How to Conservate in Situ and Ex Situ Community Based Biodiversity Park in Sumedang Regency of West Java Province?

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Abstract. Indonesia is the largest archipelagic country in the world. It has tropical climatic conditions so there are many tropical rain forest ecosystems with a high level of biodiversity. Vegetation in tropical forests is relatively large makes it as one of the largest oxygen suppliers in the world. Biodiversity is widely used for various purposes of human life as food, clothing, and other necessities. However, along with scientific and technological advances, environmental problems can threaten the biodiversity, sometimes the awareness arises when biodiversity level has entered critical condition. Biodiversity Park in Sumedang Regency, West Java Province is one of conservation in situ and ex situ. This study aims to analyze in situ conservation efforts in biodiversity parks. This research uses survey method, where data is collected through observation, interview, literature study and documentation study which then analyzed descriptively. The biodiversity park in Sumedang Regency is a conservation area with in situ and ex situ functions on a legal basis. Conservation efforts undertaken are community-based. This is because many people are taking advantage of biodiversity in the biodiversity park to fulfill their various needs. Conservation efforts undertaken are more about building sustainable communities to participate in biodiversity conservation.

1. Introduction

Indonesia is the largest archipelagic country with a total of about 13,000 islands and is known for only five major islands of Java, Sumatra, Kalimantan, Sulawesi and Papua. Indonesia also has the second largest biodiversity rainforest in the world after Brazil. Unfortunately, behind the abundant natural wealth, there are still many problems related to the environment, due to the destruction of ecosystems as a result of human activities that are less concerned with environmental sustainability.

Specifically, the problems that are still encountered with regard to the environment such as clean water that is still difficult to find, high levels of air pollution, floods, landslides and many more. It shows the level of environmental damage, especially some parts of the ecosystem elements that are degraded or damaged. The dependence of human life on various types of plants is often only known when the species is almost or even extinct. One cause of the near extinction or extinction of a biological species is the loss of appropriate habitat for the life of the species concerned or loss of elements that help the process of breeding.
Each biological species has certain life requirements so that each has a limited distribution related to the availability of its life support requirements in certain species so that habitat conservation efforts in certain species are required to preserve them.

Besides tropical rain forests, Indonesia also have several ecosystems with biotic elements (flora and fauna) as well as abiotic elements such as air, soil and water that can be utilized i.e. peat forests, seasonal forests, prairie forests, and savanna. Tropical rainforest itself is relied upon as one of the world's oxygen or lung suppliers. The types and characteristics of these ecosystems can provide information on biodiversity in a region with biodiversity as a specific area resource on the surface of the earth that can be utilized for various purposes of human life.

Diversity is a mechanism that triggers community or ecosystem stability [1]. Therefore, the potential and sustainability of the ecosystem need to be maintained and known. Environmental problems are likely to increase over time, it because environmental damage caused by human activities in the excessive exploitation of natural resources, especially the loss of habitats of certain species that humans are already dependent on the species.

As well as logging in excess will negatively impacted to the region by other effects lead to disasters such as floods and landslides, resulting in soil becomes barren, as well as an increase in temperature of the earth (global warming) is happening not only in Indonesia but also almost all countries and more days will be more disturbing the community if not quickly overcome and the consequent is loss of habitat in a species of biodiversity that was apparently utilized by humans. Based on the phenomenon, it is necessary to hold an effort that aims to maintain the environment and natural resources, including maintenance of forests to remain sustainable. One form of environmental maintenance conducted by the government of West Java is the development of Kiara Payung Biodiversity Park.

Biodiversity Park in Sumedang District, West Java Province is one of the forms of in situ and ex situ conservation or the protection of the community-based biodiversity that exist in Indonesia and in it contained various biological potential that can be utilized for various human interests. Biodiversity park is designated as an Arboretum area and conservation forest in Kiara Payung, Sindangsari Village, Sukasari District, Sumedang with land area of about 15 hectares. Topography of that area is hilly and located in mountainous areas with a height between 25 meters to 1667 meters above sea level. Land status is determined by Governor Decree No. 593/Kep.821-BPLHD/2011 about the Determination of Biodiversity Park Location of West Java.

