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# Efforts for Conservation of Raptor and Their Habitat in Indonesia: Case Study at Kamojang Geothermal Area

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**ABSTRACT**

Indonesia is well known as one of the countries that have mega-biodiversity, including raptors or birds of prey. One of the critical habitats for the top predator, Javanese Hawk-Eagle is Kamojang Nature Reserve. This Nature Reserve is also becoming a wintering area for many raptor species from northern and eastern Asia. On the other side, the Kamojang geothermal field was located and developed at Kamojang Nature Reserve area. This field is essential as a pioneer for geothermal energy development in Indonesia, from which have been operated for more than thirty five years. Furthermore, as part of the CSR program, PT Pertamina Geothermal Energy (PGE), in collaboration with the Indonesian Ministry of Environment and Forestry c.q. Nature Resource Conservation Agency of West Java (BBKSDA) and Indonesia Raptor Research and Conservation Network (RAIN) had established the Kamojang Raptor Conservation Center/Pusat Konservasi Elang Kamojang (PKEK Conservation Center) since 2014. The PKEK center has programs for rehabilitation facilities and education for the past five years. Since then, the center received 183 eagles from confiscation, private owners, and translocation. Currently, the PKEK Conservation Center r has released thirty three eagles return to the wild, and it is expected that will run their ecological and biological functions in the ecosystem. Raptor is top predator in wildlife's food-chain. Therefore, they become an indicator of the health of the ecosystem in their home-range and territory, which is dominated by tropical rainforests. The healthy and quality of tropical rainforests in Indonesia is not only significantly contribute to the survival for the raptor and other wildlife species, but also to the sustainability of geothermal development in Indonesia

## 1. INTRODUCTION

Indonesia is traversed by two young mountain ranges of the world, namely the Mediterranean Mountains to the west and the Pacific Circum Mountains to the East. These two mountainous routes allow for Indonesia to have many active volcanoes, which is often referred to as The Ring of Fire. Indonesia is also a source of geothermal energy which can be as renewable energy (Bappenas, 2016); one of them is the Kamojang Geothermal Area, West Java Province.

The Kamojang Geothermal area is the oldest geothermal development in Indonesia, and it is the first geothermal exploration phase that started in 1918. In the 1980s, Pertamina was appointed by the Government of Indonesia (GOI) to conduct a survey and explore the area for geothermal potential. The Kamojang Geothermal area became an early milestone in the development and commercialization of renewable energy sourced from geothermal steam in Indonesia (Mansoer & Indral, 2015). Currently, the Kamojang Geothermal Area is managed by Pertamina Geothermal Energy, and the power plants have produced a total capacity of 235 megawatts.

WWF (2013) reported that most of the geothermal resources in Indonesia are located in forest zones where the biodiversity is required to be conserved to provide balanced ecosystem. One of the fauna which displays the biodiversity richness of Indonesia are raptors or birds of prey that live in Indonesia. There are 81 species of diurnal raptors found in Indonesia and, depending on taxonomic views, 10 to 17 of these are endemic (Supriatna et al., 2012). Bildstein et al. (1998) and Lees and Christie (2005) listed 16 and 17 species of raptors respectively as being endemic to Indonesia. This raptor endemism is the highest in the world and reflects biodiversity richness possessed by the region. More importantly, this archipelago should be viewed as being the world's top priority for the conservation of the tropical rainforests on which those raptors are exclusively dependent. Every year, 100,000s of raptors migrate from their breeding ground in the northern part of Asia through East Asia to their wintering areas. From a total of 56 species of migratory raptors in Asia, 25 species are recorded in Indonesia. (Purwanto, et al. 2015). As a high-end predator in the food chain, (REF) it is also necessary to conserve other prey by maintaining the stability of other animal populations and preserving their habitat, In order to protect the population size of eagles.

Furthermore, human activities lead to increased illegal hunting, and deforestation, particularly in the Kamojang nature reserve (Nur et al., 2015). Javanese eagle is an endemic species of prey in Java (Andrew, 1992; Ferguson-Less & Christie, 2001). This species is facing the risk of extinction due to forest degradation that has changed its designation and illegal hunting for wildlife trade (Sözer et al., 1998). This species is categorized as "endangered" in the Red Data Book (BirdLife International, 2017). The remaining population of Javanese eagles on Java Island is predicted to be 325 pairs (Syartinilia et al. 2009).

