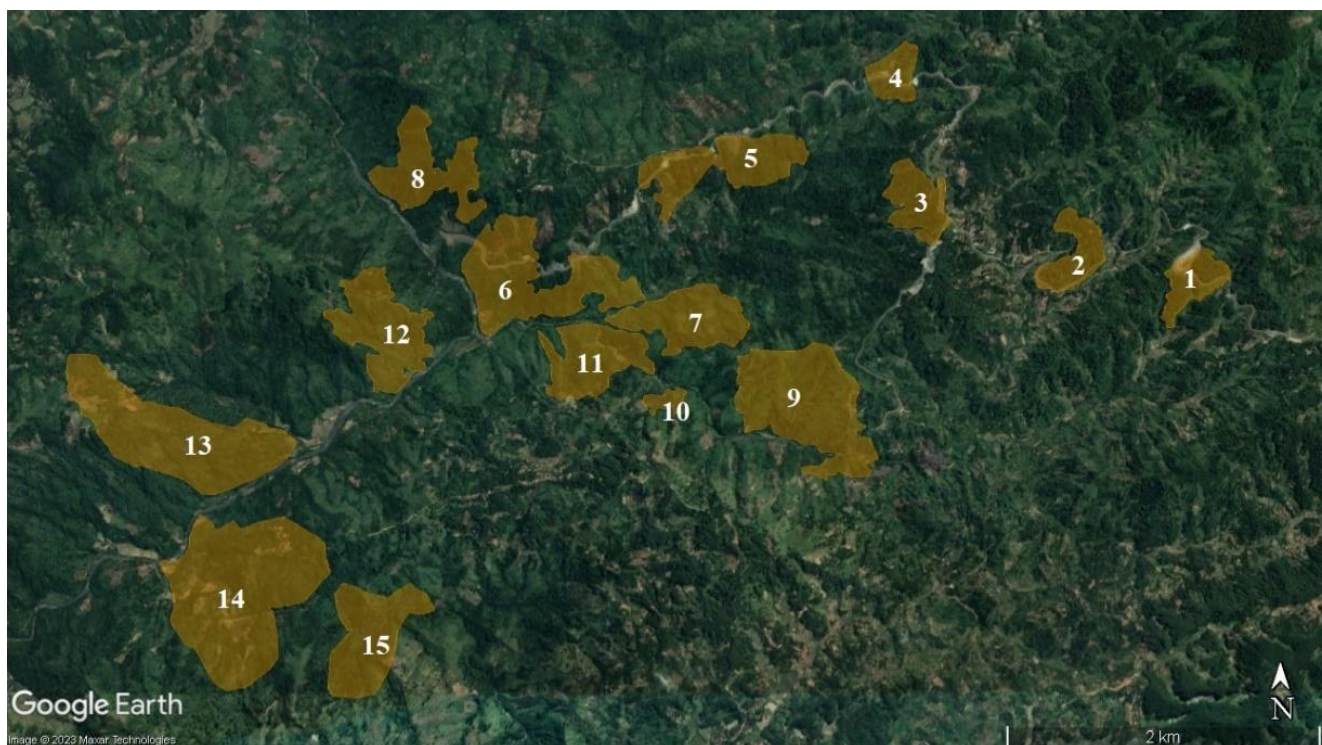


Figure 4. Biodiversity Important Area (BIA 1-15) in the UCPS area

In the BMP-AP document, the restoration area is determined to be 3,800 ha, including Working Zone 1, Working Zone 2, and Working Zone 3. For information, Working Zone 1 is a BIA area, Working Zone 2 is a corridor between BIA, and Working Zone 3 is a buffer zone 500 m from the planned inundation area (Figure 5). These zones are intended to achieve the objectives and management aspects set out in the BMP. The reforestation program aims to restore terrestrial and aquatic biodiversity components and create interconnected forest habitats along water catchment areas. This reforestation program can minimize the isolation of natural vegetation by connecting various forest patches as wildlife habitats. Wildlife corridors and buffer zone management can facilitate the movement of leopard cats and reduce the negative impact on leopard cats. Proper landscape planning can help maintain connectivity between leopard cat populations and their habitats.

Through this reforestation program, REEPS still have access to habitats and survive despite the UCPS hydropower plant. This reforestation program can reduce leopard cats' habitat overlap with built-up land and intraspecific competition. Reforestation programs also influence leopard cats' habitat preferences. It will affect habitat characteristics, such as vegetation structures supporting leopard cats in hunting prey, breeding, shelter, etc.

The existence of restoration areas will restrict local people's land use, thereby impacting their livelihoods. Therefore, to achieve the BMP objectives and support the livelihoods of local people, the Forest Partnership Framework (FPF) was arranged. The FPF is aimed to mitigate and reduce adverse impacts caused by restrictions

on access to natural resources in restoration areas. This FPF also ensures that project-affected communities who meet specific requirements will be assisted in restoring their livelihoods while simultaneously being involved in preserving the environment and the integrity of the restoration area.

