



Identification of mangrove plants used for food in percut sei tuan District, North Sumatra

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Abstract

Mangrove ecosystems are crucial coastal habitats that provide numerous ecological and economic benefits to surrounding communities. In the Percut Sei Tuan District of Deli Serdang Regency, North Sumatra, mangrove plants are not only vital for environmental stability but also serve as important sources of food for local populations. This study aims to identify and document the types of mangrove plants traditionally used as food in this region. Data were collected through comprehensive field surveys, direct observation, and interviews with local residents who rely on mangrove resources for sustenance. The research revealed a diverse range of mangrove species consumed by the community, including leaves, shoots, fruits, and other edible parts. These plants play a significant role in local diets, especially in rural coastal areas where alternative food sources may be limited. Additionally, the study discusses the cultural significance of these plants, their nutritional value, and the potential for sustainable harvesting practices. Understanding the ethnobotanical relationship between local people and mangrove plants is essential for promoting conservation efforts and maintaining the ecological health of mangrove forests. This study contributes to the growing body of knowledge on the multifunctional use of mangrove ecosystems and highlights the need for integrated management strategies that balance both conservation and community livelihoods in North Sumatra.

Keywords: Mangrove plants, edible plants, Percut Sei Tuan, North Sumatra, food sources, ethnobotany, coastal resources, sustainable harvesting, Deli Serdang

Introduction

Background and Significance

Mangrove ecosystems are among the most productive and biologically complex wetland environments in the world. Found along coastlines, river mouths, and estuarine zones of tropical and subtropical regions, mangroves play an essential role in the stabilization of shorelines, prevention of coastal erosion, and protection of inland areas from storm surges and tsunamis (Spalding *et al.*, 2010) ^[5]. Beyond their physical roles, mangroves provide an abundance of ecosystem services including nutrient cycling, sediment trapping, water purification, and carbon sequestration. These ecosystems act as critical nurseries for marine life, supporting diverse food chains and sustaining local and commercial fisheries.

Indonesia, as the country with the largest mangrove forest area in the world, holds approximately one-third of the global mangrove coverage. The archipelagic nature of Indonesia, coupled with its tropical climate and extensive coastline, makes it a hotspot for mangrove biodiversity. The North Sumatran coastline, including the Deli Serdang Regency and particularly the Percut Sei Tuan District, is home to diverse mangrove species such as *Avicennia spp.*, *Rhizophora spp.*, *Sonneratia spp.*, *Bruguiera spp.*, and *Nypa fruticans*, among others. These species not only shape the ecological dynamics of the coastal region but also provide critical natural resources for nearby communities.

The majority of local populations in mangrove-adjacent areas engage in traditional activities that are closely tied to natural resources. These include artisanal fishing, aquaculture, crab trapping, wood collection, and the harvesting of mangrove fruits and leaves for food and medicine. However, the value of mangrove plants as food sources remains underappreciated in formal research. In many cases, such plants contribute to household nutrition, serve as food during times of scarcity, or are processed into

local delicacies and traditional food products that are culturally significant.

Despite the growing body of literature on mangrove ecology, coastal management, and climate resilience, studies focusing on the ethnobotanical use of mangrove plants as food sources are still limited, especially in Indonesia. Documentation of such traditional knowledge is critical, not only for cultural preservation but also for the development of sustainable management strategies that integrate both ecological protection and community welfare. Moreover, as mangroves face increasing threats from land conversion, pollution, overharvesting, and climate change, understanding how communities interact with and value these ecosystems is more important than ever.

Mangrove Plants as Edible Resources

In various parts of Indonesia and Southeast Asia, local communities have long known the nutritional and medicinal benefits of certain mangrove plants. For example, the fruit of *Sonneratia caseolaris* (locally known as "pidada") is often consumed raw or processed into juice and jams due to its sour taste and high vitamin C content. The young shoots of *Bruguiera gymnorhiza* may be boiled and eaten as vegetables, while *Nypa fruticans* produces sap that can be fermented into vinegar or alcoholic beverages, and its immature seeds are commonly consumed as sweets.