In order to address the issues, through cooperation and partnership, Pertamina Geothermal Energy (PGE) collaborated with Indonesia Raptor Research and Conservation Network (RAIN) and the Indonesian Ministry of Environment and Forestry c.q. Nature Resource Conservation Agency of West Java (BBKSDA) to establish *Pusat Konservasi Elang Kamojang* (PKEK) or the

Kamojang Raptor Conservation Center to facilitate conservation, education and promotion program on raptors. The PKEK Conservation Center was founded in 2013. And Since then it has, created the multiplier effect of growing biodiversity awareness, researches, enhancing raptors return to their habitats as well as increasing number farmers for prey supply.

This paper presents the existence of the PKEK Conservation Center to achieve three aspects of sustainable dimensions in the Kamojang nature reserve.

## 2. THE KAMOJANG RAPTOR CENTER (PKEK)

### 2.1 Mapping and Problem Analysis

SWOT analysis offers a tool for identifying internal and external factors, which is proven to be useful if a company or institution wishes to strengthen its long-term strategy (Chandler, 2017). Preliminarily, the tool evaluates the resource perspective, which includes the strengths (S) and the weaknesses (W) from internal aspects. On the other side, the institution's strategy can be evaluated by identifying present external aspects as Opportunities (O) and Threats (T)

In order to strengthen the strategy for PKEK Conservation Center development, SWOT analysis was conducted to determine the current strategy, strength, and weaknesses of the program. IUCN Guideline was also referenced as part of the analysis for endangered species (Sutherland et al., 2018), as follow:

- Land and water management: site management (habitat protection, habitat restoration, and creation)
- Species management: species management & recovery (General responses to small/declining populations, Captive breeding, rearing and releases (ex-situ conservation)
- Education & awareness: awareness-raising & communications
- Research: population size, distribution & trends, life history & ecology, actions
- Threat: residential and agriculture development, transportation and service, biological resource use, human intrusions and disturbance, natural system modifications, pollution, climate change, extreme weather, and geological events.

Figure 1 shows SWOT analysis has been taken by the Partnership of three institutions, namely BKSDA, RAIN, and PGE. The most critical threats and weaknesses of the PKEK Conservation Center are forest degradation illegal wildlife trade and the few existing sources of information and success story of PKEK, respectively. The strength of the center is the capabilities of the role of each party. The identified opportunities are the expected ecosystem recovery around the Kamojang nature reserve, enhancement of biodiversity awareness, education, and values increase of the PKEK Conservation Center program from the stakeholders.

