Tropical Savanna Climate Zone Of East Nusa Tenggara, Indonesia

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ABSTRACT

The most frequently used climate classification map is that of Wladimir Köppen, Köppen is a plant scientist and realised that plants are indicators for many climatic elements. Each zone has its own characteristics in terms of architectural form. Climate zones themselves are found in various countries, including the climate zone in Indonesia, a country that is well known as a tropical one, a country that only has two seasons : the dry and the rainy seasons, so the Climate Zone system exists also in Indonesia. The traditional houses in the tropical savanna zone that will be discussed are traditional houses located in Eastern Indonesia. The discussion is related to cosmology, building form, and the influence of climate on traditional houses. The method used in this paper is qualitative by obtaining literature study data from various journals. The purpose of the discussion in this paper is to add some information to the scientific literature bertaining to traditional houses in the tropical savanna climate zone of east nusa tenggara according to the Koppen Classification System.

Keywords: Architecture, Climate, Traditional Houses

INTRODUCTION

Climate zones according to Ashadi (2017) In geography are studied through climatology. The study of climatology is very important for various fields outside geography including agriculture, architecture, ecology, forestry, and economics because climate is a factor that influences human's behavior and natural processes in various ways. The oldest climate classification since ancient Greek times is basically just temperature. In this period, it is known that there were variations in temperature caused by differences in latitude (but the role of land and sea has been given less attention). Until now, there have been many climate classifications, the famous climate ones are the Hettner (Germany), de Martonne (France), Koppen (Germany-Austrian), and Thornthwaite (American) classifications.

The first quantitative classification of world climates was presented by the German scientist Wladimir Köppen (1846–1940) in 1900. Koppen Classification was constructed on the basis of five vegetation groups determined by the French botanist De Candolle referring to the climate zones of the ancient Greeks. The five vegetation groups of Köppen distinguish between plants of the equatorial zone (A), the arid zone (B), the warm temperate zone (C), the snow zone (D) and the polar zone (E)Climate zones according to the Koppen classification consist of AF and AM zones for the tropical rainy zone, and AW for the tropical savanna zone. Each zone has its own characteristics in terms of architectural form. Climate zones themselves are found in various countries, including in Indonesia, a country well known as a tropical country, that is a country that only has two seasons the dry and the rainy seasons, so the Climate Zone

system in Indonesia is similar to each other but with slight differences such as humidity levels

Savanna is a tropical ecosystem dominated by grass and woody plants (trees) with sparse to quite dense density. However, in many areas in Indonesia, climatic factors encourage such vegetation to develop into forests. Savannas in Indonesia are found throughout the archipelago in a variety of climates and soils (Monk et al. 2000; Whitten et al. 1996). The savannas in Indonesia that are famous and have been widely studied by foreign researchers are the savannas on the islands of East Nusa Tenggara (NTT), in the driest eastern part of the archipelago which has seasonal rainfall (average more or legs ± 600 mm per year), such as West Timor , Sumba, and Flores (Fisher et al. 2006; Monk et al. 2000; Russell-Smith and Edwards 2006; Tacconi and Ruchiat 2006).

In this paper, the author wants to compare and classify the response of each traditional house in the tropical savanna climate zone which consists of houses in West Nusa Tenggara, East Nusa Tenggara and Timor Island. This classification will be shown in table containing a brief description of the function of the structure and materials in several houses which will be explained in the tropical savanna zone climate.

RESEARCH PURPOSE

The aim of this research is to determine the resistance of traditional houses to tropical savanna climates, so as to be able to properly explain the factors that make traditional houses in tropical savanna areas have high resistance to climatic conditions. The benefits to be achieved in this research are:

1. Adding scientific literature for researchers of traditional houses in tropical savanna climates.
2. Becoming a reference and can be considered for making studies on climate-resistant structures and materials in the tropical savanna climate zone.
3. Providing information regarding traditional houses that can be used as tourist attractions for education and learning value for both local and foreign tourists.
4. Increasing awareness of the Indonesian people to maintain and preserve the cultural values of traditional houses in Indonesia.

