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Edu-Ecotourism Planning Based on Tourist Attractions at Jonggol Teaching and Research Farm, Institut Pertanian Bogor (IPB) University

Perencanaan Edu-Ekowisata Berbasis Atraksi Wisata di Kebun Percobaan dan Penelitian Jonggol, Institut Pertanian Bogor (IPB) University

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edu-ecotourism, tourist attractions, tourism planning, landscape planning, interpretation

ABSTRACT

The Jonggol Teaching and Research Farm serves as a field laboratory for Institut Pertanian Bogor (IPB) University, featuring a diverse array of agricultural and livestock systems, including plantations of oil palm, cassava, sorghum, and indigofera, as well as sheep and cattle farming, alongside agricultural and livestock processing industries. The research aimed to develop an edu-ecotourism plan that leverages existing tourist attractions. The planning process involved preparation, data collection through field surveys, resource inventory, and interviews with managers. Employing both descriptive and spatial analyses, the research synthesized concepts and site planning. The data analysis encompassed physical, biophysical, tourism, and management aspects. Findings revealed that edu-ecotourism plays a vital role in tourism planning, functioning as an educational resource for environmental character development and a means to showcase agricultural innovations. The research identified ten tourist attractions at the Jonggol Teaching and Research Farm, which include the Sorinfer factory, various plantations, field laboratories, guest houses, and natural resources (31 flora, 2 cultivated animals, and 20 wildlife species), as well as notable topographical, geological, and soil variations, complemented by visual beauty. The resulting edu-ecotourism plan encompassed designated tourist spaces, circulation plans, green planning zones, and activity plans that incorporate interpretation services, such as attraction maps.

KATA KUNCI
edu-ekowisata, atraksi wisata, perencanaan pariwisata, perencanaan lanskap, interpretasi

INTISARI

Kebun Percobaan dan Penelitian Jonggol merupakan laboratorium lapangan Institut Pertanian Bogor (IPB) University yang dilengkapi dengan berbagai sistem pertanian dan peternakan, antara lain perkebunan kelapa sawit, singkong, domba, sapi, sorgum, dan indigofera, serta industri pengolahan hasil pertanian dan peternakan. Penelitian ini bertujuan untuk mengembangkan rencana edu-ekowisata berdasarkan atraksi wisata yang ada. Proses perencanaan meliputi persiapan, pengumpulan data melalui survei lapangan, inventarisasi sumber daya, dan wawancara dengan pengelola. Analisis menggunakan pendekatan deskriptif dan spasial, sintesis konsep, dan perencanaan tapak. Data dianalisis berdasarkan aspek fisik, biofisik, pariwisata, dan manajemen. Edu-ekowisata memainkan peran kunci dalam perencanaan pariwisata, berfungsi sebagai alat pendidikan untuk pengembangan karakter lingkungan dan sarana untuk memperkenalkan inovasi pertanian kepada masyarakat. Di Kebun Percobaan dan Penelitian Jonggol, teridentifikasi 10 atraksi wisata, termasuk pabrik pakan ternak Sorinfer, perkebunan, laboratorium lapangan, wisma, aksesibilitas, dan sumber daya alam seperti flora (31 spesies dari 15 famili), fauna (2 spesies satwa budidaya dan 20 spesies satwa liar dari 16 famili), topografi, geologi, jenis tanah, dan keindahan visual. Rencana edu-ekowisata yang dihasilkan meliputi ruang yang diperuntukkan bagi pariwisata, rencana sirkulasi, zona perencanaan hijau, dan rencana kegiatan pariwisata dengan layanan interpretasi, seperti peta atraksi.

Introduction

Institut Pertanian Bogor (IPB) also referred to as IPB University (formerly Bogor Agricultural University) is a leading institution of higher education, specializing in agricultural sciences. As part of the educational mission, this university offers field laboratories that provide students with opportunities for practical training, thesis and dissertation research, as well as internship experiences. The Jonggol Teaching and Research Farm serves as a field laboratory, featuring diverse agricultural and livestock systems, including oil palm, cassava, sheep, cattle, sorghum, and indigofera plantations, alongside facilities for product processing. In addition, the farm possesses significant natural landscape resources, including open spaces with a diverse range of flora and fauna, cultivated and wild, along with a conducive tropical climate for plantation crops. The topographic conditions support the development potential, with land optimized based on soil types, land geology, water availability, and the aesthetic qualities of the landscape.

The development of IPB West Java Innovation Valley, approved by the Decree of the Board of Trustees No. 31/K/MWA-IPB/2021, is planned for implementation at the Jonggol Teaching and Research Farm. Science, technology, and innovation become the pillars of this initiative. According to Aisyah et al. (2019), edu-ecotourism is an integrated tourism model that emphasizes environmental education and offers valuable learning opportunities. The Jonggol Teaching and Research Farm supports educational and research activities, such as training programs and technology transfer related to agricultural innovations, with the existing infrastructure, including palm-oil plantations, livestock systems, factories, and integrated field laboratories. Moreover, the extensive areas, diverse livestock species, agricultural processing plants, feed facilities, and laboratories operating under a zero-waste framework provide a strong foundation for developing edu-ecotourism. This edu-ecotourism integrated model emphasizes environmental sustainability and offers extensive educational opportunities (Aisyah et al. 2019), incorporating agricultural innovation to improve learning and sustainable tourism. This educational paradigm was employed to create added value in the form of increased education, enhanced environmental awareness, and the development of new economic opportunities through knowledge (Andari 2023). The concept served as a tool and medium for environment-based character education, as well as a platform to introduce IPB University's agricultural innovations to the broader public. Edu-ecotourism encompasses concepts of space, circulation, green, activity, and service.

Effective tourism development must be consistent with the inherent potential and resources of a given area to ensure optimal management and utilization (Partale & Partale 2019). Therefore, the planning of edu-ecotourism at the Jonggol Teaching and Research Farm is critical. The objectives of this research are to inventory tourism resources and identify potential tourist attractions, analyze the physical, biophysical, tourism, and management aspects, with a focus on the development potential of existing tourist attractions, and formulate a tourism development plan that optimizes the integration of edu-ecotourism activities based on the identified attractions.

