

# Diversity of Mangrove Plant Species Used as Food Resources by the Community in Lalombi Village

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## Abstract

Mangroves are distinctive plants that grow in coastal areas, estuaries, river mouths, and sheltered deltas in tropical and subtropical regions. The economic value of mangrove plants lies in their wood and fruit. This study aimed to identify the potential of mangrove plants as food resources in Lalombi Village. The research employed observation, interviews, and questionnaire distribution to local communities. The results revealed that five mangrove species are utilized as food resources, namely *Avicennia marina* (Forsk.) Vierh., *Nypa fruticans* Wurmb, *Bruguiera gymnorhiza* (L.) Lamk., *Acanthus ilicifolius* L., and *Sonneratia alba*. These species are processed into various food products, including mangrove *onde-onde*, mangrove syrup, mangrove crackers, mangrove tea, and mangrove *dodol*. The processing methods involve traditional techniques such as soaking, boiling, filtering, pounding, drying, and packaging. Questionnaire results indicated that the local community possesses a very good level of knowledge and positive perceptions regarding the potential of mangroves as food resources and sources of economic income. Support from the government and non-governmental organizations (NGOs) was considered beneficial, although challenges remain in terms of technology, marketing, and product legalization. This study recommends the provision of further training, policy support, and the promotion and sustainable development of mangrove-based products to enhance the welfare of coastal communities.

**Keywords:** Mangrove plants; Food resources; Coastal communities; Mangrove-based products; Lalombi Village.

## INTRODUCTION

Mangroves are distinctive plants commonly found in coastal areas, estuaries, river mouths, and sheltered deltas within tropical and subtropical regions (Tihurua et al., 2020). Mangroves form a transitional ecosystem between terrestrial and marine environments. Under suitable environmental conditions, they can develop into extensive and highly productive forests that perform essential ecological functions. Due to their location in coastal zones, mangrove ecosystems are often referred to as coastal forests, tidal forests, brackish forests, or mangrove forests (Rahmadhani et al., 2021). Mangrove ecosystems are among the coastal ecosystems that are periodically inundated by seawater. They are typically found in areas with muddy or sandy substrates and experience regular tidal flooding. In addition, mangroves receive freshwater input from inland areas, resulting in water conditions that range from brackish to saline (Matatula et al., 2019). Mangrove ecosystems play a crucial role in mitigating the impacts of ocean waves and storms, while protecting coastal areas from abrasion and erosion. Furthermore, mangroves trap mud and bind sediments, produce organic matter, and provide shelter

and feeding grounds for a wide variety of organisms. Their complex ecological functions also include serving as spawning and nursery habitats for brackish-water aquatic species (Warsidi & Endayani, 2017).

Mangrove forests are plant communities that dominate coastal areas in tropical and subtropical regions, particularly in intertidal zones with muddy substrates. Mangrove forests play a vital ecological role, including maintaining shoreline stability, absorbing pollutants, and providing habitat and food resources for various species of waterbirds and migratory birds that use mangrove areas for foraging, shelter, and breeding (Qiptiyah et al., 2013). Mangrove forests serve a wide range of functions, encompassing both ecological and economic benefits. Ecologically, mangroves function as natural barriers against coastal abrasion and provide spawning grounds, nursery grounds, feeding grounds, nesting grounds, and resting grounds for diverse organisms, including shorebirds, fish, shrimp, crabs, reptiles, and mammals (Rahim et al., 2019). Economically, mangroves represent an important source of food resources that can be utilized by coastal communities. Various parts of mangrove plants, such as fruits, leaves, and propagules, can be processed into food

products including flour, syrup, *dodol* (traditional sweet confection), crackers, mangrove coffee, and various other value-added food products that can generate income and improve the livelihoods of coastal communities (Wahyuni et al., 2021).