METHOD

The research method used in writing this paper is a qualitative descriptive method. Ramdhan (2021) states that qualitative research data is data in the form of words, sentences, expressions, narratives and images. The study of library data that supports writing is collected by conducting library searches, searching for relevant sources and searching for data via the internet. The data and information used are taken from books, articles, journals and several relevant libraries. The data obtained from these sources were used as a reference in making this paper in depth. The analysis was carried out in 3 stages, namely identification, description and interpretation. Stage 1 is identifying traditional houses located in the tropical savanna climate zone. The division of climate zones is based on Koppen's opinion. Stage 2 is a description of the traditional house's response to the climate through architectural elements, spatial planning and materials. Stage 3 is the interpretation of identification and description to find the response of traditional houses to the tropical savanna climate.

DISCUSSION

The climate division according to Koppen is based on the average rainfall and temperature obtained in several months or years. Koppen divides the classification into 5 climates marked with capital letters A, B, C, D, and E. Indonesia's territory is in Climate A, namely a tropical rainy climate with the following characteristics:

1. The average monthly temperature is above 18^{o} Celsius.
2. High rainfall and evaporation.
3. It doesn't have winter.

Climate A is divided into AF, AM, and AW. AF is a tropical rainy climate with rain all year round. AM is a tropical rainy

climate with changing seasons, and AW is a tropical savanna climate. (Princess, 2022).

The following is the characteristics of the tropical climate in Indonesia:
AF = tropical rainforest climate; monthly rainfall of not less than 60 mm (2.4 inch) in any month. AM = tropical monsoon climate; the driest month's rainfall is less than 60 mm (2.4 in) but exceeds 4% of annual rainfall. AW or AS = tropical savanna climate; the driest month's rainfall is less than 60 mm (2.4 in) and is less than 4% of annual rainfall. (https://p2k.stekom.ac.id/ensiklopedia/Klasifikasi_iklim_K%C3%B6ppen)

TRADITIONAL *BALE LUMBUNG* ARCHITECTURE

A. DESCRIPTION

Bale Lumbung is a traditional house of the Sasak tribe on Lombok Island, West Nusa Tenggara. This house has the main function as a rice barn, a place to store people's harvests. *Bale Lumbung* has a unique and distinctive shape, namely in the form of a stage with a roof that widens and tapers slightly at the very top.

B. COSMOLOGY

Bale Lumbung has an important meaning for the Sasak people. This house symbolizes prosperity and welfare of society. *Bale Lumbung* is also a symbol of the social status of the Sasak people. The bigger and taller the *Bale Lumbung*, the higher the social status of its owner. *Bale lumbung* Lombok is a traditional building used to store rice. This building has a unique shape and has a deep symbolic meaning for the people of Lombok. The Lombok *Bale Lumbung* cosmology is based on the Lombok people's belief that the universe consists of three layers, namely heaven, earth and the underworld. *Bale Lumbung* represents the sky, while the floor represents the earth. *Bale Lumbung* barns are usually built on high ground, so they resemble mountains. This symbolizes the relationship between humans and the universe. The bale barn has three doors, namely the front door, side door and back door. The front door symbolizes the entrance to heaven, while the side and back doors symbolize the entrance to earth and the underworld.

The *bale* barn also has three roofs; the front, side and rear roofs. The front roof represents the sky, while the side and the rear roofs represent the earth and the underworld. *Bale lumbung* are usually decorated with ornaments that have symbolic meaning. For example, sun ornaments symbolize light and life, while moon ornaments symbolize wisdom. *Bale lumbung* not only functions as a place to store rice, but also as a place for religious rituals. At harvest time, the people of Lombok will hold a ritual in the bale lumbung to express gratitude to God Almighty for the abundant harvest.

The following is some of the symbolic meanings contained in the *Bale Lumbung* Lombok:

- *Bale Lumbung* symbolizes the relationship between humans and the universe.
- *Bale Lumbung* represent the balance between heaven, earth and the underworld.
- *Bale Lumbung* shows life and wisdom.
- *Bale Lumbung* reflects prosperity and prosperity.

gambar 1.
(sumber : www.gadizalombok.com)

C. SPACE ORGANIZATION

Even though this house looks small from the outside, the inside is much more spacious. This house consists of 2 floors,

residents can cook on the first floor and rest on the second one. *Bale Lumbung* has two main rooms :

- Roof : The roof of the *Bale Lumbung* is a space for keeping rice. This space is usually high and wide, so it can accommodate a lot of rice.
- Floor : The floor of the *Bale Lumbung* is the space where humans live their lives. This space is usually smaller than the roof, and is equipped with simple furniture, such as a table, chairs, and bed.

