
NURTURING NATURE: A HISTORY OF BOTANICAL GARDENS IN INDONESIA

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Abstract

This article discusses various efforts to create a healthy landscape for the sake of environmental balance. The colonial government-initiated nature preservation with tropical plant studies starting in 1817. Initiated by a government policy reform in 1816, this led to the establishment of the Bogor Botanical Garden on May 18, 1817, the Cibodas Botanical Garden on April 11, 1852, the Purwodadi Botanical Garden on January 30, 1941, and finally, the Eka Karya Botanical Garden on July 15, 1959. Over time, botanical gardens evolved into centers for plant research and conservation with increasingly widespread utilization. Through historical research utilizing contemporary sources, three important conclusions are drawn. First, caring for and creating a healthy landscape reflects an early awareness of environmental conservation in Indonesia that began in 1816. Second, by endeavoring to maintain and create a healthy landscape, the government played a role as an institution in establishing long-term ecosystem balance. Third, through the development of a healthy landscape, various national interests are more easily realized, particularly in supporting the nation's economic development.

Keywords: *Botanical Garden; Kebun Raya, environmental conservation; Kebun Raya; tropical plants*

MERAWAT ALAM: SEJARAH KEBUN RAYA DI INDONESIA

Abstrak

Artikel ini membahas berbagai upaya menciptakan lanskap yang sehat demi keseimbangan lingkungan. Pelestarian alam dengan kajian tumbuhan tropis diprakarsai pemerintah kolonial tahun 1817. Diawali dengan reformasi kebijakan pemerintah tahun 1816, hal ini berujung pada berdirinya Kebun Raya Bogor tanggal 18 Mei 1817, Kebun Raya Cibodas tanggal 11 April 1852, Kebun Raya Purwodadi tanggal 30 Januari 1941, dan terakhir Kebun Raya Eka Karya tanggal 15 Juli 1959. Seiring berjalannya waktu, kebun raya berkembang menjadi pusat penelitian dan konservasi tumbuhan dengan pemanfaatan yang semakin luas. Melalui penelitian sejarah yang memanfaatkan sumber-sumber sejamin, dapat ditarik tiga kesimpulan penting. Pertama, merawat dan menciptakan lanskap yang sehat mencerminkan kesadaran awal akan pelestarian lingkungan hidup di Indonesia yang dimulai sejak tahun 1816. Kedua, dengan berupaya menjaga dan menciptakan lanskap yang sehat, pemerintah berperan sebagai institusi dalam membangun keseimbangan ekosistem dalam jangka panjang. Ketiga, melalui pengembangan lanskap yang sehat, berbagai kepentingan nasional semakin mudah terwujud, khususnya dalam mendukung pembangunan perekonomian bangsa.

Kata Kunci: Botanical Garden; Kebun Raya; konservasi lingkungan; tanaman tropis

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I. INTRODUCTION

Indonesia boasts four botanical gardens that serve as spaces for ex-situ plant conservation¹, research, and green open areas, all of which fall under the purview of the National Research and Innovation Agency (Badan Riset dan Inovasi Nasional—BRIN). Three of these botanical gardens were established during the Dutch colonial period: Bogor Botanical Garden (KRB) and Cibodas Botanical Garden (Kebun Raya Cibodas—KRC) in West Java, and Purwodadi Botanical Garden (Kebun Raya Purwodadi—KRP) in Pasuruan, East Java. The fourth, Eka Karya Botanical Garden in Bedugul, Bali, was built after Indonesia gained independence. Botanists utilize these botanical gardens for plant conservation, research, as well as environmental, plant, and landscape studies. Currently, there are no researchers, particularly historians, who put botanical gardens as integral parts of environmental history, where humans act as agents, and these gardens serve as spaces for holistic reconstruction. However, through the study of environmental history, historians can identify a pattern of past efforts to promote environmental well-being, which can be contextualized for the present and future (McNeill, 2003).

Environmental issues are not new in the field of historical studies in Indonesia. Historical records demonstrate these through the issuance of various government regulations related to environmental conservation, including regulations on forest conservation in 1865 as an effort to provide a healthier environment for the public. These regulations emerged as industrialization rapidly expanded in the late 19th century, leading to massive environmental exploitation. The regulations addressed the exploitation of forests in the Dutch East Indies and the preservation of the fauna within them. One practical application of these forest regulations was the expansion of Bergtuin te Tjibodas (Kebun Pegunungan Cibodas—KPC or Cibodas Mountain Garden) in Priangan in 1889 (Boomgaard, 1999). Upon the recommendation of the Director of Bogor Botanical Garden, Melchior Treub, the expansion of 240 hectares of Cibodas Mountain Garden encompassed forested areas at an elevation of approximately 2,930 meters above sea level (asl). This expanded area subsequently became part of the Gunung Gede-Pangrango National Park Conservation Area (Steenis, 2010).

