

# Ecotourism development through biodiversity potential identification and community perception in the protected forest on Buano Island, Western Seram, Maluku, Indonesia

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**Abstract.** *Siahaya ME, Matius P, Aipassa MI, Rayadin Y, Ruslim Y, Aponno HSES. 2021. Ecotourism development through biodiversity potential identification and community perception in the protected forest on Buano Island, Western Seram, Maluku, Indonesia. Biodiversitas 22: 3179-3191.* Forest as part of a large ecosystem has an important meaning and role in supporting living systems. Various great benefits can be obtained from the forests through its functions as a provider of water resources for humans and the environment, the ability of carbon sequestration, oxygen suppliers in the air, global climate regulators, and tourism service providers. The community has important role and participation in ecotourism that are different from other forms of tourism. Perception is a fundamental element that needs to be known before planning several activities that will involve the local community. This study aims to identify the potential of flora and fauna in the protected forest area for tourist attraction and analyze the Buano island community's (Western Seram District, Maluku Province, Indonesia) perception of ecotourism development activities. The vegetation data were collected using the combination of the path method and the compartmentalized line method. The method used for collecting wildlife data in the field is the line transect method as well as direct and indirect observations. Meanwhile, data related to community perceptions were collected through questionnaires and interviews. The results show that the villages on Buano island have biodiversity and cultural potential that could be developed as ecotourism attractions. In addition, the community's perception supported that they strongly agree on the development of ecotourism in the villages of Buano island.

**Keywords:** Community participation, development, ecotourism, perception, protected forest

## INTRODUCTION

Indonesia is a mega biodiversity country (von Rintelen et al. 2017), i.e. the country that has a very high biodiversity of both flora and fauna<sup>\*\*\*</sup>, which are very important assets (Supriatna 2008). The uniqueness and high biodiversity in Maluku are scattered in all areas with abundant concentrations of different species on each island. "Thousand Islands" is the nickname for Maluku Province, since it has a wide variety of flora and fauna. The unbalanced situation to fulfill various human needs has been marked by the increasing scarcity of several species of flora and fauna and the damage to the ecosystem as the habitat of animals.

Forest with all the potential contained in it is a natural resource that must be preserved to be used optimally for the welfare of the community without damaging the ecosystem. The people living around the forest on Buano island are still doing land clearing activities and harvesting wood from the protected forest. This is due to the lack of socialization from the forestry sector, which causes their ignorance of the designation of protected forest areas.

Conservation activities are an effort to maintain the balance of nature for humans and other living things to

interact well with each other. The increasing population and the obsession with unlimited economic growth have made it more difficult for conservation activities. In the midst of this chaotic problem, conservation activities can actually be carried out.

Nowadays, the tourism sector is a potential field in developing a country and a necessity for the community. Tourism is considered to have a positive impact on the people's economy (Holik 2016). Tourism contributes to indigenous people in improving their livelihoods (UNWTO 2019). Regions with tourism potential can revive the economic activities of the surrounding communities, increase community income, and increase the regional original revenue, which the government will reuse it to carry out development in the area to achieve prosperity. Therefore, the management of tourism must be done seriously by involving relevant parties. The tourism industry is competing to create tourism products that align with the objectives of tourism development, namely to introduce the natural beauty, culture, and customs found in an area (Sutresna et al. 2019).

The development in the tourism sector has arisen the concept of developing alternative tourism that is appropriate and actively helped maintain the sustainability

of various aspects. The determination on the forest area as a natural tourist attraction is one of the efforts to use the living natural resources and their ecosystem wisely to keep the natural resources sustainable (Nugroho 2011). According to Rodríguez-Piñeros and Mayett-Moreno (2014), the use of forest land for ecotourism has been well received because of its ability to provide income to local communities and to preserve forests.

The conservation activity which could be applied to sustainably preserve the diversity of the resources is through the concept of ecotourism (Stronza et al. 2019). It is an environmentally friendly tourism business with economic impacts for communities since it could increase the number of tourists without exploiting the natural resources (Kilipiris and Zardava 2012).

Ecotourism is a model of developing responsible natural tourism in areas which are still natural or areas that are managed naturally to enjoy the beauty of nature. It involves education and support for conservation efforts and increases the income of local communities (Butarbutar and Somarno 2013; TIES 2015). Ecotourism contributes to the conservation of biodiversity and sustains the well-being of local people (Kiper 2013). The local community contributed ecotourism development by respecting their culture and protecting nature (Mequanint and Gebremedhin 2015). Ecotourism gives benefit to the conservation of the forest (Mensah 2017). Ecotourism makes a model for conserving nature and natural resources (Bashar 2018). Furthermore, Sangpikul (2017) argued that ecotourism is a value-added product targeting various tourist groups who appreciate the uncontaminated nature and local experience, thereby generating more income to the local economy. Various terms such as sustainable tourism development, village tourism, and ecotourism are an approach to tourism development that ensure the tours can be sustainable. Ecotourism encourages regional economic growth to improve community welfare and maintains the preservation of natural resources, particularly biodiversity as a tourist attraction. Ecotourism can bring positive impacts in the form of economic improvement, conservation, environmental preservation, and empowerment of local communities.

Ecotourism development is currently one of the sustainable tourism forms. In many ways, sustainable tourism exemplifies the relationship between ecotourism and sustainable development (Bansal and Kumar 2011). The positive impact and the benefits of tourism can be enjoyed by either developed and developing countries (Uysal et al. 2016; Gursoy and Nunkoo 2019). Indonesia, which is one of the developing countries, continues to make improvements to obtain funds from tourists enjoying the natural and cultural beauty within the country.

The protected forest on Buano island has the potential of flora, fauna, various types of ecosystems, and beautiful natural phenomena, all of which can be a high tourist attraction. This beautiful and unique natural resource, potential has made Buano island to be reorganized through this natural tourism activity.

The nature of Buano island has not been developed properly to become a mainstay of natural tourism. It has

not been optimally exploited, so it has not become a favorite destination for tourists. These inhibiting factors include a large number of ecotourism attractions that have not been managed and arranged professionally; road access to tourism objects is relatively inadequate; and infrastructure, participation, and public awareness are still relatively low.

Based on the description above and considering the limited data and information regarding the condition of the protected forest on Buano island, the aims of the study were: (i) to identify the potential of flora and fauna in protected forest area for tourist attraction, and (ii) to analyze the perception of the Buano community for ecotourism development activities.