Apart from these two main rooms, the *Bale Lumbung* also has several additional equipment, such as:

- Doors : Doors are usually located in the front, side, and back of the building. This door functions as an access to enter into and exit out of *Bale Lumbung*
- Windows : Windows are usually located at the bottom of the roof. These windows function for ventilation and natural lighting.
- Stairs : Stairs are located on the side or back of the building. These stairs functions to access the roof space.

(sumber : www.gadizalombok.com)

D. STRUCTURE

The roof of the *Bale Lumbung* is made of dried straw which is arranged as tightly as possible so that rain and hot water cannot penetrate it, the walls are made of woven bamboo (*gedek)*, and the floor is made of wooden planks. *Bale Lumbung* has a unique and distinctive shape, namely in the form of a stage with a roof that widens and tapers slightly at the very top.

Bale lumbung is a kind of icon of the traditional house of the Sasak tribe from the Lombok island. This is due to its very unique and interesting shape, that is in the form of a house on stilts with a pointed roof edge which then widens slightly then straight down and the bottom widens again with a roof distance of 1.5 - 2.0 meters from the ground and a diameter of 1.5 - 3.0 meters. The construction of the *Bale Lumbung* is designed to be anti-rat, the poles are round and have a circle on top of the pole so that mice cannot climb it up.

(Jelepeng Alang sistem anti tikus)

sumber : www.gadizalombok.com

E. MATERIAL

Bale Lumbung is made from natural materials, such as wood, bamboo and straw. The house pillars are made of sturdy wood, while the walls and floors are made of bamboo. The roof of the Bale Lumbung is made of straw that is stacked tightly to be weather resistant.

Bale Lumbung has a distinctive shape, which looks like a house on stilts with a roof

that widens and tapers at the ends. This part of the roof is made of straw or reeds. Meanwhile, the walls are made from woven bamboo, and the floor is made from planks. Apart from that, the method of making it is quite natural, *Bale Lumbung* is made from loam (rey) trees and the method of installing it is without using nails, just connected and installed into joinery connection that has been made.

The roof is made of reeds and there are windows so that fresh air can enter into the storage room for the harvest

MBARU NIANG TRADITIONAL ARCHITECTURE

A. DESCRIPTION

The unique architecture of the original houses of the people of Kampung Waerebo, namely Mbaru Niang. Rumah Niang or Mbaru Niang is a traditional house whose building has a towering conical roof made of palm leaves and palm fibers that extend down until it almost touches the ground.

https://www.hdesignideas.com/2013/10/mbaru-niang-rumah-adat-di-pulau-flores.html

B. COSMOLOGY

Fransiskus Mudir as leader of the Waerebo Village Tourism Organization said that the philosophy of the Mbaru Niang cone shape is a symbol of protection and unity between the people of Waerebo Village itself. The conical shape of Mbaru Niang resembles a mountain, which is a symbol of strength and protection. Apart from that, the cone shape also symbolizes the unity of the people of Waerebo Village. Meanwhile, the circular floor of the house represents a symbol of harmony and justice between Waerebo residents. The circle shape symbolizes unity and balance.

arsitektur12ruangdalam50muliana.wordpress.com.

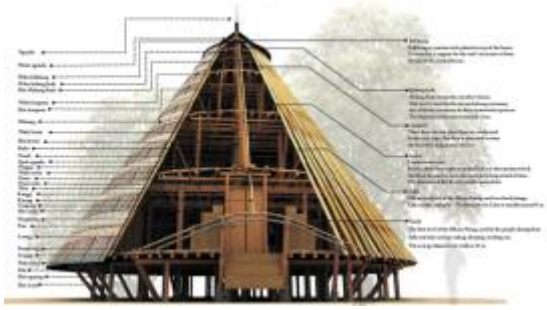
C. SPACE ORGANIZATION

The Mbaru Niang traditional house has three main rooms :

- The lower room it is a room functioning as a residence for domestic animals, such as pigs, goats and chickens. This space is also used to store food ingredients and agricultural tools.
- Living room: it is a room functioning as a family residence. This room is usually equipped with a fireplace, bed and table
- Upper room: a room that functions to storage rice and other agricultural products. It is also used as a place to store valuable objects, such as jewelry and heirlooms.