Methods

Research Location

This research was conducted at the Jonggol Teaching and Research Farm, IPB University, geographically located at coordinates $6^0$27'30" to $6^0$29'0" South Latitude and $107^0$0'30" to $107^0$2'0" East Longitude. Administratively, the farm was in the boundaries of Singasari Village, Jonggol District, Bogor Regency, West Java Province. The borders of the north, east, south, and west consisted of Cileungsi District, Singajaya Village, Cibodas Village, and Klapanunggal District, respectively.

Data Collection

Data collection took place from April to June 2022. The survey equipment included Global Navigation Satellite System (GNSS)/Global Positioning System (GPS) such as Garmin 64s used to collect coordinates of objects and tourist attraction results, binoculars used for fauna observation, hygrometer thermometer to measure air temperature and humidity, Digital Single-Lens Reflex (DSLR) camera specifically Nikon

D3200 with 55-300 mm Tele lens for documentation of objects and tourist attraction, and recording device to record voice during interview. The research used Microsoft Office for writing, Avenza Maps 3.14 for collecting spatial data, and ArcGIS 10.8 and Google Earth Pro for spatial analysis. The supporting materials included in this research were site administrative boundary maps to recognize the boundaries of the area, interview guidelines, containing a list of questions as a reference, field guidelines to help the data collection process, field observations, tally sheets to record data collected in the field, and archival documents such as the masterplan manuscript as reference materials for edu-ecotourism planning.

This research utilized primary and secondary data (Table 1). Primary data were obtained through direct observation, documentation, and measurement during the field surveys, including the list of flora and fauna species, the conservation status, temperature, humidity, and potential tourism resources. Flora and fauna data were obtained using the transect method to identify species at the study site (Figure 1). Figure 2 illustrates the locations of three designated observation paths for flora and fauna observation. The length of the transects ranged from 500 m to 1,700 m. According to Mueller-Dombois and Ellenberg (2016), the width of the transects ranged from 1 m to 5 m on both sides of the center line, depending on the land conditions, openness, topography, and the representation of the surveyed vegetation (Yoza 2017). The selection of the transect path followed the edu-ecotourism plan for the reception area and primary tourist area to identify potential flora and fauna that could serve as tourist attractions.

The recorded flora data includes species names, descriptions of the plants, their environmental conditions, photos of the plants, and the geographic coordinates of their locations. Fauna data were collected using a species list method, which comprised walking and recording the types of fauna encountered. Data collection took place in the morning (6:00–9:00 WIB) and afternoon (15:00–18:00 WIB), with observations recorded three times on each path. Fauna observations were conducted along each path, with consistent observation hours. The traveled

Table 1. Types of data and their collection methods

No.	Types	Variables	Collection Methods
1	Physical	Site administration (site area and boundaries), land topography (elevation and slope), hydrology, climate (rainfall, temperature, and air humidity), soil type and land geology, and land-use	Literature research and field survey
2	Biophysical	Flora and fauna, rarity, and conservation status	Field survey
3	Tourism	Facilities and infrastructure (building and non-building assets), accessibility (road network, road type, and distance from settlements), accommodation, objects, and tourist attractions	Literature research, field survey, and interview
4	Management	Site management, land ownership, site history, issues, and site development direction plan	Interview

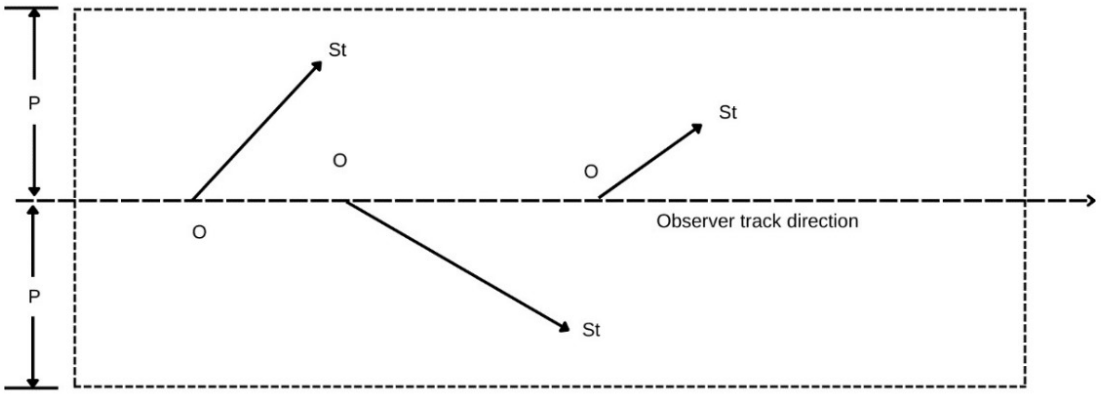

Figure 1. Illustration of Transect Method, where P is average viewing distance for observers at a specific location, O is observer position, and St is flora and fauna position

