

## Conservation of Pine Forest Biodiversity Resources in the Districts

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### Abstract

Biodiversity is the foundation of human life because everyone needs it to sustain life as a source of food, feed, industrial raw materials, cosmetics, and medicines. Indonesia is one of the countries with high biodiversity (fauna and flora), equivalent to Brazil in the Americas and Zaire in Africa or the Democratic Republic of the Congo. Indonesia is also one of the countries with the largest biodiversity in the world, and this biodiversity resource can be utilized by the community to meet the needs of clothing, food and shelter. One of the reasons for this high level of biodiversity is Indonesia's status as an archipelagic country, with islands located along the equator. The problem is how to conserve pine forest biodiversity resources in Bogor. The research method used is descriptive qualitative and theoretical research methods. The research aims to preserve biodiversity in the Bogor area by implementing legislation at both the central and provincial levels so that it can be utilized by the community to meet the needs of clothing, food, and shelter.

**Keywords:** Conservation, Resources, Biodiversity and Pine Forest in Bogor

### Introduction

Biodiversity is the foundation of human life because everyone needs it to support life as a source of food, feed, industrial raw materials, cosmetics, and medicines. Biodiversity is the diversity between organisms from all sources, including other terrestrial, marine, and aquatic ecosystems and ecological complexes as part of their diversity, including diversity within species, between species, and ecosystems. Indonesia is one of the countries with high biodiversity (fauna and flora), equivalent to Brazil in the Americas and Zaire in Africa or the Democratic Republic of the Congo. WCMC., (1994). Indonesia's natural wealth includes 27,500 flowering plant species (10% of all plant species in the world), 515 mammals (12% world mammal species), reptiles and amphibians (16% of all reptiles and amphibians in the world). One of the reasons for this high level of biodiversity is Indonesia's status as an archipelagic country, with islands located along the equator. Ecosystem level, species level, and genetic level (Steffen W., at all., 2009).. An ecosystem is a unit formed from the reciprocal relationship between living things (biological components) and their environment (non-biological components). Each ecosystem has a characteristic physical environment, chemical environment, vegetation types, and animals types, (Delacote, 2012; Niu et al., 2020; Samanci, 1996). The environmental conditions of these organisms are very diverse. These different ecological conditions lead to different types of organisms that inhabit them. This diversity is called ecosystem-level diversity. Diversity at the species level is the level of diversity

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that is easy to see. The existence of various types of plants, animals, and microorganisms indicates diversity at the species level. Species are a collection of individuals who are morphologically, physiologically, or biochemically different from other groups with specific characteristics. The next is diversity at the genetic level. Genes are hereditary material in the chromosomes that control the characteristics of living things. Genes are found in the nucleus of every living cell. Genes in living things have the same basic set but different arrangements (Amiro et al., 2010; Curtis, Slay, Harris, Tyukavina, & Hansen, 2018; Kim & Choi, 2020; Zhao, Kong, Escobedo, & Gao, 2010). Gene-level diversity gives rise to variation between individuals within a species. Genetic resources as a form of biodiversity are genetic material consisting of plants, animals, microorganisms, or others, which have the ability to inherit traits, (Orians GH and Milewski AV, 2019). In plants, genetic resources are found in seeds, tissues, other plant parts, as well as young and mature plants. In animals or livestock, genetic resources are found in tissues, other animal parts, semen, eggs, embryos, live animals, both young and adults. With Indonesia's high level of biodiversity, the potential for diversity of genetic resources is also abundant, where its distribution covers various regions. Each region in Indonesia has several unique genetic resources, which are often different from those in other areas. The decline in biodiversity in Indonesia and globally continues, (Myers N., at., all, 2000). The causes may stem from the pressures of population growth, poverty, economic system, and socio-political conditions, which encourage the conversion of land into biodiversity habitats and the over-collection of biodiversity, (Myers N., at., all, 2000). This causes a decrease in the ability of ecosystems to provide environmental services. The impact is the emergence of various disasters such as rainy season floods, dry season droughts, forest fires, and the loss of food and medicine germplasm resources, which causes a decrease in food production for human welfare. The problem is how to conserve pine forest biodiversity resources in Bogor to reduce the threats. The research method used is descriptive qualitative and theoretical research methods. This research aims to conserve biodiversity in the Bogor area by implementing legislation at central and provincial levels.