Beside the three main rooms, the Mbaru Niang traditional house has several additional rooms:

- Attic is located above the middle room and the top room. It is used to store unused items.
- Sairs are located in the front of the house. It is used to access the upper room.
- Doors are located at the front, side and back of the house.

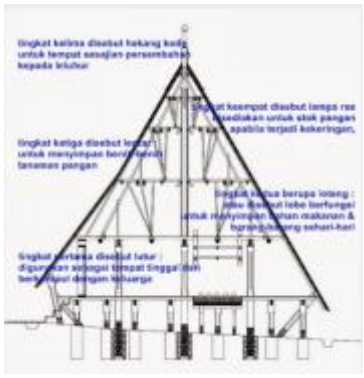


https://arsitektur12ruangdalam50muliana.wordpress.com/2015/05/08/mbaru-niang-rumah-tradisional-suku-wae-rebo-pulau-flores/

D. STRUCTURE

Mbaru Niang in Wae Rebo has a cone shape where this building has a large part at the bottom and is smaller then at the top. This cone shape is the entirety of the roof and walls that envelop the Mbaru Niang building from the top to the bottom of the one mbaru niang where the bottom part almost touches the ground, so that the entire building has no other shapes on the outside surface of the building.

https://www.hdesignideas.com/2013/10/mbaru-niang-rumah-adat-di-pulau-flores.html



https://www.hdesignideas.com/2013/10/mbaru-niang-rumah-adat-di-pulau-flores.html

The influence of the triangular and pointed shape of the building structure on the blow of the wind can be said to be stable from various directions. The pointed shape, which does not have a large shape but is smaller than the bottom part of the roof, can overcome the blow of the wind which could possibly rotate, where Wae Rebo Village is surrounded by seven hills around it which enable this to happen. This building has a smaller upper part, so the influence of wind pressure on this building is lighter than the lower part, so that at the height of this building it will have a small effect on wind forces. Apart from that, the shape of the roof which almost touches the ground is also an effort to overcome the pressure from strong winds outside the building so that the roof is not lifted. The maximum wind speed will be above the building and the wind moving under the building will be absorbed by the trees so that the wind moving around the bottom of the building is not as strong as the wind above the building. Therefore, the density between the roof and the ground below will further minimize the wind coming horizontally from outside and will not directly enter the house, so there is little chance of the roof lifting.

E. MATERIAL

The materials used to make traditional houses in Waerebo Village include among others:

- Wood it is used as the main material to make the frame and walls of the house. The wood used is strong and durable, such as teak, mahogany and jackfruit.

https://www.hdesignideas.com/2013/10/mbaru-niang-rumah-adat-di-pulau-flores.html

● Bamboo it is used as a material for making roofs and floors of houses. Bamboo is chosen because it is light, strong and easy to obtain.

The roofs of traditional houses in Waerebo Village are made from stacked palm fiber and thatch. The fiber layer is installed on the top (outer) layer, while the thatch is on the bottom (inside). The choice of these two materials by stacking them is not without reason. Palm fiber is non-flammable or fire-resistant, but if exposed to water it easily rots. Meanwhile, a thatch is flammable when exposed to sparks, but is resistant to water and does not rot easily. Therefore, the thatched roof is placed underneath or inside while the top is installed with palm fiber.

https://www.hdesignideas.com/2013/10/mbaru-niang-rumah-adat-di-pulau-flores.html

SONAF TRADITIONAL ARCHITECTURE

A. DESCRIPTION

Sonaf Nis None, or Sonaf House, is the largest traditional house in Maslete Village which has two main functions. First, as a practical residence, and second, as a religious place to carry out rituals. This building is not only the sacred residence of King Bikomi, but also reflects the philosophy and way of life of the Atoni tribe through its unique architectural and interior design. Sonaf Nis None is a non-stilt house that stands directly on the ground, with a circular shape and elliptical ground plan, and a high roof that resembles an upside-down boat. As the largest traditional building in Maslete Village, its dimensions reach 8.7 meters long, 11.6 meters wide and 5.2 meters high, reflecting the high status of its occupants, a usif (king), who is the highest group in the Atoni tribe. Sonaf Nis None is considered a symbol of the unification of tribes and is a source of strength for the Atoni people.

