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Environmental Conservation based on *Mamar* System as Local Wisdom of West Timor, East Nusa Tenggara

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Abstract
Mamar is an adaptation strategy built by the Amarasi Community to overcome environmental conditions that do not provide a prosperous life. This study aims to analyse environmental conservation practices based on the Mamar system as local wisdom and related social structures as a mechanism for environmental conservation. Environmental conservation based on the Mamar system is implemented with mechanisms and approaches to the needs of local communities for the preservation of natural resources in the long and sustainable term. The local rules such as Nuni and Bunu played an important role in maintaining and preserving the Mamar System. In addition, local figures such as Mataf and Ketiut Po'an helped the local community to stick to the local values to preserve the Mamar area.

Keywords: Conservation; Environment; Local Wisdom; Mamar; Amarasi

Introduction
Mamar can be defined as a mechanism for environmental conservation by local communities in West Timor, East Nusa Tenggara, by applying the rules and local wisdom. *Mamar* can be interpreted from a practical perspective as an "artificial oasis" built by Amarasi local communities as an adaptation strategy to overcome environmental conditions that do not provide a prosperous life. The distinction between dry and uncultivated land areas in West Timor, East Nusa Tenggara before and after the *Mamar* system treatment is presented in Figure 1 and Figure 2. To determine the research limitations, conservation in this study is defined as an effort to maintain, manage, and use natural resources and ecosystems properly for the long-term benefit of humanity (James *et al.*, 2021). The *Mamar* system has existed since the 17th century and has been applied continuously by local communities in the Amarasi sub-district for hundreds of years (Ataupah, 2020). Environmental conservation practices based on the *Mamar* system can be found in Sonraen Village, Apraen Village, Sahraen Village, and Buraen Village. *Mamar* as a traditional natural resource conservation system is a popular term among local farming communities in West Timor, East Nusa Tenggara.

Environmental conservation based on local wisdom is also practised among other local communities in Indonesia with different terminologies. Hatam tribe in the Arfak-Manokwari mountains, Papua, have the concept of conservation areas called *Igya Ser Hanjop*. They have established several norms and sanctions related to forest area utilization and conservation efforts (Putra, 2021). Baduy community in West Java have local wisdom to conserve their harmonious agricultural system and manage the forest sustainability It is also explained that conservation areas (forests) such as Leuweung Kolot, Leuweung Gede, Leuweung Tutupan, and Leuweung Titipan, especially in the Baduy Dalam area, are protected and maintained based on the customary rules called *Pikukuh* (Habiyaremye and Korina, 2021).

Fig. 1. Dryland Area (Non *Mamar*) in West Timor, East Nusa Tenggara

Fig. 2. *Mamar* Area in Amarasi, West Timor, East Nusa Tenggara

Fig. 3 and 4. Livestock Rearing in the *Mamar* System in Amarasi, East Nusa Tenggara

Agricultural conservation is the point of emphasis in the modern world (Kumar, 2022; Khangotra, 2022; Dhau and Singh, 2023; Mishra et al., 2023; Singh and Puri, 2023)Agricultural conservation such as banana crops and livestock rearing in *Mamar* systems presented in Figure 3 and Figure 4. Local community activities in environmental conservation are also conducted by the Banjar indigenous community and Tenganan traditional village in Bali (Purnamawati, 2021). In the Tenganan traditional village, daily life rules in the community are regulated by *Awig-Awig* (customary village legislation). Meanwhile, there is local wisdom in Kalimantan in which the environment is known as *Tana Ulen Lepo* (land) and *Sungai Ulen Lepo* (river) (Eghenter *et al.*, 2021). Additionally, the few other environmental conservations based on local community wisdom are *Rimbo Panghulu* in Jambi Province, Central Sumatra, *Banuang Sakti* in Bengkulu Province, and *Temedak* Forest in West Sumatra.

