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Valuing the forest: willingness-to-pay for ecopark with notes on tree architecture in Ifugao, Philippines

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Abstract: The survey aimed to examine the factors influencing local tourists' Willingness-To-Pay (WTP) for the ecopark, focusing on tree crown architecture and the georeferencing of indigenous trees. The study was conducted at the Ecotrail and Reservation Site of Indigenous Species (ECOTRIS) at Ifugao State University. The results revealed that ECOTRIS entails a significant consumption cost, as 90% of the tourists surveyed expressed a willingness to pay for its management. Among these, 72.2% were willing to pay ₱10, 18.5% ₱15, and 9.3% ₱20.The majority of respondents (69%) were aged 15–25 years, while 21% were 26–39 years old. The WTP results showed that ecological enhancements and approval of existing facilities were statistically significant factors. Regarding trail preferences, concreted trails were favored over unconcreted ones, with land use, situational features, and natural obstacles also influencing tourists' willingness to pay and satisfaction with the facilities. The study found that ECOTRIS is predominantly visited by younger male tourists and university students, rather than older individuals, women, or high school students, with significant statistical differences observed among these groups. Additionally, the tree crown architecture of native trees was perceived to have higher aesthetic value compared to non-native or exotic species. Non-native species were noted to be potentially invasive, often outcompeting native trees for sunlight in forest stands.

Keywords: Willingness-to-pay, indigenous, ecological, trail, sustainable

Introduction

The Philippines, recognized as one of the world's biodiversity hotspots with its diverse ecosystems and species, is increasingly threatened by biodiversity loss and habitat degradation due to climate change, land use changes, and other anthropogenic factors (Uchiyama et al., 2024). Among these factors, ecotourism attractions frequently face issues of overcrowding (Chávez et al., 2022). It is strongly believed that fostering sustainable communities is vital for enhancing the biological characteristics of the environment while simultaneously addressing societal structures in both rural and urban contexts. This includes individuals' participation, satisfaction, and perceptions of environmental quality (Doli et al., 2023).

Forests are among the main attractions for ecotourism, especially given the generational shift from urban to rural lifestyles. They provide essential ecosystem services (Maleknia, 2024), such as mitigating the impacts of climate change (Hong et al., 2024; Hutt-Taylor et al., 2022), supplying water (Chen et al., 2023), and offering recreational opportunities (Venter et al., 2021; Weng et al., 2023), while also playing a key role in cultural conservation.

Ecotourism is a significant financial activity that generates revenue and employment while promoting socio-cultural and ecological advancements. The assessment of tourists' Willingness-To-Pay (WTP) is a key approach for evaluating financial contributions, determining the amount individuals are willing to pay for conservation efforts, and supporting ecological integrity and the socio-economic well-being of surrounding communities (Cheung & Jim, 2020; Tavárez et al., 2024).

Tree architecture, which maximizes light capture, is determined by the carbon allocation strategies of individual trees and reflects species-specific growth patterns (Xu et al., 2019). Beyond recreational services, forests offer products and activities that benefit both residents and visitors (Askar et al., 2021).

Ifugao, a growing economic hub in the Cordillera region, is renowned for its rich forest biodiversity. This makes it a potential ecotourism hub, where biodiversity conservation efforts could also promote soil and water conservation, species diversification, and the integration of tourism and livelihood opportunities. Recognizing the limited funding of Ifugao State University (IFSU) for sustainably developing and maintaining the Ecological Trail and Reservation Site of Indigenous Species (ECOTRIS), this research aims to assess the financial viability of ECOTRIS as an ecotourism site through WTP. WTP refers to the monetary value a client is willing to pay for a product or service, typically expressed as a financial price or range.

Understanding WTP thresholds is essential, as most potential tourists are unwilling to pay above these limits. Generating funds through tourism is crucial for managing protected areas (Moyib et al., 2016). This study will contribute to the development of a management plan for the sustainable conservation and protection of ECOTRIS. Payments for ecosystem services (PES) have been proposed as a strategy to involve the public in developing and conserving these resources (Akbarizadeh et al., 2021; Su et al., 2024). Although research on the valuation of forest ecosystem services has grown exponentially (Acharya et al., 2021), many studies disproportionately focus on aggregated economic valuation through biophysical quantification, modeling, and mapping (Verkerk et al., 2014; Akujärvi et al., 2016; Forsius et al., 2016; Langner et al., 2017). The contingent valuation method (CVM) remains the most widely used approach for estimating a broad range of values, including the non-use value of ecological assets and services. This study employs a CVM survey to measure the willingness of local tourists and guests to pay for the ecological management and recreational improvement of ECOTRIS.The research hypothesizes the following:

Hypothesis 1 (H1): Local tourists and guests are satisfied with the amenities and facilities available at the ECOTRIS ecopark.

