Journal of Global Environmental Dynamics (JGED)

Contents list available at JGED website: *https://jurnal.uns.ac.id/jged*
ISSN: 2774-7727

Water Conservation Efforts at Indrokilo Botanical Gardens, Boyolali

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ABSTRACT. Conservation is a form of management effort in using the biosphere wisely in order to be able to obtain large profits in a sustainable manner for the survival of the present generation while maintaining the potential to meet future needs. Indrokilo Botanical Gardens is an ex-situ conservation area that plays a role in preserving plants using an ecoregional approach. This study aims to determine the form of water conservation efforts that have been carried out in the Indrokilo Boyolali Botanical Gardens (KRIB). The research method used is a survey, while the data collection techniques used are field observations and interviews with the KRIB management. The results of the study explain that the Indrokilo Boyolali Botanical Gardens have an important role in water and soil conservation efforts. Indrokilo Boyolali Botanical Garden has five functions, namely conservation function, education function, environmental service function, research function, and tourism function. Electrolysis Banyu Udan (EBU) and Rainwater Harvesting are water management systems in the Indrokilo Boyolali Botanical Gardens that play a role in overcoming flood and drought problems. The results of the study prove that the Botanical Gardens of Indrokilo Boyolali has a role in water conservation as evidenced by the existence of a group of plants that are included in the vegetation that plays an important role in preserving the springs in the form of the banyan tree (*Ficus benjamina*) and the Angsana tree (*Pterocarpus indicus Willd*). There are 9 species of bamboo vegetation in KRIB, this vegetation has an effect of 80-100% on the absorption of rainwater and ground water reserves for plants. Indrokilo Botanical Gardens does not only play a role in maintenance efforts outside the natural habitat for flora and fauna, but also related to environmental conservation efforts, especially conservation of water resources.

Keywords: bamboo, botanical gardens, ex situ, rainwater harvesting systems, water conservation.

Article History: Received: 2 September 2022; Revised: 26 September 2022; Accepted: 28 September 2022; Available online: 20 December 2022
How to Cite This Article: Maulidyna, A., Deanova, A. K., Nurwulandari, M. (2022). Water Conservation Efforts at Indrokilo Botanical Gardens, Boyolali. Journal of Global Environmental Dynamics, 3(3), 78-86.

1. Introduction

Conservation is a form of management effort in using the biosphere wisely in order to be able to obtain large profits sustainably for the survival of the current generation, while maintaining the potential to meet needs which will come. The use of natural resources to meet human needs in large quantities and for a long time has led to the emergence of the concept of conservation (De Royet et al., 2021). With the application of the right conservation concept, it is expected to be able to maintain human welfare in a sustainable manner. According to the Regulation of the Director General of Natural Resources and Ecosystem Conservation Numbe: P.11/KSDA/SET/KSA.0/9/2016 concerning Technical Guidelines for Drafting Management Zones or Management Blocks of Nature Reserves and Nature Conservation Areas, it is stated that conservation areas are areas designated as a nature reserve area and a nature conservation area. The important value of conservation areas is the existence of ecosystems, flora and fauna, habitats, landscapes, or historical sites that are prioritized in their management. In addition, conservation areas are useful in maintaining water sources, especially conservation areas in rain catchment areas in the mountains. Conservation is divided into two types, namely in-situ and ex-situ conservation. In situ conservation is the conservation of flora, fauna, and ecosystems carried out in their natural habitats so that they remain intact and all life processes run naturally. Ex-situ conservation is a conservation effort carried out by maintaining and breeding plant and animal species outside their natural habitat by means of species collection, maintenance, and cultivation (Efendi, 2018). An example of ex situ conservation is a botanical garden.

Botanical gardens are known as ex-situ conservation areas that have been able to survive for hundreds of years and have proven successful in preserving plants throughout the world. The Indonesian Botanical Gardens were developed based on an ecoregional approach that reflects the diversity of ecosystems and habitats of various plant species in Indonesia (Berliandaldo et al., 2021). Various types of plants that exist in Indonesia grow and develop in various forms of specific habitat types. The richness of plant species in Indonesia is estimated at 38,000 species or ranked 5th in the world. In order to maintain biodiversity in Indonesia, botanical gardens are developed under the management of provincial, district or city areas, hereinafter referred to as Regional Botanical Gardens. The development of Regional Botanical Gardens will continue to grow considering the enthusiasm of the region is so great that the target for the conservation of Indonesian plant species that