### **Biodiversity**

Biodiversity is the diversity between organisms from all sources, including other terrestrial, marine, and aquatic ecosystems and ecological complexes as part of their diversity, including diversity within species, between species, and ecosystems. Biodiversity can be seen from three levels: diversity at the ecosystem level, species level, and genetic level. An ecosystem is a unit formed from the reciprocal relationship between living things (biological components) and their environment or non-biological components, (Steffen W., at al., 2009). Each ecosystem has a characteristic physical environment, chemical environment, vegetation types, and animal types. The environmental conditions of these organisms are very diverse. Biodiversity is the diversity between organisms from all sources, including other terrestrial, marine, and aquatic ecosystems and ecological complexes as part of their diversity, including diversity within species, between species, and ecosystems. Biodiversity can be seen from three levels: diversity at the ecosystem level, species level, and genetic level. An ecosystem is a unit formed from the reciprocal relationship between living things (biological components) and their environment or non-biological components, (MEAE, 2005). Each ecosystem has a characteristic physical environment, chemical environment, vegetation types, and animal types. The environmental conditions of these organisms are very diverse. Genes in living things have the same basic set but different arrangements. Gene-level diversity gives rise to variation between individuals within a species. Genetic resources as a form of biodiversity are genetic material consisting of plants, animals, microorganisms, or others, which have the ability to inherit traits, (MEAE, 2005).

In plants, genetic resources are found in seeds, tissues, other plant parts, as well as young and mature plants. In animals or livestock, genetic resources are found in tissues, other animal parts, semen, eggs, embryos, live animals, both young and adults. With Indonesia's high level of biodiversity, the

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potential for diversity of genetic resources is also abundant, where its distribution covers various regions. Each region in Indonesia has several unique genetic resources, which are often different from those in other areas. Until now, the decline in biodiversity in Indonesia and globally continues. The causes may stem from the pressures of population growth, poverty, economic system, and socio-political conditions, which encourage the conversion of land into biodiversity habitats and the over-collection of biodiversity. This causes a decrease in the ability of ecosystems to provide environmental services. The impact is the emergence of various disasters such as rainy season floods, dry season droughts, forest fires, and loss of food and medicine germplasm resources, which causes a decrease in food production for human welfare, (Walker B, Kinzig A, Langridge J.,1999).

Pine trees have long been planted in various places in Indonesia as reforestation plants. As a pioneer plant that can grow in various conditions and its main product as a producer of sap, pine is widely planted by Perum Perhutani on the island of Java. Pine forests have been widely developed on the island of Java since the days of Dutch colonial rule. Almost all pine tree parts can be used, including the trunk that can be tapped to extract the sap. The sap from the pine tree itself can be processed into a paint thinner. While pine wood is useful for construction, matches, paper, and so on, the aroma of pine trees is often used for therapy. Not only that, there are various other benefits that you can take from the presence of pine trees for both your health and industrial needs. Like other regions in Indonesia, Bogor region cannot be separated from the problem of biodiversity loss. Locations where biodiversity is concentrated, such as forests and coral reefs, are becoming increasingly narrow and destroyed. This situation requires the authorities to immediately take concrete steps to protect, restore, and sustainably use the biodiversity in Bogor while ensuring the function of environmental services can continue to function, (Walker B, Kinzig A, Langridge J.,1999).

### **Biodiversity Resources Sustainability Act**

Law of the Republic of Indonesia number 5 of 1990 concerning Conservation of Biological Natural Resources and Their Ecosystems Considering: (a) that Indonesia's living natural resources and their ecosystems, which have an important position and role for life, are a gift from God. Therefore, it needs to be managed and utilized in a sustainable, harmonious, harmonious, and balanced manner for the welfare of the Indonesian people in particular and mankind in general, for now, and the future; (b) that the development of living natural resources and their ecosystems is essentially an integral part of sustainable national development as the practice of Pancasila; (c) that the elements of living natural resources and their ecosystems are interdependent with each other and influence each other so that the damage and extinction of one element will result in the disruption of the ecosystem; (d) that to maintain the utilization of living natural resources can take place in the best possible way, it is necessary to take conservation measures so that living natural resources and their ecosystems are always maintained and able to achieve balance and are attached to the development itself; (e) that the existing and still valid statutory regulations are legal products inherited from the colonial government, which is partial in nature. Hence, they need to be repealed because they are not following legal developments and national interests; (f) that the existing laws and regulations on national legal products have not fully accommodated and regulated the conservation of living natural resources and their ecosystems; (g) that concerning the above matters, it is deemed necessary to stipulate provisions regarding the conservation of living natural resources and their ecosystems in law, it is necessary to remember, comply with and implement: (1) Article 5 paragraph 1, Article 20 paragraph 1, and Article 33 of the 1945 Constitution. (2) Law Number 5 of 1967 concerning Basic Provisions of Forestry (State Gazette of the Republic of Indonesia Year 1967 Number 8, Supplement to the State Gazette Number 2823). (3) Law Number 4 of 1982 concerning Basic Provisions for Environmental Management (State Gazette of 1982 Number 12, Supplement to State Gazette Number 3215). (4) Law Number 20 of 1982 concerning Basic Provisions for the Defense and Security of the Republic of Indonesia (State Gazette of 1982 Number 51,

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Supplement to State Gazette Number 3234) as amended by Law Number 1 of 1988 (State Gazette of 1988 Number 3, Supplement to the State Gazette Number 3368). (5) Law Number 9 of 1985 concerning Fisheries (State Gazette of 1985 Number 46, Supplement to the State Gazette of the Republic of Indonesia Number 3299).