B. COSMOLOGY

The sonaf section which is divided into three parts describes the cosmological view of the Atoni tribe, where the world is divided into three parts: the upper world (sky), the middle world (humans), and the underworld (earth). The sky is considered the abode of Uis Neno and the spirits of ancestors who bring down rain, while the earth is a place where plants grow and where humans work to ensure plant life. The concept of the marriage between sky (Uis Neno) and earth (Uis Pah) became a symbol of life, with rain considered the sperm that allows plants to grow.

(Lang, 2015)

The roof of the sonaf is considered a symbol of the sacred sky, where Uis Neno and the spirits of his ancestors reside, while the foundation and body of the sonaf symbolize the earth which is considered "dirty" or profane. The differences in size in the sonaf reflect the hierarchy or ranking system in Atoni tribal society. In this society, there is no equality between individuals, and everyone has their own place, whether as superior or inferior.

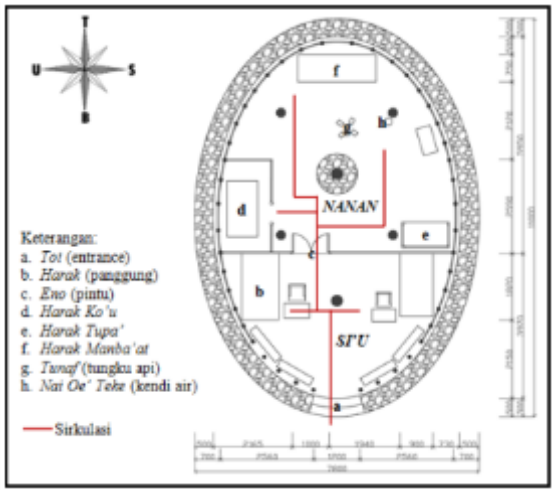
The dominating sonaf roof symbolizes the superior position of men in society, indicating higher power and a more active role than women. This also reflects the human relationship with Uis Neno which is considered more sacred and primary than relationships with other humans and nature. The overall structure and symbolism in the sonaf is a rich representation of the values,

beliefs and hierarchies in the life of the Atoni tribe.

(Lang, 2015)

C. SPACE ORGANIZATION

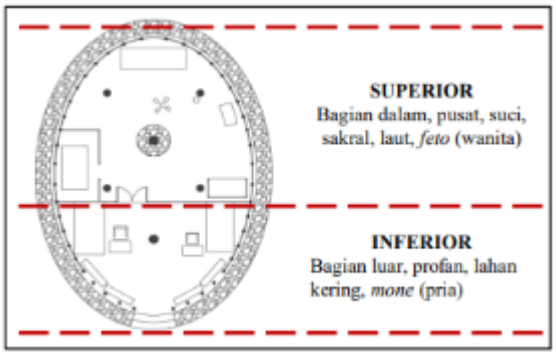
Sonaf Nis None has an elliptical ground plan with a length of 7 meters and a width of 9.5 meters. By placing the entrance in the middle of the Sonaf, the circulation pattern formed is the linear circulation. Based on the type of activity, the Sonaf Nis None is divided into two parts, Si'u and Nanan. Si'u is an open area at the front of the Sonaf which is used for tribal chiefs' meetings and follow-up deliberations after previously being held in Lopo. The Si'u symbolizes *mone* (male), public and profane. On the other hand, Nanan is an enclosed space in the interior of the Sonaf that includes a resting area, cooking area, and offering area. This room symbolizes *feto* (woman), which is private and sacred.