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are threatened with extinction should continue to increase (Witonoet et al., 2020). Management of the collection of botanical gardens in each region needs to be directed to emphasize the conservation of endangered plant species in the local area. Indrokilo Boyolali Botanical Gardens are included in the Regional Botanical Gardens whose management is managed by the Boyolali Regional Government by emphasizing the preservation of the diversity of plant species that have habitats in the Central Java and East Java areas

In the conservation area. Especially in Indrokilo Botanical Gardens, this effort is carried out in the form of soil and water conservation activities. Soil conservation itself is the placement of each plot of land in a way of use that is in accordance with the ability of the land and treating it according to the necessary conditions so that there will be no damage or land degradation (Wahyudi, 2014). Water conservation is the use of water that falls to the ground for agriculture or plant management as efficiently as possible and timing the flow of water by soaking water into the soil so that in the rainy season there is no flooding and in the dry season water for the needs of living things in the conservation area ecosystem is still available. Soil conservation has a close relationship with water conservation, because any treatment given to a plot of land in a conservation area will affect the water system in that area and in the downstream area. Soil and water conservation is important to avoid degradation of soil and water quality, such as loss of nutrients and organic matter in conservation areas, accumulation of salt in salinity areas or simply called collection of toxic compounds for plants, saturation of fresh water in roots or lower stems. a plant, and erosion disaster (Sumarmo et al., 2013). In addition, conservation also plays a role in avoiding the occurrence of degradation of water bodies such as drying up of springs, decreasing water quality due to erosion, sedimentation, mixed waste, and eutrophication. Through this conservation activity, it is hoped that it can be an effort to maintain and improve water quality so that it can be used sustainably.

Indrokilo Boyolali Botanical Garden was built in collaboration with the Indonesian Institute of Sciences (LIPI) with the Boyolali Regency Government which has been carried out since 2013 and was inaugurated in 2019. The Indrokilo Boyolali Botanical Garden is located in Kemiri Village, Mojosongo District, Boyolali Regency. This Botanical Garden has an area of 8.9 hectares which was previously a moor belonging to the village treasury. Indrokilo Boyolali Botanical Garden has the theme of lowland rain forest plants in East Java. The collection of plants contained in the conservation area of the Botanical Gardens consists of medicinal plants, local fruit plants, pruning plants, concert thematic plants, honorary plants, and boarding houses. The total collection owned by Indrokilo Botanical Gardens is 1683 species of specimens, 368 species, 267 genera, and 105 tribes. The diversity of flora collections in botanical gardens certainly requires optimal management in order to be sustainable. The availability of environmental resources as a support for flora life is an important thing that must be considered. Water resources are one of the factors that support the life of living things that are very vital, but are also vulnerable to pollution. The purpose of writing this research article is to find out the water conservation efforts that have been carried out in the Indrokilo Boyolali Botanical Gardens (KRIB). Through this research, it is hoped that it can add insight regarding how conservation efforts have been carried out, as well as how the relationship between flora vegetation in the botanical gardens and existing water conservation efforts.

2. Materials and Methods

2.1 Study Area

The research area was conducted at the Indrokilo Boyolali Botanical Gardens, located in Kemiri Village, Mojosongo District, Boyolali Regency, Central Java, which is under the auspices of the Boyolali Regency Environmental Service. Indrokilo Boyolali Botanical Garden is located at an altitude of 275 – 300 meters above sea level and has strategic value because of its location which is easily accessible from two major cities in Central Java, namely Semarang and Surakarta. Land transportation access to the Indrokilo Boyolali Botanical Gardens can be reached in approximately 5 minutes from the government center of Boyolali Regency (Budiharta et al., 2020). Geographically, Indrokilo Botanical Gardens is located at the coordinates 7°33'32.4"S 110°37'51.8"E.

Fig. 1 Research Location at Indrokilo Botanical Gardens Boyolali.
Source: Indrokilo Botanical Gardens Boyolali

2.2 Procedures

This research was carried out for approximately 3 months, starting from May-July 2022. The research procedure started from searching the literature to collect information and research themes to be taken. Furthermore, the method used in data collection is the survey method by means of field observations and interviews. Supporting instruments used in this study include stationery, camera, and a list of questions. Interview data were collected with the management of the Indrokilo Boyolali Botanical Gardens as stakeholders who are responsible for the management of plant conservation in the botanical gardens. The interview conducted is a semi-structured interview, where in this interview the researcher is free to add and improvise the questions he wants to ask as long as the questions that have been made previously have been answered well (Sugiyono, 2012).