### Method

The method used in this research is the descriptive qualitative method and literature research method (library study). Secondary data were taken from several locations in Bogor region. The area of Bogor Regency has an area of ± 2,664 km<sup>2</sup>. Geographically, it is located between 6°18'0" – 6°47'10" South Latitude and 106°23'45" – 107°13'30" East Longitude, with varied regional morphological types, from the relative lowlands in from the north to the highlands in the south, the lowlands about 29.28% are at an altitude of 15-100 meters above sea level (asl), which is a downstream ecological category. Wavy plains about 43.62% are at an altitude of 100-500 meters above sea level, the middle ecological category. Around 19.53% of mountainous areas are located at an altitude of 500 - 1000 meters above sea level, an upstream ecological category. The high mountain area is about 8.43% located at an altitude of 1,000 – 2,000 meters above sea level, which is an upstream ecological category, and 0.22% is at an altitude of 2,000 – 2,500 meters above sea level, which is an upstream category. In addition, the morphological conditions of Bogor Regency are mostly highlands, hills, and mountains, with the constituent rocks dominated by volcanic eruptions, which consist of andesite, tuff, and basalt. The combination of these rocks is classified as a relatively permeable rock type where its ability to absorb rainwater is quite large. This type of rock weathering is relatively prone to soil movement when it gets high rainfall. Furthermore, the type of soil cover is dominated by loose volcanic material that is somewhat sensitive and very sensitive to erosion, including Latosols, Alluvials, Regosols, Podsolics, and Andosols. Therefore, some areas are prone to landslides. Climatologically, the area of Bogor Regency includes a very wet tropical climate in the south and a wet tropical climate in the north, with an average annual rainfall of 2,500 – 5.00 mm/year, except for the northern region and a small part of the eastern region with less than 2,500 rainfall mm/year. The average temperature in Bogor Regency is 20° - 30°C, with an annual average temperature of 25°. The air humidity is 70%, and the wind speed is quite low, with an average of 1.2 m/second with evaporation in the open area an average of 146.2 mm/month. While hydrologically, the Bogor Regency area is divided into 7 (seven) watersheds: Cidurian, Cimanceuri, Cisadane, Ciliwung, Kali Bekasi, Cipamingkis, and Cibee. In addition, there are 32 government irrigation networks, 794 rural irrigation networks, 93 ponds, and 96 springs. Data of the biodiversity physical condition in Bogor area is the Mekarsari Fruit Park, the Botanical Gardens of the National Park Region, the Diversity of Flora, the Diversity of Fauna, and the Pine Forest, as shown in table 1. Below.

**Table 1. Biodiversity of Pine Forest in Bogor,**

<b>Biodiversity of Pine Forest in Bogor</b>					
<b>Pine forests</b>	<b>Mekarsari Fruit Garden</b>	<b>Botanical Garden</b>	<b>National Park Area</b>	<b>Flora</b>	<b>Pine forests</b>
Mount Pancar, Loji, Sekar Wangi, Cibereum, and Puncak	It has an area of 264 hectares. - Sightseeing train and entrance	-Experimental garden for plantation crops An organized forum for scientists, especially in botany, in Indonesia.	Mount Gede-Pangrango National Park and Mount Halimun	45 families divided into 115 plant species. The most dominant species in	Deer, Mammals, Birds, Amphibians /reptiles, and Fish

Jahim Ciamis	ticket One of the world's largest prime tropical fruit centers and an increasingly rare kemang plant	Natural parks that are maintained for scientific purposes, education and recreation (tourism) and conservation, education, research, nature tourism, and environmental services	Salak National Park	the TKL area are Damar (Agathis bornensis) and Kemang plants that are increasingly rare
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Source: Arsyad., (2011)