While other natural resource conservations above were practised on relatively fertile land with a wet climate, the *Mamar* system is practised on dry and critical lands in West Timor, East Nusa Tenggara. Regarding environmental conservation practices, East Nusa Tenggara is suffering from environmental damage and extinction threats. There were 6,582 ha of burned forest areas in East Nusa Tenggara during 2015-2017 due to human activities. These forest fires have further expanded the area of critical land in this region. East Nusa Tenggara has the largest critical land area in Indonesia, which is 1,773,795 ha consisting of 885,155 ha within the forest area and 888,640 ha outside the forest area related to this matter, it is also stated that East Nusa Tenggara is the watershed area with the least groundwater supply in Indonesia.

Evapotranspiration from rainwater in East Nusa Tenggara is only 250 mm/year with an estimated groundwater recharge rate of only 0.4 litres/second/km2 (Bansard and Schroder, 2021). The *Mamar* system is ecologically crucial in maintaining soil fertility, water sources (springs) and animal feed consisting of *lamtoro* leaves, banana stems and various other types of animal feed. As a social function, *Mamar* serves as an adhesive for the kinship system and can strengthen social status among local communities. *Mamar* also has an economic function for the lives of rural communities, although this function is still oriented towards a subsistence economy. This is similar to the economic function of conservation where natural resource conservation systems can provide economic incentives to local communities, even if only to fulfil their basic daily needs (Pörtner et al., 2021). Environmental conservation based on the *Mamar* system is also aligned with the Triple Bottom Line concept that prioritizes sustainability and preservation of ecological, economic, and social functions (Godoi and Pacheco, 2016).

Methods

This research was conducted using a qualitative approach in a critical interpretive paradigm. The interpretive paradigm is an attempt to find out the explanation of socio-cultural phenomena based on the perspectives and personal experiences of the people studied (Bogdan and Biklen, 2007; Maxwell, 2012; Bungin, 2020). In general, the interpretive paradigm is a social system that interprets human behaviour directly through observation. The interpretive paradigm perceives facts as something unique and has a special context and meaning as the core of understanding social meaning (Elmusharaf, 2012). Additionally, it perceives facts as fluid or non-rigid things that are attached to the meaning system and social facts in the research location (Schwartz-Shea, 2012; Kirk and Hinton, 2019). This research aims to analyze environmental conservation practices based on the *Mamar* system as local wisdom and related social structures as a mechanism for environmental conservation in West Timor, East Nusa Tenggara.

This research was conducted in Amarasi District, Kupang, East Nusa Tenggara. Amarasi sub-district was chosen as the research location considering the area is still implementing effective environmental conservation based on the *Mamar* system as local wisdom guided by related local values and has been practised from generation to generation. This research was conducted from March 2020 to February 2021. The procedures in this research are described as follows (a) selecting a sample of the first informants, namely a local Amarasi community leader from Oekabiti Village and a customary chief among the local community in Amarasi; (b) subsequent informants were selected based on information from the first informants by following snowball sampling. Furthermore, visits and in-depth interviews were conducted to obtain information according to the focus of the research to the next informant; (c) the first two steps were repeated until a condition where variations in information are no longer found during the data collection process. Technically, it can be stated that the types of questions asked to each group are different, but the types of questions asked to one group are the same. Different questions allow the obtaining of wide-ranging explanations with various elements and sources about the local community's behaviour in committing natural resource conservation based on the *Mamar* system and local structures related to the traditional conservation system in Amarasi.

An interview was conducted with a *Fetor* (local descendant of the king) who is concerned with the traditional conservation based on the *Mamar* system in Amarasi. To complete comprehensive information, a few visits to other informants have been conducted. The other informants are people outside the local community, such as village governments and sub-district level government. The number of informants is 15 people consisting of five groups, namely, (a) a group of community leaders consisting of 3 people; (b) a group of traditional leaders consisting of 3 people; (c) 3 members of youth group; (d) 3 members of village/sub-district government group; (e) 3 people of *To Tafa* (ordinary people) group. The data collection method includes in-depth interviews with 15 interviewees and forum group discussions where each group consists of 5 members. Therefore, there were 15 respondents for the group discussion. The total number of sources for this research was 30 people.

