

Potential of Ecology based Agrotourism for Agricultural Education in Besur Village, Lamongan Regency

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Submitted: 5 July 2020. Revised: 25 August 2020. Accepted: 24 October 2020

Abstract. Currently, agriculture has prospective potential to be developed as a tourist attraction, one of which is agricultural tourism with an ecological perspective. The objective of the research was to examine the potential of ecology-based agrotourism as a means for agricultural education in Besur Village, Lamongan Regency. The research applied a quantitative descriptive approach in the form of scoring, weighting, and ranking of the categories being assessed. The research data consisted of primary and secondary data. The data was collected using direct observation and in-depth interviews. The data analysis was carried out using for the feasibility of agrotourism area. The results showed that the area of Besur Village was classified as suitable (potential) with zone I that had the highest KKA value (2.6) as the object of the agrotourism. Potential ecological aspects obtained analysis 36 species of food producing plants. The highest Importance Value Index (IVI) of plant species was recorded for *Oryza sativa* spp. (83.76%) and *Zea mays* L. (27.11%). Analysis of the physico-chemical properties of soil resulted in moderate or sufficient fertility. Analysis of public perceptions obtained was 4.08 and classified as good for the development of agrotourism in Besur Village. The novelty of this research was to obtain of the potential for agrotourism management in Besur Village through an ecological approach based on the concept of Healthy Plant Management.

Key words: Agrotourism; Besur Village; Potential

How to Cite: Ifandi, S., & Rahma, Y. A. (2020). Potential of Ecology based Agrotourism for Agricultural Education in Besur Village, Lamongan Regency. *Biosaintifika: Journal of Biology & Biology Education*, 12(3), 335-342.

DOI: <http://dx.doi.org/10.15294/biosaintifika.v12i3.25886>

INTRODUCTION

The potential for tourism in Indonesia needs to be developed, especially agricultural tourism (agrotourism) to advance economic growth. Agrotourism should be an integrated part of government programs that aims to introduce and improve the welfare of rural communities (Tati & Muflikhati, 2014; Kambey et al., 2016). The series of agricultural activities from cultivation to post-harvest can be attractive for tourism activities (Budiwarjono & Wardiningsih, 2013). The development of Indonesia's population is quite high, meaning that the need for food is also increasing, therefore the agricultural sector must become a priority (Decenly et al., 2014). It is more about the impact of tourism on society and environmental resources, and arises from community development strategies, as a tool to strengthen the ability of rural community organizations to manage tourism resources (Fahrian et al., 2015).

The development of agrotourism worldwide cannot be separated from the shift in global tourism trends. This can be seen from the shift in the orientation of tourist visits from mass tourism to small groups. As a result, agrotourism is growing rapidly throughout the world, especially in Indonesia (Handayani, 2016; Kusaeri, et al., 2015). The purpose of agro-tourism is to increase the necessities of life, create jobs and increase development in rural areas

both economically and socially (Wyporska & Mosiej, 2010; Bwana et al., 2015; Budiwarjono & Wardiningsih, 2013).

In Indonesia, research on agrotourism development continues to grow, due to the increasing interest in the benefits of agrotourism for agricultural and rural development. Research activities are important to carry out, especially to provide basic data and recommendations for strategic and systematic agrotourism planning and development (Pangeman et al., 2012 ; Surur & Auliyah, 2020).

The researchers stated that the development of agrotourism by involving local culture and wisdom in agriculture and land management can increase local economic income (Pangestuti et al., 2018).

Besur Village, located in Lamongan Regency, has an agricultural area that has not been used optimally. One of the ways to optimize the area is agrotourism activities. It is expected that agrotourism locations, will be able to increase the income of the surrounding community as well as to provide education about the importance of nature conservation. Healthy Plant Management is one of the sustainability concepts being developed in Besur Village. The concept was developed by integrating ecological, social, and environmental studies. The purpose of this study was to examine the potential of ecology-based agrotourism as a means for agricultural education. This objective was used as the basis for revealing the potential fea-

sibility and suitability of the Besur Village area as an agrotourism object. It was expected that the result of the research can be useful in supporting agrotourism activities to provide alternatives and recommendations applicable for agrotourism development in Besur Village, Lamongan Regency.

METHODS

The research was carried out in April - October 2020 in the Agrotourism Area of Besur Village, Lamongan Regency, East Java. The materials used in this study consisted of questionnaire sheets, chemicals in the form of distilled water, and 70% alcohol. Meanwhile, the tools used consisted of stationery, digital cameras, measurement tape, and rope.