## Results and Discussion

### Types of Biodiversity

#### *Mekarsari Fruit Garden*

Mekarsari Fruit Garden is one of the largest centers of biodiversity conservation for tropical fruits in the world, especially select types of fruits collected from all over Indonesia. Mekarsari Fruit Garden collects about 1,400 fruits, where visitors can educate about plants. This Fruit Garden has an area of 264 hectares. To get around the Mekarsari Fruit Garden, you can use the traveling train facilities. Entrance tickets are very affordable and can be purchased for IDR 25,000. Meanwhile, to get around Rp. 15,000, the rest will get one fruit that can be harvested, visitors can enjoy the fruit that is being harvested such as gac and jambu zero jamaica. Visitors can also buy fruit where they cannot pick. Visitors can also enjoy education about rare fruits such as nutmeg, cocoa, lobbies, peanut butter, kola fruit, and so on. There are also rare fruits that are the starting material for making food and drinks, such as kola fruit. This kola fruit is used as the basic ingredient for soft drinks. There is also cocoa fruit used for education for small children as an ingredient for making chocolate, nutmeg, which is often used for sweets and cooking spices, and lobi fruit which is usually made into sweets and salad. These rare fruits typically come from Indonesia, spread from various regions such as Irian (Papua), NTT, Java, and Sumatra. There is one unique fruit from the various kinds of rare fruit, namely berenuk fruit. Humans cannot consume this fruit, but the flesh of this fruit can be used as plant fertilizer.

#### *Bogor Botanical Garden*

At first, this garden will only be used as an experimental garden for plantation crops introduced in the Dutch East Indies. But in its development, the establishment of the Bogor Botanical Gardens can be said to have started the development of science in Indonesia and as a forum for scientists, especially in the field of botany in Indonesia, in an organized manner. From here, several other scientific institutions were born, such as the (Bibliotheca Bogoriensis, 1842); (Herbarium Bogoriense, 1844); (Cibodas Botanical Gardens, 1860); (Treub Laboratory, 1884), and (the Museum and Zoology Laboratory, 1894). Based on its history, botanical gardens in the past cannot be separated from the emergence of plants science (botany) in the Renaissance. Until before the 16th century, most botanical gardens in Europe were established primarily for medicinal purposes. So, more or less a kind of living pharmacy. The Bogor Botanical Gardens itself can be regarded as the ancestor of the botanical gardens in this country. From the Bogor Botanical Gardens, some other botanical gardens were born, such as the Cibodas Botanical Gardens in Cimacan, West Java, the Purwodadi Botanical Gardens in Pasuruan, East Java, and the Bedugul Botanical Gardens in Tabanan, Bali. The Bogor Botanical Gardens currently has a fairly complete collection in its development. Recorded on the LIPI Botanical Gardens

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Conservation Center site, Bogor Botanical Gardens has a wealth of flora, with details of 213 families, 1202 genera, 3156 species, and 12,141 plant specimens.

In today's modern times, botanical gardens are natural parks maintained for scientific, educational, and recreational (tourism) purposes. Usually, a botanical garden stands side by side with a research center on flora. So far, there are about 1,800 botanical gardens spread across 150 countries. Botanical gardens have an important function as a bank (germplasm) of various plant species, ranging from common, rare, and endangered plants. We are lucky enough to have some botanical gardens, which store various plants native to Indonesia and those outside Indonesia, (Departemen Pertanian, 2008). Bogor Botanical Garden Pillars, (Bogor Botanical Garden, 2020):

- a. Conservation  
Preserving the diversity of plant species ex-situ (conservation outside the natural habitat) as a reference collection of high scientific value for the development of potential for sustainable use, as well as being used as an important backup for efforts to restore plant species threatened with extinction and restore degraded lands.
- b. Education  
Presenting clear information for visitors to increase knowledge in botany, conservation, environment, and plant utilization; and stimulate the growth and development of public awareness, concern, responsibility, and commitment to plant conservation.
- c. Research  
Carry out and facilitate various research and development activities in the fields of conservation, domestication, and reintroduction of plants and economic botany.
- d. Natural tourism  
Creating natural tourism that has scientific content and refreshing and inspiring to support a better social life.
- e. Environmental Services  
Provide an ecological impact for improving environmental quality, including water management, biodiversity, carbon sequestration, and landscape beauty.

### *National Park Area*

The geographical location of the Bogor area is found in many hilly and mountainous areas, including, (Colwell, R. K., 2009):

#### 1. Gunung Gede-Pangrango National Park

Designated as a national park in 1980, Gunung Gede Pangrango National Park (TNGGP) has an important role in the history of conservation in Indonesia. With 22,851.03 hectares, the TNGGP area is covered by mountainous tropical rainforest. The purpose of establishing this area as a national park is to protect and conserve its flora and fauna ecosystem. As the name suggests, this national park has two twin peaks: Peak Gede (2,958 masl) and Peak Pangrango (3,019 masl). The two peaks are connected by a saddle-like mountain ridge at an altitude of 2,400 meters above sea level, known as the Rhino Cage area. Mount Pangrango, which is higher, has a relatively smooth peak cone, typical of a relatively young mountain. Meanwhile, Mount Gede is lower but more active, with four active craters: Ratu Crater, Wadon Crater, Lanang Crater, and Baru Crater. TNGGP is famous for its rich mountain forest flora. At an altitude of 1,500 meters above sea level to the peaks of Gede and Pangrango, there are approximately 870 species of flowering plants, 150 species of ferns, and up to 200 species of orchids are recorded. TNGGP is also rich in fauna. TNGGP is a habitat for various types of wildlife, such as giant ladybugs, a type of beetle, more than 100 types of mammals such as deer, forest dogs, leopards, skunks and 250 species of birds. This area is also the habitat of the Javan Gibbon, Surili and Lutung, and Javan Eagle, whose populations are nearing extinction.