2.3 Data analysis

The technique used in this study is a qualitative technique. This technique has the characteristics of focusing on natural conditions and directly on primary and secondary data sources (Mekarisce, 2020). The data analyzed in the form of primary and secondary data. Primary data obtained from field observations and interviews. Observation data in the form of documentation, plant lists of soil and water conservation thematic gardens (Bima) and bamboo thematic parks (Madrim), information on KRIB, and other management information. In addition, the interview data obtained information about the management of the Rainwater Management System and the conservation efforts carried out

by the administrators of the Indrokilo Boyolali Botanical Gardens. Secondary data was obtained through data from the website and the manager of the Indrokilo Boyolali Botanical Gardens as well as literature studies and various references from books, journals, articles and so on.

3. Result and Discussion

3.1 History and Thematic Area in Indrokilo Boyolali Botanical Gardens (KRIB)

Indrokilo Boyolali Botanical Gardens (KRIB) is a place for nature tourism, research, education, environmental services as well as conservation, which is located in Kemiri Village, Mojosongo District, Boyolali Regency, Province of Central Java. Indrokilo Botanical Gardens were built in 2016. The area for conservation in Indrokilo Botanical Gardens is 8.6 ha. Indrokilo Boyolali Botanical Gardens is located at an altitude ranging from 275-300 meters above sea level. The construction of the Indrokilo Botanical Garden was initiated by the Regent of Seno Samodro since 2015 who provided input and ideas at the planning stage, budget provision, institutional formation, and human resources. With the existence of a botanical garden, it is necessary to carry out conservation activities on an Ex-situ basis with the aim of saving plant species from the threat of extinction (Purnomo et al., 2020). Raya is contained in Presidential Regulation No. 93 of 2011 concerning Botanical Gardens Part 3 Article 9 number (2) and a review of precedents for Botanical Gardens in Indonesia (Harjanti et al., 2017). The target for the construction of a conservation area in the Indrokilo Botanical Gardens is to prioritize the conservation function by multiplying plants, especially lowland tropical rain forest plants in the eastern part of Java. Indrokilo Boyolali Botanical Garden's vision is to become the world's leading Botanical Garden in the field of plant conservation in the lowland rain forest of eastern Java.

The development of the Indrokilo Boyolali Botanical Garden is divided into the initiation stage, the development stage, to the launching stage. The initiation stage is a manifestation of the commitment of the Regent and the Boyolali community to preserve the environment. This initiation stage was raised from a sense of concern about environmental problems where, especially in the Boyolali area, many local plant species have been lost due to land changes from plantations, agriculture is now housing and industry. So because of this initiation, the Boyolali Regency Government collaborated with the Indonesian Institute of Sciences (LIPI) to build a Botanical Garden in Boyolali (Budiharta et al., 2020). With this collaboration, then an MoU and the Regent of Boyolali signed a technical cooperation agreement between the Center for Plant Conservation of the Botanical Gardens of LIPI and the Environmental Agency on the Development, Development, and Management of the Boyolali Botanical Gardens. The location determination at the Indrokilo Botanical Gardens was carried out by several surveys so that it was found that the area was originally an open area used by the surrounding community for the cultivation of various types of food crops, horticulture, and plantations. Indrokilo Botanical Gardens includes ex-situ conservation, according to Sita and Aunurohim (2013) ex-situ conservation is a conservation activity outside its natural habitat, where the flora/fauna will be taken and maintained in a certain location or place with conditions/conditions made to resemble the original habitat of the flora/fauna. The location is around the Indrokilo Tomb so this Botanical Garden is called the Indrokilo Boyolali Botanical Garden. Indrokilo Boyolali Botanical Gardens is currently managed by the Technical Implementation Unit (UPT) of Indrokilo Botanical Gardens which is a work unit equivalent to Echelon IV under the Boyolali Regency Environmental Service. UPT Indrokilo Botanical Gardens in its daily activities is supported by several work units, including: nurseries, collection units, registration, and administration. All plants in the Indrokilo Botanical Gardens have been identified and registered in the Plant Digitization System.

Indrokilo Botanical Gardens was built for approximately 4 years starting in 2016 which focuses on building basic facilities and infrastructure for Indrokilo Botanical Gardens such as main roads, neighborhood roads, reservoirs, management office buildings and electricity networks. The second year in 2017 carried out physical and non-physical development. physical development such as greenhouses, paranet houses, fences, wastewater treatment plants, and parking lots. non-physical developments in 2017 are the labyrinth park and the fern thematic park. The construction carried out in 2018 was to continue physical development from previous years, in addition, the construction of the first phase of bridges and outbound areas was also carried out. In 2019 almost the entire building was completed, so in 2019 the Indrokilo Botanical Gardens began to open and more precisely the Indrokilo Botanical Gardens was inaugurated on May 3, 2019.