Several researchers have conducted various studies on environmental conservation/protection policies in Indonesia. Robert Cribb divides environmental protection policies in Indonesia into three points. First, the establishment of nature reserves for economic purposes. Second, the creation of natural monuments (*natuurmonumenten*) for tourism purposes. Third, the conservation of biological areas for scientific purposes (Cribb, 1988). Due to the extensive temporal scope of Robert Cribb's study, this article does not delve deeply into the exploration of tropical plants in Indonesia during the colonial period. In contrast, Peter Boomgaard divides environmental conservation efforts in Indonesia into two periods: the formative period (1889–1930) and the maturation period (1931–1942) (Boomgaard, 1999). According to Boomgaard, the starting point of plant conservation efforts began with the expansion of Kebun Pegunungan Cibodas in the 18th century. Meanwhile, the maturation period coincided with the issuance of the Statute Book in 1931, which provided a new framework for conservation, especially the protection of wildlife. These oriental-influenced

efforts gradually eroded proto-conservation endeavors, such as perceptions regarding the sacredness of forests. Although Boomgaard mentions the publication of “De Tropische Natuur” by the Nederlandsch-Indische Natuurhistorische Vereeniging in 1912, he focuses more on the legal aspects of conservation rather than scientific findings (Boomgaard, 1999).

Some researchers have also examined how the state played a role in creating a healthy environmental framework in the early 20th century. Weber and Wille, for example, divide the study of the creation of a healthy environment into two periods: the pioneering period and decolonization. The pioneering period began when botanist Caspar G. K. Reinwardt initiated the development of the ‘s Lands Plantentuin te Buitenzorg (Botanical Garden in Bogor), a tropical plant research garden. In the 1850s, Gerardus Johannes Mulder, an organic chemist and government advisor, used the botanical garden as a place to analyze the chemical elements of sugar cane before processing it into sugar in factories. Mulder’s research influenced Dutch colonial government policies in the field of plantations, especially regarding sugar cane. The 1900s marked the decolonization period when the colonial government began institutionalizing tropical plant research through strengthening botanical gardens (Weber, Jan-Wille, 2018).

With a focus on environmental studies, this article centers on botanical gardens and plant conservation from the perspective of well-documented historical traces found in various colonial government records. Formally, the government maintains documents related to colonial infrastructure development through the Public Works Agency (Burgerlijke Openbare Werken—BOW). BOW documents are preserved in the National Archives of Indonesia, Regional Library and Archives (BPAD), as well as the Archives and Library of BRIN (Research and Innovation Agency of Indonesia). Historical traces are also found in publications of environmental communities that have a strong awareness of conservation efforts, such as “Gids voor bergtochten op Java” (Guide to Mountain Hikes in Java). These communities established organizations like the Mountaineering Clubs (1900s), the Nederlandsch-Indische Vereeniging tot Natuurbescherming (1912), and the Nederlandsch-Indische Padvinders Organisatie (1912) (Cribb, 1988; Laarse, 2016).

Base on the previous perspective, this article examines the efforts of the colonial government to undertake plant conservation since the early 20th century. The government opted for plant conservation by establishing botanical gardens in Java and Sumatra.

II. DISCUSSION

A. Environmental Issues and the Emergence of Conservation Ideas

Excessive exploitation of natural resources in Indonesia for commercial purposes has given rise to various environmental problems. This issue dates back to the time of the Dutch East India Company (VOC) when they established a trade monopoly and subsequently gained control over certain regions. The increasing global demand for various trade commodities in the Indonesian archipelago, especially coffee, prompted the VOC to implement the *Preangerstelsel* system in the Priangan region from 1720 to 1916. The VOC extensively cleared forests to create coffee plantations for substantial profits. Based

on this profit motive, Governor-General van den Bosch continued the exploitative practices through the *Cultuurstelsel* (Forced Cultivation) in Java from 1830 to 1870. The introduction of plantation industries through forced cultivation undoubtedly had adverse effects on the reduction of forest areas in Java and the disruption of plant ecosystems. Nawiyanto's study in the Besuki Residency demonstrates that forest exploitation had been ongoing for a long time and escalated significantly since 1870 on a large scale. Various forest products, including teak forests and wilderness areas, were exploited due to increased market demand for forest products and the gradual advancement of extraction technology. Consequently, this extraction not only impacted the resource supply but also had adverse effects on the vegetation and wildlife populations (Nawiyanto, 2007). Outside of Java, particularly after the enactment of the Agrarian Law of 1870, there was a rapid transformation of forested environments into plantations, as seen in the Eastern Sumatra region. In a short span, from the influx of foreign capital into the area in the 1860s until the end of 1916, nearly one million hectares of forests were converted into plantations (Encyclopaedie Bureau, 1919). Investors began opening plantation lands in various regions, spanning from coastal areas to highland territories. However, the ecological transformation of highland areas into plantations posed a higher risk of soil erosion and environmental degradation. Investors even opened plantation lands along riverbanks without consideration for the consequences, inevitably leading to soil erosion and accelerated riverbed sedimentation. Consequently, in the early 20th century, many rivers in Eastern Sumatra experienced sedimentation to the extent that they could no longer be used for water transportation. Furthermore, riverbed sedimentation increased the risk of flooding during the rainy season (Volker, 1928).