#### 2. Mount Halimun Salak National Park

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With an area of 40,000 hectares, Mount Halimun National Park is designated as one of the national parks in Indonesia, following the Decree of the Minister of Forestry number 282/Kpts-II/1992 dated February 28, 1992. However, based on the condition of forest natural resources, which are increasingly threatened with destruction, there is pressure from parties who care about nature conservation. So in 2003, the Halimun area increased its area by including the Mount Salak forest area. And finally, Mount Halimun Salak National Park (TNGHS) was established according to the Decree of the Minister of Forestry number 175/Kpts-II/2003 with a total area of  $\pm$  113,357 ha as of June 10, 2003.

GHSNP covers a mountainous area, and the two highest peaks are Mount Halimun (1,929 masl) and Mount Salak (2,211 masl). More than 700 types of flowering plants live in GHSNP, which includes 391 genera from 119 tribes. In GHSNP, there are also 13 species of rattan and 12 species of bamboo. For its orchid collection, TNGHS has 258 species belonging to 74 genus.

For wildlife living in GHSNP, there are various types of ecosystems in which various types of rare and protected fauna are habitats. Historically, this area was once the habitat of the Javan rhino (*Rhinoceros sondaicus*) and the Javan tiger (*Panthera tigris sondaicus*). There are 61 species of mammals, some of which are endemic to Java and endangered species. Endangered species that can still be found include the Javan leopard (*Panthera pardus melas*), jungle cat (*Prionailurus bengalensis*), Javan gibbon (*Hylobates moloch*), surili (*Presbytis comata*), langur (*Trachypithecus auratus*), ajag or coyote (*Cuon alpinus javanicus*), skunk (*Mydaus javanensis*) and slow loris (*Nycticebus coucang*). In addition, TNGHS also has 244 bird species, equivalent to 50% of the number of bird species that live in Java and Bali. GHSNP is an important area for saving the Javan eagle (*Spizaetus bartelsi*), Javanese faded (*Apalharpactes reinwardtii*), Javan ciung-mungkal (*Cochoa azurea*), Javan plop (*Otus angelinae*), and Javan sparrow (*Padda oryzivora*), as well as various other types of animals, (Dandang, B. and W. Handayani, 2015).

### *Diversity of Flora in Bogor.*

In the Bogor area, there are 45 families divided into 115 plant species in the flora group. The most dominant species in the TKL area is Damar (*Agathis bornensis*), with an INP value of 11.19%. The level of diversity of flora species in the TKL area is in the high category, with a biodiversity index value (H') of 3.88. The types of individuals that exist are evenly distributed with an average evenness index of 0.81. In the TKL area, there are 16 key species, including three species with 'critical' status from the Dipterocarpaceae tribe: *Hopea bancana*, *Hopea bilitonensis*, and *meranti seminis* (*Shorea seminis*); One species is protected under Permen LHK No. 106 of 2018, namely red palm (*Cyrtostachys lace*); and bisbul tree (*Diospyros blancoi*), which is known as a flora characteristic of Bogor City. The Bogor area has unique flora, namely *Rafflesia Arnoldi* and Kemang plants in Bogor district. *Rafflesia* is a genus of parasitic flowering plants. He was found in the Indonesian rainforest by an Indonesian guide who worked for Dr. Joseph Arnold in 1818. It was named after Thomas Stamford Raffles, the expedition leader. It consists of approximately 27 species (including four as yet fully identified as identified by Meijer 1997), all of which are found in Southeast Asia, on the Malay peninsula, Borneo, Sumatra, and the Philippines. This plant has no real stems, leaves, or roots. *Rafflesia* is an endoparasite in vines of the genus *Tetrastigma* (family Vitaceae), spreading its root-like haustorium in the vines' tissue. The only part of the *Rafflesia* plant that can be seen outside its host plant is the five-crowned flower. In some species, such as *Rafflesia arnoldii*, the flowers may be more than 100 cm in diameter and up to 10 kg in weight. Kemang (*Mangifera kemanga*) is a rare plant in Indonesia. It is said that the name of this mango-like tree is the name of the Kemang area in Jakarta. The Kemang tree, which has a distinctive fruity smell with a sweet and sour taste, has also been designated as the identity flora of Bogor regency, West Java. Unfortunately, this plant is getting rare

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and hard to find. This increasingly rare Kemang plant is often considered the same species as the binjai, but some experts separate it into different types, (Afriani, D., 2012).

