

# Implementation of Sasi which impact on the sustainability of ecosystem services in Maluku

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**Abstract.** Sasi is one of the local wisdom from Maluku as a form of prohibition for the community in taking natural products based on a certain time that has been determined by the authorized customary institution in an area. However, local wisdom is often ignored and considered outdated in the development of environmental conservation programs. Whereas in practice, armed with local knowledge capital such as biological and ecological knowledge, indigenous people have been able to successfully protect potential ecological processes and regenerate various varieties of plants and animals that are sasi. In addition, Sasi implementation activities can also have an impact on local ecosystem services so that the sustainability of local communities can take place economically, socially, culturally, and ecologically. The purpose of this research is to find out the implementation activities of Sasi and the ecosystem services that are produced sustainably for the people of Maluku. The method used in this research is a systematic literature review. The results of this study show that Sasi implementation activities have a positive impact on ecosystem services in an area.

## 1 Introduction

Despite having an abundance of natural resources, Indonesia has long suffered from the Dutch Syndrome, a condition in which companies overuse resources without considering their effects to maximize profits [1]. According to some estimates, deforestation rates in Java and Kalimantan are as high as 1.8 hectares per year, which results in the loss of 21% of Indonesia's 133 million hectares of forest and 30% damage to its 2.5 million hectares of coral reefs [2]. All of these losses result in harm to the environment, a rise in natural disasters, extinction threats to protect coral reefs, flora, and fauna, as well as a decrease in marine fishery productivity and marine biodiversity [3].

In this case, the Maluku people manage natural resources with local wisdom to benefit the local populace in a sustainable way [4]. This local wisdom is known as Sasi, applied by traditional villages called Negeri [5]. One of the long-standing customs in Maluku, the sasi system is recognized by locals and visitors as a suitable method for managing land and marine resources [6]. The community continues to protect the environment and create social balance through local wisdom practices and environmental monitoring [7].

This form of community-based natural resource management [8] is usually used by the people of Maluku to describe the traditional

prohibition on taking and utilizing forest and marine products [9]. Sasi is a conservation mechanism because of its restrictive nature [10] so this activity aims to preserve the ecosystem.

The positive impact of implementing sasi is that it provides ecosystem services that are utilized by the surrounding community. When it comes to establishing marine conservation areas for the sustainability of natural resources, Sasi in Raja Ampat is very beneficial [11]. To prevent extinction, sasi is implemented to enable biota to regenerate [12].

By implementing sasi and environmental monitoring, the people of Maluku are known to have extraordinary social potential to maintain sustainability and create social harmony [7]. Various studies that have been carried out related to the implementation of sasi as a culture of the Maluku people have an indirect impact on efforts to preserve natural resources in the region.

However, Matitaputty et al. (2018) show that more than 75% of sasi on Saparua Island, Maluku Province, is declining and even disappearing. Meanwhile, sasi culture can be the right way for sustainable survival through various ecosystem services provided by nature. In addition, the sasi system's application offers hope for the adoption of co-management [13]. A system of cultural values known as sasi pertains to the management of natural resources, specifically forests and the sea, at specific intervals. These values are tailored to the specific sorts of natural resources that are

restricted in both the sea and the forest [14]. In light of this, the purpose of this research is to present information on different sasi implementation strategies that may enhance the sustainability of ecosystem services in Maluku [15].

## 2 Research Methods

According to Figure 1 below, this research employs the SLR technique, which consists of the following basic stages: planning (research identification), selection (search strategy and filtering), and discussion (data extraction and synthesis).

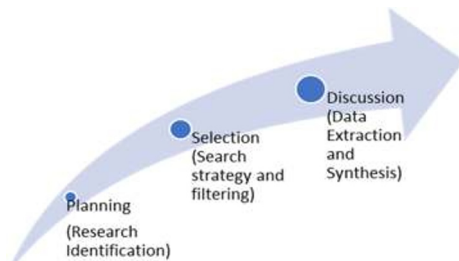


Fig. 1. Research stages

### 2.1 Planning

Finding research that is relevant to formulating the research problem is done during the planning step. Insofar as it does not contradict the research setting, this formulation of the study is clear, unambiguous, and systematic. As shown in table 1 below, a number of problem formulations were finished for this study.