Ecosystem changes and deforestation continued in the period after independence. It was no longer just investors opening up forests; local communities in the vicinity of forests also began clearing parts of the forest for agriculture or shifting cultivation. The felling of trees in the forest was partly due to a misunderstanding within the community concerning freedom from any rules, including the freedom to clear forests for agriculture and collect wood for fuel (Nawiyanto, 2007). According to experts, the practice of shifting cultivation has become one of the causes of deforestation. A.J. Koens, in the 1920s, stated that the consequences of shifting cultivation were the primary cause of deforestation in the outermost islands of the Indonesian archipelago. In another study, Hagreis mentioned that under certain conditions, especially when applied in short-term rotations, shifting cultivation can lead to the proliferation of *Imperata* grasslands and increase the potential for wildfires (Nawiyanto, 2007).

Deforestation escalated during the New Order era, which implemented various policies based on developmentalism. The Food and Agriculture Organization (FAO) reported that between 2010 and 2020, Indonesia lost approximately 753,000 hectares of forest annually. Indonesia ranks third among the top ten in the world with the highest rate of forest area reduction (FAO, 2020). Baiquni and Susilawardani (2003), in their study, have highlighted that many development practices have disrupted the natural cycles of various types of flora and fauna, leading to a decline in environmental quality. Various development cases, including mining, plantations, and timber industries, demonstrate that excessive resource

exploitation has resulted in scarcity and environmental damage, ultimately impacting the livelihoods of communities in the surrounding areas.

The widespread deforestation has led to the endangerment of local endemic plants. Furthermore, the exploitation of forest resources has resulted in a decline in biodiversity. The heterogeneity of plants and trees in natural forests has been replaced by industrial forests characterized by more homogeneous planting. In the early 20th century, for instance, foresters were alarmed by the dwindling population of the *soga* trees² (*Peltoparum pterocarpum*) in certain forest areas, which were once abundant.

Various environmental issues naturally evoke concern, leading to the emergence of environmental conservation ideas. Since the colonial period, Dutch naturalists have advocated for the conservation of the flora and fauna in the Indonesian archipelago. Naturalists such as M.C. Piepers and P.J. van Houten, for instance, urged the colonial government to prohibit the large-scale trade of birds of paradise (Cenderawasih), which had significantly decreased their numbers in their natural habitat and raised concerns about their extinction. These efforts resulted in the enactment of the “Ordonantie tot Bescherming van Sommige in het levende Zoogdieren en Vogels” (Ordinance for the Protection of Certain Live Mammals and Birds) in 1910. As a concrete step, on July 22, 1912, these naturalists established the “Nederlandsch Indische Vereeniging tot Natuurbescherming” (Dutch East Indies Association for Nature Conservation) in Buitenzorg, led by Sijfert Hendrik Koorders for seven years (1912-1919) (Yudistira, 2014).

Through this association, Koorders actively pursued the establishment of conservation areas for specific types of flora and fauna, the formulation of regulations, and the publication of research results related to nature protection (both animal and plant species). In 1913, Koorders initiated the construction of a nature monument (*natuurmonument*) in the Pancoran Mas area of Depok (Yudistira, 2014). He followed this by proposing the development of 12 additional nature monument locations, including wetlands and lakes in Banten, Krakatoa Island, Panaitan Island, the sand sea of Mount Bromo, Nusa Barung Island, the Blambangan Peninsula (Alas Purwo), and the Ijen Crater. Around the 1900s, Koorders meticulously documented the location of plants growing in the Cibodas Mountain Garden, assigning them names and numbers (Steenis, 2010).

The efforts of this association stirred the colonial government, which had previously prioritized forest management for economic purposes, to begin paying attention to environmental preservation. In 1916, the colonial government issued the *Natuurmonumenten Ordonantie* (Ordinance on Nature Monuments), which served as the legal basis for designating 55 monument/nature reserve areas in the Dutch East Indies (Yudistira, 2014). The colonial government subsequently established an institution called the *Natuur Bescherming afseling Ven's Lands Plantatuin* in 1937 to carry out the responsibilities of overseeing nature reserves and wildlife sanctuaries, as well as managing budgets and personnel. In order to safeguard animal populations within a forested area, the government issued regulations on hunting animals in Java-Madura in 1940 (Yudistira, 2014).

B. Construction of Botanical Gardens

The colonial government's efforts extended beyond protecting the forests and their ecosystems. They also focused on the development of botanical gardens as places for plant conservation and research. For this purpose, the Dutch Kingdom appointed Caspar Georg Karl Reinwardt as the *Directeur tot de Zaken van de Landbouw, Kunsten en Wetenschappen* (Director for Agriculture, Arts, and Sciences) for Java in 1815. Reinwardt was a professor of natural history as well as an expert in botany and chemistry at the University of Harderwijk in the Netherlands (Stibbe, 1919).