### *Diversity of Fauna in Bogor*

#### 1. Deer Group

In addition to having a unique flora, Bogor City also has a unique fauna or animal; it is a deer. Deer are one of the characteristics of the Bogor Palace. If you play or just pass through the Bogor Palace, you will definitely see deer playing near the fence or on the grass field. This Bogor deer comes from India to Sri Lanka. During the British Governor-General around 1814, deer were brought to Bogor to occupy the palace grounds by Thomas Stamford Raffles. Initially, there were only six deer at the Bogor Palace, until June 2011, the number has reached 650. The capacity of the Bogor Palace to accommodate the deer is only 500. To overcome the problem of the overpopulation of deer, the Bogor Palace manager will distribute the excess 150 deer to several government agencies or social foundations to be kept in a representative location. The physical characteristics of this deer are brown body hair with white spots. The body weight of an adult male deer ranges from 50-70 kg, and an adult female deer weighs 40-50 kg, with a gumba height of about 90-100 cm, (Saiful Rumakar1, at.al., 2019).

#### 2. Mammals Group

Monitoring activities of flora and fauna in Bogor through inventory and identification of dynamics of flora and fauna species (especially vertebrate animals in the TKL area) so that the structure, composition, and diversity of flora and fauna species are known since 2013. Members of the survey team involved 6 (six) experts for the taxa of mammals, birds, herpetofauna (reptiles and amphibians), and plants. Monitoring surveys are conducted at 13 locations with observation paths for fauna along the 4.25 km. Important findings and notes from the results of the flora and fauna monitoring survey in the TKL area, including 1) mammal taxa recorded 8 species from 6 families and 4 orders, 2) bird taxa recorded 18 species from 14 families from 7 orders, 3) taxa recorded Reptiles recorded 7 species of reptiles from 5 families of one order and 6 species of amphibians from 4 families of one order, 4) Order Odonata (dragonfly) recorded 4 species and Order Lepidoptera (butterfly) recorded 14 species. In the TKL area, there are indications of Sero Ambrang or beavers with a vulnerable status that need special attention, (Abdul. Haris, at al., 2014)

#### 3. Birds group

According to research, Telaga Warna is located in North Tugu Village, Cisarua District, Bogor Regency, and Cianjur Regency, with a total area of 549.66 hectares, steep, and bumpy terrain. Species diversity is the most fundamental research in ecology. One group of animals that can measure species diversity is birds because the level of bird distribution is uniform and sensitive to environmental changes. This study was conducted to determine the level of bird diversity in the area. The method used in this research is the bird observation point method and the nesting graph method of vegetation analysis. The results showed that there were 60 species of birds from 31 families. The birds with the highest Important Value Index (INP) were *Collocalia vulcanorum* (17.89), *C. linchi* (17.66), and *Surniculus lugubris* (14.30). The species diversity index ( $H'$ ) of birds is moderate ( $1 < 1.47 < 3$ ) with a low level of evenness ( $E$ ) ( $0.36 < 0.4$ ) and species richness of 9.58. The insectivorous bird group had the largest percentage (60.87%), while the nectarivorous and granivorous birds (2.90%) had the smallest percentage, (Biggs, J., at al., 2008).

#### 4. Amphibian/Reptile Group.

Research on amphibian diversity was carried out from March-June and November 2001 in the Bogor Botanical Gardens located in the center of Bogor city. Using the Visual Encounter Survey

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method, amphibian sampling was carried out at night at 25 sub-habitats in the Botanical Gardens. There are eight types of Anura from four families. The frogs found included *Bufo melanostictus* (found in all locations) and *Bufo asper* (nine locations) from the family Bufonidae; *Rana erytheae* (nine sites), *Rana chalconeta* (nine sites), *Limnonectes macrodon* (seven sites), *vejevarya limnocharis* (two locations) of the family Ranidae; *Microhyz achatina* (three sites) from the family Microhylidae and *Polypedates leucomystax* (three sites) from the family Rhacopridae. Several types of amphibians and reptiles have certain economic values for food, medicine, craft materials, or ornamental animals such as green turtles, rice field frogs, snakes, turtles, monitor lizards, and geckos, so overfishing without considering the size of the population of these species is feared to lead to extinction, (DS Yudha I., at al., 2015).