This research applied a quantitative study with a descriptive approach in the form of scoring, weighting, and ranking of the categories that were. This research data consisted of primary and secondary data. Data collection was carried out through direct observation and questionnaires to the visitors, local communities, government, and related stakeholders. In order to find out the respondents' perceptions regarding the potential of agrotourism in Besur Village, a compiled questionnaire was used. The number of respondents in this study was 100 respondents selected by random sampling.

Ecological Aspects

The types of data collected in this study were grouped into several groups with the aspects studied, among others: ecological aspects (in the form of an inventory of plant species), physicochemical properties of soil (including soil texture, effective soil depth, soil surface drainage and erosion. soil, C-organic, pH, N-total, and organic matter). Plant vegetation inventory data were identified in the ecology laboratory of the Biology Study Program, Billfath University. Meanwhile, soil samples were tested and analyzed in the soil chemistry laboratory of the Chemistry Study Program, Billfath University. All data obtained at the location of the research were then processed using descriptive analysis and presented in tabulated data.

Secondary data collection was carried out by gathering supporting data from related agencies, namely the central statistics of Lamongan Regency. Plant inventory was carried out using the checkered line method. For each agrotourism zone located on each line transect, plots were placed with a size of 10 x 10 meters for the tree level (diameter > 4 cm), 5 x 5 meters for the beta level (1.5 - 4 cm), 2 x 2 for meters seedlings or understory, and the distance of each zone from one another was 100 meters (Zulkarnain, 2012).

Data Analysis

The data that has been obtained from field measurements were then calculated for the density, frequency, and dominance values as well as the Importance Value Index (IVI) of each species. The calculation used the following formula:

$$\text{Density (K)} = \frac{\text{Number of individuals within one species}}{\text{Area}}$$

$$\text{Relative Density (KR)} = \frac{\text{Density of one species}}{\text{Density of overall species}} \times 100\%$$

$$\text{Dominance (D)} = \frac{\text{Total area of one species}}{\text{Sample area}}$$

$$\text{Relative Dominance (RD)} = \frac{\text{Dominance of one species}}{\text{Dominance of overall species}} \times 100\%$$

$$\text{Absolute Frequency (F)} = \frac{\text{Number of slots one species existed}}{\text{Total slots}}$$

$$\text{Relative Frequency (RF)} = \frac{\text{Frequency of one species}}{\text{Frequency of overall species}} \times 100\%$$

$$\text{Importance Value Index (IVI)} = \text{RD} + \text{RF} + \text{RD}$$

Analysis of the Feasibility of Agrotourism

The assessment of feasibility aspects of agrotourism areas was conducted based on feasibility aspects. In this study, the area was divided into 3 zones, namely zone I, zone II and zone III. The zoning was selected based on the types of priority commodities that were adjusted to the characteristics of the land area. Zone I was an area designated for agrotourism and education, such as enjoying the agricultural activities and rural landscape as well as providing facilities for tourism activities in the form of promotion of agricultural products. Zone II was a tourist space to accommodate social and cultural activities while enjoying the residential landscape. Zone III was a tourism area in the form of rice fields and rice terrace used for seeding and harvesting. The valuation calculation used the following formula :

$$\Sigma KKA = \Sigma Sij.Aij$$

KKA = feasibility and suitability of agrotourism location

Sij = Criteria of agrotourism for a region

Aij = The weighting of agrotourism criteria

Determination of the classification of potential objects as follows :

$$\text{Classification of potential level} = \frac{\text{Nmax score} - \text{Nmin score}}{\text{N level of classification}}$$

After the calculation of the score of each parameter was done, the total calculation was carried out and categorized based on the results of feasibility. The

results of the assessment of the tourist area was classified into: VP (Very Potential), P (Potential), LP (Less Potential). Criteria used for the assessment and classification of categories for potential was carried out using assessments based on data processing. Zones would be considered less potential, potential and very potential, according to values from 1.4-2.1, 2.2-3.0, and 3.1 to 3.8, respectively.

Analysis of Public Perceptions

The number of respondents in this study was 100 respondents selected by random sampling. This analysis was obtained from the perception data or community statements regarding agrotourism activities in Besar Village. The observed assessment data consisted of 3 aspects, i.e visitor motivation (assessment indicators included channeling hobbies, adding knowledge, and searching for inspiration), preferred types of agrotourism activities (assessment indicators included picnics, relaxing, playing, seeing the diversity of various species of plants, and participating in training on making organic fertilizers), availability of supporting facilities (assessment indicators include transportation, worship facilities, cleaning facilities, lodging, food stalls, souvenir stands, and parking lots).