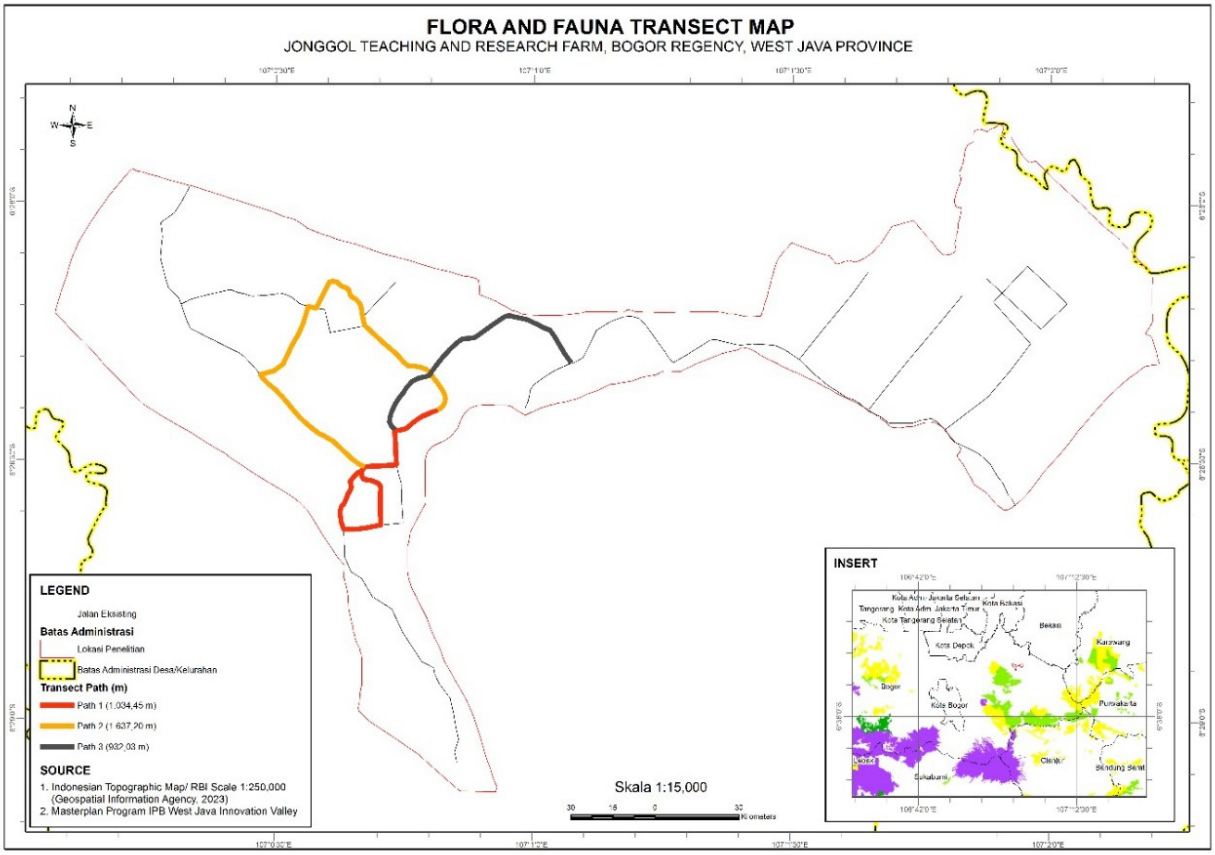

Figure 2. Flora and fauna transect map at the Jonggol Teaching and Research Farm

path was recorded, and each fauna discovery point was marked using a Global Positioning System (GPS). Recorded parameters included species type, number of individuals, activities performed, habitat used (substrate), time of encounter, and geographical coordinates. Air temperature and humidity measurements were taken simultaneously with vegetation and fauna data collection at 07:30, 13:30, and 17:30 using dry and wet bulb thermometers, tally sheets, and stationery. The thermometers were placed 150 cm above the ground, out of direct sunlight (Taolin et al. 2017). Temperature readings were taken parallel to the observer's line of sight.

In-depth interviews were conducted using structured guidelines to gather information on the site management, land ownership, site history, issues, and development plans. Secondary data included site administration information, Digital Elevation Model (DEM) data from the United States Geological Survey (USGS) for topography and hydrology analysis, land geology data from the Ministry of Energy and Mineral Resources (ESDM) Geoportal, soil type data from Food and Agriculture Organization (FAO), as well as site master plans, infrastructure inventories, and management reports from IPB Development Center (BPI).

Data Analysis

Data analysis was conducted using descriptive and spatial methods. Spatial analysis was used to assess physical aspects and provide an overview of the site's physical conditions, including topography (land slope and elevation), hydrology (drainage and water flow patterns), land geology (geological formations and characteristics), and land use (classification of agricultural, livestock, and natural areas). Furthermore, spatial data processing was carried out using ArcGIS 10.8 and Google Earth Pro. Descriptive analysis was used to examine biophysical aspects, including the identification of flora and fauna species, families, and conservation/protection statuses, based on field observations and relevant references.

A synthesis was conducted to integrate potential resources and identify constraints in line with the

research objectives (Febriyani et al. 2017). The foundational concept of site planning was developed to minimize ecological impacts and maximize tourism potential. The edu-ecotourism process consisted of landscape, activity, and service planning. Landscape planning was related to defining spaces for tourism resources, green areas, and visitor circulation. Activity planning focused on designing educational and recreation-based tourist activities, while service planning aimed at developing tourism interpretation and visitor assistance to enhance environmental education.

Result and Discussion

Existing and Potential Conditions

Physical Aspects

The topography of Jonggol Teaching and Research Farm was predominantly lowland, with a small portion consisting of low hills. The land elevation ranged from 60 m to 125 m above sea level (masl) on average (Table 2). Lowland areas, with elevations between 0 masl and 100 masl, covered 97.4 ha (35%), which included the guest house area, the Sorinfer factory, the indigofera plantation, demonstration plots/collection garden, as well as a cassava plantation. Meanwhile, the undulating plains (low hills) with elevations between 100 masl and 300 masl spanned 179.12 ha (65%). These included the Tangkolok Hill, Jabon Forest, and parts of the sheepfold, palm-oil plantation, and sorghum plantation.

The farm was predominantly composed of sloping land (Table 3). The slope ranged from 5 % to 25%, covering 185.53 ha (67%). Meanwhile, a smaller area had slopes between 25% and 35%, including a rather steep region of 25.18 ha (9%) and an area with slopes greater than 35%, covering 1.92 ha (1%). These slope conditions were important considerations for the safety and security of visitors, particularly in relation to the risks of landslides and soil erosion during edu-ecotourism activities. According to Nawari et al. (2021), land with slopes greater than 25% highly prone to soil erosion.