## MATERIALS AND METHODS

### Study area

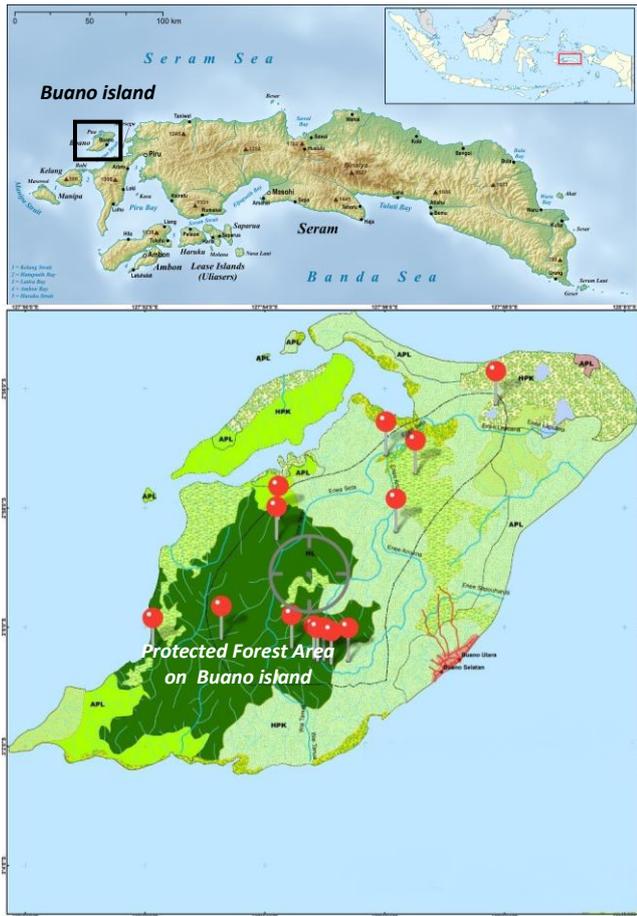
This research was carried out on Buano island, in the northern part of Seram Island in Huamual Belakang Sub-district, Western Seram District, Maluku Province, Indonesia. Buano island is bordered by waters to the west and north and by the Buano Strait to the south and east. The area of Buano island reaches 135.73 km<sup>2</sup>, which is occupied by two villages, namely North Buano and South Buano. The map of the study location is presented in Figure 1. This research was conducted from October to December 2019. Some of the landscape is shown in Figure 2.

### Data collection

This research used a combination of qualitative and quantitative methods. The quantitative and qualitative data were merged by linking qualitative and quantitative data obtained which supported each other to produce an intact result. However, in further data management, more emphasis was placed on qualitative aspects.

Data were collected from both primary and secondary sources. Primary data were obtained directly in the field through observation and recording of the vegetation and animals. In-depth interviews were carried out to analyze the community's perceptions about the plan for ecotourism development on Buano island. Secondary data were acquired from results and previous studies, textbooks, relevant journals, documents compiled by the various institutions, and community records in the village government offices. The species identification was made by cross-checking references that support this research.

The sampling technique was carried out using the Non-Probability Sampling method, i.e. purposive sampling. The sampling design was based on the judgment of the researcher who provided the best information to succeed for the objective study (Etikan and Bala 2017). Purposive sampling technique is the determination of the sampling technique with certain considerations (Sugiyono 2012). Thus, data were collected directly from the identified and selected sample population. The population in this study were the people of North and South Buano Villages who live surrounding the Protected Forest of Buano.



**Figure 1.** Research location at Buano island, Western Seram District, Maluku, Indonesia

The vegetation data were collected using the combination of the path method and the compartmentalized line method. The method for collecting wildlife data in the field used the line transect method. This method was chosen to cover the largest possible area of research in one location in a short time with a small work team, and direct and indirect observations through footprints, scat, sounds, and information from local communities who accompanied researchers while at the research location.

**Data analysis**

Field observations for an inventory of the number and types of flora were done by taking a sample location using a plot with a size of 20m × 20m through the track system. The inventory results show the quality of flora diversity as determined by Fandeli (2000) criteria as indicated in Table 1.

**Table 1.** Quality criteria of flora and fauna diversity

Scale	Number of flora species	Number of fauna species	Quality
1	<5 species	1-2 species	Bad
2	6-10 species	3-5 species	Poor
3	11-20 species	6-10 species	Fairly good
4	21-31 species	11-15 species	Good
5	>31 species	>15 species	Very good

Respondents from 2 villages populations, namely North Buano village (8,468 people) and South Buano village (1,927 people) were determined as samples using simple random sampling. The total sample was 195 samples. Slovin formula was used to determine the number of samples.

$$n = N / (1 + (N \times e^2))$$

Where:

n : Sample

N : Population

e : margin of error (confidence interval of 90% and a 10% margin of error)

The method used to measure people’s perception is the Likert scale method. The Likert scale is a measurement method used to measure people’s attitudes, opinions, and perceptions about social phenomena (Joshi et al. 2015).

In this study, the Likert scale was based on data classification, namely the attitude scale, score, and category. In accordance with the Likert scale, the highest score in this study was determined through the answers to questions given to the public with a score of 5 for the best answer and the lowest score was 1. In comparison, the answers between the lowest and highest scales are adjusted to the number of answers. For favorable statements, a score weight of 5, is given to “strongly agree”, 4 to agree, 3 to undecided, 2 to disagree, and 1 to strongly disagree.

Community’s perception was obtained through ranking. The community was asked 5 questions with a maximum total value of 5. During analysis, according to Joshi et al. (2015), the scores of all items of the questionnaire were combined (sum) to generate a composite score. Furthermore, a rating scale was made for community’s perception as follows:

Maximum score (Y) = Number of respondents × highest number of scores;

Minimum score (X) = Number of respondents × number of scores;

Total Score = Number of respondents’ answers × number of respondents;

Difference per category = highest score - lowest score / number of categories;

Likert index (%) = (Total score/Y) × 100.

The scale of community attitude is as indicated in Table 2.

**Table 2.** The scale of community attitude

Index	Categories
0-19.99%	Strongly disagree
20-39.99%	Disagree
40-59.99%	Neutral
60-79.99%	Agree
80-100%	Strongly agree

## RESULTS AND DISCUSSION

### Natural resources

Natural resources on Buano island were divided into 2, namely natural resources on land and sea. Natural resources found on the land include forest products and non-timber forest products areas. Meanwhile, other kinds of natural resources are found in the coastal area. Buano island Protected Forest was designated as the protected forest on 29 September 2014 as stipulated in the Decree 854/Menhut-II/2014 on the Maluku province's protected forest area 4,287.22 ha.

Abundant natural resources, including the diversity of forest vegetation, create the Buano forest area the best timber producer. The indigenous peoples are very dependent on natural resources in the forest. Fatem (2019) stated that in Papua, the forest has an important role in indigenous people's lives. Indigenous peoples utilize the forests around them and have a close relationship with the experience and knowledge and interact with each other between them and their environment (Parrotta et al. 2016). Wood is one of the high-value commodities from the forest. Since two hundred years ago, Buano island has been known as a producer of hardwood for use in building materials, firewood, and traditional ceremonies.

The people do forest encroachment to get the timber (Tacconi and Muttaqin 2019). Unsustainable use patterns accelerate forest degradation and certainly affect forest ecosystems and important habitats within them.

The potentials of non-timber forest products on Buano island include pandanus leaves/mat leaves, bamboos, medicinal plants, honey, rattan, wildlife, as well as the potential for tourism and natural services. These potentials have not been maximally utilized. Non-timber forest products that have been utilized on a home industry scale (traditionally) were only limited to the distillation of cajuput oil, especially in the customary forest area. This forest is one of the natural resources that can be developed to support the realization of ecotourism on Buano island.