The scoring in the questionnaire used Likert scale of 1-5 (Pambudi et al., 2018). Questions and answers from each respondent with the criterion of strongly agree, neutral, disagree, and strongly disagree were given a value of 5, 4, 3, 2, and 1 respectively. All perceptual assessment results obtained from the visitor questionnaire were analyzed descriptively and presented in tabulated data. Furthermore, to obtain the assessment score of the respondent's perception of interpretation using the following formula:

$$M = \frac{\sum fx}{n}$$

Information:

M = Perceptual value

f = frequency of x

x = Weighting (score)

Σ = Sum

n = Number of respondents

The criteria for the respondent's interpretation obtained as follows (Helmi, et al., 2016) :

1,00 - 1,80 = Very Poor

1,81 - 2,61 = Poor

2,61 - 3,41 = Acceptable

3,41 - 4,21 = Good

4,20 - 5,00 = Very Good

RESULTS AND DISCUSSION

Ecological Aspects

From the observation and inventory of plant species in the agrotourism area of Besar Village 36 species were dominant and having the priority. It consisted of species of food-producing plants, each of which consisted of tree level vegetation (9 species), belta level vegetation (7 species), and seedling level plants (20 species) (Table 1).

Based on the Importance Value Index, it was known that the most dominant species at the seedling and understory level were Asian rice (*Oryza sativa* spp.) with an importance value of 83.76% and corn (*Zea mays* L.) plants with an importance value of 27.11%. At the belta level, the dominant species was *Annona squamosa* L. with an importance value of 3.53%, while the most dominant species at the tree level was *Persea americana* Mill. with an importance value of 3.01%.

From the results of the study, it was known that Poaceae family seedling level was the most dominant and had the highest IVI value, compared to the other plants even those from belta and tree levels. A large number of species from the Poaceae family was due to its density, even distribution, and resistance to shade. Its existence was very important in the stability of the ecosystem, especially as a source of food for the people in Besar village. According to Mawazin & Subiako (2013), plants that have a higher IVI value will be more stable, both in terms of species preservation and growth, that can increase their composition and diversity.

Physical Properties of Soil

From the observations of the physical properties of the soil in the research location, it showed that the existence of soil physical properties had a strong influence on the type of vegetation and the suitability of land use for agrotourism (Table 2).

Physical properties of the soil carried out in the laboratory test showed that the land structure in Besar Village had soil texture, depth, drainage and erosion properties which were categorized as good and quite suitable. The soil texture, depth, drainage, and soil erosion were in a good and suitable category. The average soil composition in the research location had a relatively balanced and ideal composition, and able to provide optimum conditions to support plant growth. The contribution of observing the physical properties of the soil was to determine the suitability of land for the development of agrotourism facilities, such as the suitability of land for building facilities, playgrounds, and picnic areas for visitors. This was in accordance with the opinion of Syofiani et al., (2020);

Haryati (2014) that the objective of observing the physical properties of the soil is to reduce negative impacts, therefore the ecological balance can be maintained.

Soil Chemical Properties

In the measurement of soil chemical properties, the results showed that the soil samples analyzed at the research location were categorized as having moderate fertility (Table 3).