As a botanist, Reinwardt initiated the construction of van's Lands Plantentuin te Buitenzorg (Bogor Botanical Garden or Kebun Raya Bogor—KRB) on May 18, 1817, which was located near the residence of the Governor-General of the Dutch East Indies. As its first director, he was assisted by 2 supervisors and 43 workers. Initially, KRB served as a place to cultivate various plant species from the Indonesian archipelago and from several countries with high economic value before being cultivated in plantations. Over time, KRB evolved into a botanical garden for the observation and conservation of plants.

To complete KRB's collection, Reinwardt explored the *Gunung Salak* region and various places in West Java from July to November 1817 to gather specimens of local plants. His explorations continued in 1819 with visits to the Priangan region, Mount Gede, and areas beyond Java. Before concluding his assignment and returning to the Netherlands, he visited East Java in late 1821. By 1822, KRB had collected approximately 900 plant species, which published in "*Enumeratio plantarum Javae*" (1827-1830) and "*Über den Charakter der Vegetation auf den Inseln des Indischen Archipels*" (1828) (Stibbe, 1919).

The colonial government appointed Dr. Carl Ludwig Blume as the new Director of KRB. Blume continued Reinwardt's work of inventorying the plant collection and compiling a catalog of plants growing in KRB. He successfully created a catalog of 914 plant species published in 1823 under the title *Catalogue van 's-Lands Plantentuin*.

During a period of financial austerity by the colonial government, KRB lacked of a director and a plant illustrator. KRB temporarily employed two gardeners (*hortulanus*), W. Kent and J. Hooper, until the colonial government brought horticulturist and plant curator Johannes Ellias Teijsmann from the Netherlands in 1830. Justus Karl Hasskarl, the assistant head of KRB, along with Teijsmann, traveled to several islands in the Indonesian archipelago to discover undocumented plants and enrich KRB's collection. Hasskarl reorganized the plant collection at KRB, grouping them based on their families. For the sake of scientific knowledge, from 1837 to 1844, he rearranged and replanted the plants according to their original habitats. In 1862, he requested botanical experts from the colonial government, successfully cataloging no less than 8,000 plant species, which increased to 10,000 species in the 1863 catalog. In 1866, Teijsmann and his assistant, Simon Binnendijk, published a catalog titled *Catalogus van 's Pantentuin te Buitenzorg (Catalog of Plants Cultivated in the Bogor Botanical garden)*. The catalog also included plant species growing in the Cipanas, Cibodas, (Cibeureum, Kandangbadak, and Pangrango Gardens (Stibbe, 1919).

Starting with Teijsmann's leadership, the colonial government began to intervene in KRB's affairs. Everything done by KRB had to be done with the knowledge and approval of the government, including the construction of Bergtuin te Tjibodas (Kebun Pegunungan Cibodas—KPC). The first generation of botanists and naturalists working at KRB, especially in the acclimatization of cinchona, were appointed as colonial employees for colonial projects, which Goss referred to as "Floracrats" (Goss, 2011).

Teijsmann established KPC as a branch of Kebun Raya Bogor on April 11, 1852, coinciding with the first planting of cinchona trees (*Cinchona calisaya*) outside their native habitat. Cinchona is a native plant of South America, found in the Andes Mountains. Haskarl brought live cinchona plants to the Dutch East Indies after being tasked by the colonial government to travel to Peru to study the plant. Located at an altitude of 1,275 meters above sea level at the foot of Mount Gede-Pangrango, KPC became a place for acclimatizing high-value economic plants from abroad, such as cinchona. During that time, cinchona trees became one of the world's important commodities because processing their bark, which contains quinine alkaloids, produced quinine pills used as a treatment for malaria. The Dutch colonial government had a great need for quinine pills as a remedy for malaria, as malaria outbreaks caused the deaths of around 80,000 Europeans living in Batavia (Kurniawati, dkk., 2021). To meet the raw material needs for quinine pills, the naturalist Franz Wilhelm Junghuhn began planting cinchona trees in the Cinyiruan Pangalengan area, on the slopes of Mount Malabar, and established a center for processing cinchona bark. With further research by the British chemist J.E. Howard in 1860, it was found that the cinchona trees planted by Junghuhn were a new variety named *Cinchona pahudiana* (Goss, 2011). As the yield from cinchona plantations increased, the government built the Bandoengsche Kinine Fabriek NV quinine pill factory on June 29, 1896, and exported cinchona bark that couldn't be processed in the factory to foreign countries (Kurniawati, dkk., 2021).