In addition to agricultural land, harvesting timber, and non-timber forest products, forest is also used for customary activities since the Buano protected forest has many sacred sites. Part of it is related to respect for the natural environment, which is believed to be sacred and sacred places. For example, sacred places are prohibited to be exploited to avoid forest damage and to grow the plants

on it. This could be seen from the characteristics of the vegetation in the forest, where the diameter of the forest trees can reach more than 100 cm. However, in the vicinity of the forest without sacred sites, local people still carry out land clearing activities in protected forest areas.

### Potential of flora

Based on the inventory and interviews about plant species of protected forest, 110 species of plants from 41 families are presented in Table 3.

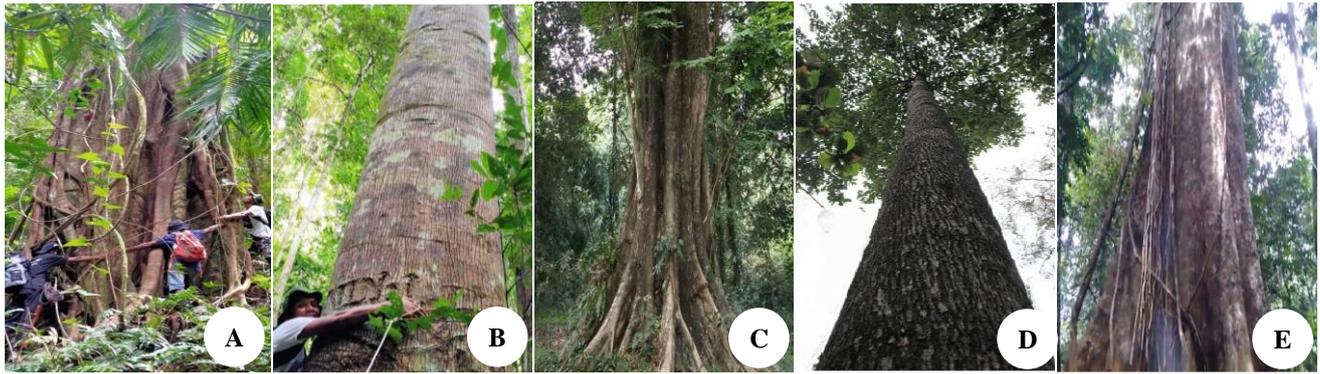
Lasi (*Adina fagifolia*), gufasa (*Vitex Cofassus*), matoa (*Pometia pinnata*), kayu besi (*Intsia bijuga*) are hardwoods (Figure 3), which the people of Buano often use them for construction materials and furniture such as tongkat langit (*Ailanthus integrifolia*), tanjung (*Mimusops elengi*), pule (*Alstonia scholaris*), linggua (*Pterocarpus indicus*), jabon (*Anthocephalus cadamba*), and suren (*Toona sureni*). In general, these species of trees are in the community's customary forests, located in the middle of the island of Buano and are about 6-10 km from settlements (parent country and hamlet); most of them are in the protected forest areas.

The community did not know this protected forest until the intervention program of the Ministry of Forestry, namely Social Forestry for HKM (Community Forest) and Forest Rehabilitation in 2017. In 1997 the Maluku Provincial Forest Service, together with the Buano island community groups in the villages of North Buano and South Buano, planted a boundary of protected forest, but the community did not understand the purpose of planting boundary palms for protected forest areas (LPPM 2018).

The identification of 50 floras indicated that there are more than 31 species in the criteria of diversity quality of flora (Fandeli 2000). Kristiyanto (2019) found 47 species of vegetation in the cultural park of Setu babakan, Jakarta, while Henri et al. (2017) found 41 species of vegetation in biodiversity park of Pelawan Forest, Central Bangka. Compared with the results in other regions, it could be seen that the diversity quality in the Protected forest area on Buano island was higher than the aforementioned sites. The difference in quality diversity of the species in several areas might be caused by the number of observations in an area, the differences in environmental conditions, and the level of disturbance in each study area.



Figure 2. A-D. Landscape of the protected forest on Buano island, Western Seram District, Maluku, Indonesia



**Figure 3.** Trees can reach more than 100 cm on Buano island, Western Seram District, Maluku, Indonesia: A. *Adina fagifolia*; B. *Vitex cofassus*; C. *Pterocarpus indicus*; D. *Anthocephalus cadamba*; E. *Intsia bijuga*

**Table 3.** The vegetation species in secondary forest in the protected forest area on Buano island, Western Seram District, Maluku, Indonesia

Species	Local name	Family	Benefits								
			I	II	III	IV	V	VI	VII	VIII	
<i>Adina fagifolia</i>	Lasi	Rubiaceae	√								
<i>Ailanthus integrifolia</i>	Tongka langit	Simaroubaceae		√							
<i>Aleurites moluccana</i>	Kemiri	Euphorbiaceae				√	√				
<i>Alstonia scholaris</i>	Pule	Apocynaceae	√	√				√			
<i>Alstonia spectabilis</i>	Pule batu	Apocynaceae	√	√				√			
<i>Annona muricata</i>	Nangka belanda	Annonaceae				√					
<i>Anthocephalus cadamba</i>	Jabon	Rubiaceae	√	√							
<i>Anthocephalus macrophyllus</i>	Samama	Rubiaceae		√				√			
<i>Areca catechu</i>	Pinang	Arecaceae						√			
<i>Arenga pinnata</i>	Mayang	Arecaceae						√			√
<i>Artocarpus altilis</i>	Sukun	Moraceae		√	√	√	√		√		
<i>Artocarpus heterophyllus</i>	Nangka	Moraceae	√	√	√	√	√				
<i>Artocarpus integer</i>	Cempedak	Moraceae	√	√			√				
<i>Averrhoa bilimbi</i>	Belimbing	Oxalidaceae					√	√			
<i>Barringtonia asiatica</i>	Hutong laut	Lecythidaceae						√			
<i>Bombax malabaricum</i>	Kapuk hutan	Bombacaceae		√						√	
<i>Brachychiton discolor</i>	Papaya hutan	Malvaceae						√			
<i>Calophyllum inophyllum</i>	Bintanggur pantai	Guttiferae			√			√			
<i>Calophyllum soulattri</i>	Bintanggur	Guttiferae			√			√			
<i>Cananga odorata</i>	Kenanga	Annonaceae						√			
<i>Canarium amboinense</i>	Kenari	Burseraceae			√	√	√	√			
<i>Canarium Indicum</i>	Kenari	Burseraceae			√	√	√	√			
<i>Canarium sylvestre</i>	Nanari	Burseraceae			√	√	√	√			
<i>Carica Papaya</i>	Pepaya	Caricaceae				√	√				
<i>Ceiba pentandra</i>	Kapuk	Malvaceae		√					√	√	
<i>Celtis paniculata</i>	Kasian	Cannabaceae	√								
<i>Cerbera manghas</i>	Mangga berabu	Apocynaceae							√		
<i>Cinnamomum verum</i>	Kayu manis	Lauraceae						√			
<i>Cocos nucifera</i>	Kelapa	Arecaceae				√				√	√
<i>Colona scabra</i>	Marong merah	Tiliaceae						√	√		
<i>Cordia subcordata</i>	Salimuli	Boraginaceae	√		√	√		√	√	√	
<i>Diospyros pilosanthera</i>	Belo hitam	Ebenaceae	√								
<i>Durio zibethinus</i>	Durian	Bombacaceae		√		√	√	√			
<i>Dysoxylum caulostachyum</i>	Langsat utang	Meliaceae	√								
<i>Elaeocarpus nouhuysii</i>	Kayu burung putih	Elaeocarpaceae	√	√							
<i>Elaeocarpus sphaericus</i>	Kayu burung	Elaeocarpaceae	√	√							
<i>Endospermum moluccanum</i>	Kayu raja	Euphorbiaceae	√								
<i>Erythrina variegata</i>	Galala	Fabaceae						√		√	√
<i>Eugenia aromatica</i>	Cengkeh	Myrtaceae						√			
<i>Eugenia reinwardtiana</i>	Kayu merah	Myrtaceae	√	√		√	√	√			
<i>Eugenia sp.</i>	Cengkeh hutan	Myrtaceae						√			
<i>Fagraea ceilanica</i>	Papaceda	Gentianaceae						√			
<i>Falcataria moluccana</i>	Salawaku	Fabaceae	√						√	√	√
<i>Ficus ampelas</i>	Kayu ampalas	Moraceae	√	√				√			
<i>Ficus benjamina</i>	Beringin daun kecil	Moraceae							√		√