### 5. Fish Group.

The Bogor Regency Government is committed to advancing the ornamental fish cultivation sector, as stated by the Regent of Bogor Hj. Nurhayanti at the inauguration of the Center for Marketing of Non-Consumable Fish Products in Ciomas District, Bogor Regency in 2015. This Promotion Center was established to provide convenience to fishery business actors, especially ornamental fish businesses, in marketing their products. Within five years, the production of ornamental fish continues to increase. Ornamental fish production has increased by 109.82% since 2010, from 112 million to 243 million in 2015 (Disnakkan, 2015). This increase continued to grow in 2016, until the end of the year, ornamental fish production reached more than 250 million. There are more than 24 types of freshwater ornamental fish cultivated by the people of Bogor Regency, but there are 10 types of ornamental fish that are popular and most in-demand by the people of Bogor. The production of these 10 types of ornamental fish also continues to increase every year. (LIPI, Biology News, Journal of Life Sciences. 2017).

### *Pine Forest in Bogor.*

The pine forest is a destination that is often loved when the holidays arrive. Bogor is one of the cities that offers many indulgent Pine Forest tours. The cool air and the shade of the trees are the main attraction for tourists after being tired from work. This variety of Pine Forest destinations in Bogor can be the perfect vacation destination, (Afriani, D., 2012).

- a. Mount Pancar Pine Forest  
The Mount Pancar Pine Forest is one of the most visited tourist destinations by tourists because it has unique spots such as bird nests, wooden houses, and swings served for tourists. This destination is open 24 hours so Traveler Friends can camp
- b. Sekarwangi Pine Forest  
Located in Sukawangi Village and Warga Jaya Village, Sukamakmur District, Bogor Regency. One of the advantages of Cantang Malang is that it is located at an altitude of 1,000 to 1,200 meters above sea level, so the air is so cool. Not only presenting Pine Forest but Cantang Malang is also known to have other trees such as Teak.
- c. Loji pine forest  
The next Pine Forest is located in Pasir Jaya Village, Bogor, still in the same area as the Elang Loji Sanctuary, Halimun Salak National Park.
- d. Cibeureum pine forest  
Cibeureum is one of the Pine Forests that Traveler Friends can find not far from the animal conservation center, Taman Safari Indah, approximately 800 meters from Jalan Raya Jakarta-Puncak.
- e. Pine Forest Peak Jahim Ciamis  
This forest is usually only used as a rest area, so visitors have no tariffs or entrance tickets. Many families even bring lunch to eat together when visiting here. The cool air makes many residents even deliberately stop by to unwind after going through a long journey.

### Threats to Biodiversity in Bogor

(The World Conservation Agency's or IUCN, 2008), latest red list shows a third of Earth's inhabitant species are threatened with extinction. Recently, at the October 2008 IUCN conference, it was revealed that about 16,928 (38%) species are threatened with extinction out of a total of 44,838 species recorded. Amphibians and mammals are the most threatened animal groups. As many as 1,139 of the total 5,487 mammal species are in danger of extinction. Meanwhile, for amphibians, the figure is 1,983 species or 32% of the total species. Threats to biodiversity arise due to changes in land use and cover, species harvesting, entry of newcomers, air and water pollution, and climate change. The source of causes of these pressures comes from demographic, economic, socio-political, science and technology, and cultural factors.

- a. Changes in land use and land cover  
This pressure causes habitat loss for various types of plants and animals. Clearing forests for agricultural, mining, residential, and industrial lands has led to a decrease in the area of lowland forest ecosystems, mountain forests, swamp forests, mangroves, and karst forests.
- b. Overfishing of Species  
This pressure causes habitat loss for various types of plants and animals. Clearing forests for agricultural, mining, residential, and industrial lands has led to a decrease in the area of lowland forest ecosystems, mountain forests, swamp forests, mangroves, and karst forests.
- c. Water and Soil Pollution  
Disposing liquid waste from households and industries without prior treatment is very dangerous for various ecosystems, especially inland and marine waters. Polluted rivers can kill various types of aquatic biota, while polluted seas kill marine life and damage coral reef ecosystems. Pollution also threatens biodiversity in agricultural land through the excessive use of chemical fertilizers and pesticides.
- d. addition of newcomers  
Invasive newcomer species are considered one of the causes of the decline in biodiversity and cause economic losses..

### Pine Tree Benefits for Health

Pine forest is a type of forest with homogeneous plants. Pine trees themselves can only live in areas that have moderate climatic conditions. The existence of pine forests brings various benefits for health and industrial purposes. The benefits of pine forests for health are as follows, (De Foresta, H. And G. Michon, 1997):