Lalombi Village is located in South Banawa District, Donggala Regency, and lies along the trans-island highway connecting the provinces of Central Sulawesi and West Sulawesi. In 1973, the mangrove forest area in South Banawa District, Donggala Regency, Central Sulawesi, was recorded at approximately 1,167 hectares (Marzuki, 2020). Based on preliminary observations conducted in Lalombi Village, several mangrove species have been identified and utilized as food resources, with such practices having been carried out for approximately the last two years. Mangrove fruits are processed using both traditional and modern methods; however, modern processing techniques have not yet been fully implemented due to limited electricity supply. Products derived from mangrove plants include flour, chips, food colorants, and beverages. Furthermore, interview results revealed that *Acanthus ilicifolius* L. is utilized as a raw material for producing mangrove leaf tea. Food ethnobotany is a branch of science that examines the relationship between humans and plants, particularly concerning the use of plants as food resources (Detia, Kencanawati, & Haryanto, 2024). Mangrove plants, which commonly grow in coastal areas, possess considerable potential as food resources. Examples include the fruits of red mangrove apple (*Sonneratia caseolaris*) and the leaves of sea holly (*Acanthus ilicifolius*). *Sonneratia caseolaris* is a tree species that grows in swampy areas along riverbanks and constitutes an important component of mangrove vegetation (Warsidi & Endayani, 2017). Meanwhile, *Acanthus ilicifolius*, commonly known as sea holly or jeruju, is another mangrove-associated plant species that is processed into various food products. It is an emergent aquatic plant that thrives in estuarine environments (Harahap et al., 2022).

Mangrove fruits contain various anti-nutritional compounds, including saponins, phytic acid, oxalic acid, cyanogenic glycosides (cyanogens), tannins, and alkaloids (Ayu et al., 2019). These anti-nutritional compounds may be either toxic or non-toxic. Non-toxic compounds generally do not cause chronic diseases but may interfere with the digestion and absorption of nutrients in the body (Gemede & Ratta, 2014). In contrast, toxic anti-nutritional compounds have the potential to cause various health problems, such as neurological disorders, reproductive issues, goiter, and even death when consumed in excessive amounts. However, at low concentrations, certain anti-nutritional compounds may also provide health benefits, including antioxidant, anti-inflammatory, and antimicrobial activities. Flavonoids and tannins are recognized as

natural sources of antioxidants (Mutha et al., 2021), while flavonoids have also been reported to possess anti-inflammatory properties (Kim et al., 1993). Furthermore, phenolic compounds, including tannins, can function as natural antimicrobial agents (Bandaranayake, 2002). The beneficial and adverse effects of anti-nutritional compounds are largely influenced by the plant species and the concentration of these compounds present (Qiptiyah et al., 2013).

Sustainable mangrove management should be implemented through the development of environmentally friendly mangrove-based economic activities, the empowerment of coastal communities, and support from government agencies and related organizations. Such management practices not only contribute to the conservation of mangrove ecosystems but also enhance community welfare through the development of mangrove-based industries and ecotourism initiatives (Amal et al., 2024). In addition to supporting environmental conservation efforts, the sustainable utilization of mangroves can create economic opportunities for coastal communities through the development of various mangrove-based products, including food, beverages, and handicrafts. These activities can increase the added value of mangrove resources while ensuring the preservation of the ecosystem. Furthermore, active community participation in mangrove management can foster greater awareness and collective responsibility regarding the importance of conserving mangroves as natural coastal protectors and as vital resources that support the livelihoods of local communities (Rosulva et al., 2021). This study aimed to identify the potential of mangrove plants as food resources in Lalombi Village and to explore their utilization as learning media.

## MATERIALS AND METHODS

### Study area

This study was conducted from April 2025 to July 2025 in Lalombi Village, South Banawa District, Donggala Regency, Central Sulawesi, Indonesia. The research site was selected because Lalombi Village possesses a relatively extensive and diverse mangrove ecosystem that is utilized by the local community as a source of food resources. The mangrove area in the village serves as a habitat for various mangrove plant species with the potential to be processed into food products. Furthermore, the utilization of mangroves as food resources by the residents of Lalombi Village has been practiced for generations. Therefore, this location was considered representative for identifying the mangrove plant species used by the local community and for examining the various forms of their utilization as food resources.