Hypothesis 2 (H2): Local tourists and guests are willing to pay for leisure facilities to support the ecological management and enhancement of the ECOTRIS ecopark at Ifugao State University Potia Campus, Alfonso Lista, Ifugao, Philippines.

Materials and Methods

Study Area

The ECOTRIS was declared by the Ifugao State University through executive order as ecopark area in February 2024 (Figure 1). Presently, the park is under the supervision of a Department of Forestry under the College of Agriculture and Sustainable Development in Ifugao State University, which is responsible for conserving the biodiversity, cleaning, waste disposal and silvicultural treatment including governing entrance into the ecopark. However, the administration of the technical working team of the ecopark is in static activities, to do such as the biodiversity conservation, the forest park lingers to worsen notwithstanding social and environment interactions and it is essentials to intensify management. Record of the species are endangered, vulnerable

and threatened, and some are rare. The security situation of park needs to be re-organized and holistic approach should be done. This will advance the conservation and preservation of the aesthetic and the biodiversity within (Doli et al., 2021).

Data Gathering

Study Area

The Ecological Trail and Reservation Site of Indigenous Species (ECOTRIS) was officially declared an ecopark by the Ifugao State University (IFSU) through an executive order in February 2024 (Figure 1). Currently, the park is managed by the Department of Forestry under the College of Agriculture and Sustainable Development at IFSU. This department oversees biodiversity conservation, cleaning, waste disposal, and silvicultural treatments, as well as regulating access to the ecopark. However, the technical working team responsible for the ecopark's administration has limited activities in place. Despite its potential for biodiversity conservation, the forest park continues to face challenges due to inadequate management, coupled with social and environmental pressures.

The park harbors several species categorized as endangered, vulnerable, threatened, or rare. Addressing its security and management requires a reorganization and a holistic approach to advance conservation efforts. Such measures are critical for preserving the ecopark’s biodiversity and aesthetic value (Doli et al., 2021).

Data Gathering

The study employed the contingent valuation method (CVM), utilizing a survey questionnaire as the primary instrument to gather local tourists’ opinions on their willingness to pay (WTP) for ecopark conservation and improvement (Thapa et al., 2022). The questionnaire was revised and simplified to suit the needs of respondents, the majority of whom were students from the university and nearby schools. 300 respondents were asked to answer the questionnaire.

Currently, the ecopark charges only a minimal admission fee, which provides limited financial support for ecological conservation. This study aimed to gauge visitors’ perceptions and willingness to pay for ecological management and improvements. Respondents provided their judgments through the questionnaire, which included options to indicate their WTP for resources or their willingness to accept (WTA) monetary compensation to ensure the protection of ecological benefits (Myung, 2017).

Data Analysis

Descriptive statistics were employed to summarize the survey results, which were presented in tables, bar charts, and graphs. These statistics provided a clear understanding of the findings (Doli et al., 2021). Variations among groups were analyzed using analysis of variance (ANOVA).

Tree architecture was discussed in terms of composition, ecological importance, and functionality within the ecosystem. Images of various tree crown forms were captured and included in the analysis to support the findings.