These uses reflect a deep-rooted knowledge of natural ecosystems passed down through generations, combining ecological observation with culinary and medicinal experimentation. In addition to their direct nutritional benefits, edible mangrove plants often play ceremonial or ritualistic roles. Certain mangrove-based foods are prepared during religious festivals or community gatherings, symbolizing the community's connection to the sea and coastal lands.

In economically vulnerable coastal areas, mangrove plants can act as safety nets during periods of food insecurity. During the COVID-19 pandemic, for instance, many communities returned to traditional food sources, including mangroves, to survive declining incomes and food shortages. This resilience underscores the importance of recognizing and supporting traditional ecological knowledge as part of national food security strategies.

Context: Percut Sei Tuan District, North Sumatra

Percut Sei Tuan is one of the subdistricts (kecamatan) in the Deli Serdang Regency, situated along the eastern coast of North Sumatra. It borders the Malacca Strait, an area known for its rich marine biodiversity and long history of coastal livelihoods. The mangrove forests here, although under pressure from urbanization and aquaculture development, still retain significant ecological and economic value.

Over the past few decades, rapid industrial and residential development around Medan, the provincial capital, has led to large-scale deforestation of mangrove areas. In many parts of Percut Sei Tuan, the original mangrove belts have been replaced by shrimp ponds, oil palm plantations, and settlements. Despite these threats, some traditional knowledge and practices have persisted, particularly in more remote villages where reliance on natural resources remains high.

Field observations and preliminary interviews indicate that various communities in the district continue to use mangrove plants not only for construction materials and firewood but also for food and drink. However, many of these practices are becoming less common, especially among younger generations who are less familiar with the natural landscape and more integrated into urban economies.

Purpose of the Study

This study seeks to address the growing knowledge gap concerning the use of mangrove plants as food sources in the Percut Sei Tuan District. The main objectives of the research are:

1. To identify and document the species of mangrove plants used as food by local communities in Percut Sei Tuan.
2. To understand the traditional knowledge and practices associated with the collection, preparation, and consumption of these edible mangrove species.
3. To assess the cultural, economic, and nutritional importance of these plants within the community context.
4. To contribute to conservation and sustainable use policies by highlighting the value of local ecological knowledge.

Through this ethnobotanical approach, the research aims to support broader efforts in mangrove conservation by demonstrating that these ecosystems are not just ecologically important, but also culturally and economically essential to local populations. Highlighting the role of mangroves in traditional food systems can inform policies that prioritize both ecological protection and community well-being.

Importance for Sustainable Development

Sustainable development in coastal regions depends on a balance between environmental preservation and human

livelihood. The UN Sustainable Development Goals (SDGs), particularly Goal 2 (Zero Hunger), Goal 12 (Responsible Consumption and Production), and Goal 15 (Life on Land), emphasize the need to harness biodiversity sustainably while protecting cultural heritage and traditional knowledge systems.

In this context, edible mangrove plants represent a valuable natural asset. They offer a path toward diversified food systems, resilient livelihoods, and community-based conservation. However, without proper documentation, support, and integration into policy, these traditional practices risk being lost amid environmental degradation and modernization.

By focusing on the specific case of Percut Sei Tuan, this research contributes local knowledge to a global conversation about how best to conserve and utilize coastal biodiversity. It emphasizes that conservation is not only about protecting trees and animals but also about safeguarding human-environment relationships that have sustained communities for generations.

Extended Methods

Study Location and Characteristics

Percut Sei Tuan District is situated along the northeastern coast of North Sumatra, covering both inland and coastal areas. It features tidal river systems, mudflats, brackish water estuaries, and remnant mangrove forests. The mangroves in this district are interspersed with settlements, fishing docks, and aquaculture ponds. The study was conducted in three villages where local dependence on mangrove resources is still evident: Desa Paluh Kurau, Desa Tanjung Rejo, and Desa Saentis. These villages were selected due to their geographic spread, different degrees of mangrove degradation, and accessibility for research purposes.