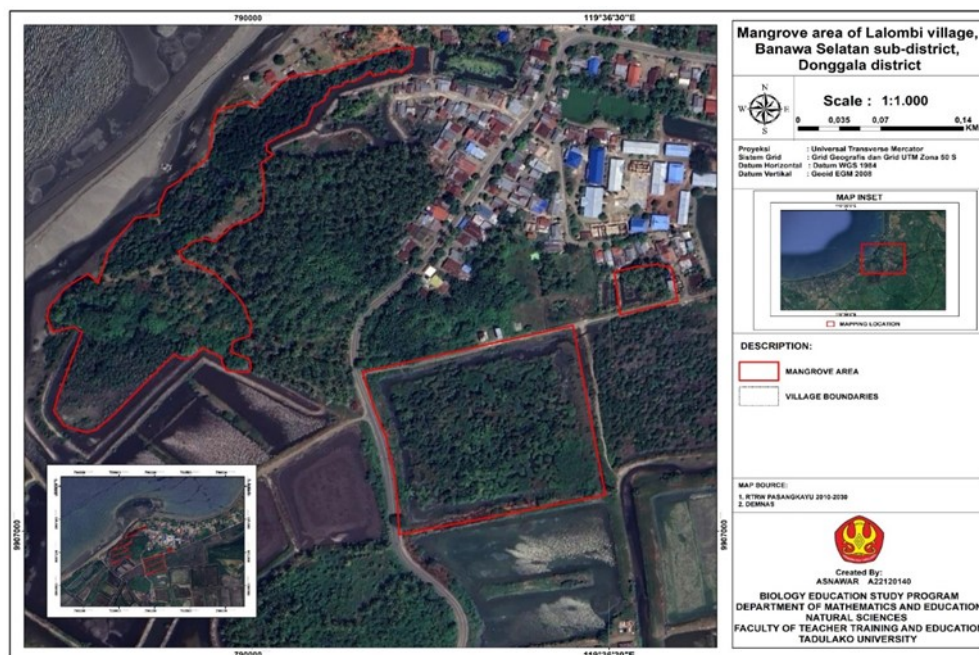


Figure 1. Map of the research location in Lalombi Village, Central Sulawesi, Indonesia.

## Procedures

### Sample Collection

The study was conducted in an area with an extensive mangrove ecosystem that is utilized by the local community as a source of food materials. The study sample consisted of 10 community members selected through purposive sampling, specifically individuals who possessed knowledge and experience regarding the utilization of mangrove plants as food resources.

### Data collection

Data were collected through field observations, structured interviews, questionnaires, and documentation. Field observations were conducted to identify the mangrove plant species present in the study area. Structured interviews were carried out using an interview guide to obtain information regarding the mangrove species utilized by the community and the food products derived from them. Questionnaires were administered to assess community perceptions of the use of mangrove plants as food resources. Documentation was conducted to support the research data by recording photographs of the mangrove plant species and their processed food products.

### Data analysis

Data obtained from observations, interviews, and documentation were analyzed using a descriptive qualitative approach. Questionnaire data were analyzed using the following formula (Sudijono, 2015):

$$P = (F/N) \times 100\%$$

Where:

P = Percentage score of responses

F = Frequency of respondents' answers

N = Total number of respondents

100 = Constant value

Descriptive analysis was conducted by classifying community perception scores into five categories: very good, good, fair, poor, and very poor. The criteria used for categorizing perception levels are presented in Table 1.

Table 1. Classification of Community Perception Scores on the Types and Utilization of Mangrove Plants as Food Resources.

Score	Eligibility Category
80%-100%	Very Good
60%-80%	Good
40%-60%	Fair
20%-40%	Poor
00%-20%	Very Poor

## RESULTS AND DISCUSSION

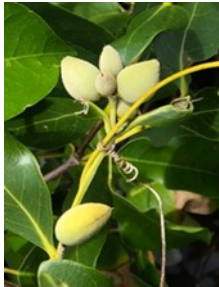

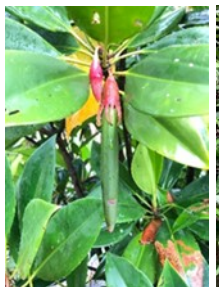







### Identification of Mangrove Plant Species and Their Utilization as Food Resources

The results of this study revealed that five mangrove plant species are utilized by the community of Lalombi Village as food resources, namely *Avicennia marina* (Forsk.) Vierh., *Nypa fruticans* Wurmb, *Bruguiera gymnorrhiza* (L.) Lam., *Acanthus ilicifolius* L., and *Sonneratia alba*. These species possess distinct characteristics and potentials for processing into various food products. As shown in the table below, the five mangrove species are processed into different food products by the local community. *Avicennia marina* is used to produce mangrove *onde-onde* (glutinous rice balls), *Nypa fruticans* is processed into mangrove syrup,