Results and Discussion

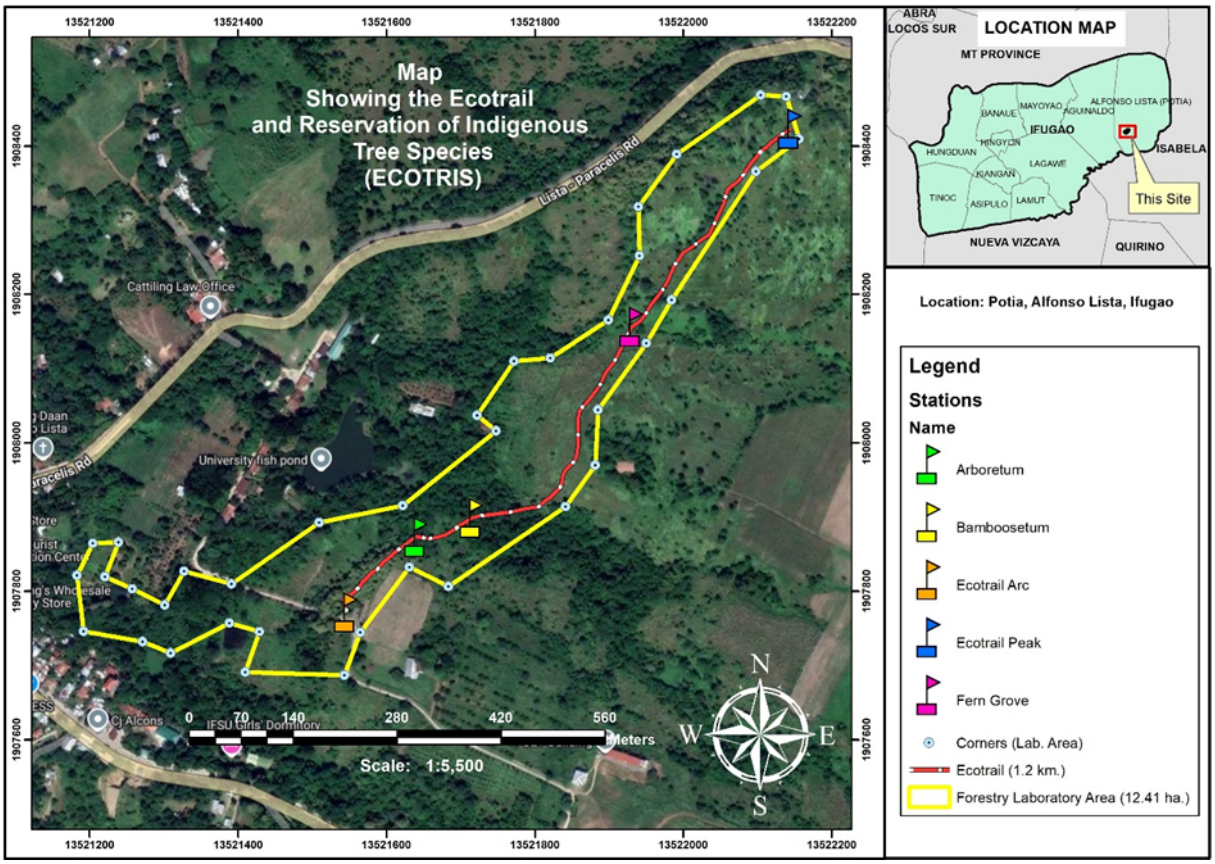

Figure 1: The Map of the ECOTRIS in Ifugao State University, the red color line represents the Ecotrail.

The Ecological Trail and Reservation Site of Indigenous Species (ECOTRIS) is a forest park and biodiversity conservation project established in 2019 within the 400-hectare land of the Ifugao State University Potia Campus, located in Alfonso Lista, Ifugao (Figure 1). The ECOTRIS features an arboretum, a bamboo setum, a fern grove, a grassland area, and a peak that offers a panoramic view of the entire Potia Campus.

The forest park hosts various tree species classified as endangered, vulnerable, and threatened under the International Union for Conservation of Nature (IUCN). Silvicultural treatments, enrichment planting, and assisted natural regeneration techniques have been employed to support the growth of both planted trees and naturally occurring vegetation.

The tourism sector has emerged as a key area of study in development economics over the past few decades (Holik, 2016). With its diverse offerings, tourism has the potential to drive regional development and maximize local opportunities (Paranata et al., 2017). Ecotourism, as one of the fastest-growing global industries, presents significant opportunities for countries, towns, and regions while also introducing new challenges.