Initially, the Indrokilo Botanical Gardens were built in the form of open land and then developed into a Botanical Garden which was packaged in the form of a thematic garden. . Conservation at the Indrokilo Botanical Gardens began in 2019 so that currently some plants have not yet produced fruit. Indrokilo Botanical Gardens has the main function as ex-situ conservation where each plant collection has complete data and each collection specimen will be registered and integrated with existing data in all Botanical Gardens in Indonesia, this can be accessed through the SIGIT application. According to Hekmatyar and Adinugraha (2021), the conservation area is a conservation area that is managed in a zoning system and can be used for educational purposes, to support cultivation, research, tourism or recreation, as well as a means of knowledge. There are 5 main functions of the Indrokilo Boyolali Botanical Gardens, namely the Conservation Function as a means to preserve plant diversity ex-situ or outside their habitat. The concept of the conservation function at the Botanical Gardens Indrokilo Boyolali is the enrichment of plants with minimal treatment so that the goal is natural conservation where the plants that grow will adapt to their respective habitats. The research function, Indrokilo Botanical Gardens can be used as a reference in deepening knowledge, for example in the field of botany. The function of environmental services, the Indrokilo Botanical Gardens area also has a role to prevent floods and droughts with Rainwater Harvesting as well as being a city biopore that can contribute to infiltrating rainwater into the soil through plant roots in the Indrokilo Botanical Gardens area. Many environmental services have been found in the Indrokilo Botanical Gardens, for example, as supporting environmental services for certain animal habitats, for example, many additional animals such as butterflies, birds and dragonflies have been found. In addition, the environmental services provided at Indrokilo Botanical Gardens are providers and regulators. Regulatory environmental services, namely Indrokilo Botanical Gardens, play a role in climate regulation because the plants found in Indrokilo Botanical Gardens can affect the climate around them, although this is not directly visible. Indrokilo Botanical Gardens also has an educational function, namely as a natural

laboratory that can be used in training and educational activities. The educational function, for example, is used as an educational support area such as the Renewable Energy Corner Park.

The conservation area in the Indrokilo Botanical Gardens is divided into several thematic parks named after wayang figures, where this has the aim of preserving the nation's culture and traditional Javanese culture, especially on the island of Java. The thematic parks in the Indrokilo Boyolali Botanical Gardens are divided into nine thematic park areas, including the sadewa, pandu, nakula, madrim, abiyasa, kunthi, bima, yudistira, and arjuna theme parks. The sadewa theme park consists of pruning plants that are shaped like a "mountain" picture in a wayang show which looks like in Fig. 2 Pandu Park, is a thematic garden consisting of a collection of ornamental plants such as a collection of orchids. Nakula thematic park has a collection of medicinal plants such as noni plants and wild plants, where in the nakula thematic park you can find various types of medicinal plants that have their respective properties and benefits. Madrim thematic gardens can be found in various types of collections of bamboo plants, for example yellow bamboo. Abiyasa thematic park has a large collection of ferns such as elephant ferns and many other types of ferns. Abiyasa thematic park is in the form of a dome where the shape of this abiyasa theme park has a unique shape so that many visitors are interested in visiting this thematic park. This Abiyasa thematic park has also become one of the icons in the Indrokilo Botanical Gardens. The kunthi theme park has a collection of vines such as betel plants and other types of plants that live in vines. The Bima Thematic Park is included in the collection area of plant species that have a role in groundwater conservation, such as banyan trees and Angsana plants. Lerak plants and gayam plants can be found in the Yudhistira thematic garden or known as the honorary plant collection in the Indrokilo Boyolali Botanical Gardens. The last thematic park is Arjuna Park, in this thematic park you can find a large collection of local fruit plants such as mulwo fruit, mundu fruit, and other types of local fruit. Arjuna thematic park which contains local plants is a park that has the largest area in the Indrokilo Botanical Gardens when compared to other types of thematic gardens.

3.2 Rainwater Harvesting System in Indrokilo Boyolali Botanical Gardens

Water is the source of life, with the existence of water life will continue to be maintained and water becomes a part of life starting so that without water there will be no life. The clean water crisis is now a global problem. Flood disaster during the rainy season, drought in the dry season is now a problem that often occurs today. One of the things that can cause floods and droughts is an error in rainwater management. So there is a need for proper rainwater management to overcome the problem of water needs and water shortages for the needs of people's lives so that a more effective and efficient way is needed to overcome water problems, one way is to make a rainwater harvesting system both from the domestic scope of rainwater harvesting activities. also maximize the high rainfall that falls (Silvia and Safriani, 2018).