*Bruguiera gymnorrhiza* is utilized for making mangrove crackers, *Acanthus ilicifolius* is processed into mangrove tea, and *Sonneratia alba* is used in the production of mangrove *dodol* (traditional sweet confection). These

products demonstrate the potential of mangrove resources to support local food diversification and contribute to the livelihoods of coastal communities.

**Table 2.** Mangrove Plant Species and Their Utilization as Food Resources in Lalombi Village.

Scientific and Local Names	<i>Avicennia marina</i> ( <i>api-api</i> )	<i>Nypa fruticans</i> ( <i>nipah</i> )	<i>Bruguiera gymnorrhiza</i> ( <i>sala-sala</i> )	<i>Acanthus ilicifolius</i> ( <i>gagantu</i> )	<i>Sonneratia alba</i> ( <i>popa</i> )
Plant Part(s) Used					
Product(s) Produced					
	Fruit	Fruit	Fruit	Leaf	Fruit
	Onde-Onde Mangrove	Sirup Mangrove	Krupuk Mangrove	Teh Mangrove	Dodol Mangrove

### Community Interview Results

Based on interviews conducted with the respondents, namely Mrs. Kasma Lasite, Mr. Nahlan, Mrs. Marifa, and Mr. Sarifudin, it was found that knowledge regarding the utilization of mangroves as food resources was acquired through various training programs organized by government agencies, non-governmental organizations (NGOs), and information accessed through social media. The community utilizes several mangrove species, namely *Avicennia marina*, *Nypa fruticans*, *Bruguiera gymnorrhiza*, *Acanthus ilicifolius*, and *Sonneratia alba*, which are processed into a variety of food products, including mangrove *onde-onde*, mangrove syrup, mangrove crackers, mangrove tea, and mangrove *dodol*. The utilization of these mangrove resources provides economic benefits by increasing household income while also supporting local food security. Nevertheless, the community continues to face several challenges, including the seasonal availability of raw materials,

limited production facilities, the time-consuming nature of processing activities, and the absence of approval from the Indonesian Food and Drug Authority (BPOM), which restricts the market reach of these products. To address these challenges, community members store raw materials during harvest seasons, take advantage of training programs and equipment assistance provided by various organizations, and actively pursue product certification and legal authorization. The respondents also reported that the training programs they had attended significantly enhanced their knowledge and skills in processing mangrove resources into safe and economically valuable products. Furthermore, they expressed confidence that mangrove-based enterprises have strong potential for sustainable development, provided that they are supported by mangrove ecosystem conservation efforts, continuous training programs, government assistance, and strengthened product promotion and marketing strategies.

**Table 3.** Community Perceptions of the Utilization of Mangrove Plants as Food Resources.

Indicator	Score (%)	Category
Knowledge and Perception	100%	Very Good
Personal Experience	90%	Very Good
Economic and Social Impact	86.6%	Very Good
Support and Training	80%	Good
Expectations and Sustainability	73.3%	Good
Challenges	70%	Good
Knowledge Sharing	100%	Very Good
Average	85.7%	Very Good

## Discussion

The mangrove fruits utilized by the community of Lalombi Village possess not only economic value but also nutritional benefits that contribute to human health. *Bruguiera gymnorrhiza* fruit is known to contain high levels of carbohydrates, dietary fiber, and antioxidant compounds, making it a promising alternative food resource for coastal communities. These nutritional properties enable mangrove fruits to be processed into various food products, such as crackers and flour, which have good nutritional value and extended shelf life (Jacob et al., 2013). The utilization of mangroves as food resources involves a variety of processing methods. The fruits of *Avicennia marina* (Forsk.) Vierh. are processed into mangrove onde-onde, *Nypa fruticans* Wurmb fruits are used to produce mangrove syrup, *Bruguiera gymnorrhiza* (L.) Lam. fruits are processed into mangrove crackers, and the leaves of *Acanthus ilicifolius* L. are utilized to make mangrove tea. These processing activities are generally carried out using traditional methods, beginning with soaking to remove bitter or potentially toxic compounds, followed by boiling, drying, pounding, and packaging. Such processing steps are essential to ensure the safety and suitability of mangrove-based products for human consumption.