To support their research tasks, Haskarl and Pierre-Médard Diard, a zoologist and member of the Natuurkundige Commissie voor Nederlands-Indië (Natural Science Commission for the Dutch East Indies), proposed to Teijsmann the creation of a library containing source literature for researchers at KRB. They asked Teijsman to purchase 25 books that had belonged to Jacques Pierot, who had passed away in Macau, China in 1841 during a voyage to Japan. The purchase took place in May 1842 and formed the initial collection of the Bookerij library, which later became known as the Bibliotheek 'S Land Plantentuin te Buitenzorg in 1850. In 1948, the library became more widely recognized as Bibliotheca Bogoriensis and was acknowledged by the international organization Natuurwetenschappelijk Onderzoek as a documentation center for the fields of biology, agriculture, fisheries, veterinary medicine, and chemistry (Hajatullah, 2002).

On January 13, 1868, the government appointed R.H.C.C. Scheffer as the Director of KRB. With a background in botany, Scheffer established the experimental garden (*cultuurtuin*) of Tjikeumeuh in 1876 on a land area of 75 hectares, located approximately three kilometers north of KRB. In addition to cultivating plants through seeds or cuttings, this garden conducted experiments through methods of renovation, product preparation,

and the like. Scheffer also founded an agricultural school (*landbouwschool*) for the native population in 1877, but it was later deactivated in 1884. After Scheffer's departure, the government appointed Melchior Treub as the Director of KRB, a position he held from November 13, 1880, until 1910. Under Treub's leadership, KRB rapidly evolved into an internationally renowned center for scientific research (Goss, 2011). In his efforts to develop KRB, Treub established supporting institutions such as a laboratory for guest researchers in 1884,³ the Museum of Zoology in 1894, and a Marine Research Laboratory in Batavia in 1904 (Hajatullah, 2007).

The establishment of the Museum of Zoology cannot be separated from the role of Jacob Christiaan Koningsberger, an agricultural zoology expert. At that time, the KRB management realized that a botanical garden not only required experts in plants but also zoologists who could research pests and plant diseases caused by various types of animals. According to *Gouvernements-besluit* No. 1 dated March 22, 1893, the *Land Plantentuin* was allowed to employ an expert to conduct agricultural research at private expense. This enabled Koningsberger to work at KRB starting from August 1894 (Kadarsan, 1994). As a comparative study, Treub and Koningsberger visited the Colombo Museum established by the British government in Ceylon (present-day Sri Lanka) to observe the arrangement of zoological collections. With the support of funding from the *Nederlandsch-Indische Handelsbank* and *Nederlandsch-Indische Landbouw Maatschappij*, the construction of the museum took place from mid-1900 to August 1901. The museum was named the *Landbouw-Zoologisch Laboratorium*, which later became known as the *Museum Zoologicum Bogoriense* (MZB) (Kadarsan, 1994).

Koningsberger succeeded Treub as the Director of KRB from 1911 to 1917. He appointed the botanist and plant collector J.A. Lorzing to establish a branch of the KRB in Sibolangit, Deli Serdang, North Sumatra, in 1914. The Sibolangit Botanical Garden (Kebun Raya Sibolangit—KRS) was situated at an elevation of 500 meters above sea level and focused its activities on the research of wild plants in North Sumatra, with the goal of later cultivating and reintroducing them outside their natural habitats. Lorzing curated the collections and built herbarium facilities, including a drying oven for preserving specimens. On May 24, 1934, the colonial government transformed KRS⁴ into a nature reserve through Decree SK.Z. B Number 85/PK. The Dutch East Indies government considered Sibolangit as a strategically important area for the development of the city of Medan and its surrounding regions (Sari and Tri Widodo, 2004).

During D.F. van Slooten's tenure as the head of KRB from 1948 to 1951, he assigned the botanist and microbiologist L.G.M. Baas Becking, who served as the Financial Director of KRB, to establish a branch of KRB in Purwodadi, Pasuruan, East Java. Better known as the Hortus Dry Climate (*Hortus Iklim Kering*), the Purwodadi Botanical Garden (Kebun Raya Purwodadi—KRP) was founded on January 30, 1941, with the mission of collecting and preserving arid-zone plants that grow in low-lying dry areas. Initially focused on researching plantation crops, KRP began reorganizing its plant collections by their botanical families based on the Engler and Pranti classification system starting in 1954 (Soerohaldoko, 2001).

The next branch of KRB established was the Eka Karya Botanical Garden (*Kebun Raya Eka Karya*—KREK) in Bedugul, Bali, commonly referred to as the Bali Botanical Garden. KREK is situated within the reforestation area of Candikuning, bordering the Batukau Nature Reserve. While the previous four botanical gardens were constructed by the Dutch, KREK was built by an Indonesian native, Prof. Ir. Kusnoto Setyodiwiryo (Rifai, 1982),⁵ who served as the Director of the Central Institute for Natural Research/Head of the Indonesian Botanical Gardens, with assistance from I Made Taman, the Head of the Institute for Nature Conservation and Preservation. Its inauguration took place on July 15, 1959. Spanning an area of 50 hectares at an altitude of 1,250-1,450 meters above sea level, KREK is well-suited for the ex-situ conservation of gymnosperm plants (*Gymnospermae*) from around the world. To augment its collection, KREK imported plants from KRB and KRC, such as *Araucaria bidwillii*, *Cupressus sempervirens*, and *Pinus masoniana*. KREK also curated plants native to Bali and the Lesser Sunda Islands, including *Podocarpus imbricatus* and *Casuarina junghuhniana*. Over time, KREK evolved into a conservation site for highland plants from Eastern Indonesia (Ringo, 2022; Darma, 2021).