Table 2. Land elevation class condition at Jonggol Teaching and Research Farm

Elevation Class (masl)	Total Area (ha)	Percentage (%)	Description
0–100	97.4	35	Lowlands
100–300	179.12	65	Low hills

Table 3. Land slope class condition at the Jonggol Teaching and Research Farm

Slope Class (%)	Total Area (ha)	Percentage (%)	Description
0–5	63.49	23	Flat
5–25	185.53	67	Gentle
25–35	25.18	9	Rather steep
>35	1.92	1	Steep

The Jonggol Teaching and Research Farm was situated in a tropical climate zone with an average annual rainfall of approximately 2,696 mm. The air temperature typically ranged between 28.1 °C and 30 °C, while the relative humidity fluctuated between 71.3% and 86.5%. According to de Freitas & Grigorieva (2017), air temperatures above 29 °C, combined with high humidity (>75%), led to discomfort, particularly during outdoor activities. Beljai et al. (2014) suggested that an ideal humidity range for human comfort was between 40% and 75%. In the farm, the temperature fell in the typical range for tropical lowlands. However, high humidity significantly impaired thermal comfort by affecting the body's ability to cool down through evaporation, suggesting the importance of incorporating shaded green spaces, water elements, and ventilation corridors to enhance visitor comfort and the usability of outdoor areas.

Water sources were primarily derived from groundwater, with three boreholes and four ponds located across the site. Additionally, the farm was traversed by several rivers, including Cihaur, Cibodas, Cikarang, and Cipeundeu rivers, which contributed to the hydrological system and the aesthetic value of the landscape (Figure 3).

The geological structure of the research site consisted of two main formations. The first formation was the Holocene-aged Alluvial Fan Formation, dating back to approximately 2.6 B.C. during the Quaternary period. The second formation was the Jatiluhur Formation, which dated from the late middle to early Miocene period, around 23 million years ago (Gani et al. 2022). The varied geology of the area provided some visually attractive perspectives from the sorghum plantation and Jabon Forest, where interesting geological formations were visible from an elevation of 125 masl.

Figure 3. Hydrological conditions at the Jonggol Teaching and Research Farm: (a) A reservoir near the Jonggol Animal Science Teaching and Research Unit (JASTRU) sheep pen; (b) A borehole located in the Jonggol Animal Science Teaching and Research Unit (JASTRU) sorghum farm; (c) A stream crossing IPB-Cargill Palm-Oil Teaching and Research Farm; and (d) A stream (artificial drainage) crossing the farm and plantation area

The soil types at the site were predominantly dark brown clay-textured soils characterized by low fertility (Mardhika & Sudradjat 2015). Soil quality played a crucial role in edu-ecotourism planning since soils with suitable texture provided optimal conditions for plant growth, enhanced landscape aesthetics, supported biodiversity, and improved microclimate regulation for visitor comfort. For example, loam soils facilitated root penetration, nutrient availability, and effective water drainage (Adeniji et al. 2025). Healthy vegetation, supported by suitable soil conditions, was essential for creating shaded areas, attracting fauna, and maintaining landscape stability. Therefore, understanding and managing soil texture was fundamental for the development of functional and attractive edu-ecotourism spaces at the Jonggol Teaching and Research Farm.

Land use at the farm was classified into three categories in accordance with the Decree of the Rector of Bogor Agricultural University No. 075/IT3/SP/2012. A total of 60 ha was allocated to the Agronomy Experimental Farm, which IPB-Cargill Palm-Oil Teaching and Research Farm currently used. Furthermore, 40 ha were designated for Primate Animal Breeding and are currently used for cassava cultivation. Approximately 168 ha were assigned to the Jonggol Animal Science Teaching and Research Unit (JASTRU), primarily used for feed and livestock research.

Biological Aspects

The vegetation at the research site was characterized by open density. A total of 31 plant species from 15 families were identified at the Jonggol Teaching and Research Farm. The majority of the plants found at the site were plantation crops, fodder plants, and types of hedgerows deliberately cultivated and developed for educational and research purposes. These plants served various purposes, including providing animal feed and acting as living fences. Additionally, *Sorghum*

bicolor and *Indigofera zollingeriana* species of fodder plants were cultivated at the farm. The species were key ingredients for producing fermented animal feed (Sorinfer). Palm-oil (*Elaeis guineensis*) and cassava (*Manihot esculenta*) were cultivated as commodities at the farm. The hedgerow species found at the site included gamal (*Gliricidia sepium*), turi (*Sesbania grandiflora*), large-leaf mahogany (*Swietenia macrophylla*), jabon (*Anthocepalus cadamba*), acacia (*Acacia longifolia*), lamtoro (*Leucaena leucocephala*), and moringa (*Moringa oleifera L.*).

The fauna at the research site consisted of both cultivated and wild animals. Cultivated animals consisted of local cattle and thin-tailed sheep. The fauna wildlife comprised 20 species from 16 families, including 18 bird species, one mammal species, and one reptile species. These species were not listed as protected by Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) or under the Ministry of Environment and Forestry Regulation Number P.20/MENLHK/SETJEN/KUM.16/2018, governing protected plant and animal species. Based on the International Union for Conservation of Nature (IUCN) Red List, only 19 and 1 species were classified as Least Concern (LC) and Near Threatened (NT), respectively.

Tourism Aspects

The existing infrastructure at the Jonggol Teaching and Research Farm comprised building and non-building assets, with 22 types of infrastructure facilities having been inventoried (Table 5). However, the current condition of these facilities was incomplete and inadequate to support tourism development. Existing tourism-related facilities were limited to entrance gates and guest houses, while supporting infrastructure included area signboards, warning boards, and access roads. Basic tourist amenities such as toilets, trash bins, and security posts were limited in the vicinity of the guest house and the Sorinfer factory. Worship facilities, including prayer rooms or mosques, were absent in the area. The lack of comprehensive tourist facilities and infrastructure had the potential to deter visitor interest (Junensih & Ratnawili 2021).