According to Nashir et al. (2022), the fruits of *Avicennia marina* (Forsk.) Vierh. contain high levels of carbohydrates and dietary fiber, making them a promising alternative food resource that can be processed into flour and various value-added food products. Prior to processing, mangrove fruits generally undergo pretreatment steps such as soaking and boiling to reduce compounds that may cause bitterness, thereby improving product safety and consumer acceptability. Similarly, the fruits of *Bruguiera gymnorrhiza* (L.) Lam. are rich in carbohydrates, dietary fiber, and antioxidant compounds, making them a valuable food resource for coastal communities. These nutritional properties enable the fruits to be processed into products such as mangrove flour and crackers, which possess good nutritional value and storage stability (Afifah et al., 2022). The utilization of *Nypa fruticans* Wurmb has also been widely studied as a raw material for traditional beverages. *Nipah* sap can be processed into syrup or fermented drinks through filtering, heating, and packaging processes. These

products have considerable economic value and are commonly developed as household-scale enterprises by coastal communities (Cheablam & Chanklap, 2020). Meanwhile, *Acanthus ilicifolius* L. contains various bioactive compounds that make it suitable for use as a herbal beverage ingredient. The leaves can be processed into herbal tea through drying techniques that help preserve the active compounds while extending the product's shelf life (Bualuang et al., 2022). Finally, the fruits of *Sonneratia alba* represent another mangrove resource with significant potential for food utilization due to their content of bioactive compounds, including phenolics, flavonoids, tannins, and vitamins that are beneficial to human health. These fruits can be processed into a variety of value-added food products, one of which is mangrove dodol, a traditional sweet confection with economic potential (Aulia & Sulistiyaningsih, 2020).

Furthermore, the seven assessment indicators produced varying percentage scores, with an overall average score of 85.7%, which falls within the "very good" category. The indicators of knowledge and perception and knowledge sharing achieved the maximum score of 100%, indicating a high level of understanding and a strong willingness among respondents to share information. The personal experience indicator also recorded a high score of 90%, reflecting active participation and positive engagement in the activities being evaluated. The economic and social impact indicator achieved a score of 86.6%, suggesting that respondents perceived positive benefits at both the individual and community levels. Meanwhile, the indicators of support and training (80%), expectations and sustainability (73.3%), and challenges (70%) were also categorized as good. However, these results indicate the need for further improvement, particularly in ensuring program continuity and addressing existing constraints. Overall, these findings suggest that the program has been implemented effectively and has achieved positive outcomes, although several aspects still require enhancement to maximize its impact. The interview results further revealed that the community possesses a good level of knowledge regarding the utilization of mangroves. Respondents recognized that mangroves function not only as environmental protectors but also as valuable food resources with economic potential. Support from government agencies and related

institutions has also contributed to improving community skills through training programs focused on product processing and packaging. According to the study by Kusmana (2014), a high level of community knowledge regarding mangrove ecosystems contributes significantly to their sustainable utilization. Communities are no longer limited to using mangroves as timber or fuelwood; instead, they are increasingly developing value-added food products and other processed goods that can enhance household income and improve local livelihoods.

## CONCLUSIONS

Based on the results of this study, it can be concluded that five mangrove plant species are utilized as food resources in Lalombi Village, namely *Avicennia marina* (Forsk.) Vierh., *Nypa fruticans* Wurmb., *Bruguiera gymnorrhiza* (L.) Lam., *Acanthus ilicifolius* L., and *Sonneratia alba*. These mangrove species are processed into various food products, including mangrove onde-onde, mangrove syrup, mangrove crackers, mangrove tea, and mangrove *dodol*. The findings also indicate that the local community possesses a good level of knowledge and positive perceptions regarding the utilization of mangroves as food resources. Although the development of mangrove-based products faces several challenges, the community continues to recognize their economic potential and their contribution to local livelihoods.

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**Competing Interests:** The authors declare that there are no competing interests.

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