Table 1. Importance Value Index (IVI) of vegetation in Besur Village Agrotourism

	Scientific Name	Family	IVI (%)
Seedling level plants			
	<i>Allium cepa</i> L.	Amarylidaceae	15.38
	<i>Amaranthus</i> sp.	Amaranthaceae	14.06
	<i>Apium graveolens</i> L.	Apiaceae	17.19
	<i>Zea mays</i> L.	Poaceae	27.11
	<i>Zingiber officinale</i> Rosc.	Zingiberaceae.	24.28
	<i>Ipomoea aquatica</i> Forsk.	Convolvulaceae	13.07
	<i>Kaempferia galanga</i> L.	Zingiberaceae	13.49
	<i>Cosmos caudatus</i> Kunth.	Asteraceae	12.93
	<i>Curcuma domestica</i> Val.	Zingiberaceae	11.39
	<i>Alpinia galanga</i> (L.) Swartz.	Zingiberaceae	11.37
	<i>Cucumis melo</i> L.	Cucurbitaceae	10.67
	<i>Ananas comosus</i>	Bromeliaceae	9.66
	<i>Oryza sativa</i> spp.	Poaceae	83.76
	<i>Musa paradisiaca</i> Linn.	Musaceae	13.94
	<i>Citrullus vulgaris</i> Schard.	Cucurbitaceae	11.05
	<i>Brassica juncea</i> L.	Brassicaceae	9.19
	<i>Cymbopogon citratus</i>	Poaceae	7.17
	<i>Curcuma xanthorrhiza</i> Roxb	Zingiberaceae	6.83
	<i>Solanum melongena</i> L.	Solanaceae	5.84
	<i>Lycopersicon esculentum</i> Mill.	Solanaceae	5.73
Belta level vegetation			
	<i>Annona squamosa</i> L.	Bromeliaceae	3.53
	<i>Morinda citrifolia</i> L.	Rubiaceae	2.72
	<i>Bougainvillea spectabilis</i> L.	Nyctaginaceae	2.31
	<i>Citrus aurantifolia</i> Christm.	Rutaceae	3.40
	<i>Punica granatum</i> L.	Lythraceae	1.5
	<i>Duranta repens</i> Auct.Non. Jacq.	Verbenaceae	1.5
	<i>Allamanda cathartica</i> L.	Apocynaceae	1.5
Tree-level vegetation			
	<i>Persea americana</i> Mill.	Lauraceae	3.01
	<i>Tamarindus indica</i> L.	Fabaceae	2.72
	<i>Averrhoa bilimbi</i> L.	Oxalidaceae	2.31
	<i>Syzygium aqueum</i>	Myrtaceae	2.31
	<i>Spondias dulcis</i>	Anacardiaceae	1.50
	<i>Artocarpus camansi</i> L.	Moraceae	2.31
	<i>Coffea</i> sp.	Rubiaceae	1.50
	<i>Artocarpus heterophyllus</i>	Moraceae	1.50
	<i>Nephelium Lappaceum</i> L.	Sapindaceae	1.50

Note : IVI (Importance Value Index)

Table 2. Analysis of soil physical properties parameters.

Parameter	Description	Width (Ha)	Percentage (%)
Soil texture	Smooth	2.687	1.48
Effective soil depth	0-30 cm	5.989	3.30
Surface drainage	Periodic flooded	29.273	16.15
Soil erosion	Present	11.286	6.23

Table 3. Analysis of soil chemical properties parameters.

Parameter	Range of value	Description
C-organic (%)	1.016	M
pH	6.6-7.0	N
N-total (%)	0.181	L
Organic materials (%)	1.751	M

Table 3, shows that the soil at the study site had an average C-organic content by 1.016% and classified as medium category. According to Rahmah et al., (2014) and Hendrajat, et al., (2018) the 1.016% C-organic content value can be classified a mineral soil with moderate organic content and that is good for cultivation and is classified as productive soils. The measurement result of pH that indicated the soil pH measured directly in the field, had an average of 6.6-7.0 which classified as neutral. This showed that the ponds or paddy fields in Lamongan Regency do not have a high acidity potential because the land comes from the conversion of paddy fields and part of the swamps that have non-acidic alluvial soils (Hendrajat et al., 2018). The total N-content in the study location was relatively low with an average value of 0.81%. The low N content is thought due to the N loses easily through washing or evaporation.

The organic matter in the soil was in average of 1.751% which classified as moderate and is not be-

longing organosols or peat soils (Hendrajat et al., 2018). Based on the results of the analysis that has been carried out, it can be concluded that the soil chemical properties of each vegetation showed different results depending on the zoning and the method of composting. The physico-chemical data of the agrotourism area in Besur Village were generally classified as good or sufficiently suitable to support the ecotourism object. Meanwhile, ecological data in the form of identification of plant species showed that the agrotourism area of Besur Village had a moderate level of biodiversity, and was suitable for tourism objects as well.

Potential Aspects of Agrotourism Areas

The results of the Agrotourism Area Feasibility assessment in Besur Village showed that the zone I area had a value of 2.8 and fell in the potential or conditional category as an agrotourism object (Table 4).

Table 4. Potential for agrotourism area feasibility in Besur Village

Area Under Assessment	Potential Feasibility of Agrotourism Area				Total weighted	Ranking
	A	B	C	D		
	40%	30%	20%	10%	Σ KKA	
Zone I	2	3	2	1	8	P
<i>Site for educational tourism</i>	0.6	0.7	0.6	0.7	2.6	
Zona II	3	3	2	2	10	LP
<i>Residential area</i>	0.2	0.2	0.4	0.8	1.6	
Zona III	1	2	1	3	7	LP
<i>Rice fields</i>	0.3	0.4	0.4	0.3	1.4	

Note: LP = Less Potential; P = Potential, VP = Very Potential, KKA = Feasibility of agrotourism area.