Indonesia is a country that has high rainfall, so this is a blessing for residents in Indonesia to get clean water. One of the managements implemented in Indrokilo Botanical Gardens is Elektrolisa Banyu Udan (EBU) and Rainwater Harvesting. The two types of management applied certainly help to overcome the problems of flooding and drought.

Fig. 2 The Sadewa Thematic Park is shaped like a "*gunungan*"

There are many functions of rainwater that are very important including:

a. Rainwater is a source of water from the sky which is starting to be forgotten by the current generation, while the sky water itself becomes the source of water on earth.
b. Rainwater is very good water with low mineral content while having a high enough oxygen level, so it is very suitable for the daily consumption needs of the body.
c. The rainwater that falls for the first time serves to neutralize pollution in the air, both from vehicle fumes, factory fumes and others. After the first rain, the air will feel fresh.
d. When rainwater falls and then seeps into the ground, the heavy pollutants in it will automatically dissolve by itself, and groundwater quality improves. Rainwater can be a source of clean water.

When we are able to manage rainwater well, known as TRAP (Tampung Absorb Flow and Maintain) will be able to become water reserves for the needs of the dry season.

Several parts of the equipment used for Rainwater Harvesting (PAH) in Indrokilo Botanical Gardens include:

1) Leaf Repellent Filter Leaf

Filter is a tool that functions to filter large dirt and carry it along rainwater on gutters. If large dirt is carried and enters the pipe, it can clog the pipe which makes the water product not optimal. Types of dirt in question such as: leaves, stones. gravel, twigs, and so on.

2) Coarse Dust and Fine Dust Filter Coarse and fine

Dust filters are part of the function to collect fine and dissolved dirt by water harvested from the roof of the house and cause the water produced to be more cloudy. Types of fine dirt in question such as: sand, dust, moss, and so forth.

3) Spillover

The overflow pipe serves to drain water from a reservoir or toren that is already full (*Overload*) with rainwater and crop yields so that it can be channeled into infiltration wells.

4) Toren

Toren is part of a tool that functions to collect harvested water from gutters to be stored as water reserves if needed by the owner.

5) Infiltration

Wells are used to accommodate the overflow of water from reservoirs that are already fully filled (*overload*), so that water is not wasted and can be returned to the ground as groundwater reserves.

Fig. 3 Indrokilo Botanical Gardens: 1) Rainwater Harvesting Observation (PAH); 2) Electrolisa Banyu Udan (EBU)