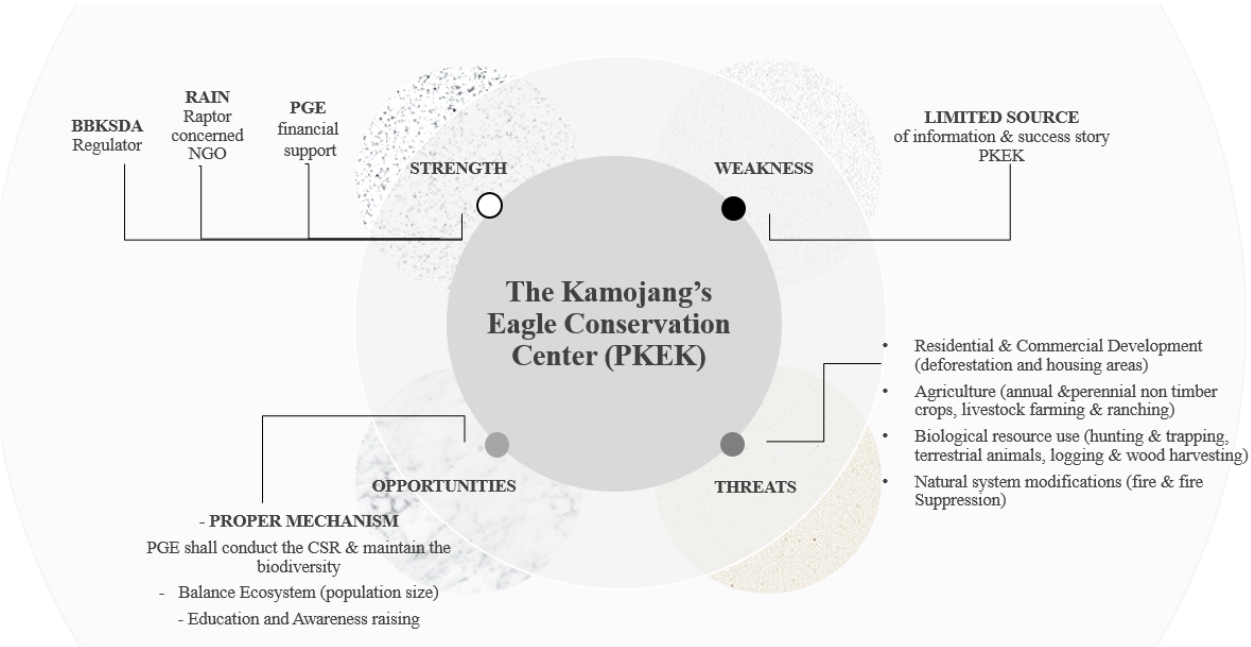


**Figure 1: SWOT Analysis for the Kamojang Raptor Conservation Center.**

Based on the analysis, the Kamojang's Eagle PKEK Conservation Center was established for species management and preservation as the primary focus, research, education, and awareness.

### 2.2 Establishment of the Kamojang Raptor Conservation Center

The Government of Indonesian (GOI) through the Ministry of Environment and Forestry has assigned 25 endangered species as the top priority. They set a target of increasing the population size by 10 % (ten percent) in 2015-2019, one of the species is Javan Hawk-eagle (*Nisaetus bartelsi*). The GOI has also issued a Minister's Regulation Number: P.58 / Menhut-II / 2013 concerning the Strategy and Action Plan for the Javan Eagle Conservation for 2013-2022.

PGE's company policy is rooted in the strategy to increase the company's commitment to a CSR policy and environmental sustainability. It includes aspirations that relate to all three dimensions of sustainable development, which consist of social,

economic, and environmental aspects. The PKEK Conservation Center is one of PT Pertamina Geothermal Energy Area Kamojang's CSR Programs. The Center was selected to fulfill the company policy on sustainability aspects as well as contributing to the GOI program for endangered species. This program was initiated in 2013 and was further established on 2014 by PGE, BBKSDA, and RAIN Indonesia.

The Elang Kamojang Conservation Center collaborated agreement among three parties was made to stabilize the Javanese eagle population in nature. Activities of the conservation is attached in Appendix A

Each party provides different roles for the collaboration BBKSDA provides a place for conservation facilities and support through relevant regulations. PGE constructed facilities of the Conservation Center in Kamojang Nature Park and have been financially supporting on PKEK management. RAIN as a non-governmental organization has been assisting technical management of the Conservation Center.

### 2.3 Management of Confiscated Eagles

The International Union for Conservation of Nature (IUCN) Guideline for Reintroduction and Other Conservation Translocation and IUCN Guideline for Placement of Confiscated Animals was adopted in the PKEK Conservation Center (PKEK, 2014).

Figure 2 shows the scheme of resource and management for eagle management. PKEK Conservation Center received eagles from confiscation, illegal trade, private owners, and translocation. There are several possible options which can be considered for eagle conservation, namely: returning the animals to the wild, maintaining animals in captivity, and the last option is to euthanize the animals, i.e., humanely put them to death. The rehabilitation program and captive breeding follow the IUCN Guidelines for Re-introductions (IUCN, 1998); the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Guidelines for the Disposal of Confiscated Live Species of Species (Resolution Conf. 10.7); the IUCN Guidelines for the Prevention of Biodiversity Loss Due to Biological Invasion.