Results

According to Ataupah (2020), *Mamar* is derived from Rote language "*mamme*" and Helong language "*maman*" which was later modified to "*Mamar*" which means eating betel. This term was chosen because the dominant plants in *Mamar* are areca nut and betel (besides lime), which are the basic ingredients for the eating betel tradition. *Mamar* in Dawan language is known as "*Po'an*". Among Dawan farmers, the term *po'an basah* is associated with water; and the dominant types of plants are betel nut, areca nut, coconut, banana, jackfruit, and so on. The process of forming *Mamar* occurred over a long period of time through several successions of climax vegetation as it exists today. Certain plants such as Banyan trees (*Ficus* spp.), Albesia (*Albezia chinensia*), cottonwood (*Gessampinus heptaphylia*), and various other old trees become the characteristics of *Mamar*.

The sequence of planting and the structure of crops grown in *Mamar* do not follow a particular cropping scheme. The density of plants varies from one *Mamar* to another. The formation of *Mamar* began with farming on non-forest land or shrubs that were usually located around very limited water sources. Farmers begin to leave this farming land without significant maintenance and leave its management to the *Mamar* guards. The development and maintenance at this phase began to be controlled strictly through local rules, allowing the *Mamar* system to survive successfully to this day. Generally the process to form a stable *Mamar* without disturbance from nature and humans takes 15-25 years. Environmental conservation activities in the *Mamar* system are always practised through a mechanism of cooperation between community members in Amarasi. Related to environmental conservation in the *Mamar* system is a local wisdom system called *Bua*, which means finger gathering. It can be realized as a gathering of energy, thoughts, and food when doing an activity. The term *Bua* is often known as *Bua Nukuf*.

There is another wisdom called *Fiti*, which translates as "to carry" and means mutual cooperation to help the older or weaker ones. In other words, cooperation to ease the work. *Ma Fiti* means working together to complete something. *Ma Fiti* can be interpreted as "Many hands make light work." *Fiti* or *Ma Fiti* has a very deep psychological meaning because there is a reciprocal satisfaction in doing these activities, where those who are helped feel satisfied and those who help feel relieved because they have helped others. Additionally, there is a local wisdom called *Feineka*, in which this activity helps others not in a physical form but instead mentally opens the minds of others. E.g. the appearance of someone to encourage others to work, in terms of providing mental support to others. If an individual in Amarasi is proactive in conserving the environment through the *Mamar* system, it will have a positive impact and contribute to community life and environmental sustainability. Therefore, the particular individual is greatly appreciated and obtains a high social status in the community. There are terms to illustrate rich people (rich in spirit) who are wise and honourable and own *Mamar* as an inheritance. The terms are *no'ah bonaki*, which means silver-rooted coconut, and *pu'ah bonaki*, which means silver-rooted areca nut. Local people in Amarasi who own *Mamar* are referred to as people who own coconut husks, areca nut husks, where deer sleep and birds nest.

People who own *Mamar* will protect and nurture the springs and rivers; try to maintain the fertility of the soil and protect the trees and plants within *Mamar*. It means that as *Atoin Meto* people, they are wise wealthy people because they use their wealth to protect and maintain the environment and natural resources around them. These natural resources include coconuts, areca nuts, bananas, breadfruit, and various other types of trees, springs and rivers, soil fertility and wildlife fertility such as deer and birds. There is a local rule in the *Mamar* system called *Nuni*, an obligation to maintain and preserve soil fertility as well as maintain and preserve water sources in *Mamar*. Besides, there is another rule called *Bunu*, a prohibition not to cut any kind of tree in *Mamar*. The *Mamar* guard who is called *Mataf*, is assigned to guard and catch people who infringe the rules of the *Mamar* system, such as cutting down trees and hunting or catching wildlife in the *Mamar*. Another guard is called *Ketiut po'an* who applies *Hake*, a prohibition for taking; harvesting or picking coconuts or areca nuts, and collecting non-timber forest products in the *Mamar* before the harvest time. *Hake* rules state that the harvesting of crops in the *Mamar* such as coconuts, areca nuts, bananas and other non-timber forest products can only be