<i>Ficus pubinervis</i>	kopi-kopi	Moraceae		√				√	
<i>Ficus septica</i>	Beringin batu	Moraceae					√	√	
<i>Ficus tinctoria</i>	Beringin daun besar	Moraceae	√	√			√		
<i>Ficus variegata</i>	Saka/Gondal	Moraceae	√	√			√		
<i>Flacourtia rukam</i>	Tomi-tomi	Salicaceae	√			√			
<i>Gironniera subaequalis</i>	Samar putih	Cannabaceae	√						
<i>Gmelina arborea</i>	Jati putih	Verbenaceae	√	√	√			√	√
<i>Gmelina moluccana</i>	Kayu titi	Lamiaceae	√	√	√			√	√
<i>Gnetum gnemon</i>	Ganemo	Gnetaceae				√	√		
<i>Helicia moluccana</i>	Parudang	Proteaceae	√	√					
<i>Heritiera littoralis</i>	Benteng	Malvaceae	√		√			√	
<i>Hernandia nymphaeifolia</i>	Kampak-kampak	Hernandiaceae		√			√	√	√
<i>Hibiscus tiliaceus</i>	Waru	Malvaceae					√	√	√
<i>Homalium foetidum</i>	Samar merah/Asmale	Salicaceae	√	√				√	
<i>Horsfieldia sylvestris</i>	Lobi-lobi buah kecil	Myristicaceae	√					√	
<i>Intsia bijuga</i>	Kayu besi	Leguminosae	√	√					
<i>Kleinhovia hospita</i>	Kayu kinar/halaman	Malvaceae	√				√		
<i>Lansium domesticum</i>	Langsat	Meliaceae				√			
<i>Laplacea amboinensis</i>	Nani air	Theaceae						√	
<i>Litsea angulata</i>	Makila	Lauraceae	√	√		√	√	√	
<i>Lumnitzera littorea</i>	Manjariti	Combretaceae		√					
<i>Mangifera foetida</i>	Mangga hutan	Anacardiaceae		√		√		√	
<i>Mangifera indica</i>	Mangga	Anacardiaceae		√		√		√	
<i>Mangifera odorata</i>	Mangga kueni	Anacardiaceae		√		√		√	
<i>Maranthes corymbosa</i>	Batu kayu	Chrysobalanaceae	√	√	√				
<i>Melaleuca cajuputi</i>	Kayu putih	Myrtaceae					√		
<i>Metroxylon</i> spp.	Sagu	Arecaceae				√			
<i>Mimusops elengi</i>	Tanjung	Sapotaceae	√	√					
<i>Moringa oleifera</i>	Kelor	Moringaceae				√	√		√
<i>Musa acuminata</i>	Pisang meja	Musaceae				√	√		
<i>Musa paradisiaca</i>	Pisang tanduk	Musaceae				√	√		
<i>Musa textilia</i>	Pisang raja	Musaceae				√	√		
<i>Myristica fatua</i>	Pala hutan	Myristicaceae		√		√	√		
<i>Myristica fragrans</i>	Pala	Myristicaceae		√		√	√		
<i>Myristica</i> spp.	Darah sontong	Myristicaceae				√	√		
<i>Nauclea orientalis</i>	Kayu marsegu	Rubiaceae	√		√				
<i>Nephelium lappaceum</i>	Rarmbutan	Sapindaceae				√	√		√
<i>Ochrocarpus excelcus</i>	Lolang kei	Guttiferae						√	
<i>Octomeles sumatrana</i>	Binuang/Pulaka	Datiaceae	√	√					
<i>Palaquium javanese</i>	Siki panggayo	Sapotaceae		√					
<i>Pandanus tectorius</i>	Pohon tikar	Pandanaceae				√		√	√
<i>Paraserianthes falcataria</i>	Sengon	Fabaceae						√	√
<i>Persea americana</i>	Alpoket	Lauraceae				√			
<i>Pimelodendron amboinicum</i>	Mamina	Euphorbiaceae	√						
<i>Pometia pinnata</i>	Matoa	Sapindaceae				√	√		
<i>Pongamia pinnata</i>	Kayu besi pantai	Papilionaceae	√				√		
<i>Pouteria obovata</i>	Kayu sisir/Maren	Sapotaceae				√	√		
<i>Premna corymbosa</i>	Gufasa pantai	Lamiaceae					√		
<i>Psidium guajava</i>	Guyawas	Myrtaceae				√	√		
<i>Pterocarpus indicus</i>	Lingua	Fabaceae	√	√					
<i>Pterocymbium tinctorium</i>	Kalabasa	Malvaceae	√	√	√			√	
<i>Pterospermum celebicum</i>	Bayur	Malvaceae	√	√					
<i>Spondias dulcis</i>	Kedondong	Anacardiaceae				√	√		
<i>Sterculia ceramica</i>	Kuboha	Sterculiaceae				√	√		
<i>Syzygium malaccense</i>	Jambu bol	Myrtaceae						√	
<i>Syzygium</i> sp..	Guyawas hutan	Myrtaceae	√	√				√	
<i>Syzygium obtusifolium</i>	Cengkeh hutan	Myrtaceae	√	√			√		
<i>Syzygium zeylanicum</i>	Koramu	Myrtaceae			√	√		√	
<i>Terminalia catappa</i>	Ketapang	Combretaceae	√	√	√	√			
<i>Theobroma cacao</i>	Coklat	Malvaceae				√	√		
<i>Timonius timon</i>	Timon	Rubiaceae				√	√		
<i>Toona sureni</i>	Sureng	Meliaceae	√	√	√			√	
<i>Vitex cofassus</i>	Gofasa kei	Lamiaceae	√	√					
<i>Xylocarpus granatum</i>	Kira-kira	Meliaceae	√	√					
<i>Xylocarpus moluccensis</i>	Kira-kira	Meliaceae	√	√					

Note: I. building materials; II. furniture; III. shipping timber, IV. food/fruits; V. pharmaceuticals; VI. Firewoods, VII. crafts materials, VIII. traditional materials

The flora data shows that the species can be used as building construction materials and household furniture. In addition, there are also species of medicinal plants and fruit-producing plants that can be consumed. Therefore, the diversity of species and the aesthetics of their habitats are special attractions that can contribute to ecotourism development. This illustrates the rich potential of flora's biodiversity in protected forest areas on Buano island and can attract tourists to see and enjoy it.