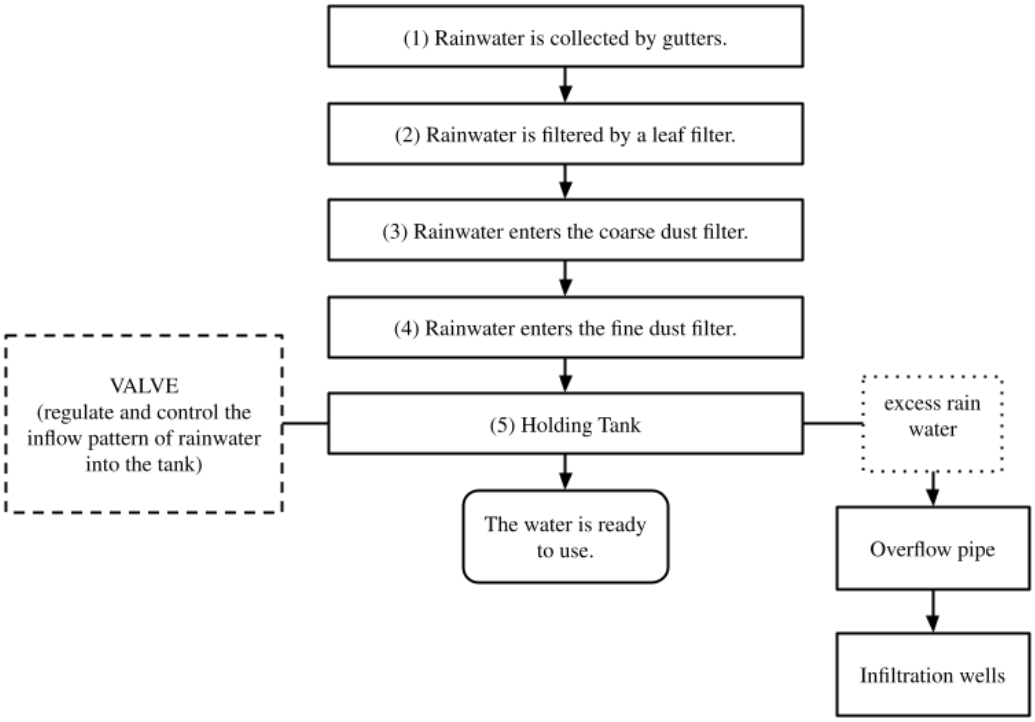

Fig. 4 Rainwater harvesting process in Indrokilo Botanical Gardens, Boyolali

Rainwater harvesting is a technology or method used with the aim of collecting rainwater from the ground, rock hills, or roofs of buildings and used as a source of clean water for daily needs. Rainwater harvesting (PAH) is one form of simple technology that has benefits for overcoming clean water problems (Lestari et al., 2021). In addition, Rainwater Harvesters can also help overcome flooding. Rainwater harvesting (PAH) also includes efforts that can be made to utilize rainwater that falls to the earth to meet human water needs and/or water conservation purposes. In general, the quality of rainwater is very high (UNEP, 2001), rainwater contains almost no contaminants so that rainwater is very

clean and free of microorganisms, but if rainwater is in contact with rainwater catchment surfaces, storage tanks, rainwater drainage, the These will contain physical, chemical and micro-biological contaminants (Yulistyorini, 2011). Rainwater harvesting through the roof or on the roof of the house is then channeled into a reservoir or channeled into infiltration wells, including a concept that is often encountered or practiced by many people in Indonesia. Indonesia. The system implemented in Rainwater Harvesting is also a culture of saving water and caring for the environment and including an effective way through an ergonomic approach. According to Khan et al., (2018), the Rainwater Harvester (PAH) system applies appropriate technology that is studied from the environmental, technical, economic, ergonomic, socio-cultural studies. Synergy between the approach of hydrogeology and ergonomics to form a technology that is appropriate for humans, environmentally friendly, and energy efficient.

The process of harvesting rainwater at the Botanical Gardens Indrokilo Boyolali consists of several processes as shown in Figure XX. Process rainwater harvesting in Indrokilo Botanical Gardens, Boyolali. According to Malik et al (2016), the rainwater harvesting system generally consists of a water catchment area, collection channel or pipe that drains rainwater that falls on the roof of the storage tank (*cistern or tanks*). The stages of harvesting rainwater begin with rainwater falling on the roof and then collected in gutters, then rainwater from gutters will be filtered by leaf filters. After the water enters the leaf filter, the rainwater then enters the coarse dust filter. In the pipe there is a ball that functions as a cover when the water is full. Then the rainwater enters the branch. The rainwater that has been filtered in the coarse dust filter will then enter the tank cover which is equipped with a fine dust filter. This is to ensure that the rainwater is really clean. Excess rainwater in the tank will come out automatically by using a spill pipe connected to the infiltration well. At this stage there is also a rainwater harvesting installation equipped with a valve that functions to regulate and control the pattern of rainwater entering the tank, so that the water entering the holding tank will not be excessively full if the water stored exceeds the capacity it will be channeled to the overflow pipe. where the division process is assisted by the valve. The water that has been collected in the holding tank and has gone through several filtering processes, both fine dust and fine dust filters, will be channeled through pipes so that the water is ready to be distributed for daily needs. Indrokilo Boyolali Botanical Gardens utilize the water from Rainwater Harvesting to water plants in several existing thematic gardens, some are also channeled to faucets for hand washing activities and so on.

3.3 Collection of Thematic Plants for Water and Soil Conservation at Indrokilo Boyolali Botanical Gardens

At KRIB the role in conservation is carried out through water and soil conservation which is placed in the Bima thematic park. In this park zoning found types of plants that have a function for water conservation in the form of banyan trees (*Ficus benjamina)* and Angsana tree plants (*Pterocarpus indicus* Willd). According to observations and interviews with KRIB management, this conservation thematic park is dominated by the Angsana tree, with 11 living plants. *Pterocarpus indicus* Willd itself is a type of woody plant that belongs to the *Poaceae*. Angsana is a native plant species from Southeast Asia, has an optimum temperature to grow between 22°C-32°C, and grows best in tropical climates with high elevations (Danarto, 2013). Currently, the Angsana tree has been designated as a vulnerable plant and needs to be protected by the IUCN since 1998. Angsana is known to have a significant role in conserving water. In Malik and Kusumarini's research (2019), Angsana is known to be one of the plants that fills the vegetation around the Tiga Rasa Springs, Mount Muria Kudus. The vegetation around the springs plays an important role in preserving the existing springs.