Table 1. Research Problem Formulation

No	Research's Question
1	What are the types of sasi in Maluku?
2	How is sasi implemented in Maluku?
3	Is there a positive impact resulting from sasi implementation activities for the environment in the form of ecosystem services available to people in Maluku?

### 2.2 Selection

Following the conceptualization of the research topic, selection is the second step, which is broken down into phases for gathering and choosing research data. Search strategy techniques were applied in database sources during the data collection phase. Terms or keywords can be used in this manner. The snowball sampling technique, which filters research data by establishing specified data criteria, was used to collect data. Table 2 presents the selection procedure technique used in this study.

Table 2. Summary of the Selection Process

Category	Description
Data source	Google Scholar, Science Direct, Scopus
Method of collecting data	Snowball Sampling
Search strategy	Keywords/terms: (sasi, sasi+maluku, ecosystem services, sustainable, local wisdom, OR CBRNM)+(evaluation, indicator, model, analysis OR assessment), Review
Data Criteria	Kriteria inklusi: Journal and Proceeding Article, English and Bahasa Indonesia, publish between 2013-2023, Research Article, Related to sustainability and the topic. Exclusion criteria: Review Article, Book, Report Published before 2013 and not open access journal.

### 2.3 Discussion: Data Extraction and Synthesis

This section presents a discussion of the findings from the analysis of the gathered article data. Through data extraction efforts and synthesis of research findings, the discussion in this instance seeks to address the formulation of the research topic.

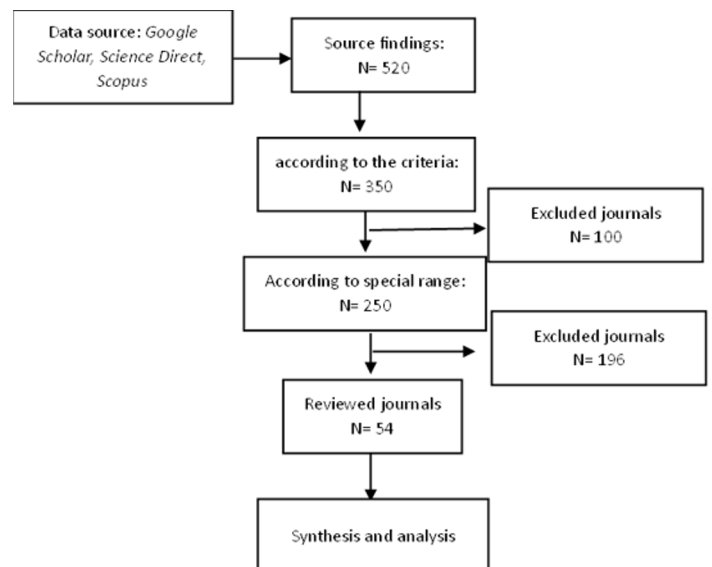


Fig. 2 Research method chart and data extraction

### 2.3 Causal Loop Diagram

Due to their ability to model systems, Causal Loop Diagrams (CLDs) are an essential tool for system analysis. A CLD enables us to comprehend cause and effect rather than assuming a linear relationship between system constituents. One can see and thus gain a better understanding of the feedback mechanisms that

occur in a system by creating a CLD. As such, they make it possible to examine a system's processes in addition to its structure. The CLD facilitates the transfer of system knowledge as well. Figure 3 show how to build the CLD from a system.