The suitable or potential category showed that the ecosystem condition of the agrotourism area in Besur Village could be used as an ecotourism object. However, it was necessary to have a management strategy in advance to develop the tourist spots. Hermita, (2015) stated that agrotourism as a conservation effort is an integrated and coordinated system of activities for the development of tourism as well as agriculture. The location of the zone I also has unique attraction. It has a good natural landscape and complete supporting facilities. The characteristics of land were fertile and suitable for planting various types of food crops, horticulture, and aesthetic crops (Figure 1).



Figure 1. Besur Village Agrotourism. (a) Natural landscape of Besur agrotourism, (b) Food crops vegetation.

Based on the value of the feasibility analysis, zone II and III areas had the value of 1.6 and 1.4, both areas were classified as Less Potential (LP). Accord-

ing to the Chief of the Village, the land on the area was less fertile. The residential area and rice fields in Besur Village were intended for growing only two type of species of plant, i.e. rice and maize, because of its proximity to nearby river as a water source. Also, these two areas only function as a circulation route without tourism activities, therefore, both areas were considered less potential.

Aspects of Public Perception

Based on the results of community perceptions, respondents provided an assessment of agrotourism activities in Besur Village through closed-ended questionnaires using a Likert scale 1-5, with a total of 100 respondents. Based on the results of the questionnaire analysis, the data showed that most of the respondents were female, 16-25 years age group, and students/ university students (Table 5).

Table 5. Analysis of public perceptions

Variable	Indicator	Value	Criterion
Aspects of visitor motivation	Add knowledge	5	Very good
	Spend hobbies	3	Acceptable
	Search for insights	4	Good
Aspects of agrotourism activities preferred	Picnic and leisure	4	Good
	Observe the diversity of plants	5	Very good
	Attend the training of making organic fertilizer	3.50	Acceptable
Aspects of the existence of facilities and management	Transportation and cleanliness	5	Very good
	Home stay	4	Good
	Souvenir shops, eatery & parking lot	3.27	Acceptable
Average		4.08	Good

The assessment of the motivational aspects of the visitors stated that they strongly agree for visiting agrotourism in Besur Village to broaden their knowledge or to learn (5 point). This condition was supported by the results of interviews, that the visitors in general with an average number of visits of 10 people per/ day consisted of community groups from educational institutions such as school children, students, and related agencies with a percentage of > 43%. In accordance with the opinion of Hermita, (2015), which stated that agrotourism facilities are not only fulfilling the needs of visitors but also as a means of education and scientific development.

The agrotourism activity that is most preferred by the visitors was to enjoy and observe the diversity of various types of plants in the agrotourism area (5 point). This condition was supported by the existence of controlled and maintained natural resources by special rules and management. Concerning the assessment of the availability of supporting facilities and management of agrotourism activities in Besur Village, the visitors agreed that the existing facilities were sufficient (4 point). According to the assessment result, transportation and cleaning facilities were the most important for community visits. In addition, hospitality and friendly services brought a comfortable feeling to the visitors.

The majority of people in the agrotourism area stated their readiness to be involved in agrotourism development. Apart from the community, the development of agrotourism in Besur Village was also

supported by stakeholders and local governments such as the Lamongan Tourism and Culture Office. The community and local government expected that agrotourism would increase the regional income of Lamongan Regency.

The novelty of this research is to study of the potential for agrotourism in Besur Village, in line with the ecological approach using Healthy Plant Management as the basis. This study was conducted after the discovery of plant commodities that were able to produce superior food sources, naturally and integrated with recreational and educational activities. Therefore, it was expected that agrotourism would be able to systematically solve agricultural problems. The novelty of this research was to obtain of the potential for agrotourism management in Besur Village through an ecological approach based on the concept of Healthy Plant Management. Also, this study was useful for preserving and maintaining indigenous knowledge.

CONCLUSION

According to agrotourism feasibility analysis zone I area of Besur Village had the potential as an agrotourism object with the highest score by 2.6. In terms of ecological aspects, the diversity of crops for producing food were as many as 36 species with the highest Importance Value Index (IVI) of plant species belonged to *Oryza sativa* spp. (83.76%) and *Zea mays* L. (27.11%). Meanwhile, the analysis of the physico-

chemical properties of the soil resulted in moderate or sufficient fertility. The results of the analysis of public perceptions were 4.08 and classified as good. This showed that Besur Village is suitable as an object for agrotourism area.

ACKNOWLEDGEMENT

We would like to present our gratitude to the Directorate of Research and Community Service, Directorate General of Research and Development, Ministry of Research and Technology/National Research and Innovation Agency of Republic Indonesia which has funded the research.

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