There needs to be a search effort on how ecosystem conditions are there and will help provide input on how should the effort to protect and conserve the ecosystem there. Based on the background that has been presented it can be concluded to take the title "How to Conserve In Situ and Ex Situ Community-Based Biodiversity Park in Sumedang District West Java Province?".

2. Methods

The method used in this study is a survey, where researchers come directly to the location of research and conduct data collection and analysis of the results of the analysis then will be made the report of research results in scientific papers. The biodiversity park is designated as Arboretum and Conservation Forest area in Kiara Payung, Sindangsari Village, Sukasari District, Sumedang Regency with a land area of about 15 Hectares.

Sumedang Regency itself borders with other districts and cities in West Java Regency of Indramayu in the north, Regency of Majalengka in the east, Regency of Garut, Bandung City in the west and Subang Regency in the west. It has 26 districts with distance from Bandung as the capital of the province is about 45 Km. Biodiversity Park which is still included in the complex of Kiara Payung Campground is located adjacent to Padjadjaran University, Bandung Institute of Technology at Campus Sumedang and Institute of Local Government.

Data collection techniques in this study include 1) observation to see first-hand the in situ and community-based ex situ conservation efforts conducted in the Biodiversity Park; 2) the interview is used to complete the role and participation of the community in the in situ and ex situ conservation efforts in the Biodiversity Park; 3) documentation studies from relevant agencies regarding in situ and
ex situ conservation efforts; 4) literature study ie various theories related to in situ and ex situ conservation efforts at research sites from various published scientific papers. Data analysis technique used in this research is descriptive analysis that do description in a structured and systematic based on data obtained at research location.

3. Results and Discussion

3.1 History of biodiversity park in tropical forests ecosystem

Biodiversity Parks include to the Campgrounds area of Kiara Payung according to the name of the region which is located in Kiara Payung Street, Sukasari District, Sumedang Regency, West Java Province with tropical rain forest ecosystem and a high level of biodiversity.

Tropical rain forests (Tropical rain forest or mountain rain forest) is very interesting, is the climatic climax ecosystem [2]. The plants present in this forest never shed their leaves, the condition is very varied as there is a flowering, some are changing, some are in germination or are in the level of life according to the nature or behavior of each type of plant. Geographically, the area of tropical rainforest covers an area between the turning point of the Cancer star and the constellation Capricornus, that is an area between 23°27'LU and 23°27'LS. Based on the net primary productivity of the tropical rain forest is the highest compared to other regions, which reached 1000-3500 g / m² / year, followed by a tropical monsoon forest that reaches 1000 to 2500 g / m² / year [3].

Kiara Payung Campground itself is a forest area that has the function of conservation as well as the function of tourism. Besides that Kiara Payung Campground is a Scout Region West Java Scout, where this place is often used as a camping center for scouts. Even Kiara Payung Campground has also been used as a scout activity both internationally and nationally, for example the National activities, i.e. Jamboree in 2006 which was attended by approximately 50 thousand participants from various regions in Indonesia. In addition, Kiara Payung Campground itself is often used as a camping place from several schools / institutions / institutions that conduct scouts or other camping events.

The biodiversity park of West Java Province is set in Arboretum and Conservation area in Kiara Payung, Sindangsari Village, Sukasari District, Sumedang Regency, West Java Province. The land area is 15 Ha. Topography of hilly and mountainous areas with altitude between 25-1667 meters above sea level. Meanwhile land status determined by Governor Decree No. 593 / Kep.821-BPLHD / 2011 on the Determination of Biodiversity Park Location of West Java. Road Access to the location is still very limited; there is no development of access road yet to the Biodiversity Park. Facilities and infrastructure that has been built in the location of the park that is a nursery, saung, water reservoir.