Figure 2: Some of the natural features and landscape inside the ECOTRIS

The survey results indicate that the majority of visitors were male (61%), with females comprising 39% of the respondents. Among the visitors, 12% were non-college students, 86% were university students, and 2% were non-students or outsiders. A significant proportion of local visitors (69%) were aged between 15 and 25, followed by 21% aged 26 to 39. There was a noticeable decline in interest among visitors aged 55 to 64, reflecting reduced engagement in recreational activities at the ecopark. As shown in Figure 3, the 15–25 age group represented the largest segment of local tourists. This finding aligns with studies by Liu et al. (2024) and Djagoun et al. (2022), which suggest that younger individuals and those with higher levels of education exhibit greater willingness to pay for ecosystem services.

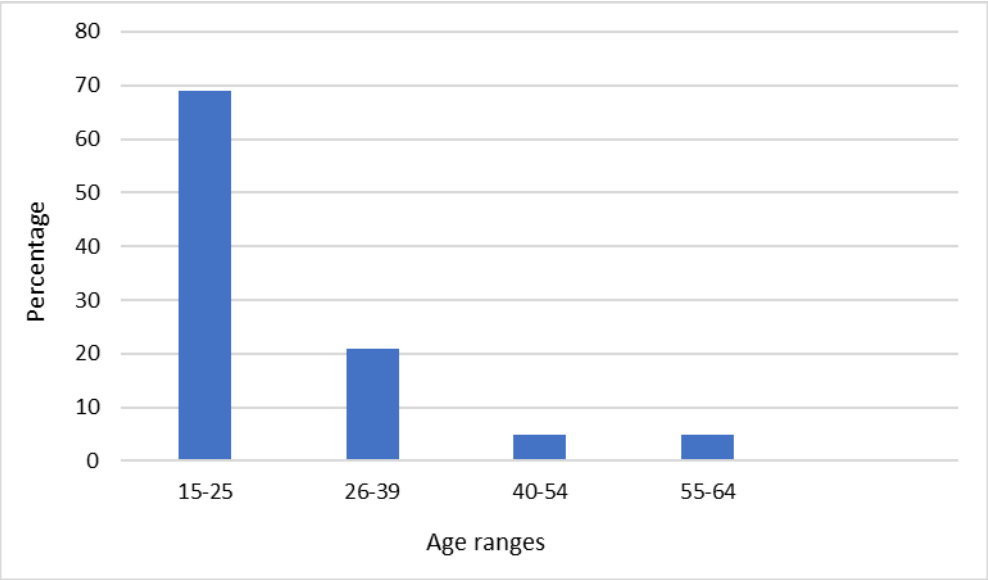

Figure 3: Respondent age compared to the number of local visitors and guests.

Hypothesis 1 (H1)

Local tourist and guest are contented through the amenities or facilities accessible at the ECOTRIS ecopark.

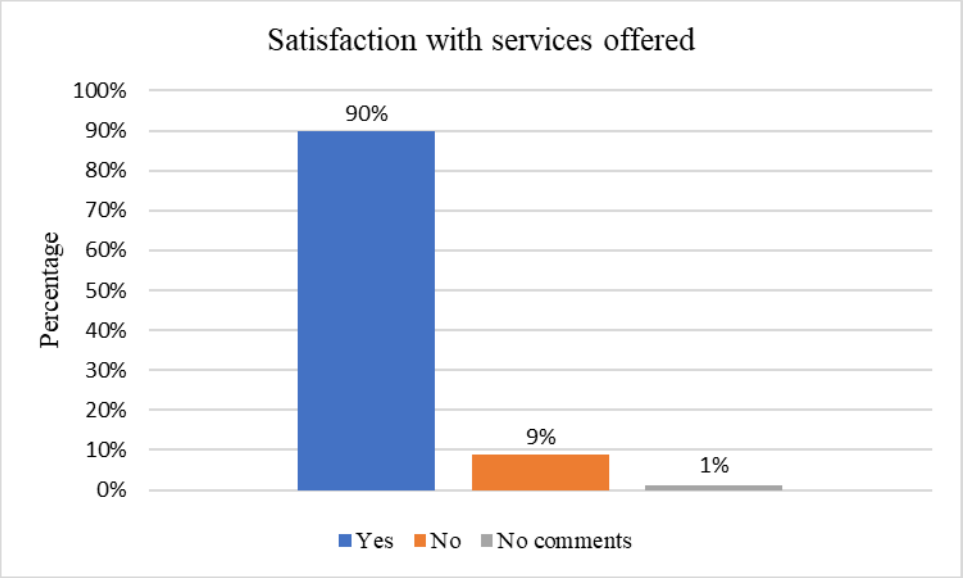

Figure 4: Visitor's satisfaction with services offered

Figure 4 illustrates the levels of satisfaction with services offered, expressed in percentages. The majority of respondents (approximately 90%) indicated satisfaction ("Yes"), while a smaller portion (around 10%) were dissatisfied ("No"). A negligible percentage provided no comment, reflecting the strong positive reception of the services overall. Despite the generally positive feedback, respondents noted that the ecopark requires significant infrastructure investment, with insufficient development affecting their overall satisfaction levels.