At the same time, project-affected communities participate and are involved in implementing the Action Plan (AP). This policy refers to the Minister of Forestry Regulation no. P-39/Menhut-II/2013 concerning Empowerment of Local Communities through Forestry Partnerships. Community empowerment through the Forest Partnership aims to enable local people to gain direct benefits through strengthening capacity and providing access, participating in sustainable forest management, and gradually developing into independent and responsible economic actors.

The regulation explains that Perhutani, especially the Forest Management Unit (KPH), is responsible for mitigating social impacts and preparing Forest Partnership agreements with local people to improve the community's socio-economic status. Local community refers to local communities that fulfill administrative requirements as well as local communities that live in and around forests, whose livelihoods depend on forests, and whose activities can impact forests. Because of these regulations, PT. PLN collaborates with Perum Perhutani to implement FPF. The principles set out in the FPF are the basic guidelines for the Forest Partnership Action Plan (FPAP), which aims to deal with the community regarding commodities allowed to be collected/harvested, planted, or cultivated from BIA, corridors, and buffer zones.

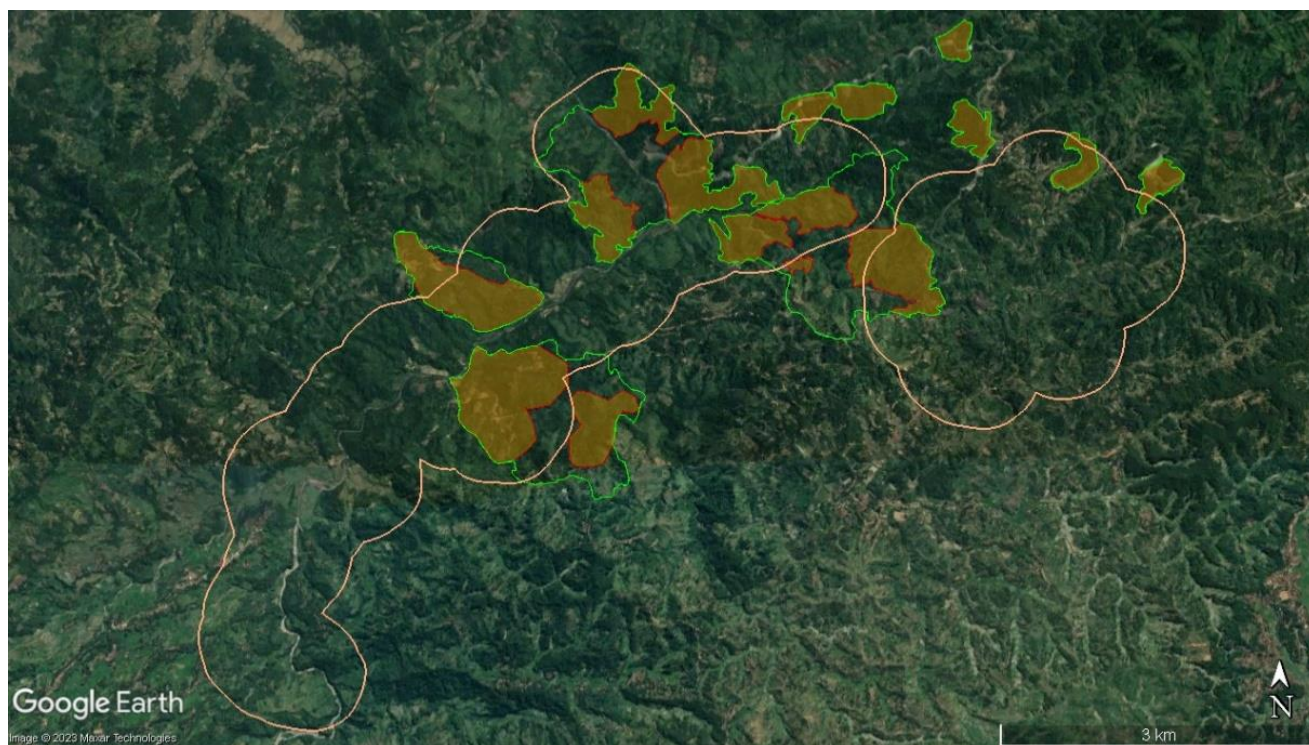


Figure 5. Working Zone 1, 2, and 3; ■ : BIA and Working Zone 1; □ : Working Zone 2; □ : Working Zone 3

In conclusion, the protection effort of leopard cats was conducted through stakeholder participation in the UCPS area. As the initiator, PT. PLN involves various stakeholders related to the construction of the UCPS hydropower plant, including Perum Perhutani, contractors, and the local people. PT. PLN protects leopard cats by managing the impacts produced by the UCPS hydropower plant and biodiversity.

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