The primary accommodation available was a guest house, which served students requiring temporary lodging for internships, research, and related activities through the Jonggol Animal Science Teaching and Research Unit (JASTRU). There were no other accommodations located near the Jonggol Teaching and Research Farm. In terms of accessibility, the farm was relatively reachable, about 58 km

Table 4. Fauna diversity at Jonggol Teaching and Research Farm

Taxa	Family	Local Name	Scientific Name	Conservation Status		
				IUCN	CITES	Permen LHK
Aves	Alcedinidae	Cekakak sungai	*Todirhamphus chloris*	LC	-	-
	Apodidae	Wallet linchi	*Collocalia linchi*	LC	-	-
	Ardeidae	Kuntul kecil	*Egretta garzetta*	LC	-	-
	Cisticolidae	Prenjak jawa	*Prinia familiaris*	NT	-	-
	Columbidae	Tekukur biasa	*Streptopelia chinensis*	LC	-	-
	Cuculidae	Wiwik kelabu	*Cacomantis merulinus*	LC	-	-
		Bubut alang-alang	*Centropus bengalensis*	LC	-	-
		Bubut besar	*Centropus sinensis*	LC	-	-
		Kedasi hitam	*Surniculus lugubris*	LC	-	-
	Estrildidae	Bondol peking	*Lonchura punctulata*	LC	-	-
	Hirundinidae	Layang-layang batu	*Hirundo tahitica*	LC	-	-
	Nectariniidae	Madu srigantil	*Nectarinia jugularis*	LC	-	-
	Passeridae	Gereja erasia	*Passer montanus*	LC	-	-
	Phasianidae	Puyuh biasa	*Cortunix cortunix*	LC	-	-
	Pycnonotidae	Cucak kutilang	*Pycnonotus aurigaster*	LC	-	-
	Rallidae	Kareo padi	*Amaurornis phoenicurus*	LC	-	-
	Sylviidae	Cinenen kelabu	*Orthotomus ruficeps*	LC	-	-
		Cinenen pisang	*Orthotomus sutorius*	LC	-	-
Mammal	Sciuridae	Bajing kelapa	*Callosciurus notatus*	LC	-	-
Reptile	Varanidae	Biawak air	*Varanus salvator*	LC	-	-

Remarks: IUCN = International Union for Conservation of Nature; CITES = Convention on International Trade in Endangered Species of Wild Fauna and Flora; Permen LHK = Peraturan Menteri Kehutanan dan Lingkungan (Ministry of Forestry and Environment Regulation Number P.20/MENLHK/SETJEN/KUM.16/2018); LC = Least Concern; NT = Near Threatened

Table 5. Facilities and infrastructure at the Jonggol Teaching and Research Farm

No.	Conditions	Infrastructure Facilities
1	Utilized, Not Damaged	Sheep drinking trough, guest house, indigofera plantation, indigofera nursery, cattle paddock, demonstration plots/collection garden, sorghum plantation, palm-oil plantation, and cassava plantation
2	Utilized, Not Damaged	Tool shed, fertilizer and fodder shed, goat shed, sheep shed, staff mess, feed mill, teaching lab, and workshops
3	Not Utilized, Not Damaged	Sheep quarantine pen
4	Not Utilized, Damaged	Climatology station, buffalo enclosure, cowshed, and electricity pole

Table 6. Potential features to be developed as tourist attractions at the Jonggol Teaching and Research Farm

No.	Features	Attractions
1	IPB-Cargill Palm-Oil Teaching and Research Farm	Explore IPB-Cargill Palm-Oil Teaching and Research Farm, learn about the palm-oil agro-industry from land utilization, Crude Palm-Oil (CPO) processing, product diversification, and the marketing process
2	Sorghum plantation	Learn the process of sorghum cultivation from land preparation, seed preparation, fertilization, weeding, and harvesting of sorghum; recognize the utilization of sorghum as animal feed, and sorghum research
3	Demonstration plots/ collection garden	Know the types of fodder plants, how to cultivate and utilize them
4	Sheepfold	Learn about sheep farming, transporting forage with a tractor to the barn, feeding, grazing, counting sheep, and learning how to check sheep health
5	Cowshed	Learn about cattle farming, cattle grazing, and cattle feeding
6	Jonggol Animal Science Teaching and Research Unit (JASTRU) nursery	Learn how to sow indigofera seeds and prepare seedlings before planting in the field
7	Cassava plantation	Introduction to cassava cultivation technology with IPB Prima method, learning directly in the field how to cultivate cassava, introduction to cassava varieties developed, cassava utilization, and cassava products
8	Sorinfer Manufacturing and Commercialization (Sorinfer factory)	Visiting the farmed feed factory, seeing the processing of Sorinfer farmed feed, introduction to production tools and ingredients, and the benefits of Sorinfer
9	Tangkolok Hill	Exploring Tangkolok Hill, enjoying the beautiful scenery of the forest ecosystem
10	Jabon forest	Enjoying the beautiful scenery of jabon stands, learning about jabon trees

(± 1 hour 39 minutes) from Central Jakarta, 39 km (± 1 hour 35 minutes) east of Bogor Regency Capital (Cibinong), 48 km (± 1 hour 16 minutes) from Bogor City Center; and 64 km (± 1 hour 50 minutes) from IPB University Dramaga Campus, Bogor. The nearest village administrative center, Singasari Village, was approximately 1.8 km to 2 km (± 10 minutes) from the farm.

Within the Jonggol Teaching and Research Farm, accessibility remained inadequate. Mobility relied heavily on production roads primarily intended for agricultural and livestock activities. These roads mainly consisted of dirt and rocky (sealed) tracks, which became muddy and flooded during rainfall. The road widths, approximately 3 m, allowed for private vehicles and production transport, such as trucks and tractors. However, there was no dedicated area available for vehicle parking, complicating accessibility for visitors. Attractions are also described as critical resources that stimulate visitor interest at a tourist destination (Muntasib et al. 2014; Ebejer 2021). Table 6 illustrates that several key features have the potential to be developed into diverse tourist attractions.

Management Aspects

Since 1980, the 268-ha agricultural and livestock area owned by IPB University in Singasari Village, Jonggol District, Bogor Regency, has been used as a center for education, teaching, research, and community service in the fields of plantation and animal husbandry. This area was jointly managed by the Faculty of Agriculture and the Faculty of Animal Husbandry of IPB University. Furthermore, IPB University approved the development of IPB West Java Innovation Valley at the Jonggol Teaching and Research Farm, which will serve as a center for research, education, and sustainable agricultural innovation, as part of its commitment to promoting agricultural advancement through science, technology, and innovation. This initiative emphasized the implementation of a Zero-Waste System, the

promotion of edu-ecotourism, and the development of innovation-based agriculture. These three elements served as the foundational pillars for the future development of the Innovation Valley. The IPB West Java Innovation Valley program remained in the site planning phase conducted by BPI. The aim was to create a sustainable, education-driven agricultural innovation hub that integrated research, environmental conservation, and community empowerment.