Ren et al. (2020) highlighted that factors such as family size, income, and education positively influence willingness to pay (WTP), whereas age tends to have a negative effect. Local tourists and guests emphasized the need for improvements to several amenities. For instance, restrooms should be constructed at each station, sheds for resting areas need upgrades,

and pathways and trails must be widened and better connected across the ecopark compared to the existing infrastructure. Additionally, more signage providing clear instructions throughout the park is necessary, along with stricter rules and regulations to guide ecopark management. These measures would ensure the long-term sustainability and continued appeal of the ecopark, beyond merely generating revenue.

Unchecked growth can strain infrastructure, the environment, local communities, and other sectors, potentially leading to adverse effects on sensitive cultural, heritage, and natural areas. Such impacts may also disrupt the daily lives of local residents, resulting in negative perceptions of tourists and tourism in general.

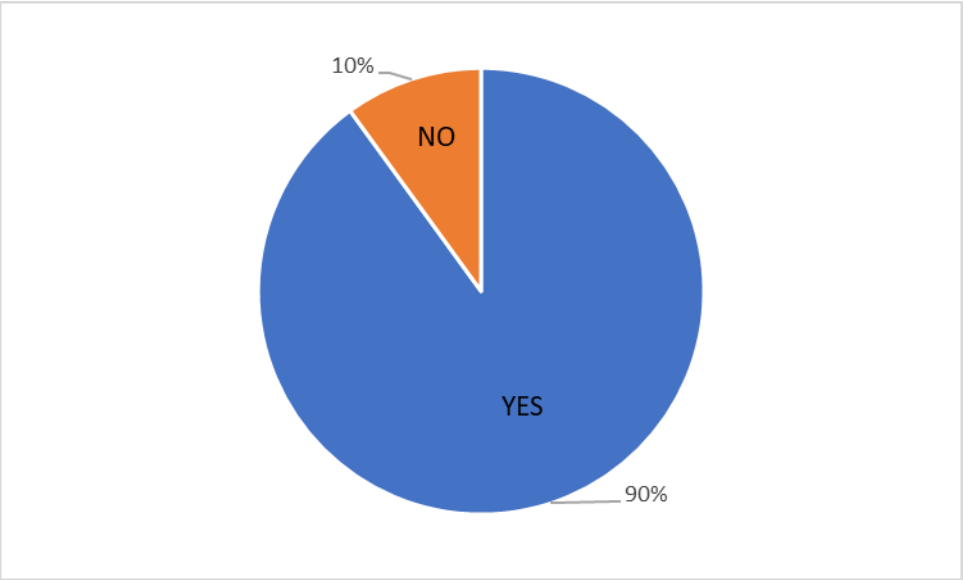

Figure 5: Willingness to pay for the ECOTRIS services

Hypothesis 2 (H2)

Local tourist and guest are willing to pay for leisure facilities for ecological administration and improvement of the ECOTRIS ecopark in Ifugao State University Potia Campus, Alfonso Lista, Ifugao Philippines.

The willingness-to-pay (WTP) analysis for the amenities in the ECOTRIS ecopark revealed that approximately 90% of local tourists and guests were willing to pay an entrance fee, while about 10% expressed hesitation or were unwilling to pay (Figure 5). The survey included a follow-up question to determine the amount they deemed affordable and whether they were open to paying an additional environmental fee, either inclusive or exclusive of the entrance fee.

WTP serves as a foundation for monetizing non-market ecosystem services (Asmare et al., 2022; Heckenhahn & Drupp, 2024). Protected areas, such as ecoparks, face increasing pressure to justify their operations economically, particularly in developing countries where renewable resources are heavily utilized. Natural parks, ecoparks, protected landscapes, and other conservation areas are under threat from growing demand and recreational pressures, which often lead to exploitation and environmental degradation (Bal & Mahonty, 2014).