C. The Institutionalization of Botanical Gardens

The institutionalization of botanical gardens began with the establishment of van's Lands Plantentuin te Buitenzorg (Bogor Botanical Gardens, *Kebun Raya Bogor*—KRB) on May 18, 1817. The colonial government appointed the botanist Caspar Georg Karl Reinwardt as the first director, a position he held until 1822. For the first time, KRB became a place for cultivating economically valuable plantation crops from foreign countries, such as coffee. Structurally, KRB was under the jurisdiction of the Department van Landbouw (Department of Agriculture). In the 19th century, KRB served not only as an ordinary botanical garden but also as a tropical plant garden. The colonial government heavily relied on KRB as a center for botanical knowledge and as a repository for collecting and cataloging plants. Moreover, at least until 1826, the colonial government often sought the advice of the KRB director in making decisions related to infrastructure and agriculture policy (Weber, 2018).

KRB gradually transformed into a center for acclimatizing native Indonesian plants, such as sago from the Maluku Islands, as well as plants from other countries, such as sugarcane from Brazil, oil palm from Africa, corn from America, and longan from China. During Treub's leadership (1880-1910), KRB was developed into a place where botanists and chemists from all over the world could work. KRB was transformed into a colonial and interdisciplinary science site directly linked to agricultural laboratories worldwide. Therefore, Treub initiated several infrastructure changes, particularly enhancing the capacity of agricultural and botanical laboratories, which became a significant hallmark of his directorship. Treub successfully connected KRB and its personnel to private laboratories (*proefstation*) established in the Dutch East Indies since the 1870s. These private laboratories played a catalytic role in the growth of plant science in Java. Many private laboratories conducted research on crops such as sugarcane, oil palm, tea, rubber, cinchona, and coffee in Sumatra and Java, funded by American and European entrepreneurs (Weber, 2018).

From 1940 to the early 1950s, the management of KRB underwent several changes due to World War II and the Indonesian War of Independence. During this period, scientists sought to transform the botanical garden into a hub for international scientific collaboration and a peer partner with scientists worldwide. After Indonesia gained independence, the Indonesian government aimed to decolonize KRB. Previously, KRB had functioned to assist in the development of crops for export, which supported the colonial economy. Scientists and government officials worked to restore the botanical garden's function as a non-aligned, independent center of science that was not bound by capitalism, imperialism, or colonial authority. Goss noted that between 1931 and 1955, scientists and officials in Bogor sought ways to break away from the colonial orientation in which Dutch scientific research was used to regulate and exploit the natural resources of the Dutch East Indies, while also integrating science into the global scientific network (Goss, 2018).

The decolonization of KRB began in the early 1930s due to the global economic depression, which had repercussions in the Dutch East Indies. During this time, the meaning and mission of natural science started to face opposition from the government circles when scientists sought ways to make science more than just a functional complement to colonial agriculture. However, decolonization brought about contradictions, disruptions, and a lack of focus in the direction of scientific inquiry. Moreover, various policies underwent abrupt changes in the shifting political landscape throughout the 1940s, including the adoption of competing plans against the decolonization of science. However, only some of the government's efforts yielded results (Goss, 2018). Many interested parties insisted that research at the botanical garden should be more aligned with practical needs. However, KRB director W.H. van Leeuwen and his successor K.W. Dammerman chose to deepen their commitment to research for research's sake, not always directly linked to economic gain. Their efforts were not successful because H. J. van Mook, the Director of the Economy, replaced Dammerman with L.G.M. Baas Becking in 1939. The goal was to centralize scientific authority in Bogor so that scientists could formulate policies and conduct extensive scientific research for the benefit of the colony. However, the scientific staff at KRB did not accept van Mook's technocratic concept and vision of the botanical garden. They only supported government policies if KRB became the flagship of colonial science (Goss, 2018).

In late 1942, during the Japanese occupation, around a hundred Dutch scientists who had previously worked in various scientific institutions and agricultural experiment stations contributed to the economy, albeit as prisoners of war. During this period, KRB, which was renamed Syokubutzer, did not face pressure from the government to produce economically valuable products. Ryōzo Kanehira, serving as the Head of the Herbarium and Library of KRB from 1943 to 1945, was more interested in writing taxonomies of the flora of the Dutch East Indies and the history of botanical research. His writings laid the foundation for general studies on the Malay flora and its history. Kanehira also prepared a three-volume work on the botany of the Dutch East Indies. After the Japanese occupation, the Dutch East Indies government, aiming to regain control, sought to implement the centralized science

plan that had been established by van Mook in 1940. Independent research stations and institutions that had previously operated autonomously would now come under government control. Van Mook pushed for the formation of a central institution that would oversee and coordinate all scientific endeavors in the Dutch East Indies (Goss, 2018).