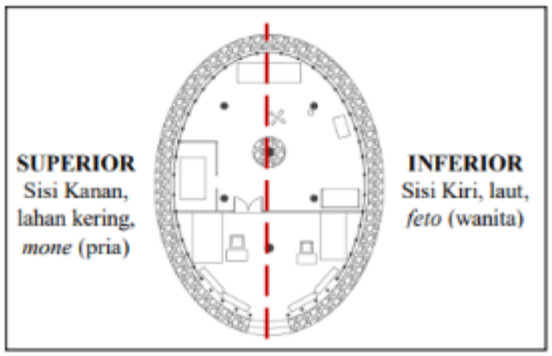
(Lang, 2015)

In terms of gender, the Sonaf Nis None room is divided into two parts, where the right (North) is used for men's activities, while the left (South) is used for women's activities. The right side is considered higher or superior, reflecting the dominance and active role of men in society. On this side, it is also the place where the *usif*/king, who is a *mone* (man), carries out his activities.

The division of the interior of the room into two parts reflects the Atoni tribe's expression of the universe, where Sonaf's body as a symbol of the earth which is divided into dry land (*pah meto*) and sea. Dry land symbolizes *mone* (man), while the sea, which is a source of water, symbolizes *feto* (woman). Combining this space organization will produce four types of space. The left Si'u becomes inferior-inferior, while the right Si'u becomes inferior-superior. The left side becomes superior-inferior, and the right side, where there is the *usif*/king sleeping area, becomes superior-superior. The highest position is superior-superior, followed by superior-inferior, inferior-superior, and the lowest is inferior-inferior.



(Lang, 2015)



(Lang, 2015)

D. STRUCTURE

1. Roof (Ni Ume): The roof of this traditional house has a tapering cone shape about 6 meters high. The roof covering material which is made from thatch leaves or reeds, which is believed to have the function of protecting residents from natural dangers and negative influences.

2. Walls (Ni Ena): Walls about 1.5 meters high surround the house and are made from woven bamboo or wood. The upper walls are designed to provide good air circulation, while the lower sections can be raised to protect occupants from drafts and wild animals.

3. Supporting Pillars (Ume Kbubu): Consist of several types of poles, including the poles surrounding the building (Ni Ana), attic poles (Ni Tefu), and building support poles (Ni Enaf). These poles are round and planted 0.50 meters deep.

4. Attic (Ni Tefu): Circle-shaped following the shape of the roof, the attic is used to store food ingredients and produce for seedlings for the next planting season.

E. MATERIAL

The upper walls are usually made of woven bamboo or wood to provide good air circulation. The lower part of the walls can be raised with additional wood or bamboo to protect residents from gusts of wind or wild animals.

UMA LULIK

A. DESCRIPTION

Uma Lulik is a traditional house of the Ngada people in Ngada Regency, East Nusa Tenggara. The word "Uma" means house, while "Lulik" means sacred, holy or sacred. So, Uma Lulik can be interpreted as a sacred or holy house for the Ngada people. This traditional house has a conical shape that resembles a mountain, symbolizing the strength and protection of ancestral spirits.

B. COSMOLOGY

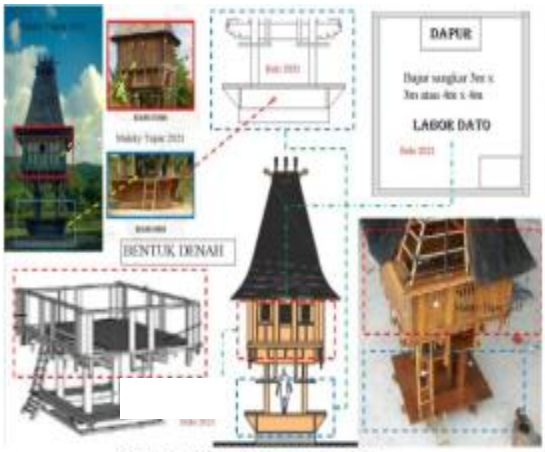
For the Ngada people, Uma Lulik has a very important meaning. Apart from being a residence, Uma Lulik is also:

● A symbol of rich culture and tradition: The shape, materials and structure of Uma Lulik reflect the values and beliefs of the Ngada people.
● A place of traditional ceremonies: Wedding, death, harvest and other traditional ceremonies which are held at Uma Lulik.
● A connection with ancestors: The Ngada people believe that the spirits of their ancestors reside in Uma Lulik, so they often hold rituals and offerings there.