However, concerns over the rapid depletion of global biodiversity have heightened awareness of the critical role natural resources play in sustaining ecosystem services. Biodiversity is considered fundamental to maintaining long-term ecological functions while also offering opportunities for human use, such as scientific research and recreational activities, including ecotourism.

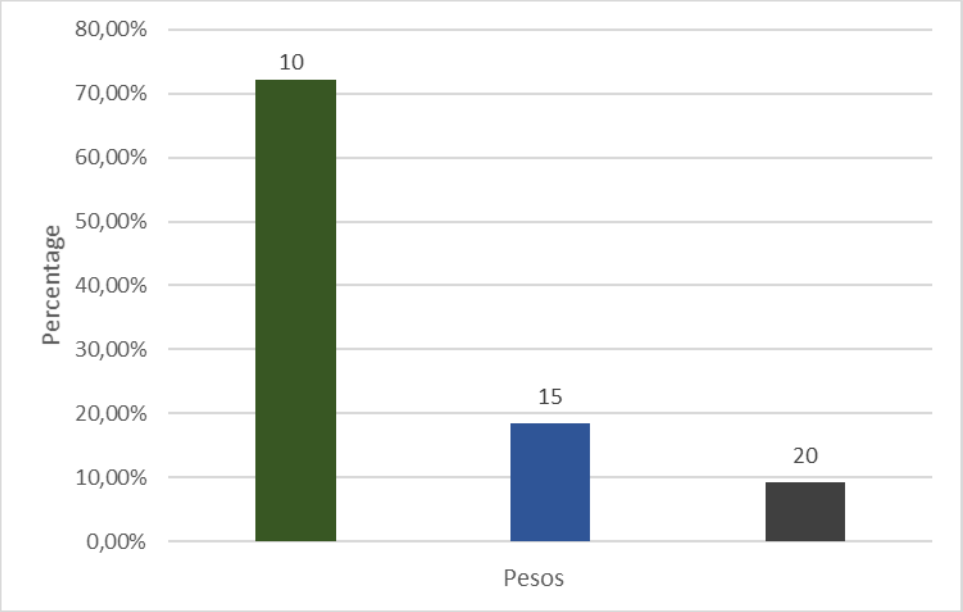

Figure 6: Amount in peso visitor's willing to pay

The amounts respondents were willing to pay, shown in Figure 6, indicate that the majority (over 70%) preferred an entrance fee of 10 pesos, considering it more affordable given the current level of development in the park. The insufficient investment in shaded rest areas and restrooms negatively impacted their willingness to pay higher amounts. In comparison, less than 20% of respondents were willing to pay 15 pesos, and only 8% were agreeable to 20 pesos.

The appropriate allocation and utilization of natural resources for societal growth and well-being necessitate environmental accounting and valuation. Galati et al. (2023) emphasize that personal preferences are influenced not solely by socio-economic factors but also by psychological factors, which significantly impact individuals' decisions and behaviors regarding specific actions.

Table 1. Analysis of Variance (ANOVA) test among and between the entrance fee and services offered

	F	P
10-15	5.01	0.0011
10-20	32.001	<0.0001
15-20	39.211	<0.0001
WTP	7.103	0.0072
Services		
Pathway (Cemented)	19.014	<0.0001
Trail (Not Cemented)	52.871	<0.0001
Landscape per station	64.63	<0.0001
Natural Obstacle	53.836	<0.0001

The analysis of variance (ANOVA) test used in this study to compare statistical differences among groups revealed distinct outcomes between the entrance fee and services offered at the ECOTRIS ecopark. The majority of the respondents' comparisons were highly significant (Table 1). The study found that a statistically greater proportion of male local tourists and guests participated compared to females, and university students were more represented than high

school students. When evaluating ecosystem services, it is essential to consider independent probabilities and subjective uncertainties, as highlighted by Davies et al. (2023).