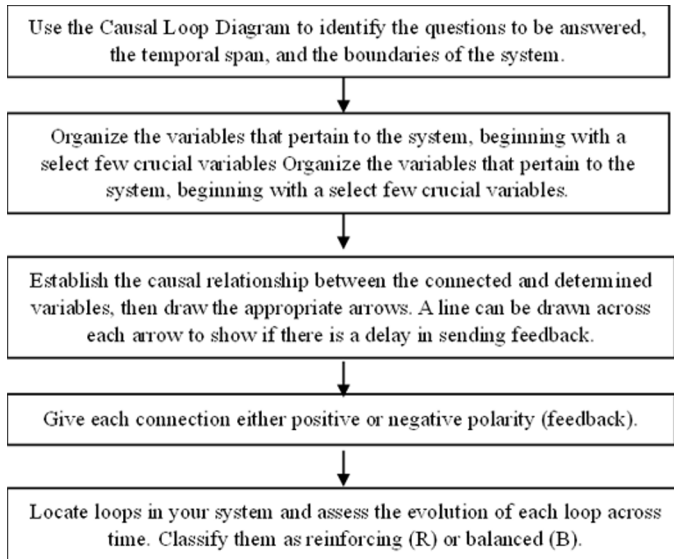


Fig. 3. Steps to create a CLD

### 3 Results and Discussion

#### 3.1 Sasi

Maluku's natural resources have been controlled using the sasi system since the 16th century [16]. The indigenous people of Maluku practice sasi, which is defined as an attempt to protect natural resources on land and in the sea [17]. The Maluku people and some districts of Papua maintain the sasi tradition, which is their cultural heritage and set of principles that were passed down from their predecessors to protect the natural world and its resources [18]. To preserve or conserve natural resources on land and in the sea, the society has practiced sasi, another type of restriction, for many generations [19]. This indicates that the society practices sasi to preserve natural resources for an established period of time, both on land and at sea. The final result of implementing sasi is the preservation of natural resources which is maintained and sustainable [20], production increases and has an impact on increasing income.

In practice, two types of sasi are generally recognized, namely village (state) government sasi, namely sasi issued and announced by the village (state) government and church/mosque sasi which are announced by religious leaders [21,22]. However, these two types of sasi are in principle carried out through a planning process (area, validity period, natural products to be sasi and sanctions for violations that will occur), organizing (placement of authorized customary institutions), implementation (installation of sasi signs, creation of guard posts, harvesting,

maintenance) to supervision [23]. Besides that, also have individual sasi, which is enforced by the landowner personally [24]. In addition, sasi can also be applied according to the location and type of natural resources, namely marine sasi and land sasi (river and forest) [17].

Sasi is in existence to prevent selected plant and animal species from being exploited in a given area for an allocated amount of time. Resources that are being imposed include marine resources like fish, trochus shells, and sea cucumbers, as well as plant and animal resources like coconuts, nutmeg, areca nuts, pineapples, and cuscus. On land, sasi mostly involves private property; but, in the sea, sasi covers resources perceived to be shared property [25].

#### 3.2 Marine Sasi

The concept of the tragedy of the commons has been applied to the control and utilization of fisheries and marine resources, which will lead people to exploit fisheries until the resources run out. This happened because they consider the sea and fish to be shared resources [26]. In the Maluku Islands, especially in the sea area, there is a customary system known as *sasi laut* or marine sasi. The implementation of marine sasi in Maluku could be a strategy to manage fisheries and traditional marine resources in compliance with local communities [27].

Some studies have proven the effectiveness of coastal resource management based on local wisdom, one of which is marine sasi. Marine sasi is a tradition of managing marine resources in coastal areas with an open-close system to regulate resource utilization within a certain period so that it is responsible, fair and sustainable [28].

“Sasi Laut” or marine sasi, most of the subjects covered by sasi are fishery-related, such as pelagic fish that inhabit the waters near shore and sedentary marine organisms. Coastal waters that face a hamlet, a harbor, a coral reef habitat, or other locations with obvious limits are typically subject to sasi restrictions. There are areas in Maluku where sasi controls estuary fisheries [8].

Marine sasi in Watmuri Village, Tanimbar Islands Regency involves the role of the government and traditional leaders, where the sasi's shutting and opening starts from the “marinyo” (one of the members of the traditional institution) who is tasked with conveying messages to the community regarding the time of implementation of the sasi [29]. An example of marine natural resources in this area is sea cucumbers [30, 31].

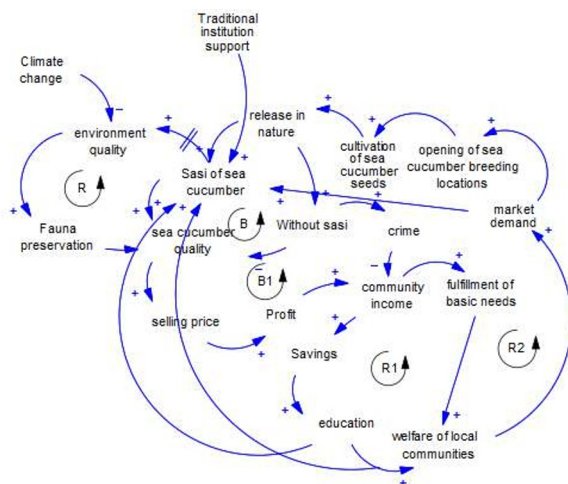
The sustainability of strategic coastal resources such as lola, sea cucumbers and lobsters without implementing sasi is threatened under the right of transfer to outside parties. External parties who are fisheries entrepreneurs have the motive of unlimited use of resources in the pursuit of

profit. The development of modern diving technology provides space for excessive resource extraction activities by investors which threatens resource sustainability [28].