Edu-Ecotourism Planning

Landscape Planning

Landscape planning employed a supply-based approach, aligning with the site's existing development direction and potential. According to Gold (1980), potential resources were spatial units stimulating the desire to travel. Islamiah et al. (2020) stated that landscape planning evolved into space, circulation, and green plans (Figure 4).

The determination of space zones for edu-ecotourism planning at the research site was based on the number of potential tourist attractions, the accessibility of the area (proximity to water sources and main roads), and the absence of risks to visitors. The farm plan's space allocation consisted of reception (4%), service (3%), tourism (10%), production (68%), and a buffer zone (15%), as illustrated in Figure 4. The reception area played a crucial role as the primary entrance and initial point of contact for visitors, reflecting the core identity of the farm to create a positive first impression and attract visitor interest. The service space used the management building to provide visitors with a place to stay and rest, as well as other services such as information, cleaning, and security. The tourism space showed attractions, including educational and natural environment tourism. The production space accommodates the cultivation of commodities supporting tourism activities. The buffer space comprised forest and was inaccessible by road, protecting the site from external disturbances and managing land resources to prevent soil erosion. The

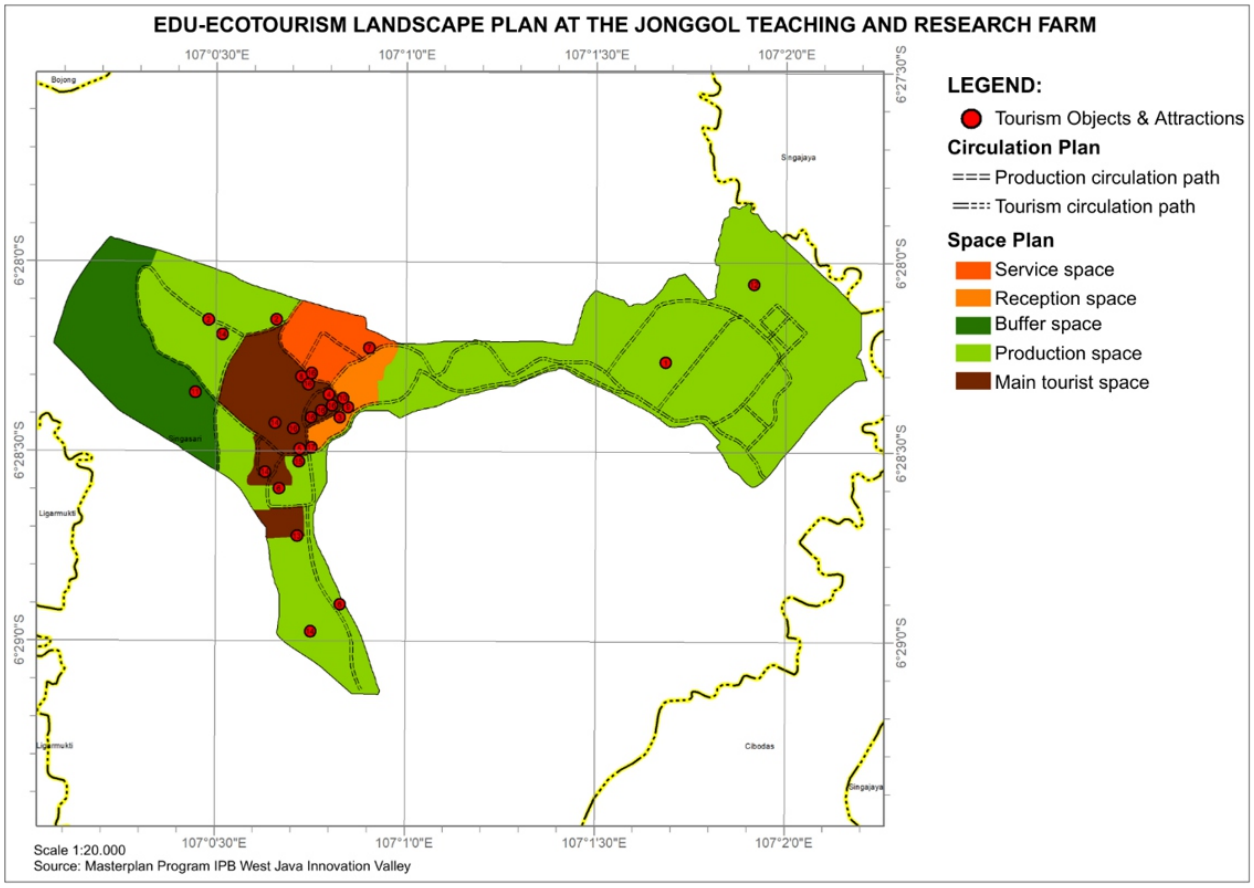

Figure 4. Landscape plan for edu-ecotourism at the Jonggol Teaching and Research Farm

development of infrastructure facilities was consistent with the IPB West Java Innovation Valley master plan (Table 7).

The reception space (20,000 m^2) showed the primary identity of the Farm and introduced visitors to IPB University's agricultural innovations. Meanwhile, the service area offered various accommodations and visitor facilities, including student dormitories and public spaces (40 rooms at 30 m^2 each, totaling 1,600 m^2), a hotel with public spaces (20 rooms at 30 m^2 each, totaling 1,000 m^2), a camping ground (20,000 m^2), a mosque (400 m^2), staff housing (400 m^2), and a management office (250 m^2). Additional amenities included cafeterias, plazas, information centers, shelters, restrooms, and security posts. The main tourist space offered educational and recreational attractions, functioning as the central hub for visitor activities. The production area was designated primarily for agricultural cultivation and secondary for accommodating tourism-related functions. This area included sorghum, cassava, palm-oil, and indigofera plantations. The buffer space ensured environmental protection by preventing external disturbances, minimizing soil erosion, and preserving biodiversity in buffer areas with land slope exceeding 25%. The buffer zone contributed to biodiversity conservation and was strategically located around Tangkolok Hill, Jabon Forest, and water reservoirs, which were relatively inaccessible by road.