Tree Crown Architecture

*Figure 7: Tree crown architecture of extreme left Bangkal (*Nauclea orientalis *L), center Gmelina (*Nauclea orientalis *L) and extreme right Tibig (Ficus nota).*

The tree crown architecture of native trees, as shown in Figure 7, highlights the Bangkal (Nauclea orientalis L.) from the family Rubiaceae, which exhibits a spreading tree form. Bangkal is noted for its higher aesthetic value to visitors compared to the non-native Gmelina (Gmelina arborea), from the family Lamiaceae. Non-native species like Gmelina often overtop native species, limiting the latter's access to sunlight and hampering their growth. The undergrowth beneath the Gmelina consists of clusters of Hauili (Ficus septica), Is-is (Ficus ulmifolia), and Niog-niogan (Ficus pseudopalma), all from the family Moraceae. On the extreme right of the observed cluster is the Tibig (Ficus nota), also from the Moraceae family, which exhibits a rounded crown form. Tree architecture, or the three-dimensional structure of trees, reflects how photosynthetically fixed carbon is allocated within the plant (Nunes et al., 2023). The georeferences for this cluster of trees are provided in Figure 8.

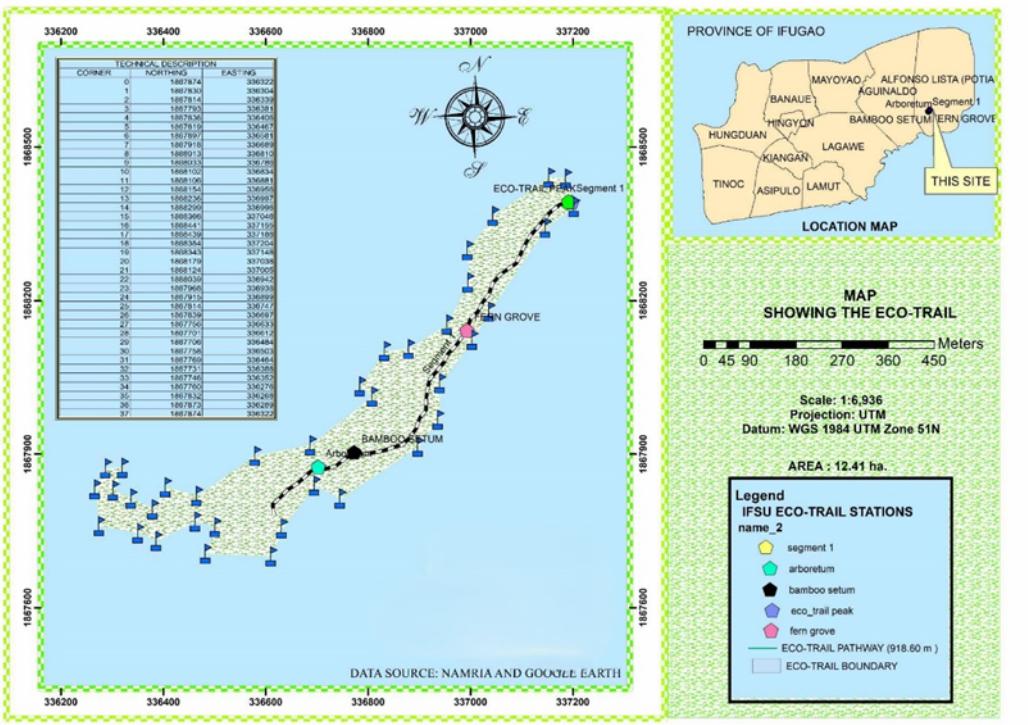

Figure 8: The map of ECOTRIS showing the different land-use with georeferences of trees.

Figure 8 shows the blue flags, which indicate the trees marking the boundaries of the site. The tree canopy strata of the ecopark exhibit varied undergrowth, with non-native species outcompeting native ones in terms of sunlight and nutrient access. Tree architecture can be considered a by-product of environmental pressures on plant growth, reproduction, and survival (West et al., 2009; Lines et al., 2022). An essential component of a tree is its crown and branching structure, which have evolved in different patterns throughout the history of land plants (Chomicki et al., 2017). Trees and forests provide numerous habitats for other organisms, as demonstrated by both contemporary and historical examples (Rößler, 2000; Spindler et al., 2018).

Recent architectural developments aim to combine the natural aesthetics of wood and other plant materials with principles from functional morphology (Menges and Reichert, 2015; Knippers et al., 2019). Consequently, a more biodiverse forest offers greater aesthetic value to visitors, as the tree crown and canopy stratification contribute to a more appealing landscape ambiance.