The banyan plant (*Ficus benjamina*) is known to play a major role in conserving water through the presence of its roots. The presence of plant roots will help the process of absorption of rainwater, so that the amount of runoff that is not absorbed can be minimized. Through vegetation roots, the rain catchment area becomes wider so that the amount of water that is absorbed and re-enters the soil surface becomes greater. Abundant groundwater reserves will help during the dry season, thereby preventing drought and ensuring a sustainable water supply. In addition, hanging roots on banyan trees also play a role in absorbing water and mineral content (Utari et al, 2020). According to research by Rudin et al (2020), generally banyan trees can be found around springs, because this type of tree has large trunks and strong roots, even the roots can penetrate the aquifer layer and help open channels for water to reach the surface as springs. Vegetation from banyan plants in tropical forests is known to be able to withstand flow rates and prevent erosion, banyan trees can also be used as a rehabilitation tool on critical land (Naharuddin, 2017). The two plants were chosen as plants planted in the air and soil conservation thematic because of their ability to help the process of soil and air conservation which has been proven in previous studies.

The technique used in this study is a qualitative technique. This technique has the characteristics of focusing on natural conditions and directly on primary and secondary data sources (Mekarisce, 2020). The data analyzed in the form of primary and secondary data. Primary data obtained from field observations and interviews. Observation data in the form of documentation, plant lists of soil and water conservation thematic gardens (Bima) and bamboo thematic parks (Madrim), information on KRIB, and other management information. In addition, the interview data obtained information about the management of the Rainwater Management System and the conservation efforts carried out by the administrators of the Indrokilo Boyolali Botanical Gardens. Secondary data was obtained through data from the website and the manager of the Indrokilo Boyolali Botanical Gardens as well as literature studies and various references from books, journals, articles and so on.

3.4 The Role of Bamboo Vegetation for Water Conservation in Indrokilo Botanical Gardens

Bamboo, which is a member of the Poaceae tribe, is a type of plant that is very easy to find, especially in Indonesia. Bamboo plays an important role in the social, economic, cultural, and ecological life of the community. Bamboo is known as a plant that has a very fast reproduction and growth process, due to its rhizome-dependent root system (Mishra et al. 2014). Apart from its high socio-economic benefits, bamboo is also known to be able to play a role in overcoming environmental problems such as forest reforestation, restoration of critical land, carbon sequestration, and for water purification (Setiawati et al. 2017). Based on the research of Pande et al. (2012) conducted in plantation areas, it is known that bamboo vegetation has an effect of 80-100% on the absorption of rainwater and groundwater reserves for plants.

Fig. 5 Blooming Angsana tree (*Pterocarpus indicus* Willd.)
Source: www.nparks.gov.sg

Fig. 6 Banyan tree (*Ficus benjamina*) morphology.
Source: flickr.com

Although the use of bamboo is quite high, this activity does not cause significant damage to the bamboo root system, nor to the quality of the soil where it is grown. Bamboo vegetation has a close relationship with reducing the amount of runoff water through increasing land permeability, so that it can increase the ability of soil drainage to optimize penetration into the soil (Singh et al. 2015).

The Environment Bamboo Foundation, said that bamboo has been proven to be able to increase water flow even in certain cases when new springs emerge. This is because bamboo has the ability to absorb rainwater higher than other types of plants. Generally, plants are only able to absorb 30-45% of rainwater, but bamboo plants absorb up to 90% of rainwater, although it still depends on the type of bamboo and rainfall in the location (Wardani and Prihatmaji 2014; Kaushal et al. 2021).

The collection of bamboo plants in Indrokilo Botanical Gardens can be found in the Madrim Thematic Park. The types of bamboo that can be found are very diverse, but the most dominating species are Buddha's Belly bamboo (*Bambusa vulgaris f.* Waminii TH Wen) with 15 individuals, giant bamboo (*Dendrocalamus giganteus* Munro) with 11 individuals, and Timor black bamboo (*Bambusa lako* Widjaja) with a number of 10 individuals. In addition, there is also a collection of other bamboo plants such as malay dwarf bamboo (*Bambusa heterostachya* (Munro) Holttum), 7 individuals, common bamboo (*Bambusa vulgaris* Schrad.) 5 individuals, giant timber bamboo (Guadua angustifolia Kunth) 4 individuals, dragon bamboo (*Dendrocalamus asper* (Schult. & Schult.t f.) Backer ex K. Heyne) of 4 individuals, tropical bamboo (*Schizostachyum sp.*) of 3, and 1 individual of giant black bamboo (*Gigantochloa atter* (Hassk.) Kurz). The bamboo thematic location is located around the river in the Indrokilo Botanical Gardens. The existence of bamboo along the banks of the river in addition to providing an ecological function for water conservation, also adds to the coolness around the bamboo thematic area which can increase the comfort of visitors to the botanical garden. In addition, the presence of bamboo vegetation can also play an important role for the ecosystem around the river. Water conservation through the provision of vegetation is one of the efforts that can be done to protect springs, certain plant vegetation can provide additional spring water in the area around water sources and protect them (Yuliantoro and Frianto, 2019). Although the collection of bamboo in the Indrokilo Botanical Gardens area has not been included in the zoning of plants capable of conserving soil and water, through previous literature studies, bamboo has been shown to be able to play an important role in water conservation through the provision of rain catchment areas.