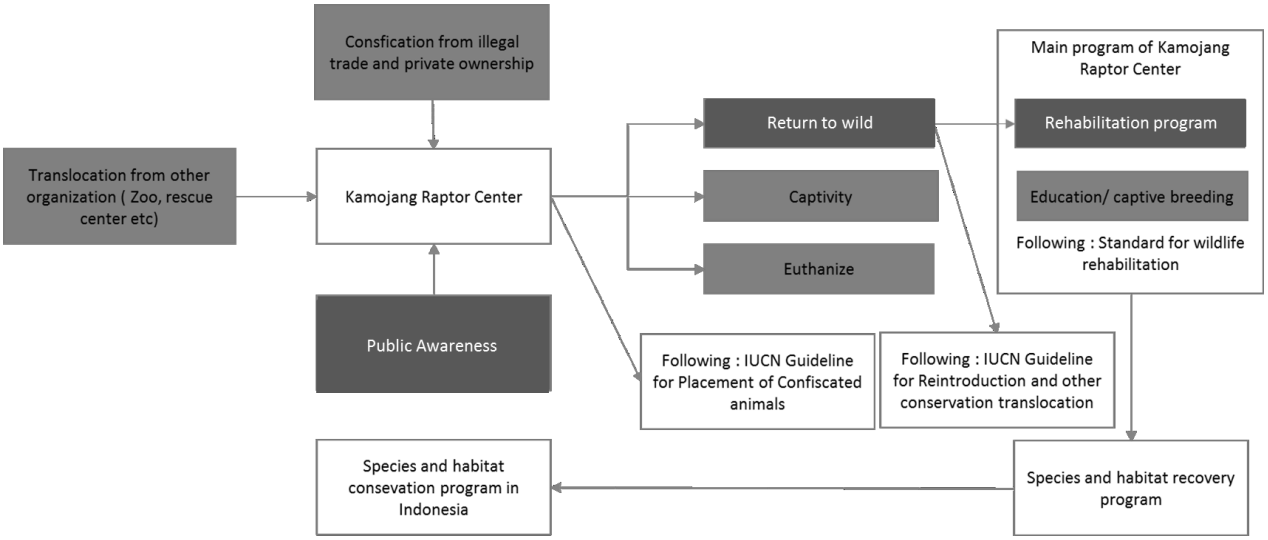


**Figure 2: Scheme of resource and management of eagle at Kamojang Raptor Center.**

### 2.4 Three Dimensions of Sustainable Development

The triple bottom line concept is applied to describe results and multiplier effects on the sustainability dimension for the existence of PKEK. This concept consists of the social aspect, environmental (ecological) aspect, and financial aspect.

#### 2.4.1 Social Dimension

United Nations Educational, Scientific and Cultural Organization (UNESCO) presented the purpose of environmental education activities is to encourage community to attain knowledge, skills, attitudes that can eventually foster awareness, commitment, and to create new behavioral patterns. These actions aim to develop environmental ethics, and improve the quality of life (UNESCO. 1997). These actions are in line with purposes of PKEK conservation center in the educational aspect, which is to increase awareness for the community.

In this context, the social dimension highlights the participation from the community, which can be monitored based on the number of eagles received by PKEK, the number of visitor to the PKEK raptor center and the number who participate as volunteers or for unpaid internship. This social aspect interprets the community participation as values creation for local people who have realized the crucial aspects of the existence of eagles in nature and their habitat. In the long run, it's a balanced ecosystem shall be recovered in the Kamojang nature reserve.

Figure 3 shows that PKEK Conservation Center has received 183 eagles since 2014, consisting of four types of eagle's collection in the PKEK Raptor Center where those collected due to public awareness having the highest number (137 = 75%), followed by those collected from the confiscation and private owners by, law enforcement (25 = 14%); from translocation from other institutions (19 = 10%) and those rescued from nature (2 = 1%). The Variety of eagle's conserved in the PKEK Conservation Center is Javan

Hawk-eagle (*Nisaetus bartelsi*), Changeable Hawk-Eagle (*Nisaetus cirrhatus*), and, Crested Serpent Eagle (*Spilornis cheela*) and *Spilornis Cheela malayensis.*