conducted once every three months. *Ketiut po'an* and *Mataf* impose taboos (*Meo*) that cannot be violated by anyone. If anyone violates the regulations set by *Mataf* and *Ketiut po'an*, they will get fined or sanctioned called *Tasane*. The person who receives *Tasane* is called *Musanab*. A *Tasane* includes a cow, a buffalo, or several pigs. The consequence allowing local communities in Amarasi to avoid violating the rules to preserve natural resources. Besides local values, the local community of Amarasi also perform rituals based on their belief system. The rituals performed by Amarasi community members are interpreted as a form of human devotion to the *Uis Neno* deity and the preservation of natural resources in the *Mamar* system. Through rituals, people are reminded to obey and respect the *Uis Neno* deity who is believed to inhabit the *Mamar*. They cultivate a constant awareness to obey the deity's desires to avoid destroying natural resources in the *Mamar* area. The ceremonies as a traditional conservation system are one of the most important rituals in Amarasi's community life.

A ritual is held to clean the spring once a year to preserve and maintain the water sources. In *Mamar* there are water sources used for consumption by both humans and animals and a sacred spring. The spring is called *Oe Hae*, which is specifically used for offerings at traditional ceremonies. The local community believed that the water lord spirits inhabit the sacred springs and often transform into big snakes, eels, fish or shrimps. Therefore, catching fish, shrimp or eels in *Mamar*'s spring is strictly prohibited. The harvest ceremony is held twice a year after the *Bunu* and *Hake* period ends. This ceremony is usually held around December or January and June or July and attended by the local village government along with the entire family of *Mamar* owners and is led by *Mataf* and *Ketiut po'an*. The ceremonies usually take place at the entrance of *Mamar*. In the ritual procedures, *Mataf* or *Ketiut Po'an* also announce the schedules for the joint harvest, fence repair, and *Mamar* cleaning.

Discussion

Mamar is a popular term among Amarasi farmers in West Timor, East Nusa Tenggara. In the context of farming, the *Mamar* system is also known as agroforestry. This system is one form of farming that has been implemented for a long time in East Nusa Tenggara. This system is applied by cultivating land for perennials, food crops, fodder crops, and livestock rearing. Agroforestry is defined as a permanent land use system. Seasonal and annual crops are planted together or in rotation to form a multi-layered crop structure (Manafe *et al.*, 1990). This system can provide ecological and economic benefits. Mamar do not follow a particular cropping scheme as in agroforestry with various plant densities that differ from one to another.

Agroforestry is a biological production system that deliberately combines trees and shrubs with crops, livestock, and other production factors. Furthermore, agroforestry encompasses both traditional forms of land use that rely on trees and shrubs as part of crop and livestock production systems, and technologies that have only been developed to integrate woody perennial crops in various land use systems to make these systems more productive and sustainable. One form of an agroforestry system that has been cultivated among farmers in mainland Timor, especially in Amarasi is the *Mamar* system. *Mamar* is a form of traditional agroforestry which is generally found along water sources (springs) and rivers that always flow throughout the year and are relatively close to farmer settlements. The form of agroforestry that is cultivated is planting a mixture of annual crops (perennials) such as coconut, areca nut, banana, betel nut, mango, jackfruit, orange, and so on with food crops (sweet potatoes), fodder crops or fish, and forest plants as an additional type of farming on the same land. These farming activities are generally conducted with traditional maintenance and management based on local structures. However, there are only a few areas that implemented advanced management systems. Some experts have identified *Mamar* as having crucial ecological, sociological, and economic functions, such as creating a microclimate (cool temperature), a source of germplasm, soil and water conservation, a source of food and feed, a source of energy (firewood), a source of income for farmers, a place of communication etc.