According to Islamiah et al. (2020), the circulation plan was divided into production and tourist circulation paths. The IPB West Java Innovation Valley Master Plan revealed that the circulation plan comprised a 4,720 m^2 production and tourism circulation path, as well as a 3,295 m^2 circulation path. The production circulation path was a 3-m-wide management and production route for agricultural equipment such as trucks and tractors, integrated with pedestrian paths to maximize site efficiency and transport plantation products. Furthermore, the path connected the indigofera and sorghum plantations, as well as the Sorinfer factory, including paths around sheep and cattle pens for educational tours, and outside the building, providing access to various objects and tourist attractions. As shown in Table 8, green planning comprised the development of open spaces in the area. The farm was located in a hot area where temperatures reached 35.3 °C during the day, with low air humidity of around 57.2% and open vegetation density. Therefore, green spaces, including core, development, buffer, and conservation zones, improved land use functions and enhanced the climate quality for human activities (Sulistyantara & Pratiwi 2011; Kurniawan et al. 2022).

Activity Planning

Planning and organizing tourist activities represented a form of development aimed at enhancing existing sites and attractions. This development allowed visitors to explore the various features of the Jonggol Teaching and Research Farm.

Service Planning

Service planning included the provision of tourist interpretation facilities, which played a crucial role in enhancing the management of edu-ecotourism activities. Interpretation also served as a medium for introducing priority locations to potential visitors. Currently, the available facilities are limited to name

Table 7. Space plan for edu-ecotourism activities at Jonggol Teaching and Research Farm

No.	Space	Existing Condition	Infrastructure Development
1	Reception Space	Entrance gate	Ticket counter, visitor vehicle parking facility, and innovation gallery
2	Services Space	Guest house, employee mess (converted to a tool and fertilizer warehouse)	Student dormitory, public dormitory, camping ground, plaza, prayer room/mosque, employee mess, information center, management office, shelter, toilet, and security post
3	Main Tourist Space	Demonstration plots/collection garden, Jonggol Animal Science Teaching and Research Unit (JASTRU) nursery, Sorinfer manufacturing and commercialization (Sorinfer factory), sheep and cattle pens	Sign and label, interpretation board, booklet, viewing point, shelter, photography spot, trash bin, closed house, and greenhouse
4	Production Space	Indigofera plantation, sorghum plantation, palm-oil plantation, and cassava plantation	Palm-oil processing plant
5	Buffer Space	Water reservoirs, Tangkolok Hill, and Jabon Forest	Arboretum green space, water reservoir green space, sign and label, and interpretation board

Table 8. Green planning to support edu-ecotourism activities at Jonggol Teaching and Research Farm

No.	Green Zone	Location	Vegetation Type Selection
1	Core	Production space: indigofera plantation, sorghum plantation, palm-oil plantation, and cassava plantation	Production function (main commodities): palm-oil (*Elaeis guineensis*), indigofera (*Indigofera zollingeriana*), sorghum (*Sorghum bicolor*), and cassava (*Manihot esculenta*)
2	Development	Reception and tourist service spaces: guest house, connecting path between the palm-oil plantation and the entrance gate, management building area, and Sorinfer factory	Beauty/architectural, shade, and directional functions: flamboyant (*Delonix regia*), acacia (*Acacia longifolia*), mahogany (*Swietenia macrophylla*), and kersen (*Muntingia calabura*)
3	Buffer	Tangkolok Hill and Jabon Forest	Ecological function and erosion control: jabon (*Anthocepalus grandifolia*), kaliandra (*Calliandra calothyrsus*), and lamtoro (*Leucaena leucocephala*) combined with grasses and ground cover creepers such as elephant grass (*Pennisetum purpureum*) and centro (*Centrosema* sp.).
4	Conservation	Water reservoirs	

Table 9. Edu-ecotourism activities plan at the Jonggol Teaching and Research Farm

No.	Activity	Attractions	Location	Time
1	**Edutourism (pasture activities):** education on sheep farming, education on fodder plants feeding and drinking, counting the number of sheep, education on how to check the health of sheep	Sheep, fodder plants	Sheep pen	07:30–17:00 (UTC+07:00)
2	**Edutourism (pasture activities):** cattle farming education, fodder plant education, feeding and drinking, cattle health check education	Cattle, fodder plants	Cow shed	10:00–14:00 (UTC+07:00)
3	**Edutourism (pasture activities):** livestock herding and grazing practices, introduction to grazing systems	Sheep	Cattle paddocks and pastures	10:00–14:00 (UTC+07:00)
		Cow		08:00–16:00 (UTC+07:00)
4	**Edutourism (pasture activities):** practical use of a tractor for transportation of fodder forage	Tractor, fodder plants	Path between the demonstration plots/collection garden and the sheep and cattle pens	07:30–10:00 (UTC+07:00)
5	**Edutourism (pasture activities):** introduction to the collection of planted fodder plants, and learning the cultivation of fodder plants	Fodder plants	Demonstration plots/collection garden	07:30–10:00 (UTC+07:00)
6	**Edutourism (plantation activities):** introduction to the types of fodder plants developed, indigofera cultivation practices from preparation of planting media to seedling care and preparation for planting in the field	Indigofera	Jonggol Animal Science Teaching and Research Unit (JASTRU) nursery	07:30–12:00 (UTC+07:00)
7	**Edu-ecotourism (plantation activities):** exploring palm-oil plantations, learning oil palm agroindustry from land utilization, Crude Palm-Oil (CPO) processing, product diversification, marketing process, and tracking activities	Palm-oil	IPB-Cargill Palm-Oil Teaching and Research Farm	2–3 days
8	**Edu-ecotourism (plantation activities):** cassava development research (research activities), introduction of IPB Prima cultivation technology for cassava commodities, drone flight practice for watering cassava, tracking, and sightseeing activities	Cassava	Cassava plantation	2–3 days
9	**Edu-ecotourism:** sorghum development research (research activities), learning sorghum cultivation, exploring sorghum plantation, tracking, and sightseeing activities	Sorghum, a bird's eye view in a sorghum plantation	Sorghum plantation	2–3 days
10	**Edu-ecotourism (plantation activities):** exploring indigofera plantation, learning indigofera cultivation in the field, seeing indigofera harvesting process and transportation by tractor, trekking, and sightseeing activities	Indigofera	Indigofera plantation	2–3 days
11	**Edutourism (production activities):** Sorinfer factory visit and tour, Sorinfer farmed feed processing, introduction to production tools and materials, and the benefits of Sorinfer for livestock	Sorinfer production tools and materials	Manufacturing and commercialization of Sorinfer (Sorinfer factory)	08:00–16:00 (UTC+07:00)
12	**Ecotourism:** tracking, introduction to plant species along the trail, birdwatching, sightseeing, selfie/ photography, camping	Vegetation and wildlife (birds), bird's eye view around Jabon Forest, sorghum plantation, water reservoirs, and the naturalness of Tangkolok Hill	Jabon Forest, sorghum plantations, indigofera plantations, lamtoro forest, water reservoir, and Tangkolok Hill	2–3 days