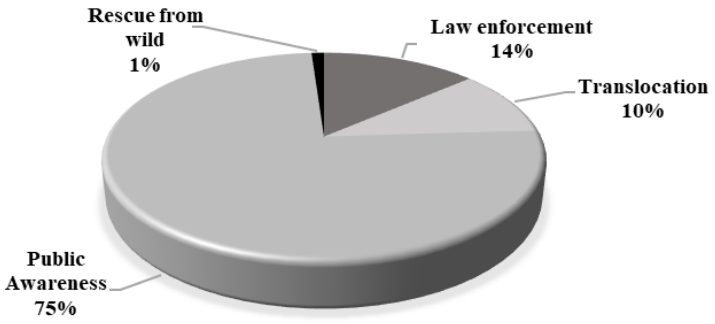


**Figure 3: Source of the eagle collected at Kamojang Raptor Center during 2014-2018; (N=183).**

In the last four years, there are 40,618 people that visited the PKEK Raptor Center. The participant numbers are growing over the year with various backgrounds from practitioners, teachers, students, researchers, and the surrounding community. In the PKEK program, it can be seen that education and promotion program to society successfully lead to the increasing awareness towards biodiversity around the Kamojang nature reserve. Additionally, it also leads to increasing community understanding on the benefit of the bird raptor species (Figure 4).

During the operation of the center, the PKEK Raptor Conservation involves enlisting participants in to volunteers to develop its vast network of conservation actors. The range of conservation actors they integrate into their operation activities is derived from different backgrounds such as community volunteers, students, teachers, journalists, and entrepreneurs. There are thirty seven registered actors for assisting trade investigation, field activities (surveys, post-release monitoring), education promotion and rehabilitation activities (i.e., cleaning cages or feeding the birds).

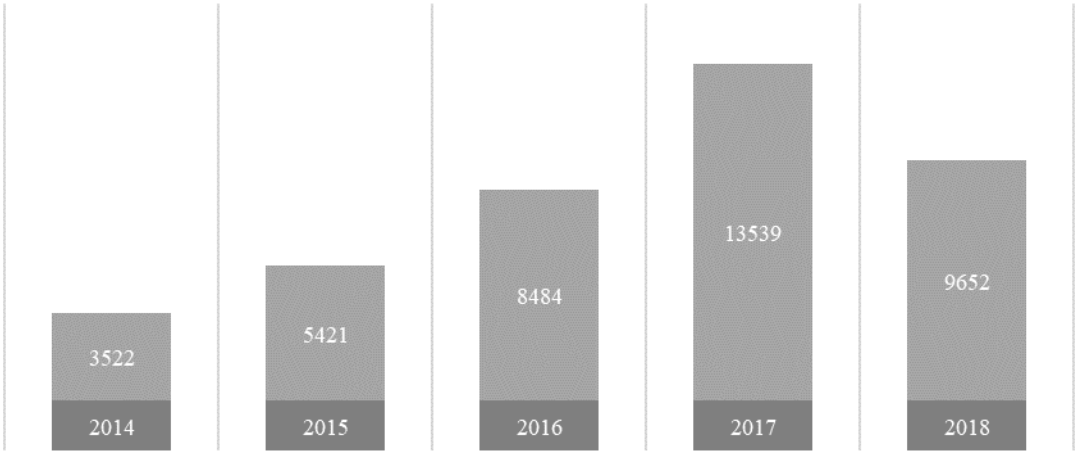


**Figure 4: Number of the visitor to Kamojang Raptor Center in 2014-2018, N= 40.618 persons.**

2.4.2 Environmental Dimension

As discussed earlier, the PKEK Conservation Center has developed programs dedicated to specific raptor conservation issues: rehabilitation and preparing the birds to be released into their natural habitat.

One of the issues the PKEK Conservation Center presently is working on is the protection of raptor bird species. In Asia, there are 90 types of eagles, where 80 species of them can be found in Indonesia (Lees & Christie, 2005).