The Indonesian government decided not to cooperate with the Dutch East Indies government, refused to return scientific institutions along with their facilities and infrastructure, and declined to run an institution with the assistance of workers, even if most of them were not competent in their fields. This naturally led to a decline in the performance of institutions, including KRB. Consequently, at the end of 1948, the Department of Agriculture and Fisheries, led by Wisaksono Wirjodihardjo, directly managed KRB. The Indonesian government then appointed Kusnoto Setyodiwiryo as the Head of the Natural Research Office in late 1949, which later became the Central Institute for Natural Research (Lembaga Pusat Penyelidikan Alam—LPPA) in 1950. KRB, now known as the Indonesian Botanical Garden (*Kebun Raya Indonesia*—KRI), became one of the institutions under LPPA, alongside the Bibliotheca Bogoriensis, Herbarium Bogoriense, Treub Laboratory, Museum Zoologicum Bogoriense, and Marine Research Laboratory.

Kusnoto positioned KRI as a world-class natural science research center connected to the global scientific network. According to Kusnoto, creating a culture of research in Indonesia and linking it to global scientific research was of utmost importance. However, the number of Indonesian scientists was extremely limited, necessitating assistance from abroad to operate scientific institutions in Bogor (Goss, 2018). In the celebration of Treub's 100th birthday in 1951, Kusnoto outlined three key factors to build a scientific reputation and research in Indonesia: maintaining the presence of Dutch scientists, collaborating with UNESCO, and enhancing the education of young Indonesian scientists. Additionally, Kusnoto suggested a gradual transition towards Indonesian scientific leadership while retaining Dutch scientists, such as M.A. Lieftinck as the Head of the Museum Zoologicum, Koba Ruinen as the Head of the Treub Laboratory, and Rien Donk as the Head of the Herbarium Bogoriense. During Kusnoto's leadership, scientists launched an international scientific project titled *Flora Malesiana*, involving botanists from Asia, Australia, Europe, and North America. They also successfully published a comprehensive taxonomy of the flora of Southeast Asia (Goss, 2018).

At the end of 1952, the Indonesian government designated KRI as the main institution under the Department of Agriculture. Most Dutch biologists and botanists who were still working at KRI until 1954 made a commitment to stay in Bogor and continue their research. In the herbarium section, there were still four Dutch botanists working under the guidance of Donk. However, in early 1955, a dispute arose regarding who should lead the branch of KRI⁶ in Padang, West Sumatra. Donk criticized the Indonesian government for failing to manage valuable scientific knowledge in Bogor and threatened to quit. After careful consideration, Kusnoto removed Donk from his position as the Head of the Herbarium Bogoriense and replaced him with Indonesian forestry expert Anwar Dilmy in February 1955 (Kostermans,

1982). This marked the beginning of reducing the involvement of Dutch scientists in the development of science in Indonesia (Goss, 2018). Kusnoto's vision for Dutch scientists to transfer their knowledge to Indonesian scientists did not go as smoothly as planned. Kusnoto hoped that Indonesian scientists would take on a more significant role once Dutch scientists no longer worked at KRI. In reality, Dutch scientists still considered themselves superior and were reluctant to share their knowledge and expertise with Indonesian scientists (Kartawinata, 2010). Nevertheless, Kusnoto remained optimistic about the future of KRI.

In the pursuit of advancing science, Kusnoto established Akademi Biologi (Academy of Biology). Vice President Mohammad Hatta officially inaugurated the academy on October 10, 1955, at Cibodas Botanical Garden. With government-sponsored scholarships that came with a service commitment, 30 graduates of science-oriented high schools (Sekolah Menengah Atas—SMA, Ilmu Pengetahuan Alam—IPA) received education to become scientists in various fields. Upon graduation, they were required to serve as researchers at KRI, replacing Dutch scientists. Some of these young individuals were sent abroad to pursue doctoral degrees.

The government formed the Indonesian Academy of Sciences (Majelis Ilmu Pengetahuan Indonesia or MIPI) in 1956, followed by the Department of National Research Affairs (Departemen Urusan Riset Nasional—Durenas) in 1962, which later became the National Research Institute (Lembaga Riset Nasional—Lemranas) in 1966. Both entities merged into the Indonesian Institute of Sciences (Lembaga Ilmu Pengetahuan Indonesia—LIPI) based on Presidential Decree No. 128 of 23 August 1967. President Soeharto appointed Prof. Dr. Sarwono Prawirohardjo as the first Head of LIPI. LIPI was tasked with guiding science and technology, seeking scientific truths, and establishing the Academy of Sciences. As a government institution conducting scientific research, LIPI oversaw four botanical gardens (Bogor Botanical Gardens, Cibodas Botanical Gardens, Purwodadi Botanical Gardens, and Eka Karya Botanical Gardens), Herbarium Bogoriense, Museum Zoologicum Bogoriense, as well as research institutions such as the National Biology Institute (Lembaga Biologi Nasional—LBN) (Pudjiastuti dan Mashad, 2017). To bolster its research resources, LBN offered opportunities for students from public universities to intern while working on their theses. After graduation, they could join LBN's research workforce directly (Kartawinata, 2010).