Institutional Biodiversity Park of West Java Province has been settled by the Decree of the Governor of West Java Number 660.1/ Kep.1085 / Yan-sos / 2015 on Management of West Java Biodiversity Park with the Trusting Agency are the Provincial Environmental Management Agency. Funding for the management of Biodiversity Park comes from Pupuk Kujang, CSR Pertamina and Ertiga Suzuki. It is Recorded that there are 187 species of local plants and the number of rare plant species in the region as many as 12 species.

3.2 Ecosystem in biodiversity park

Biodiversity Park is a reserve area of local biological natural resources outside forest areas that have functions as in situ and ex situ conservation, especially for pollination plants and / or seed dispersal should be assisted by animals with vegetation structure and composition can support the preservation of pollinating animals and seed dispersers (Rule Minister of LH No. 3 of 2012).

The development of Biodiversity Park aims to save a variety of native / local plant species that have a very high degree of threat to its sustainability or threats that result in its extinction (Art. 1, 3, LH 3). Kehati Park besides functioned as RTH border water source, also serves as an ex situ conservation area and in situ various species of plants and animals, especially native and threatened species (Gunawan and Sugianti 2015, pp 1829). Kiara Payung Biodiversity has a height of 1800 m above sea level; the region is designed with 5m x 5m cropping pattern, where each 1 hectare of land is
occupied by 400 plants of various species. Initially, the Biodiversity Park is a site for a wide range of conservation-related activities. So that the collection of existing plants in the Biodiversity Park variety of species [4] Some collection of plants in Biodiversity Park can see in figure 1.

Figure 1. Some collection of plants in Biodiversity Park.
Source: Observation Results, 2016.

The addition of plant collections in the Biodiversity Park continues to be carried out by BPLHD West Java Province, in connection with the continued development without maintaining the balance of the ecosystem. In its implementation, BPLHD West Java Province make Biodiversity Park as the center of local plant seeds. Other than as a seed center, Biodiversity Park also as a means of education and ecotourism. The ecosystem located in Kehati Park is a natural ecosystem in the form of Tropical Rain Forest. Tropical rain forest is an area characterized by lush and lush vegetation and rainfall and high temperatures along year. Tropical rain forest is the richest ecosystem in the world in terms of biodiversity. Despite coverage of less than 7 percent of Earth's land, tropical rain forests contain more than 50 percent of the world's animal and plant species.

Tropical rain forest is one of the oldest types of forest vegetation that has covered much of the land located at 10º LU and 10º LS [1].

Tropical rainforest ecosystems are formed by climatic vegetation in rainfall areas 2000-4000 mm per year, 25º C average temperature with small temperature differences throughout the year and 80% moisture averages. The type of tropical rainforest ecosystems is present in areas with climatic A and B types or it can be said that the type of ecosystem is located in an area that is always wet, areas with podosols, latosols, Alluvial, and regosol, with good drainage and located away from the beach [1].

Tropical rain forests (Tropical rain forest or mountain rain forest) is very interesting, is the climatic climax ecosystem [2]. The plants present in this forest never shed their leaves, the condition is very varied as there is a flower, some are changing, some are in germination or are in the level of life according to the nature or behavior of each type of plant. Tropical rain forests have vegetation that is typical of wet tropics and covers all the land surface that has a hot climate, sufficient rainfall, and evenly divided. Tropical Rain Forest Ecosystem at Kehati Park can see in figure 2.

Figure 2. Tropical Rain Forest Ecosystem at Kehati Park.
Source: Observation Results, 2016
The area of land with the lowest productivity is desert and the deserts are only 10-250 g/m²/year. Recorded as many as 187 local plant species and a number of rare plant species found in the region as many as 12 types, including buni (*Antidesma Bunius*), Gandaria (*Bouea Gandaria*), cassia (*Cinnamomum iners*), riots sintok (*Cinnamomum Sintoc*), manglid (*Manglietia glauca*) and jamblang Duwet (*Syzygium Cuminii*).