The environment dimension is captured through number eagles released into the environment, and the Center has released 33 eagles return to the wilderness and it is expectd that theys will run their ecological and biological functions in the ecosystem. The such birds consist of Javanese Hawk-eagle (*Nisaetus bartelsi);* Changeable Hawk-eagle (*Nisaetus cirrhatus*); Crested Serpent Eagle (*Spilornis cheela*); Crested Goshawk (*Accipiter trivirgatus*); Spotted Kestrel (Falco Moluccensis) and barred eagle *(Owl Bubo Sumatranus).*

The purpose of this release a political statement, education on animal fate, and promotion of local conservation values. 2). increase the long-term conservation potential of species and regions. 3). restoring the ecological role and function and biology of released animals.

Subsequently, after releasing the birds into their habitat, post-release monitoring is an essential part of the conservation program. This post-release monitoring of birds eagle was carried out intensively for twenty one days. The eagles survive using a variety of habitat in the Kamojang Nature Reserve area, where 80% of the habitat is forest, including primary forest (19%), secondary forest (33%) and cultivated forest (28%). Other habitat types consist of plantation areas (16%) and settlements (4%) (Figure 5).

The released eagles have filled and occupied several areas in the Kamojang Nature Reserve as their home. The birds have a variety of behaviors and physiological processes to adapt to the environment. To maintain their lives, they carry out vigorous activities, conduct competition, and work together to get food, protection, and breeding (Alikodra, 2002). Their behavior is an indication that the released eagles have carried out their functions as a critical species of a top predator that regulates the balance of the food chain in an ecosystem.

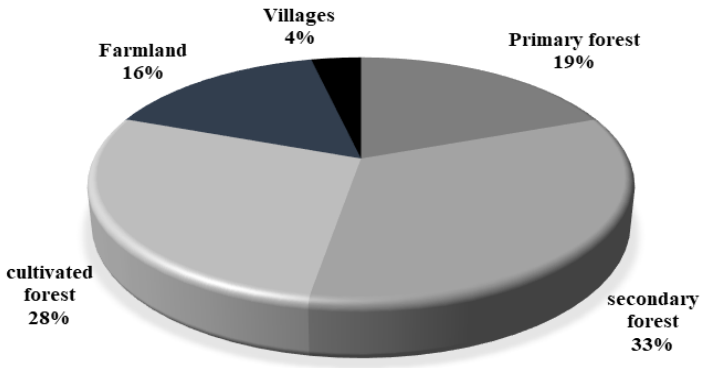


**Figure 5: Habitat used by the released eagles at Kamojang Nature Reserve.**

In addition, reforestation program is conducted by PGE Kamojang in coorporated with local community. The program to support the bird eagles released to their habitat. This is also as part of company commitment on sustainability ecosystem in the Kamojang Nature Reserve and geothermal resources. Also, the PGE Kamojang has prepared the plant nursery. The nursery plays important role in the propagation and growth of the Kamojang endemic seeds in to plants of desirable sizes, including the *Engelhardia Spicata* which known as Javan Eagle Hawk natural habitat for nesting and perching (Djohan and Suhesthiningsih, 2013). Reforestation of 55,000 endemic plant seeds was conducted during a period of 2016-2017 at eagle's habitat around the Kamojnag Nature forest, which are location at Cipateungteung and Kamojang well pad of KMJ-32. This activity resulting the succes ratio of reforestation about 98%.

2.4.3 Economic Dimension

Investment values of the existence of PKEK raptor conservation and the benefit for the ecosystem in the Kamojang nature reserve have not studied yet. However, the Center presents economic dimension within the community involvement in the forms of supplying live prey such as quail or chicken, snakes, and live mice or rats. Currently, there are up to sixty farmers are involved it providing live prey to feed the eagles. This activity becomes an alternative income for the local community.

**2.5 Raptor Conservation Challenges and Efforts in Indonesia**

The authors' identified challenges on the conservation efforts, including habitat destruction, illegal hunting, wildlife trading, lack of Conservation Center facility, uncertainty of support continuity donors or in funding for conservation programs.

First, most of the problems faced by predatory bird communities are habitat destruction resulting from deforestation, forest degradation and forest fragmentation (Newton, 1990; Bildstein et al. 1998; Birdlife International, 2004; Nijman, et al. 2009; Rakhman, 2012). Nur et al. (2015) study showed that the land underwent some changes for human activities (91.10 %) and geothermal exploitation (8.9 %) in Kamojang. People were of the opinion that bird protection has not contributed to helping communities to overcome their economic problems, or protecting the environment creates conflict with efforts to improve people's lives (Setiadi, et al., 2000; Rakhman, 2012).