During that period, A.J.G.H. Kostermans⁷ played a significant role in the mission of academic biology education and creatively contributed to preserving Herbarium Bogoriense and its staff. Kostermans had the ability to synergize the global scientific network, Indonesian scientists, and the New Order government, making the Botanical Gardens in the 1970s a focal point of “research fever” in Indonesia. During this time, the government placed a greater emphasis on economic development, leading the botanical gardens to become fully integrated into government programs as branches of scientific research for natural sciences (Goss, 2018).

III. CONCLUSIONS

A. Inference

Botanical gardens were established in Indonesia since the colonial era, not merely as an effort to create green spaces that contribute to a healthy environment. They were also established as a means to conserve the diverse plant species found within them. As a result, various studies on tropical plants were conducted to preserve and develop the numerous tropical plant species that Indonesia possesses. Ultimately, the research on tropical plants stored in botanical gardens transformed them into long-term research spaces, giving rise to generations of botanists in subsequent periods.

B. Recommendation

This study suggests avenues for further research. First, investigate the historical evolution of a particular botanical garden, highlighting the changing purposes and management over time, and how these changes reflect broader societal and environmental shifts. Further research can also be conducted to evaluate the impact of botanical garden research on environmental and conservation policies in Indonesia and make recommendations for policy improvements.

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- 1 According to the Regulation of the President of the Republic of Indonesia Number 93 of 2011, a botanical garden is an ex-situ plant conservation area that possesses a documented collection of plants arranged based on taxonomic classification patterns, bioregions, thematic criteria, or a combination of these patterns. The primary purposes of a botanical garden include activities related to conservation, research, education, tourism, and environmental services. Ex-situ plant conservation refers to the sustainable preservation, research, and utilization of plants conducted outside their natural habitats.
 - 2 This plant produces tannins that are used in the tanning of animal hides and in the dyeing of batik fabrics.
 - 3 The laboratory that was constructed in 1884 was subsequently named the Treub Laboratory.
 - 4 Around the 1950s, the management of the Sibolangit Nature Reserve was transferred to the Forestry Department, thus becoming separate from the management of the Bogor Botanical Gardens. The Minister of Agriculture of the Republic of Indonesia designated 24.85 hectares of the Sibolangit Nature Reserve as a Nature Tourism Park (Taman Wisata Alam or TWA) through Decree Number 636/Kpts/Um/1980. As a TWA, this area serves as both a natural preservation site and a nature tourism destination under the supervision of the Conservation Section of Region II in Stabat, North Sumatra Natural Resources Conservation Agency (Balai Besar Sumber Daya Alam or BBSDA).
 - 5 Kusnoto Setyodiwiryono was an agricultural expert who graduated from Wageningen University in the Netherlands in 1936. Upon returning from his studies in the Netherlands, he worked at the Algemene Proefstation voor den Landbouw, specializing in plant breeding and primarily addressing issues related to dryland agriculture in the Lesser Sunda Islands. He began his involvement in botanical garden management in 1936-1937. After the transfer of sovereignty in 1949, he worked in the Department of Natural Sciences and actively participated in the formation of the Indonesian Academy of Sciences (Majelis Ilmu Pengetahuan Indonesia—MIPI) in 1956, which later became the Indonesian Institute of Sciences (Lembaga Ilmu Pengetahuan Indonesia—LIPI) in 1967..
 - 6 Bogor Botanical Gardens established a branch botanical garden near the main road from Padang to Solok in West Sumatra. Vice President Mohammad Hatta inaugurated this botanical garden, named Setia Mulya, in January 1955. In 1961, LIPI transferred the management of the garden to the West Sumatra Regional Government. Based on Presidential Decree No. 35 of 1986, Setia Mulya Botanical Garden changed its name to Bung Hatta Grand Forest Park (Taman Hutan Raya Bung Hatta).
 - 7 Prof. Dr. André Joseph Guillaume Henri Kostermans was a Dutch botanist who specialized in the study of Southeast Asian flora. He played a significant role in the development of Herbarium Bogoriense and passed on his knowledge to Indonesian botanists. He became an Indonesian citizen and changed his name to Achmad Jahja Goh Hartono Kostermans. Due to his deep affection for Indonesia, he was buried in the Dutch cemetery complex at Bogor Botanical Garden upon his passing.
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