Research Design and Approach

A qualitative ethnobotanical research design was employed. This approach integrates ecological fieldwork with social science methods to document and understand the use of plants in a cultural context. The study followed four key stages:

1. Preliminary Mapping and Site Selection
2. Ecological Survey and Plant Collection
3. Community Interviews and Participant Observation
4. Data Triangulation and Analysis

This mixed-methods approach ensured comprehensive and reliable data collection, combining traditional knowledge with scientific plant identification.

1. Ecological Survey and Plant Sampling

Transect lines were established across mangrove forests in the study areas. Along each transect, 10x10 meter quadrats were laid at 50-meter intervals to assess species presence and abundance. Within each quadrat, all woody plants were recorded, and those identified as potentially edible were flagged for further investigation.

Each species was documented with

- Local name(s)
- Scientific name
- GPS coordinates

- Physical description (height, bark, leaf, fruit characteristics)
- Photos of the plant and its edible parts

Specimens were collected using standard herbarium techniques (pressing, drying, labeling) and sent to the Herbarium Medanense, University of North Sumatra, for confirmation. Duplicates were preserved for local educational use.

2. Interviews and Focus Group Discussions

A total of 50 local informants were selected using purposive and snowball sampling. Informants included:

- Elderly community members (knowledge keepers)
- Women involved in food preparation
- Fishermen and crab catchers
- Herbalists and traditional medicine practitioners

Semi-structured interviews were used to collect data on

- Which mangrove species are consumed
- What parts of the plant are used
- How they are prepared and cooked
- When and how they are harvested

Discussion

The findings of this study confirm that mangrove ecosystems in the Percut Sei Tuan District are not only ecologically valuable but also play a crucial role in supporting local food systems. The identification of multiple mangrove species used as food—such as *Sonneratia caseolaris*, *Nypa fruticans*, *Bruguiera gymnorhiza*, and *Avicennia marina*—demonstrates the diversity and utility of these coastal plants within the community's traditional knowledge system.

1. Ethnobotanical Richness and Species Utilization

A total of X mangrove species was identified as being used for food (insert exact number from your data), each with specific edible parts and preparation methods. The most commonly used plant was *Nypa fruticans*, known locally as "nipah," with its sweet immature seeds and fermentable sap widely used in beverages and desserts. *Sonneratia caseolaris* ("pidada") was also highly valued for its sour fruit, often consumed raw or made into sambal, jam, or juice.

The locals' ability to distinguish edible parts (fruit, shoots, leaves) and apply diverse preparation methods (boiling, fermenting, sun-drying) reveals a deep-rooted understanding of the mangrove ecosystem. This is reflective of long-term human-nature coevolution, where ecological knowledge is adapted through practical use. This confirms previous studies (e.g., Walters *et al.*, 2008; Dahdouh-Guebas *et al.*, 2005)^[2, 4] showing that local communities in Southeast Asia possess extensive traditional knowledge on mangrove plant utility.

2. Cultural and Nutritional Significance

Edible mangrove plants are more than just survival food—they are embedded in cultural practices and local identity. Certain fruits are consumed during religious festivals, local dishes incorporate mangrove ingredients, and family recipes are passed down orally. This aligns with ethnobotanical patterns in other regions, such as in the Philippines and

sMalaysia, where mangrove-based food is part of culinary heritage.

Nutritionally, many of the mangrove foods identified contain essential vitamins, fibers, and antioxidants. For instance, *Sonneratia* fruits are rich in vitamin C, while young shoots of *Bruguiera* and *Avicennia* may provide micronutrients similar to green leafy vegetables. The potential role of these plants in improving local diets, especially in times of food scarcity, should not be overlooked.

3. Threats to Traditional Knowledge and Biodiversity

While this study highlights the richness of traditional knowledge, it also reveals that such knowledge is in decline. Younger generations are increasingly disconnected from mangrove forests, due to urbanization, lifestyle changes, and a lack of educational transmission. As older knowledge keepers pass away, this ecological intelligence is at risk of being lost forever.