### Table 1. Primary Biosphere Productivity

| Ecosystem Types           | Primary Productivity (G/M²/Year) |
|---------------------------|----------------------------------|
| Tropical rain forest      | 1000-3500                        |
| Tropical Season Forest    | 1000-2500                        |
| Medium Climate Forest:    |                                  |
| Always Green              | 600-2500                         |
| Slow down                 | 600-2500                         |
| Borreal Forest            | 400-2000                         |
| Savana                    | 200-2000                         |
| Climate Medium Grassland  | 200-1500                         |
| Tundra and Alpine         | 10-400                           |
| Desert and Desert Bush    | 10-250                           |

Source: [5]

Productivity especially in the tropics is influenced by several factors, such as:

#### 3.2.1 Temperature

Temperature is a very important environmental factor for all living things. Temperature is also an environmental factor that often operates as the limiting and most easily measured factor (Fatchan 2013, pp. 70-71)

Much of the temperature in this region ranges from 20-28 °C (Walter, 1981). Global radiation varies based on atmospheric, latitude, and altitude [5]. Air temperatures in tropical rain forest areas never fall to the point of freezing (0°C) but at very high temperatures where temperatures fall almost to the frozen point, but vit is ery rarely [6].

The average temperature in most areas is 27 °C, and the monthly temperature range is 24-28 °C, thus this seasonal temperature range is much smaller than the day and night temperature range which can reach into 100.

Maximum temperatures is rarely reach 38°C also rarely fall to below 20°C [7]. Based on the average annual temperature gradient, the productivity will increase from the poles area to the equator [8], but for rainforest temperatures, the temperature is not the dominant factor that determines productivity, but the duration of growing season [9].

In Kiara Payung Biodiversity Park Forest, the air temperature is around 28-30°C with temperate climate ferguson. The Schmidt-Ferguson classification system is well known in Indonesia and is widely used in annual crops, using a comparison value (Q) between the average number of dry months (Md) and the average number of wet months (Mw) in one year. This classification does not include the element of temperature because it considers the amplitude of temperature in the tropics is very small, to determine the dry and wet months then the category is as follows:

- **Dry Moon:** If in one month has rainfall <60 mm.
- **Moist month:** If within one month has rainfall 60-100 mm.
- **Wet Moist:** If in one month has rainfall> 100 mm.

#### 3.2.2 Sunlight

Light is an essential factor for photosynthesis, and light is also necessary for some reproductive processes. The climate of light in a place depends on the duration of irradiation, the timing, the intensity, and the quality of light received [10]. The area of tropical rain forests receives more annual sunlight available for photosynthesis than with temperate climates [11]. This is due to 3 factors:

- The axis of the earth's axis causes the tropics to receive more sunlight than in the outer atmosphere compared to the temperate climates.
- The passage of sunlight in the thinner atmosphere (due to a more perpendicular angle in the tropics), reduces the amount of rays absorbed by the atmosphere. In tropical rainforest areas, 56% to 59% of sunlight at atmospheric boundaries can reach the soil surface.

- Period of growth, which is limited by the ambient temperature is longer in the tropical rain forest areas (except in areas of very high)

3.2.3 Rainfall. The amount of rain, especially which is falling in an area for a year, is an important factor, as rainfall determines the availability of water for growth and other vital processes. The less rainfall, there is a tendency for more plants with properties to help inhibit water [10]. Very good sunlight in Kehati Forest can see in figure 3.

![Figure 3. Very good sunlight in Kehati Forest.](image)

Source: Observation Results, 2016

In tropical rainforest areas the amount of rainfall per year ranges from 1600 to 4000 mm with wet wetland distribution of 9.5-12 wet months [6]. This condition makes this region has an even rainfall most of the year that will support high productivity.