### Potential of fauna

The inventory results from direct and indirect observations and interviews with the surrounding community and other supporting secondary data show that the field has bird and non-bird species. The existence of flora in the protected forest area of Buano island cannot be separated from the presence of animals since there is a very close interaction between them.

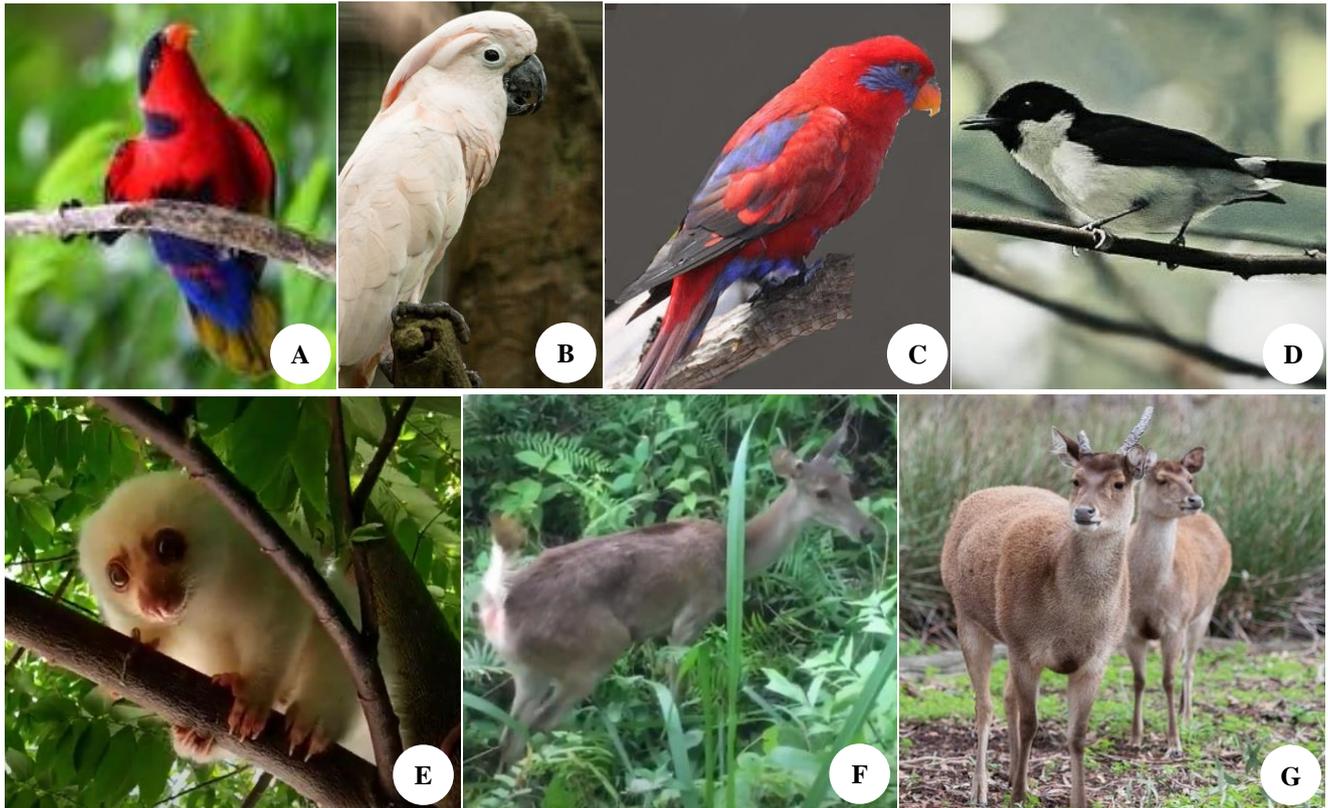
There are 39 species of bird found in the protected forest area on Buano island include: nuri maluku (*Eos bornea*), nuri raja ambon (*Alisterus amboinensis*), kasturi tenguk ungu (*Lorius domicella*), kakatua seram (*Cacatua moluccensis*), nuri telinga biru (*Eos semilarvata*), kehicap buano (*Symposiachrus boanensis*), nuri pipi merah (*Geoffroyus geoffroyi*), uncal ambon (*Macropygia amboinensis*), raja perling seram (*Basilornis corythaix*), kepudang seram (*Oriolus forsteni*), isap madu seram (*Lichmera monticola*), cikukua seram (*Philemon subcorniculatus*), gagak hutan (*Corvus enca*), trinil semak (*Tringa glareola*), cekakak sungai (*Todiramphus chloris*), walet sapi (*Collocalia esculenta*), kuntul karang (*Egretta sacra*), cabak maling (*Caprimulgus macrurus*), delimukan zamrud (*Chalcophaps indica*), pergam laut (*Ducula bicolor*), pergam mata putih (*Ducula perspicillata*), tekukur biasa (*Streptopelia chinensis*), walik dada lembayung (*Ptilinopus viridis*), tiang lampu biasa (*Eurystomus orientalis*), bubut alang alang (*Centropus bengalensis*), wiwik maluku (*Cacomantis aeruginosus*), cabai kelabu (*Dicaeum vulneratum*), srigunting lencana (*Dicrurus bracteatus*), cikalang kecil (*Fregata ariel*), tepekong kumis (*Hemiprocne mystacea*), gosong forsten (*Megapodius forsteni*), kehicap pulau (*Monarcha cinerascens*), sikatan kelabu (*Myiagra galeata*), sikatan burik (*Muscicapa griseisticta*), betet kelapa paruh besar (*Tanygnathus megalorhynchus*), kipasan dada lurik (*Rhipidura rufiventris*), celepuk Maluku (*Otus magicus*), perling ungu (*Aplonis metallica*). Siahaya et al. (2021) stated that the number of birds identified on Buano Island was 28 species. This is due to the short time in conducting research so that the presence of the birds was not visible at that time. Meanwhile, according to Burung Indonesia (2021), birds on Buano island were 33 species.

Among the 39 bird species, 4 birds are included in the IUCN Red List (2020) could be seen in Figure 4, namely, *Lorius domicella* is Endangered (EN), *Cacatua moluccensis* is Vulnerable (VU), *Eos semilarvata* is Near Threatened (NT), and *Symposiachrus boanensis* is Critically Endangered (CE).

Furthermore, the species of insects found were 20 species including: Butterflies: *Graphium sarpedon*, *Ideopsis juvenata*, *Vindula* sp., *Papilio Memnon*, *Eurema candida*, *Elymnias Vasudeva*, *Ornithoptera priamus*, *Ornithoptera gambrius*, *Troides hypolitus*, *Troides oblongomaculatus*, *Troides Helena*; Ants: *Dolichoderus thoracicus*, *Oecophylla smaragdina*, *Camponotus* sp., *Aenictus ceylonicus*; Mosquitos: *Anopheles* sp., *Tripteroides* sp.; Grasshoppers: *Acrophylla wuelfingi*, *Oxya japonica*, *Atractomorpha crenulata*.