C. SPACE ORGANIZATION

Uma Lulik has three main rooms :

- Bottom room : The bottom room is a room that functions as a residence for domestic animals, such as pigs, goats and chickens. This space is also used as a place to store food ingredients and agricultural tools.
- Living room : The living room is a room that functions as a family residence. This room is usually equipped with a fireplace, bed and table.
- Upper room : The upper room is a room that functions as a storage area for rice and other agricultural products. This room is also used as a place to store valuable objects, such as jewelry and heirlooms.



Gambar 3. Bentuk uma Lulik
(Tupor, 2021; Belo, 2021)

D. STRUCTURE

Uma Lulik has a conical shape that resembles a mountain. The roof of Uma Lulik in Fuiloro has a tapered shape with a sharp angle of around 55°. This angle causes the roof height to be around 7m to 9m. The shape of the towering roof is similar to the roofs of traditional houses in several traditional villages in East Nusa Tenggara, Indonesia, which are termed 'tower roofs' (Winandari, 2017).

The Uma Lulik wall in Fuiloro is rectangular in shape with a width as wide as the side of the plan and a height of about 3m. The walls are formed from wooden planks with a dominant vertical arrangement. The Uma Lulik column in Fuiloro is the main structure supporting the Uma which consists of 4 whole round logs + 3m to 4m high. The column is planted into the ground.

The walls of Uma Lulik in Fuiloro are made of wooden planks arranged vertically. This arrangement has several advantages, including :

● Strong and sturdy: The vertical arrangement makes the walls stronger and sturdier, so they can withstand quite heavy roof loads.
● Durable: The vertical arrangement makes the walls more durable, because they are not easily damaged by the weather.
● Aesthetic: The vertical arrangement makes the walls look neater and more beautiful.

The structure of Uma Lulik has several unique features :

● Uma Lulik's construction relies on connecting wood and rattan rope, without using nails.
● Uma Lulik roofs made from palm fiber and thatch which can last for decades.
● Uma Lulik's sturdy structure makes it earthquake resistant.

E. MATERIAL

The materials used to build Uma Lulik are natural and environmentally friendly, such as:

- Wood used for pillars, main structure, and walls.
- Bamboo used for walls, roofs and stairs.
- Thatch used for roofing.
- Fiber used for roofing.
- Rattan used for weaving.

The Uma Lulik roof is made from thatch and is formed in stacks with a layer of palm fiber at the top and thatch at the bottom. The choice of these two materials is not without reason. Fiber is waterproof and does not rot easily, while thatch does not burn easily. The wall materials use ironwood and red wood. The column material uses intact wood from the forest around the settlement. Uma Lulik's wall materials in Fuiloro use ironwood and red wood. Ironwood has strong and durable properties, making it suitable for use as walls. Redwood also has strong and durable properties, and has a beautiful red color. The material for the Uma Lulik column in Fuiloro uses intact wood from the forest around the settlement. Whole wood has strong and sturdy properties, making it suitable for use as columns. Apart from that, intact wood also has high aesthetic value. The use of ironwood, redwood and whole wood in the construction of Uma Lulik has several advantages, including:

● Strong and sturdy: This wood has strong and sturdy properties, so it can withstand quite heavy building loads.
● Durable: The wood can last for decades, if cared for properly.
● Aesthetic: The wood has beautiful colors and textures, resulting in an attractive appearance.

The use of natural materials in the construction of Uma Lulik also has a deep symbolic meaning. Natural materials symbolize the closeness of indigenous peoples to nature.

The materials used for the columns are ironwood, teak and red wood. Wood has very high resistance to climatic conditions in Indonesia. In fact, this wood is maintained with strength and beauty at the same time. The flooring material uses materials from the surrounding environment such as bamboo and wooden planks. These materials consist of ironwood, rose wood, acadiro, bamboo, palapeira/palapa and gamuteira/gamuti. The use of bamboo as a floor covering material was only found during the period of Portuguese rule. During the period of Indonesian and Timor Leste rule, bamboo material was no longer used as a floor covering. The round shape of bamboo makes it less comfortable for users when used as a sitting mat. The long process of traditional ceremonies and the lack of convenience are one of the reasons why bamboo is no longer used as a floor covering since the Indonesian government.