3.2.4 Soil. Soil is a factor in the tropics that does not support high productivity. The soil in tropical rainforests is very old soil, except for volcanic soil. The Pleistocene period has no effect on the soil here, and it is likely that the soil here comes from the Tertiary period [9]. The soil contained in Kehati Forest Kiara Payung is laterite soil with pH 3-4 and low nutrient content and very sensitive to disturbance. The laterite soil is the soil whose nutrients have been lost, because the element has been carried by a fairly high rainfall. The laterite soil itself has a characteristic red color, not infrequently laterite soil is also referred to as red soil. The laterite soil is formed from a wet, cold, or water-soaked environment. If it is specifically seen laterite soil has a deep soil profile, containing organic matter, neutral to acid pH, easy to absorb water, and certainly many contained iron and aluminium. Since laterite soils are easy to absorb water, laterite soils are well used for building foundations.

3.3 Conservation development efforts in situ and ex situ in the biodiversity park
Initially the land in Kehati Park is owned by the government and organized by the community. People use this land as plantation. However, based on morphological conditions, if the land is still used as a plantation, it will trigger the occurrence of landslides. Here is a figure 4 and 5 Land Used Plantation Utilization by the Community.

![Figure 4. The laterite soil is a form of soil contained in Kehati Kiara Payung Forest](image)

Source: Observation Results, 2016
The development of Taman Kehati aims to save a variety of native / local plant species that have a very high degree of threat to its sustainability or threats that result in its extinction (Art. 1, 3, LH 3). Kehati Park in addition to functioning as RTH border water source, also serves as an ex situ conservation area and in situ various species of plants and animals, especially native and threatened species. Collection of existing plants in the Biodiversity Park of various species [4].

Based on RTRW, the land should be a recharge area. So eventually the land is taken over by the government to restore its original function (the recharge area). Regional Environmental Management Agency (BPLHD) West Java Province in cooperation with Kehati Foundation to manage the land into a protected forest which became known as Taman Kehati.

Now community-based conservation in that biodiversity Park has begun to be encouraged, although not all elements of society have been involved. Communities at previous time as farmers in the area, empowered by BPLHD and Kehati Foundation to participate in the conservation of the area's socialization. Some people refused to participate in the socialization that was held by BPLHD and Kehati Foundation. Those communities who rejected this activity partly become “naughty”. They damaged some of Taman Kehati facilities, such as nurseries. The nets of iron nurseries are damaged by the community.

Even, according to one of the managing teams from Kehati Foundation, there have been incidents of community burned the forest to open plantation land. Some trees planted by Taman Kehati management also can not grow because around the place of planting trees are grass that was planted by the community for fodder. Now, however, such incidents was decreased. Here are pictures of a damaged plant nursery. Figure 6 show a perforated metal mesh.

![Figure 5. Terraces Former Plantation Society before Becoming Conservation Forest (Kehati Park). Source: Observation results 2016.](image)

**Figure 5.** Terraces Former Plantation Society before Becoming Conservation Forest (Kehati Park). Source: Observation results 2016.

**Figure 6.** The red circle shows a perforated metal mesh. Source: Observation results 2016.

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Agency (BPLHD) West Java Province in cooperation with Kehati Foundation to manage the land into a protected forest which became known as Kehati Park.

The pro community and participate in the socialization activities about that was held by BPLH and Kehati Foundation have finally aware that environmental conservation is very important to support sustainable human life. Economically, this activity has not resulted yet in an increase in the economy of the community. However, ecologically, the environment is sustainable and flora and fauna are protected from extinction. Overall Conservation of Kehati Park can see in figure 7.

Reciprocal of community availability to participate in preserving Kehati Park, the community is allowed to take forest products. Many people are taking grass to feed cattle and plant crops such as coffee, onions, chili and cabbage. The utilization for this plantation on condition that society should not disturb government owned trees. Grassroots Community for Animal Feed and land use by the community for the plantation can see in figure 8 and figure 9.