There were also 9 species of mammal found including: Kuskus Putih (*Phalanger ursinus*), kuskus kelabu (*Phalanger vestitus*), kuskus coklat (*Phalanger orientalis*), rusa timor (*Cervus timorensis*), rusa sambar (*Cervus unicolor*), ular mono boa (*Candonia carinata*), ular patola (*Morelia amethystina*) kelelawar ekor trubus kecil (*Emballonura monticola*), babi hutan (*Sus scrofa*), kambing (*Capra aegagrus hircus*). Meanwhile, there were 3 species of mammal have been declared Vulnerable (VU) namely Kuskus Putih (*Phalanger ursinus*), rusa timor (*Cervus timorensis*), and rusa sambar (*Cervus unicolor*) could be seen in Figure 4. Likewise, there were 2 reptiles species including: biawak maluku (*Varanus indicus*), and soa-soa (*Hydrosaurus amboinensis*).

Based on the inventory results, it is known that the potential of fauna in the research location is very diverse. Fandeli (2000) stated that the fauna found in the protected forest area of Buano island were very high, namely 69 species. Likewise, in the Park of Pelawan Forest, Central Bangka, there were 41 species of flora and 135 species of fauna (Henri et al. 2017). Furthermore, the higher the number of species both flora and fauna in an area, the better the quality. Providing information about the various species present in each observation path is interesting for tourists to provide more knowledge about vegetation and wildlife species, the ecological processes of existing vegetation and wildlife species, and are something new for eco-travelers. The high diversity of flora and fauna will attract a lot of interest from local and foreign tourists to come and get new, unique, and different experiences. Thus, it can be interpreted that Forest protected on Buano island is very good to be developed into ecotourism attractions. Ecotourism involves conservation, provides effective economic incentives to conserve, increases cultural biodiversity, and protects natural and cultural heritage.



**Figure 4.** Fauna based on IUCN provisions (2020): A. *Lorius domicella*; B. *Cacatua moluccensis*; C. *Eos semilarvata*; D. *Symposiachrus boanensis*, E. *Phalanger ursinus*, F. *Cervus timorensis*, and G. *Cervus unicolor*

### Other ecotourism potentials

#### *Cultural and traditional tourism*

The local wisdom can be found in the cultural artifacts that show the civilization of the people. Artifacts are cultural objects with historical value, art, and knowledge maintained and preserved by the community. The artifacts on Buano island consist of traditional houses (heirloom houses), old graves, and sacred places (Figure 5).

#### *Coastal forest*

The coastal forest on Buano island (Figure 6) is open for people, white sand, low vegetation elevations, bushes, and various plants that live in groups. Coastal forests grow in dry sandy, generally avoiding high tides. The coastal forest has a biodiversity that is utilized by the Buano community either directly or indirectly. In addition, coastal forests have sociocultural functions, one of which is a marine tourism place worthy of tourists visiting. These functions and benefits must be maintained, while their quality and quantity must be preserved to survive human life now and in the future.

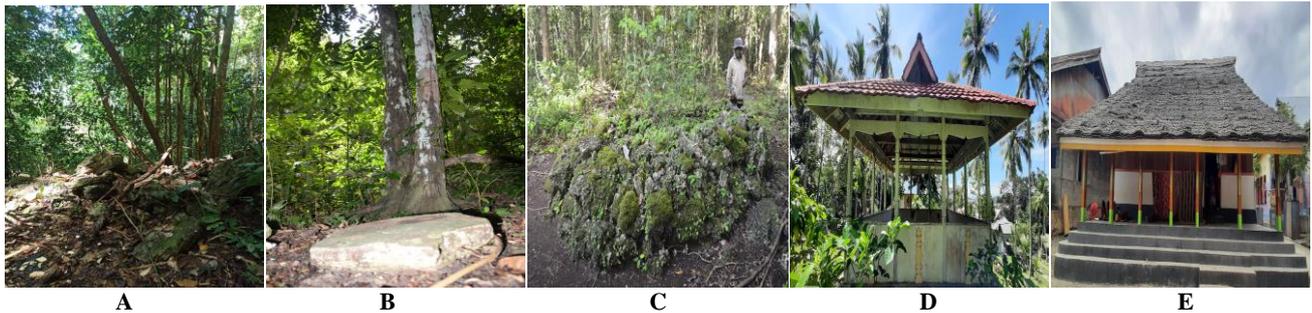
#### *Cajuput forest*

Cajuput management (*Melaleuca cajuputi*) was first carried out in 1987 by a trader from China. After his death, the community independently developed cajuput oil

business until now. The area of cajuput on Buano Island is  $\pm 900$  ha. Tourists who visit Buano Island can see the distillation of cajuput done in the cajuput forest. Cajuput oil can be purchased directly by tourists from the distillation site.

#### *Traditional agroforestry "Dusung"*

Traditional agroforestry knew in Maluku as "dusung" has been entrenched in the people of Maluku. This "dusung" system has brought Maluku to be known as "the Spice Island" (Bone et al. 2012). When observed, the canopy stratification in the "dusung" is very similar to natural forests. The conditions and micro-climates that are formed are the same as in natural forests. The people of Buano Island manage biodiversity and the environment with their local knowledge. The species of plants cultivated in "dusung" include cocoa (*Theobroma cacao*), cloves (*Eugenia aromatica*), coconut (*Cocos nucifera*), nutmeg (*Myristica fragrans*), candlenut (*Aleurites moluccana*), and sago (*Metroxylon sago*). They are planted along with various types of useful plants, especially fruit and tree species with use-value of building materials, fuelwood, and others. Therefore "dusung" can also be used as a tourist spot where tourists can enjoy the "dusung" atmosphere and the fruits contained in it.



**Figure 5.** Sacred sites in the protected forest area, old grave, and heirloom house: A. Sacred fortress; B. Sacred Baileo Hatutapalan; C. Sacred grave of Guru Kekasih Allah; D. Sacred old grave of Guru Mahu; E. One of thirty heirloom houses



**Figure 6.** Other ecotourism areas: A. Coastal forest; B. Mountain view from coastal forest; C. Cajuput distillation house; D. The Cajuput leaves; and E. *Metroxylon sago* trees in the “dusung”

### Community perception of the development of ecotourism

Community education is one of the factors that influence the level of understanding of ecotourism development. The results obtained from the people living on the island of Buano show that community education varies widely. The number of people who did not go to school was 22.46%, who did not complete elementary school was 12.46%, while who completed elementary school was 23.65%, junior high school was 21.98%, senior high school was 12.66%, student level was 4.36%, and diploma level was 1.06%. Meanwhile, the undergraduate level was 1.30%, the postgraduate level was 0.05%, and the Doctoral level was 0.02%.

Education participation on Buano Island is still dominated by men, i.e. 61%, while women are merely 39%. The composition of the people who study at each level of education is followed more by men, except at the junior high school level, where 52% of the participants are women. The strong patriarchal culture influences this condition. Society prioritizes the education of boys over girls.