**Fig 4.** The installation of a marine sasi sign

Figure 5 is an image of a causal loop diagram (CLD) which depicts a local community-based management of sea cucumbers in Maluku and shows each variable that influences the implementation of this activity.



**Fig. 5.** Causal loop diagram of community-based sea cucumber management in Maluku

Based on the causal loop diagram above, shows that the implementation of sea cucumber sasi provides economic, social and environmental benefits for local communities. Good quality sea cucumbers through the implementation of sasi increase the selling price which has an impact on the income of local communities. The implementation of marine sasi also provides insight for the community because they have savings that can be withdrawn at any time [31,32]. Apart from that, the existence of Ma'ano culture, namely the activity of helping each other harvest natural resources together, also has a positive social impact on society [30]. The approach in which local wisdom due to the distinctiveness of the local culture, marine sasi has the potential to draw tourists by offering them a well-rounded experience and enhancing the standing of local communities [33].

Marine sasi is a symbol of preserving marine nature by maintaining stability so that the ecosystem is sustainable for communal use for the next generation. The impact of implementing sasi is in the form of a positive impact, namely that residents no longer commit theft, each other protects common property rights and other people's property rights and the relationship between humans and nature becomes harmonious [34]. The implementation of marine sasi means that people do not take marine products arbitrarily and are aware that careless harvesting will destroy habitats and other species [35, 36]. In relation to this, research conducted by Natan et al. shows that the implementation of marine sasi in Ihamahu Country has a better economic sustainability impact compared to villages/states that do not implement marine sasi [26].

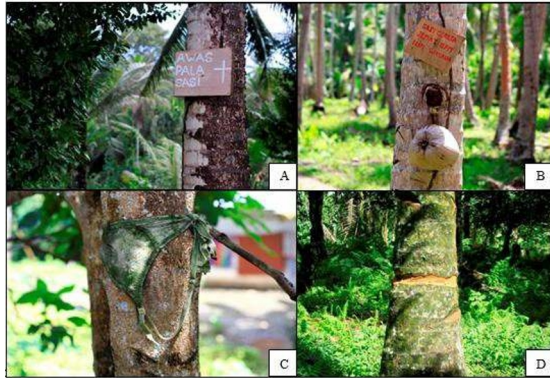
### 3.3 Land Sasi

Eliminating taboos and opposes on forests that indigenous groups had long stuck to as part of local forestry laws was one of the reasons why positive legislation meant for protecting forests failed. While they are aware of it, individuals often overlook instances of forest encroachment since the current system of forest conservation laws alienates those living close to the forest. The village community believes that the forestry police apparatus has the authority to take care of the forests [37].

Furthermore, some kinds of crops that historically served as the primary exports for the Maluku villages are governed by sasi darat, also known as land sasi. Research on the Sasi culture system has been conducted using two methods. The first strategy focuses on the Sasi elements of protecting natural resources, while a second study examines the Maluku community's traditional community system and community culture, including how local customs resisted the pressures of globalization [24].

The best way to maintain biodiversity is to use a variety of approaches, including local, religious, and cultural methods based on community wisdom. It was shown that the *Tabaru* traditional community on Halmahera Island continued utilizing both strategies to preserve plantation land. For instance, *Cincang* is a technique to lessen illnesses that attack coconut stalks, Sasi is a strategy for religiously based plantation protection, and *Kasse tanda* is a technique to increase yields and prevent fruits from falling. The goal of culturally protected plantation property is to preserve a variety of plants that have social and economic significance [38].





**Fig. 6.** [A] Nutmeg (*Myristica fragrans* Houtt.) Sasi, [B] Coconut (*Cocos nucifera*) Sasi, [C] Kasse Tanda technique on mango (*Mangifera indica* L.) [D] Cincang technique on coconut (*Cocos nucifera*). [28].