The Mamar system has been existing since the 17th century, particularly in Amarasi (Ataupah, 2020). The *Mamar* system as local wisdom in environmental conservation is practised

individually and collectively based on local community rules (Dawson *et al.*, 2021). The *Mamar* system has been existing since the 17th century, particularly in Amarasi (Ataupah, 2020)Environmental conservation is implemented based on the principle of cooperation between community members in Amarasi. The cooperation principle like *Bua Nukuf* and *ma fiti* is beneficial for natural conservation because the local community help each other to maintain the natural resources in the *Mamar* area. From the ecological wisdom of local communities, it is clear that the formation of *Mamar* is a strategy to conserve natural resources traditionally based on relevant local values, especially related to the conservation of water, land, forest and wildlife resources. Based on local values like *no'ah bonaki* and *pu'ah bonaki*, individuals who own *Mamar* will attempt to maintain the natural resources within the area, including soil fertility, trees, and plants. Furthermore, *Mamar* serves economically as a source of food and trade commodities with high economic value. Agricultural techniques applied in Mamar such as maintaining the soil and water resources as well as the cropping system could minimize the potential for landslides to occur. This is because, well-maintained water and soil and the presence of cropping systems like intercropping between annual crops, mix cropping, or strip cropping on cultivated land could mitigate the landslide susceptibility (Priyono et al., 2023).

A rural community that conserves natural resources is often based on their social and cultural system (Baines, 1982; Pernetta and Hill, 1984; Shackeroff and Campbell, 2007). All of the local values practised in Amarasi are an effort to maintain the values of unity in the community which impacts environmental preservation. One form of controlling is the belief system, rituals, and taboos in managing and exploiting certain natural resources such as forest, land, and water resources. Despite the discrepancy of the rural community's belief system to modern society, it serves an important function in preserving their natural resources. By adhering to that belief system through rituals, rural communities always consider their action in exploiting natural resources wisely to maintain their sustainability. The belief system in Amarasi developed a constant awareness to not cause damage to natural resources, especially in the *Mamar* Area. The socio-cultural life of local communities in Amarasi is also characterized by various rituals. Rituals like cleaning the spring benefit the environment, particularly the water sources. The prohibition of catching eels, fish, and shrimps in the sacred springs is beneficial for the springs since those animals are natural cleaners of the spring's groundwater channels. If the animals are caught, the channels will become clogged and water discharge will automatically decrease. Besides, the harvest ceremony ritual is also relevant to maintain the natural resources through the scheduling of *Mamar* cleaning and its' barrier repairing, social integration through the gathering, and local subsistence economy through the joint harvest.

Conclusion

Based on the discussion above, it can be concluded that Mamar can be interpreted from a practical perspective as an "artificial oasis" built by Amarasi local communities in West Timor as an adaptation strategy to overcome environmental conditions that do not provide a prosperous life. The response of the local community is manifested in the process of life adaptation through environmental conservation acts towards the natural resources of land, water, flora and fauna which are the source of life needs of local community. Environmental conservation based on the *Mamar* system is conducted by applying local structures that are authentic, straightforward and measurable in accordance with the situation and conditions of the community. The *Mamar* system has persisted since the 17th century because it is applied with mechanisms and approaches to the needs of local communities for the preservation of natural resources in the long term. The strength of *Mamar's* system in sustaining the socio-economic and cultural life of the Amarasi community is supported by the ecological, economic, and social variables of the Mamar system itself. The local rules in the Mamar system are *Nuni*—an obligation to maintain and preserve soil fertility in Mamar, maintaining and preserving water sources in Mamar—and *Bunu*—a prohibition not to cut any kind of tree in Mamar. Besides, Mamar guards such as *Mataf* and *Ketiut po'an* greatly helped the supervision of the enforcement of the local rules in the community. The rules established allowing the local community to preserve natural resources through the *Mamar* system.

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GL, BW and TND conceived the concept, wrote and approved the manuscript.

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