This public education shows that the higher a person's education level, the faster they will receive new information. If the protection of flora and fauna continues to be developed, they will also actively impact people with low education. In addition, education is a means of supporting development in various sectors, including the tourism industry sector.

Community perception is very important in the development of ecotourism. By knowing the public perception, ecotourism development can provide better and sustainable results (Eshliki and Kaboudi 2012). In its

development, the role of the community must be prioritized/considered in all respects. In connection with the development of ecotourism on the Buano island, an assessment was carried out to the community by distributing questionnaires to determine people's perceptions of the ecotourism development on the Buano island.

Furthermore, the support of local communities for the ecotourism program is very important since it provides more significant opportunities for local communities to involve themselves in the decision-making process and enjoy the benefits of tourism industry development while empowers the local community. On the contrary, if tourism development does not get community support, it will easily lead to conflict (Mensah and Ernest 2013).

In connection with the development of ecotourism on the Buano island, an assessment was carried out to the community by distributing questionnaires to determine people's perceptions of the ecotourism development on the Buano island. The maximum score obtained was 975. The result of the community perception is described as follows:

*Community perception of the ecotourism development can create opportunities for employment and increase the local village income*

Community perception of the ecotourism development can create opportunities for employment and increase the local village income (Figure 7). Based on villagers' data, most of the inhabitants of Buano are classified as people living in poverty and included in the category of underdeveloped villages. To improve the living standards

of the Buano people living around the Buano Protection Forest, an ecotourism program can be run.

This study shows that 57.44% of the respondent strongly agreed and 28.21% of the respondents agreed that ecotourism programs can create employment opportunities and increase local village income. According to them, if they could take part in economic activities of the ecotourism development program, these could increase their livelihood, get job opportunities, and increase the local village income. In addition, 3.59% of the respondents disagreed due to lack of understanding about the ecotourism development program and lack of knowledge regarding the meaning of ecotourism. Sangchumnong (2019) stated that the community lacks knowledge about tourism promotion. Thus improving locals' environmental knowledge can encourage favorable attitudes towards ecotourism (Zhuang et al. 2019). However, the index scale value obtained a value of 87.46, which means that the community strongly agrees and enthusiastic about the development of ecotourism in their village.

*Community perception of the preservation of the potential of natural resources (flora and fauna) in the protected forest to support the development of ecotourism on Buano island.*

Alternative strategies to increase community participation in the ecotourism development on Buano island are based on ecotourism principles in terms of conservation, namely by reducing the occurrence of illegal logging and conversion of forest land (land in the buffer zone). The community's active role is needed to protect the population, species, habitat, uniqueness, and endemic plant and animal ecosystem in the forest.

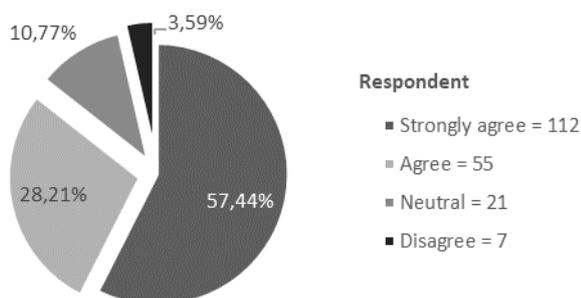
According to the local community, some of the plants are partly local plants, and there are also endemic animals of Buano island. The ecological impacts felt by the community were also divided into positive and negative impacts. The negative impact was the destruction of natural preservation due to the irresponsible behavior of domestic and foreign tourists. They tend to litter in the environment where the animals live; thus, these animals will eat trash from tourists and the forest environment becomes dirty. In addition, there are also positive impacts taken from the diversity of flora and fauna in the area around tourist

objects. It could be used as a place for research on flora and fauna diversity as well as a source of knowledge for tourists.

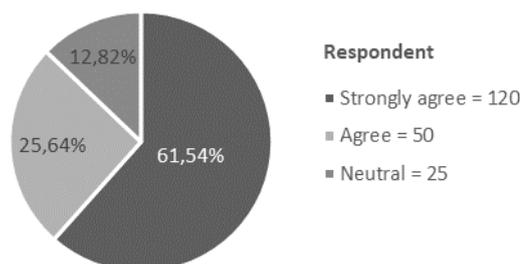
The result of interviews with the respondents shows that most Buano people positively welcomed the preservation of natural resources (flora and fauna) to support the tourism development. It can be seen that 61.54% of respondents strongly agreed, 25.64% of respondents agreed, and 12.82% of respondents stated neutral (Figure 8). The Likert Index obtained was 89.74. This means that the community strongly agrees that the natural resources on Buano island are maintained and conserved to support ecotourism. Due to the people at present have begun aware of the ecological potential in their area, there have been efforts to introduce and assist the conservation of natural resources both on land and in the waters to the local community by LPPM NGOs (The community institute for participation in development) and the Ministry of Environment and Forestry of the Republic of Indonesia through the Watershed Management Center-Protected Forest (BPDAS-HL) Maluku since 2017.

The tourism sector is good to be developed on Buano island since this island has the potential of natural resources which are suitable for tourism, especially ecotourism based on environmental sustainability. On the other hand, the communities around the forests generally use the forests for their survival.

Community participation in preserving the Buano Island Protected Forest area as an ecotourism attraction tends to be high due to the community's realization and understanding of the importance of preserving existing forests. The life of this village community is very dependent on existing natural resources and needs to be managed sustainably through active actions to protect the forest. Thus, the availability of natural resources around the forest area is not lost and extinct. In line with Siahaya et al. (2016), forest for the community is nothing new, especially for rural communities that still have traditional values and culture. Furthermore, since ancient times, people have seen forests as a source of food, medicine, energy, clothing, the environment, and their place of residence. To protect the forest, the Buano people adapt to the surrounding environment to feel responsible and consciously to protect and manage the forest.



**Figure 7.** Community perception of the ecotourism development can create opportunities for employment and increase the local village income



**Figure 8.** Community perception of the preservation of the potential of natural resources (flora and fauna) to support the development of ecotourism on Buano island

*Community perception of the existence of traditions and culture that is still preserved to support the development of ecotourism on Buano island*

Tradition and culture also play an important role in developing tourism (Stankov et al. 2019); thus, tradition and culture need to be preserved. Buano people still hold cultural values and local wisdom in all aspects of their lives. The result of interviews shows that 77.95% of respondents strongly agreed and 16.92% agreed to preserve customs and culture in ecotourism development. There were only 5.13% of the respondent stated neutral (Figure 9), due to their opinion that the arrival of tourists to their villages could damage the authenticity or biological integrity of a cultural product. Most of them said that the customs and culture that exist in their village must remain preserved due to many sacred places of their ancestors and traditional houses which are still preserved. This is also an attraction to support tourism. The attractiveness factor to the existence of unique historical objects can attract tourists to visit. This could be one of the successful development of tourism in the region and the community could get more profits (Setyagung et al. 2013; Khlaikaew 2015; Ismagilova 2015). The Likert index obtained was 94.56. This means that the community strongly agrees with the traditions and culture that they still preserved to support ecotourism on Buano island.