The Saparua people are familiar with various kinds of Sasi. Sasi for public welfare as land Sasi: numerous tree species, include coconut, jackfruit (cempedak), areca nut (pinang), banana, sago (sagu), nutmeg (pala), clove (cengkeh), and so forth. This includes regulations for safeguarding a variety of natural resources, including sago leaves, pineapple, walnuts, cempedak, durian, areca nut, and nutmeg [39].

Sasi is able to sustain the communal economy of Saparua through sustainable living. In an interview on May 17, 2017, Mr. Ahmad Sanaky said that dark seeds coated in red fuli indicate ripe nutmegs. These ripe nutmegs are sold for Rp 110,000 and require 200 pieces to make 1 kg. One kg of dry flowers and ten fruit peels can be sold for Rp 150,000 and Rp 10,000, each, from a kilogram of nutmeg fuli. People would require about 400 pieces of sasi, if they were gathered before they were ripe, for 1 kg, or Rp 75,000; similarly, nutmeg fuli 1,200–1,300, yields 1 kg of dry blossoms and 20 peels, for Rp 10,000 [15].

In the broadest sense, Sasi has sustainability ideals and plays an important part in ensuring the sustainability of human life by supporting the sustainability of natural resources. It is not a norm that binds society in a limited sense. An equally significant aspect is environmental sustainability, as the practice of Sasi educates people to coexist peacefully with the natural world [15].

### 3.4 Ecosystem Services from the implementation of local wisdom

An ecosystem is defined as a geographically bound system, in which a group of organisms interacts with biotic and abiotic elements of the environment as an orderly unit that is reciprocal [40]. Biotic components can influence changes

that occur in the abiotic environment. For example, humans can change land or empty land into land: cultivating food crops, plantations, forestry, fisheries, tourism, housing or settlements, trade and so on [41].

An ecosystem's processes lead to a flow of material and energy cycles that generate products and services that are used by many living things, especially humans. These products and services are referred to as ecosystem services. Ecosystem services have function of providing, regulating, and supporting natural processes that occur in ecosystems and preserving cultural values [42].

The many advantages that people derive from ecosystems are known as ecosystem services. The UN Millennial Ecosystem Assessment (2005) adopted the concept first presented by Gretchen Daily in 1997. It outlines four categories of ecosystem services: (1) provision (i.e., products obtained from the ecosystem, such as food, fiber, and air); (2) regulation (i.e., benefits acquired from ecosystem functioning, including air and air filtration); (3) culture (i.e., intangible benefits obtained from ecosystems, such as religious enrichment, cognitive development, leisure, and aesthetically pleasing exhibits); and (4) support (i.e., ecological functions like pollination, nutrient cycling, and soil formation). Currently, ecosystem services are increasingly being taken into account in decision-making to support the achievement of sustainable development goals [43,44].

Communities confront challenges when it comes to forest management, such as (a) scarce funding; (b) inadequate expertise and experience; (c) restricted access to resources (particularly for those residing near to protected areas); and (d) inadequate institutional frameworks in community-based forest management programs. Because of this, their ability to reduce emissions from deforestation and forest degradation that result from using non-timber forest products and ecosystem services is hampered [45].

Ethnotechnologies that local communities hold and use to manage, exploit, and preserve the environment for future generations are referred to as local knowledge. This has the benefit of being adaptable and flexible to changes in the environment [46]. Similar to the Pranoto Mongso, the ecological wisdom that demonstrates ecosystem services is a part of the local wisdom in the Karst region of Gunungkidul. The attitudes, beliefs, and norms of individuals dictate how an ecosystem functions. In the period of climate change and unstable situations, the narrative process of imparting knowledge of Pranoto Mongso with its Phenology or bio-indicators is deemed essential [47].

Table 3 shows how the local wisdom can impact on ecosystem services.