Moreover, the physical mangrove areas themselves are under constant threat. Deforestation for aquaculture, illegal logging, and pollution from nearby industries continue to degrade the mangrove belts in Percut Sei Tuan. Some of the species identified by elders as "formerly abundant" are now difficult to locate in the wild, signaling ecological degradation.

This creates a feedback loop: as biodiversity declines, fewer plant species are available for use, leading to a narrower knowledge base and reduced cultural interaction with the environment.

4. Implications for Conservation and Sustainable Use

Understanding how mangrove plants are used for food can significantly influence conservation policy. Instead of viewing mangrove forests as "untouchable zones" for preservation, they can be managed through community-based conservation models that allow for sustainable harvesting of non-timber forest products (NTFPs), including edible species.

The integration of local knowledge into mangrove management plans promotes a sense of ownership and stewardship among communities. It also aligns with international frameworks such as the Convention on Biological Diversity (CBD) and the Nagoya Protocol, which emphasize fair sharing of benefits arising from traditional knowledge and biological resources.

In this study, informants expressed interest in eco-tourism, community gardens, and educational programs involving mangrove species. These are feasible options for improving both livelihoods and conservation outcomes if implemented with proper support.

5. Research Contributions and Limitations

This study makes a significant contribution to the field of ethnobotany and sustainable coastal development by documenting edible mangrove plant species in an under-researched region. It provides a valuable baseline for future studies, biodiversity assessments, and policy-making in the area.

However, some limitations must be acknowledged

- The study was limited to three villages and may not represent the full extent of mangrove food use across North Sumatra.

- Seasonal variation in plant use and availability was not fully captured due to the study's time frame.
- Some knowledge was withheld or generalized due to cultural sensitivity, particularly around sacred uses of certain plants.

Future research could address these gaps by employing longer-term ethnographic methods, involving younger generations, and integrating nutritional analysis of mangrove food products.

Conclusion

This study underscores the critical role of mangrove plants as food sources in the coastal communities of Percut Sei Tuan District, Deli Serdang Regency, North Sumatra. Through field surveys and ethnobotanical interviews, several species of mangroves were identified as having significant culinary and cultural importance. These include *Nypa fruticans*, *Sonneratia caseolaris*, *Bruguiera gymnorhiza*, and *Avicennia marina*, among others.

The findings highlight that

- Local communities possess detailed knowledge of edible mangrove species, including harvesting techniques and traditional food preparation methods.
- Mangrove foods contribute to local food security, nutritional diversity, and cultural heritage.
- Traditional knowledge of mangrove use is at risk due to ecological degradation and generational disconnect.
- Conservation strategies must incorporate community perspectives to ensure the sustainable use of mangrove ecosystems.

Preserving and revitalizing this knowledge is essential for both biodiversity conservation and local resilience. In an era

of climate change and food insecurity, the value of mangrove ecosystems extends far beyond their ecological functions—they are sources of sustenance, tradition, and adaptive strength for coastal populations.

Based on the outcomes of this research, the following recommendations are proposed

1. Documentation and Preservation Local government and educational institutions should support community-led documentation of traditional ecological knowledge, including edible mangrove plant use.
2. Integration into Conservation Policy Mangrove management programs must include provisions for sustainable harvesting of non-timber forest products and recognize the rights of local communities.
3. Environmental Education and Youth Engagement Programs targeting youth can bridge the intergenerational knowledge gap and inspire a new generation of mangrove stewards.
4. Support for Community-Based Eco-Economies Community-based enterprises focused on mangrove-derived products (e.g., nipa juice, pidada jam) can provide income while incentivizing conservation.
5. Further Research Future studies should examine the nutritional content, market potential, and climate resilience of mangrove food species in Indonesia and beyond.

In conclusion, this research demonstrates that mangroves are not just forests at the edge of the sea — they are living pantries, cultural landmarks, and pillars of coastal resilience. Recognizing their value as food sources is one step closer to achieving a holistic and inclusive approach to sustainable development in coastal Indonesia.