![Figure 7. Overall Conservation of Kehati Park. Source: Observation results 2016.](image)

![Figure 8. Grassroots Community for Animal Feed. Source: Observation results 2016.](image)

![Figure 9. Figure of land use by the community for the plantation. Sources: Observations, 2016.](image)
3.4 Improving conservation in situ and ex situ with building sustainable communities

Park development on Biodiversity Park is good. Park management involved local communities consist of ± 20 people and has been added by the member of Karang Taruna at local village. The community have the training and knowledge about the animals and plants in the Biodiversity Park and given the opportunity to become a Guide when there are visitors who come to the Biodiversity Park. However, the legality of the community who helps manage the Biodiversity Park is still unclear.

One of goal of the Biodiversity Park development is develop outdoor recreation facilities (ecotourism). The initial phase of this development has done, namely in the form of training for the community to be a Guide. However, public facilities necessity for tourism such as the mosque and lodging are still not completed yet. The village where Sindang Sari Village Park is placed is potential to be developed into a Home Stay. Travelers who come there do not have to look for lodging far from the Garden of Biodiversity. In addition, the development of indigenous cultures and local wisdom are also need to developed, so that tourists who travelled to the Park has a diverse destination tourist destination. This will certainly be an addition to a tourist attraction to visit.

Knowledge, skills, and concerns of local communities must also be increased. In order to provide certainty that people have the ability and knowledge in the management of natural resources, it would require an effort that is able to provide enhanced skills and awareness of society to participate actively, responsive and effective in the process of community-based natural resource management.

4. Conclusions

Biodiversity Park in Sumedang Regency originally is an area with land managed by the community, the lack of public awareness in environmental preservation made the government took over the region to serve as a conservation area that has function as an area of conservation in situ and ex situ tropical rainforest which also have a legal basis to protect the biodiversity exist there.

In situ conservation efforts that are in the research area is to empower communities to manage and use its land with regard to sustainability, raise awareness continued with socialization and education for the community and develop ecotourism in it. Meanwhile the ex situ conservation efforts carried out by planting a variety of commodities and non-cultivation in that region which did not utilize by the local community. Based on what has been described above, the biodiversity park is should have maintained as a conservation area and continue to be developed which should involve investors from the private sector to maximize conservation and ecotourism development in the Biodiversity Park.

References
[1] Indriyanto 2012 Forest Ecology (Jakarta: Earth Literacy)
[2] Irwan and Z Djamal 2010 Principles of Ecosystem Ecology, Environment and preservation (Jakarta: Earth Literacy)
[3] H J Weidelt 1995 Tropical Natural Forest Silviculture (Groningen: Institut Fuer Waldbau)
[4] Roemantyo and Noerdjito 2012 Precautionary Wildlife Collection Development Evaluation of West Java Province Bandung
[5] R H Whittaker and G E Likens 1975 The Biosphere of Man. In Primary Productivity of the Biosphere. Edit by: Lieth and Whittaker (New York: Springer-Verlag)
[6] E Warsito 1999 Study of Ecological Classification of Tropical Rain Forest Case Study in West Lombok Dissertation (Yogyakarta: PPS etc. Gadjah Mada)
[7] D J Mabberley 1983 Tropical Rain Forest Ecology (Glasgow and London: Blackie)
[8] M G Barbour, J H Burk and W P Pitts 1987 Terrestrial Plant Ecology (California: The Benjamin / Cumming Publishing Company Ins)
[9] H Walter 1981 Ecology of Tropical and Sub-Tropical Ecology (New York: Van Nostrand Reinhold Co)
[10] Suharini, Erni and A Palangan 2014 Biogeography (Yogyakarta: Waves)
[11] M Wiharto 2009 Tropical Rain Forest Vegetation productivity. [Online]. Available: www.irthebest.com. Accessed December 12, 2016