*Community perception of community involvement in the ecotourism program (souvenir craftsmen, tour guides and culinary services) to implement the ecotourism development plan on Buano island*

To develop ecotourism, the participation of local communities cannot be ignored, because they know their area better than outsiders. In this case, community involvement in various ecotourism program activities is highly necessary. Ecotourism activities should ensure the participation of the local community, and steps need to be sought so as the local community can indeed be involved in ecotourism activities. Nugroho et al. (2016) suggested that villagers should be ready to guide the tourist to the tourism objects and explain their society’s history and traditions.

Interviews with the respondents show that they desire to be directly involved in various activities to implement a tourism development plan. The result of analysis shows that 64.62% of the respondents strongly agreed, 28.72% of the respondents agreed, and 6.67% of the respondent stated

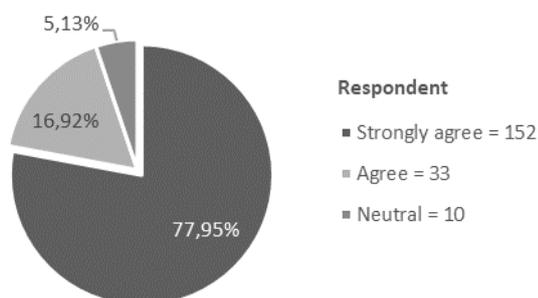
neutral (Figure 10). The Likert index obtained was 91.59, meaning that the community strongly agrees to be involved in various activities in the ecotourism development plan in their area.

Some of the non-timber forest products are managed by the Buano community. They process them into handicrafts, e.g., making woven mats of various sizes, baskets, and bags from pandanus leaves. They also make roofs of houses and roofs of traditional Buano houses (replacement of damaged roof) from thatch leaves, and make cajuput oil from cajuput leaves. The collection of pandanus leaves, thatch leaves, and cajuput leaves is usually done in groups of Buano women. The women also make some traditional foods from sago.

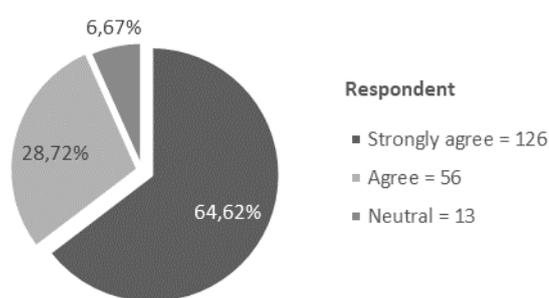
There are some benefits that the community can get, including tourists who stay at several people’s houses, guide services, and local transportation using boats to go around the island and mangroves. They can also sell handicrafts as souvenirs, traditional food, and cajuput distillation. Generally, the woven mats, thatch roof, and cajuput oil are sold to collectors in the village or sold to Namlea (Buru Island), Piru, and Ambon City. Some environmental experts claim that ecotourism can positively impact tourist destinations (Chan and Baum 2007; Weaver and Lawton 2007; Zambrano et al. 2010).

*Community perception of integrated farming programs (agriculture, forestry, animal husbandry, and fisheries) to support the development of ecotourism on Buano island*

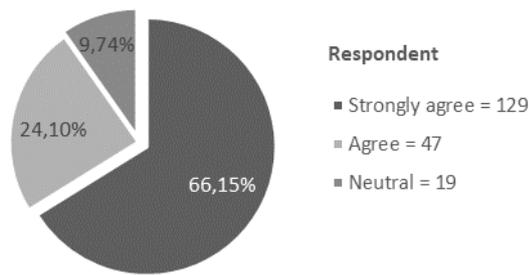
The community was very enthusiastic about the existence of integrated farming programs, where 66.15% expressed strongly agree, 24.10% agree, and 9.74% were neutral (Figure 11). With the Likert index of 91.28, it means that the community strongly agrees with the program. The Likert index was 91.28, meaning that the community strongly agrees with the program. The survey and villagers’ data shows that 80% of the people on Buano island are farmers and fishermen. Agriculture is developed on a small scale and in mixed farming. The most widely planted crops are cassava, sweet potato, corn, and beans. Plantation commodities dominated by coconuts, cocoa, coffee, and cloves are high-value plants that make money quickly. Fishermen catch both demersal and pelagic fish, and only a small proportion is cultivated fishermen (sprouts and crab nets). The fisheries production is sold to Seram and Ambon islands.



**Figure 9.** Community perception of the existence of traditions and culture that is still preserved to support the development of ecotourism on Buano island, Western Seram, Maluku, Indonesia



**Figure 10.** Community perception of community involvement in the ecotourism program (souvenir craftsmen, tour guides and culinary services, homestay) to implement the ecotourism development plan on Buano island, Western Seram, Indonesia



**Figure 11.** Community perception of integrated farming programs (agriculture, forestry, animal husbandry, and fisheries) to support the development of ecotourism on Buano island, Western Seram District, Maluku, Indonesia

The establishment of partnerships with the Western Seram District government, the Agriculture and Plantation Service, the Fisheries Service, and the Animal Husbandry Service and other related parties is expected to develop Integrated farming program activities to support the ecotourism development on Buano island. Nugroho et al. (2016) stated that developing a tourism village is multidisciplinary and integrated, involving all stakeholders, especially the local people.

Significantly, most North Buano and South Buano villagers strongly agreed on the perception. This shows that they are very enthusiastic about the ecotourism development plan in their village. The development of tourism must still refer to the concept of tourism that pays attention to the preservation of environmental functions, ecological potential, and maintaining the Sociocultural values that exist in the local community.

Buano island is a coastal area that is still new to tourists. Based on interviews with local people, tourists from outside Maluku and foreign tourists have visited Buano island to enjoy the natural surroundings. Even though the number of visits to this area is not as high as the protected forest areas on other islands in Indonesia, people have already benefited from tourist visits. For this reason, the promotion of tourism on Buano island and its surroundings needs to be done in order to be better known and more attractive to tourists. Harianto et al. (2020) stated that there is a need for ecotourism promotion in the Liwa Botanic Gardens area, Lampung, Indonesia to attract tourists to visit.

In conclusion, ecotourism can bridge the preservation of Buano protected forest with a very high potential for natural resources and the people who live around it. Ecotourism is one form of environmentally friendly tourism, and ecotourism is expected to function as an instrument to empower the local community economically as well as to be a solution to reduce the pressure on the ecosystem in the Buano protected forest area.

Local communities in Buano village still respond positively to the development of ecotourism in their area. Those who hold positive perceptions feel that the ecotourism development plan will benefit them in creating employment opportunities and increasing income of the

village so as it leads to a better quality of life, providing business opportunities, increasing demand for local crafts, and developing integrated farming for the community. On the other hand, the community can also pay attention to the protected forest areas by respecting the natural environment in which flora and fauna must be preserved.

Ecotourism development can be realized following natural conditions, regions, and the hopes and views of the community if all levels of society participate in implementing the ecotourism development program. Realizing the development of ecotourism on the island of Buano requires community commitment on Buano island and other parties to the principles of management, development, and maximum achievement of the general goals of ecotourism development.

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