Table 3. Local wisdom and impact to Ecosystem Services

Location	The Local Wisdom	Implication to Ecosystem Services
Kuta Village, Ciamis	People are prohibited from digging their wells to maintain the condition of underground water for use in the nyepuh ritual. Water source from the sacred forest.	Cultural Services for the local community in the nyepuh ritual.
Wonosadi, Beji Village, Ngawen, Gunung Kidul	Believe in the existence of a sacred place (a big banyan tree). Vegetation is maintained and water catchment areas are maintained.	Services for providing raw water resources for local communities and controlling erosion.
North Sumatera	Lubuk Larangan, protects the watershed area by prohibiting taking fish outside the predetermined time.	Provision services for protected fish species.
Tana Toraja, South Sulawesi	Ma'pesung (ritual in maintaining the condition of springs) and Karama or Romang Karamaka (prohibition on cutting down trees in the forest).	Supporting services in atmospheric oxygen production, water cycle and habitat provision.
Sungai Langka Village, Lampung.	The local communities' traditional practices— ruwat bumi, ambengan, kenduren, mutual assistance in spring cleaning, tirakatan— allow them to preserve the area's rivers.	Services providing clean water for the community.
Manggarai, Flores	The Barong Wae ceremony is a custom carried out to pay tribute to the water guardian spirit that provides the Manggarai people with life every day.	Cultural Services for the local community.

Source: modification from some articles

As seen in Table 4, the use of sasi will have an impact on ecosystem services, just as other cultures from different places.

Table 4. Sasi Impact on Sustainable Ecosystem Services

Ecosystem Services	Description
Provisioning services	<ul style="list-style-type: none"> <li>The application of sasi continues to have a good effect on the number and quality of the natural resources it produces, as coconut, nutmeg, sea cucumber, fish, coral, sago, jackfruit, banana, clove, areca nut and others.</li> </ul>

	<ul style="list-style-type: none"> <li>By implementation of sasi also can provide the fresh water and natural medicines for the local community ;</li> </ul>
Regulating services	<ul style="list-style-type: none"> <li>Local wisdom such as sasi, pamali places, sacred places and dusung can support forest conservation by protecting flora and fauna as well as maintaining balance and preserving nature.</li> <li>The implementation of traditional conservation will give impact to air quality, climate, water runoff, erosion and pollination.</li> </ul>
Supporting services	<ul style="list-style-type: none"> <li>The sustainability status is assigned to the management of the Lompa fishery in the Sasi area of Central Maluku Regency, Haruku State was very good. By protecting the fish and coral reef will give impact for habitat provision.</li> <li>When local community do the land sasi will give impact to protect the forest. That means will support for nutrient an water cycling, soil formation and primary production.</li> </ul>
Culture services	<ul style="list-style-type: none"> <li>Sasi is the local wisdom from Maluku based on shared responsibility, sustainability, and benefit principles. It seeks to achieve sustainable development to preserve the natural riches found in the area and allow future generations to enjoy them. By that, sasi bring spiritual value for the community to do this culture everytime to protect the natural resources.</li> <li>Succeeding of Sasi in Maluku show if this local wisdom can give education for peoples to learn how to do traditional conservation by building positive relationships amongst communities and promoting healthy natural circumstance. To ensure that natural resources become sustainable and can be enjoyed by future generations, the role of sasi in environmental control is determined by adherence to the regulations and guidelines for implementation, utilization, development, maintenance, restoration, and monitoring that are environmentally sound.</li> </ul>

- The benefits of implementing Sasi in villages are increasing people's income after mass implementation of Sasi and protecting plants from damage that can be caused by irresponsible people (exploitation). Beside to give habitat for the animal, sasi also will maintain the environment to be good and can use for do culture recreation. This also can see from open Sasi Lompa in Haruku village.

*Source: modification from some articles*

## 4 Conclusion

Sasi is a term used to describe the Maluku indigenous people's efforts to protect the island's natural resources, both marine and terrestrial. The Maluku people and certain sections of Papua continue to practice the sasi tradition, which is their cultural legacy and set of principles that were handed down from their ancestors to protect the natural world and its resources. Sasi is enforced to prevent specific plants and animals from being exploited in a particular area for a specific amount of time.

In the most general way, Sasi has sustainability ideals and plays a significant role in ensuring the sustainability of human life by supporting the sustainability of natural resources. It is not a norm that binds society in a limited sense. An equally essential component focuses on environmental sustainability, teaching people to coexist peacefully with the natural world through the application of Sasi. That means the implementation of sasi will impact sustainability of Ecosystem Services and also will improve social (children's education completion, better nutrition, decreased infant mortality rates, and fewer medical visits) and economic (production and income growth) for local community in Maluku.

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