Second, illegal hunting and wildlife trading are the main threat to the raptor population in Indonesia (Bildstein et al. 1998; 2006; Rakhman, 2012). Gunawan et al. (2017) stated that around 2,471 eagles were sold through social media platform, namely Facebook from January to December 2015. The high level of trade and ownership of eagles in Indonesia is due to the low level of public awareness about the importance of eagle conservation efforts and their habitat in Indonesia. Besides, there is still a strong inherent view in most people that maintaining wild animals is a part of conservation (Rakhman, 2012).

The success of the rehabilitation program can be evaluated through two things which are health feasibility in wound healing and healing of diseases. The animal's success returns to wilderness (Hall, 2001). Some experts argue that the success of bird release can be seen from the success of breeding and producing offspring (Csermely, 2000). The successful release of rehabilitated animals can also be predicted based on the understanding biological and non-biological factors. These factors are relate to medical and physical readiness, stages of rehabilitation, release strategies, and available habitat. (Miller, 2012).

Third, the standard and facilities for conservation center do not only need to fulfill the prerequisites set by government regulations, but it should also pay attention to other aspects suggested by the SSC-RSG-IUCN (Species Survival Commission-Reintroduction Specialist Group-IUCN), which needs to considered several aspects of ecology, health, and animal welfare as well as the sustainability aspects of the rehabilitation program. Operational standards for procedures and adequate facilities in the management of confiscated animals also greatly influence the success of the release program (IUCN, 1998)

Fourth, new strategies and methods needs to be developed to increase the funding and find new donors for the conservation organization. Fortunately, there is no crucial need for more funding to subsidy the PKEK Conservation Center. However, it could be a challenge for other organizations to deliver their conservations goals and aid the overall impact of the conservation projects.

PKEK maintains the programs to carry out conservation education, awareness activities through various forms and media of education as well as to emphasize the importance of the Raptor is as the top predator in wildlife's food chain, so they become an indicator of their health-home ecosystem in their home-range and territory. The tropical rainforests in Indonesia are not only contributing to survival for the raptor and other wildlife species, but also for the sustainability of livelihoods for local people who are living in the area. Besides, the standard and minimum facilities of conservation programs at PKEK Conservation Center are expected to be a reference for the management of eagles in Indonesia.

## 3. CONCLUSIONS

Indonesia is endowed with rich biodiversity and abundant geothermal resources. The resources are a distinct advantage so that the government can sustainably utilize the gifts and inheritance to improve welfare. However, it is essential to put together relevant responsibilities to preserve the richness of biodiversity and natural resources for future generations

Efforts to increase the population of raptor endangered species, particularly the Javanese eagle requires human intervention to minimize the high rate of confiscated eagles and to release this species back to their habitat. Raptor is the top predator in wildlife's food chain, so they become an indicator of their home-range and territory health.

The health and quality of tropical rainforests in Indonesia are not only contributed to the survival of raptor and other wildlife species. However, it is also essential for the sustainability of geothermal development as the industry is dependent on the preservation of the surrounding environment.

The PKEK Conservation Center management is not only limited to conservation operations, facilities, and monitoring releasing eagles to the environment. It expects to maximize three aspects of sustainability dimensions, especially community involvement on biodiversity community awareness and enhancing local economic by embracing sustainable solutions.

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**APPENDIX A. KAMOJANG CONSERVATION ACTIVITIES**

**Information Center in PKEK Kamojang Conservation Center**

**Conservation Educational Activities**

**The Eagle Observation Cages in PKEK**

**Eagle handed over by the owner to the PKEK**

**A pair of Brahminy Kite had been rehabilitated at kamojang raptor center before release into their habitat**

**Javan Hawk Eagle, known as Garuda Pancasila - The National Symbol of Indonesia**

**Eagle Health Check by Vet**

**Post-release Monitoring Activity**