Conclusion

The survey assessment was conducted at the Ecological Trail and Reservation Site of Indigenous Trees (ECOTRIS) at Ifugao State University, also known as the leisure ecopark or botanical garden. A total of 300 respondents, aged 18 to 64 years, were asked to complete the questionnaire. Most respondents expressed satisfaction with the current level of development at the ECOTRIS ecopark, and many were enthusiastic about paying to improve the park's amenities. Approximately 90% indicated their willingness to contribute to the sustainable development of the recreational park at Ifugao State University.

The survey aimed to examine local tourists' and guests' appreciation of the ecopark amenities and their willingness to pay for ecological enhancement and improvement. Given the growing demand for recreational spaces and forest parks in the heart of Ifugao province (Reidi et al., 2020), the findings highlight the public's desire for improved facilities at the ECOTRIS ecopark.

To fully capture the diversity of visitor willingness-to-pay, a broader and larger respondent sample should be considered in future research.

The tree architecture of native species is more prominent and has greater aesthetic value than non-native species, which tend to dominate the upper strata. These diverse tree forms contribute to the beauty of the ecopark. Non-native trees, however, are characterized as invasive, as they outcompete native trees in terms of light, soil nutrients, and space. Further studies are needed to assess how these factors negatively impact native trees.

Acknowledgement

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Annex 1:

Contingent Valuation Method (CVM) Questionnaire

Section 1: Demographics

1. What is your age?
   - ☐ 15–25
   - ☐ 26–39
   - ☐ 40–54
   - ☐ 55–64
   - ☐ 65 and above
2. What is your gender?
   - ☐ Male
   - ☐ Female
   - ☐ Prefer not to say
3. What is your educational background?
   - ☐ High school
   - ☐ College/University
   - ☐ Postgraduate
   - ☐ Other (specify): _____
4. Where are you from?
   - ☐ Within the university
   - ☐ Nearby community
   - ☐ Outside Ifugao province
   - ☐ International

Section 2: Visitor Experience

5. How many times have you visited the ECOTRIS ecopark?
   - ☐ First time
   - ☐ 2–3 times
   - ☐ More than 3 times
6. How satisfied are you with the following ecopark features?
   (Rate from 1 = Very Dissatisfied to 5 = Very Satisfied)
   - Trails (Concreted/Unconcreted): _____
   - Restrooms: _____
   - Rest areas (Shaded/Shelters): _____
   - Signages and directions: _____
   - Overall cleanliness: _____
7. Which feature would you prioritize for improvement? *(Select all that apply)*
   - ☐ Restrooms
   - ☐ Rest areas
   - ☐ Trail improvements

- ☐ Signage and directions
- ☐ Waste management
- ☐ Other (specify): _____

Section 3: Willingness-to-Pay (WTP)

8. Are you willing to pay an entrance fee to help fund the management and improvement of ECOTRIS?
   - ☐ Yes
   - ☐ No
9. If yes, how much are you willing to pay as an entrance fee?
   (Choose one)
   - ☐ ₱10
   - ☐ ₱15
   - ☐ ₱20
   - ☐ Other amount: ₱_____
10. Would you be willing to pay an additional environmental fee to support biodiversity and ecological management?
    - ☐ Yes
    - ☐ No
11. If yes, how much would you be willing to pay as an environmental fee?
    (Choose one)
    - ☐ ₱5
    - ☐ ₱10
    - ☐ Other amount: ₱_____

Section 4: Perception and Attitudes

12. What motivates you to visit the ECOTRIS ecopark? *(Select all that apply)*
    - ☐ Recreation and relaxation
    - ☐ Educational purposes
    - ☐ Nature appreciation
    - ☐ Exercise and physical activity
    - ☐ Other (specify): _____
13. Do you think the ECOTRIS ecopark contributes to biodiversity conservation?
    - ☐ Yes
    - ☐ No
    - ☐ Not sure
14. Do you believe native trees have more ecological and aesthetic value compared to non-native species?
    - ☐ Yes
    - ☐ No

Section 5: Suggestions

15. What additional features or improvements would you like to see in the ECOTRIS ecopark?
16. Any other comments or feedback about the ecopark?