- a. Contains Flavonoids and Vitamin C  
The first benefit of pine trees is related to flavonoids and vitamin C content. In the 1940s, French researchers found that pine bark and needle leaves contain a lot of vitamin C. Not only that, but they also found that pine trees are rich in antioxidants: flavonols and bioflavonoids. This compound is then extracted into Pycnogenol and marketed as a dietary supplement. Pycnogenol is also used as a jet lag drug, relieves blood circulation, knee pain, menstrual cramps, and even medications to improve memory in the elderly, (Y.Andi S. and W., Surakusumah, 2007).
- b. Relieve Muscle Pain  
The next benefit of pine trees is to relieve muscle pain. In this case, you can use pine oil to relieve muscle pain. The trick, add five drops of pine oil with two tablespoons of vegetable oil. Then massage on the part of the body that hurts the muscles. However, choose P. pinaster pine oil, not Scotch pine (*P. sylvestris*) because Pine scotch can irritate the skin.
- c. Reduce Stress  
In addition to relieving muscle pain, the following health benefit of pine trees is reducing stress. Research at Japan's Kyoto University shows that taking a 15-minute walk in a pine

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forest per day can reduce stress. If it is difficult to find pine forests in your area, this can be replaced by using pine or spruce essential oil. In addition to relieving stress, the smell of pine can also calm emotions.

### d. Cure Bronchitis

Pine's ability not only to reduce stress and calm yourself but also can relieve colds, sinuses, shortness of breath, and bronchitis. It's easy; add three drops of essential pine oil to a bowl of hot water. Then, cover your head with a towel and inhale the scent of pine through your nose and mouth, (Brady, N.C., and R.R. Weil., 1999).

### *Benefits of Pine Trees for Industrial Needs*

The planting pine trees on Java Island in the 1970s was initially intended to reforest vacant land. In addition, it is also intended as a preparation to meet the needs of wood in the paper industry. However, in its development, there were efforts to get other products in the form of sap. The tapped pine sap is then processed to produce gondorukem and turpentine, which are raw materials for advanced industries. Gondorukem is used as a raw material in the paper, ceramic, plastic, paint, batik, printing ink, polish, pharmaceutical, and cosmetic industries. Meanwhile, the most important are used as raw materials in the cosmetic industry, paint oil, a mixture of solvents, antiseptics, camphor, and pharmaceuticals. Apart from the sap, another part of the pine tree used for industrial purposes is the wood used for light construction, furniture, pulp, matches, and chopsticks. The pine flowers have now been processed into various crafts such as flower arrangements for party decorations, photo frames, and various other crafts that have fairly profitable selling power, (Prodi Kehutanan FP.UM Makassar, 2016)

### **Steps to preserve the pine forest.**

Indeed, there are many causes for the threat of biodiversity resources, especially pine forests in Indonesia. In addition, it is not easy to overcome the problems described previously. Some of the steps taken are using in situ and ex situ conservation methods. In situ conservation is the conservation of place or conservation of genetic resources in natural populations of plants or animals, for example, forest genetic resources in natural populations of tree species. This is a process of protecting endangered plant or animal species in their natural habitat or predators. In situ conservation methods are conducted by establishing nature reserves, national parks, and wildlife sanctuaries. Meanwhile, Ex-situ Conservation is conservation that protects rare plant and animal species by taking them from unsafe or threatened habitats by placing them in human protection. Ex-situ conservation methods are by establishing safari parks, zoos, botanical gardens, and collection gardens. However, several ways that can be applied to preserve biodiversity are by establishing nature reserves, establishing wildlife reserves, and providing punishment for people who destroy the preservation of biodiversity in Indonesia. The government has also made various efforts to preserve living natural resources and their ecosystems. Those various efforts carried out by the government, including increasing conservation and forest management as follows, (Prawesty Tunngul Damayatanti, 2011): (a) Increase the population of 25 endangered species (according to the IUCN red list of threatened) by 10 percent according to the 2013 baseline data to preserve biological natural resources and their ecosystems. (b) Optimizing the management of conservation areas covering an area of 20.63 million ha, including protection of essential karst, peat, and mangrove areas, (c) Prevention and control of forest fires quickly and well and reduce the number of forest fire hotspots; (d) Improving the quality of data and information on biodiversity.

Apart from the steps described above, several other steps can be taken: establishing Wildlife Sanctuaries, establishing Protected Forests, providing Sanctions and Punishments for those who destroy ecosystems, promoting biodiversity, establishing Nature Reserves, conducting outreach to the community regarding the importance of resource conservation, biodiversity resources, and create biodiversity protection areas.

## **Conclusion**

From the results and discussion, it is concluded as follows: (1) Threats to biodiversity in Bogor are not new but have existed for a long time, based on theory, responses from government and society. So it is necessary to overcome this pressure. It is necessary to maintain from the relief aspect, where there is already legislation at the central and provincial levels on efforts to conserve biodiversity. (2) The need for law enforcement on regulations to be perfected and enforced, as well as the government's commitment at the provincial or district/city level, is still considered weak, especially in the aspect of budget allocation for the preservation of biodiversity or the environment. (3) All of this will be maximized if the government and the community are aware of the importance of biodiversity so that it can be used better and reduce the threat of biodiversity.

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