CONCLUSION

Climate has a significant influence on the shape, structure and materials of traditional houses throughout Indonesia due to its geographical location on the equator with a subtropical climate, characterized by high rainfall and humidity. Traditional houses that have inherited knowledge from generation to generation show local wisdom in dealing with local climatic conditions. Without relying on modern architectural knowledge, traditional societies in the past were able to build houses that not only had structural strength, but also comfort and aesthetic values. This conclusion reflects a deep understanding of the surrounding environment, the use of local materials, and adaptation to the needs and lifestyle of the community.

In other words, a traditional house is not only a physical form of residence, but also a reflection of local wisdom in adapting to the surrounding environment. This architectural model shows that traditional society has lived a sustainable life, utilized local resources wisely, and maintained balance with nature. The sustainability of traditional houses amidst climate change and architectural modernization shows their relevance in today's context. Local materials, design taking into account the local climate, and in-depth knowledge of community needs are the keys to the success of this architectural model.

Thus, the conclusion of this paper invites us to see traditional houses as valuable heritage that not only have historical and cultural value, but can also provide inspiration for sustainable building design in the future. Integration between local wisdom and modern needs can create a built environment that is environmentally friendly and resilient to global climate change. Below there is a table that describes the resilience of buildings in tropical savanna climate conditions.

Traditional House	Picture	Structural Resistance to Tropical Savanna Climates	Material Resistance to Tropical Savanna Climates
BALE LUMBUNG		• The roof of the Bale Lumbung house is made of dry straw which is arranged as tightly as possible so that rain and hot water cannot penetrate. The roof of the Bale Lumbung is made of straw that is stacked tightly to be weather resistant. • These openings can help air circulation inside the house.	• Wood has water-resistant and fire-resistant properties. This makes wood an ideal material for building houses in areas that experience frequent rain and forest fires. • Bamboo is also a strong and durable material. Bamboo has elastic properties, so it can withstand strong wind loads.

		These openings can help provide natural lighting in the house. These openings can reduce the heat load on the house	• The roof is made of reeds and there are windows so that fresh air can enter the room where the harvest is stored
MBARU NIANG		• The influence of triangular and pointed building structures on wind can be said to be stable from various directions. • The pointed shape which does not have a large shape but is smaller than the lower part of the roof can overcome the wind. • This building has a smaller upper part, so the influence of wind pressure on this building acts lighter than the larger lower part.	• Palm fiber has non-flammable or fire-resistant properties, but if exposed to water it easily rots. • Thatch is flammable when exposed to sparks, but is resistant to water and does not rot easily. • Wood is used as the main material to make the frame and walls of houses. The wood used is strong and durable wood. • Bamboo is used as a material for making roofs and floors of houses. Bamboo was chosen because it is light, strong and easy to obtain.
SONAF		• The roof covering material is made from thatch leaves or reeds, which is believed to have the function of protecting occupants from natural dangers and negative influences. • The upper walls are designed to provide good air circulation, while the lower sections can be raised to protect occupants from drafts and wild animals.	• Fiber is a fiber that comes from palm leaves. Palm fiber is strong, durable and non-flammable. • Clay has cool and comfortable properties, making it suitable for hot savanna climates. • Wood can protect the house from wind and rain
UMA LULIK		• The walls of Uma Lulik in Fuiloro are made of wooden planks arranged vertically • The vertical arrangement makes the walls stronger and sturdier, so they can withstand quite heavy roof loads. • The vertical arrangement makes the walls more durable, because they are not easily damaged by the weather.	• Ironwood has strong and durable properties, making it suitable for use as walls • Redwood also has strong and long-lasting properties, and has a beautiful red color • Whole wood has strong and sturdy properties, making it suitable for use as columns • Fiber is waterproof and does not rot easily. • thatch is not flammable.

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