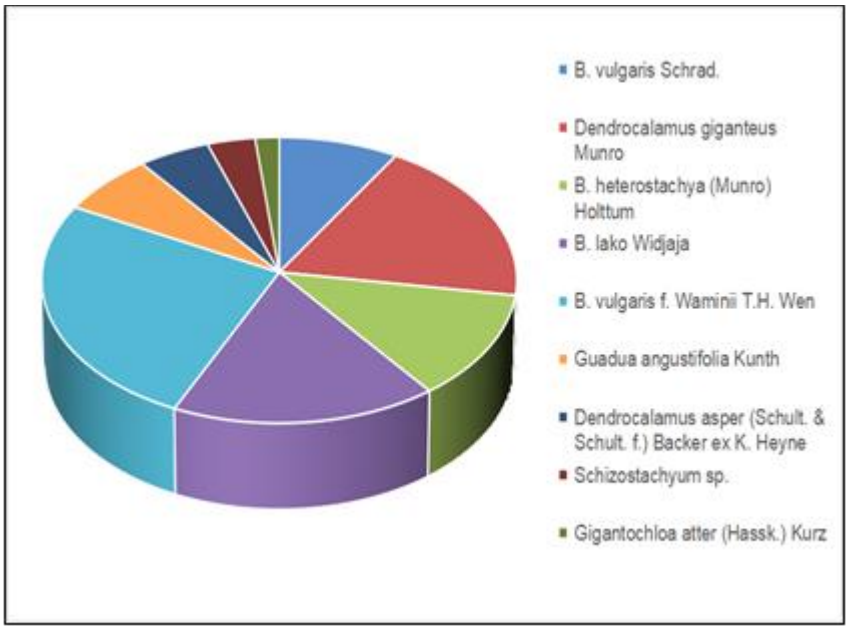

Fig. 7 The types of bamboo collection in Indrokilo Botanical Garden, Boyolali.
Source: kebunrayaindrokilo.boyolali.go.id

Table 1
The collection of bamboo plants in Indrokilo Botanical Gardens

No.	Genus	General Name	Scientific name	Amount (individuals)
1.	Bambusa	Buddha's Belly bamboo	*Bambusa vulgaris f.* Waminii TH Wen	15
		Timor black bamboo	*Bambusa lako* Widjaja	10
		Malay dwarf bamboo	*Bambusa heterostachya* (Munro) Holttum	7
		Common bamboo	*Bambusa vulgaris* Schrad.	5
		Giant timber bamboo	Guadua angustifolia Kunth	4
		Tropical bamboo	*Schizostachyum sp.*	3
		Giant black bamboo	*Gigantochloa atter* (Hassk.) Kurz	1
2.	Dendrocalamus Gigantochloa	Giant bamboo	*Dendrocalamus giganteus* Munro	11
		Dragon bamboo	*Dendrocalamus asper* (Schult. & Schult.t f.) Backer ex K. Heyne	4

Source: kebunrayaindrokilo.boyolali.go.id

4. Conclusion

In this study, it can be concluded that the Indrokilo Boyolali Botanical Garden has five operational functions, namely the conservation function, the education function, the environmental service function, the research function, and the tourism function. Indrokilo Boyolali Botanical Gardens has an important role in air conservation efforts, this is evidenced by the existence of a rainwater harvesting system that can prevent drought or lack of air by maximizing the use of rainwater that falls. In addition, there are water conservation plants located in the Bima thematic park, which can be found types of plants that have a function for water conservation in the form of banyan trees (Ficus benjamina) and Angsana trees (Pterocarpus indicus Willd). Several types of bamboo are also found in the Madrim theme park and in the area around the river in the Indrokilo Botanical Gardens. The presence of vegetation of various types of bamboo is also known to play a major role in conserving air in the Indrokilo Botanical Gardens. This proves that the Indrokilo Botanical Garden has fulfilled its conservation function. Conservation is carried out not only through maintenance efforts outside the original habitat for flora and fauna, but also related to environmental conservation efforts, conservation of air resources.

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