signage and warning signs that prohibit entry into restricted areas. According to Deri et al. (2023), effective signage must guide tourists across the resort, explain why a site is interesting, and include characterizations of the site. It may also have educational or motivational intent and describe historical facts related to the site. Additionally, it may advertise nearby points of interest or potential tourist attractions. An interpretation board (Figure 5) could provide the interpretation in context. The board was designed and positioned along the roadside near the entrance gate to capture the attention of passing visitors. Additional boards were also placed near key areas, such as the management office and guest house, for easy access to information about edu-ecotourism activities.

Conclusion

In conclusion, the Jonggol Teaching and Research Farm has been developed as an edu-ecotourism area by using existing tourism resources. Infrastructure facilities such as the Sorinfer Manufacturing and Commercialization (Sorinfer factory), plantations, livestock field laboratories, guest houses, and road networks have been integrated to support educational tourism activities. Furthermore, the site incorporates natural resources, including 31 species of vegetation and 22 faunas from 15 families and 16 families (2 domesticated and 20 wildlife species), along with varied topography, geological diversity, and scenic landscapes. The site has been organized into reception, tourist service, tourism, production, and buffer space. Separate circulation paths have been designed for production activities and tourist movement to ensure functionality and visitor safety. The green open space is also structured into core, development, buffer, and conservation areas to maintain ecological balance and landscape aesthetics. Tourism activities are planned based on edu-ecotourism principles, emphasizing educational experiences integrated with agricultural and livestock practices. In addition, tourism services are enhanced by providing interpretive facilities, including a distribution map of tourist attractions, to improve visitor orientation and engagement.

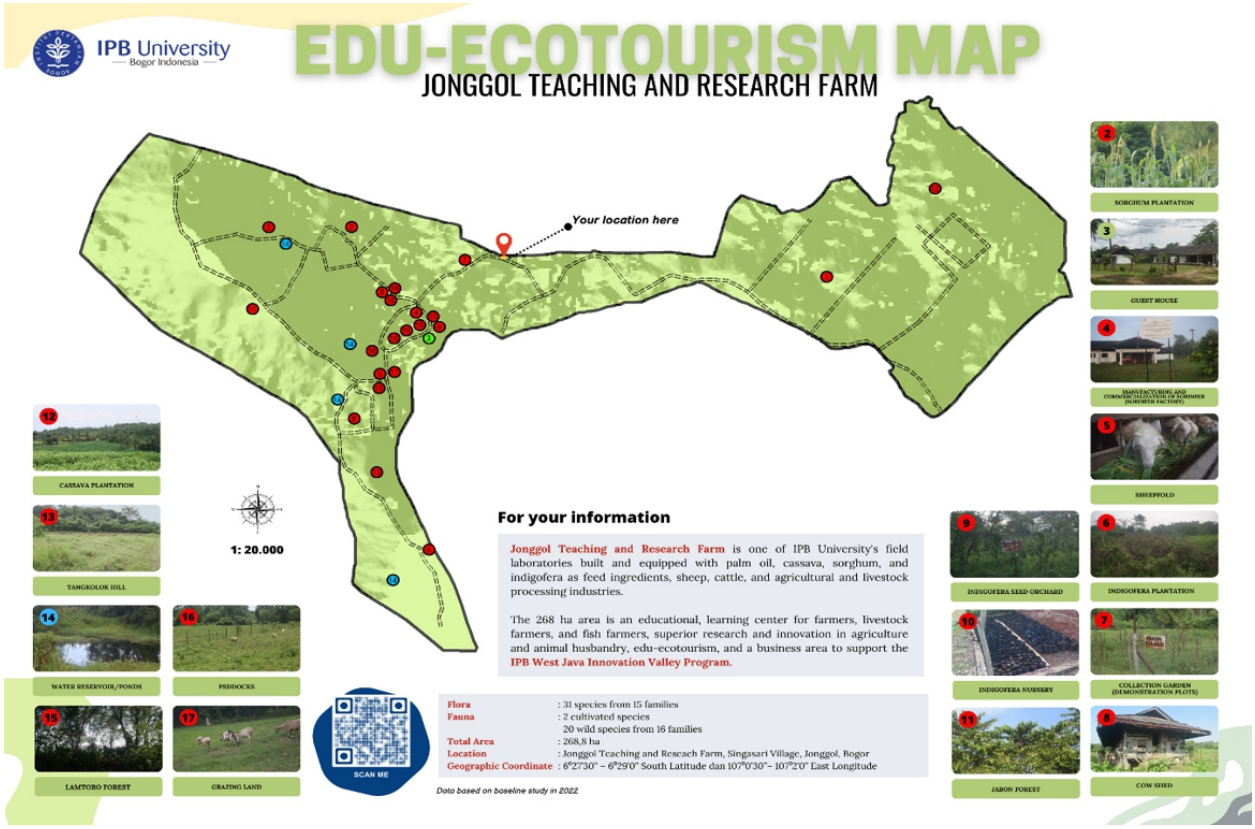

Figure 5. Edu-ecotourism map interpretation board at Jonggol Teaching and Research Farm

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