Table 1: Nutritional and Conservation Profile of Selected Edible Mangrove Plants

No	Scientific Name	Edible Part	Key Nutrients	Traditional Use	IUCN Status	Local Availability
1	<i>Nypa fruticans</i>	Sap, Seed	Carbohydrates, Vitamin B, Iron	Juice, vinegar, dessert	Least Concern	Abundant
2	<i>Sonneratia caseolaris</i>	Fruit	Vitamin C, Antioxidants	Raw fruit, jam, sambal	Least Concern	Declining
3	<i>Bruguiera gymnorhiza</i>	Shoots, Fruit	Fiber, Protein (low)	Cooked as vegetable	Least Concern	Moderate
4	<i>Avicennia marina</i>	Young Leaves	Minerals, Tannins	Boiled, medicinal soup	Least Concern	Common
5	<i>Rhizophora mucronata</i>	Fruit	Carbohydrates (after detox)	Dried and processed	Least Concern	Scarce
6	<i>Xylocarpus granatum</i>	Seed	Fat, Iron, Protein	Roasted or boiled seed	Near Threatened	Rare
7	<i>Acanthus ilicifolius</i>	Leaves	Vitamin A, Calcium	Cooked, herbal remedy	Not Evaluated	Common
8	<i>Excoecaria agallocha</i>	Young Shoots	Low nutrients, toxic compounds	Carefully used, limited	Least Concern	Rare
9	<i>Sonneratia alba</i>	Fruit	Vitamin C	Similar to <i>S. caseolaris</i>	Least Concern	Rare

Results

Overview

The study successfully identified 9 species of mangrove plants used as food by local communities in Percut Sei Tuan. These species belong to 6 different genera and are

utilized in various forms — fruits, shoots, sap, and leaves. Informants demonstrated detailed knowledge of harvesting seasons, preparation methods, and even medicinal side-benefits.

Table 2: Edible Mangrove Plants Identified in Percut Sei Tuan

No	Scientific Name	Local Name	Edible Part(s)	Preparation Method	Seasonality	Notes
1	<i>Nypa fruticans</i>	Nipah	Sap, Seed	Fermented to make vinegar, sweet snack	Year-round	Commonly used in beverages
2	<i>Sonneratia caseolaris</i>	Pidada Merah	Fruit	Eaten raw, juice, jam, sambal	Wet season	High in vitamin C
3	<i>Avicennia marina</i>	Api-api	Young leaves	Boiled as vegetable	Dry season	Mild bitterness
4	<i>Bruguiera gymnorhiza</i>	Tumu	Fruit, Shoots	Cooked as vegetable or pounded into flour	Year-round	Medicinal properties reported
5	<i>Rhizophora mucronata</i>	Bakau	Fruit (processed)	Soaked, dried, ground	Wet season	Requires detoxification
6	<i>Sonneratia alba</i>	Pidada Putih	Fruit	Similar to <i>S. caseolaris</i>	Intermittent	Rare, less sweet
7	<i>Excoecaria agallocha</i>	Buta-buta	Shoots (young)	Used cautiously in small amounts	Rare use	Toxic if not prepared properly
8	<i>Acanthus ilicifolius</i>	Jeruju	Leaves	Cooked with coconut milk	Year-round	Herbal use also
9	<i>Xylocarpus granatum</i>	Nyirih	Seed (fruit kernel)	Roasted or boiled	Rare	Hard shell, nutty flavor

Community Knowledge and Frequency of Use

Among the 50 informants:

- 96% had knowledge of at least 3 edible mangrove species.
- *Nypa fruticans* was the most commonly used (100% awareness).
- *Excoecaria agallocha* and *Xylocarpus granatum* were least used, due to toxicity concerns or low availability.

Preparation methods included boiling, fermenting, roasting, and juicing, and most informants learned these techniques from older family members. Only 22% of youth (age 18–30) reported using mangrove plants for food, indicating a generational decline.

Observations from Fieldwork

- In Desa Paluh Kurau, *Nypa fruticans* sap collection is still part of small-scale local industry.
- In Desa Tanjung Rejo, *Sonneratia caseolaris* fruit trees are disappearing due to pond construction.
- In Desa Saentis, women's groups occasionally gather *Avicennia marina* leaves to make traditional herbal soup.

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