

## **COMMUNITY BEHAVIOR IN ENVIRONMENTAL PRESERVATION EFFORTS (Case Study of the Wai Lawe Spring in the Kumah Protected Forest, East Adonara District, East Flores Regency)**

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### **ABSTRACT**

*Wai Lawe Spring is the primary water source in Puhu and Tapobali Village. This spring is located in the Kumah protected forest area, with an area of 141.41 ha. Still, in its management, it was found that community activities threatened the preservation of the spring, namely land clearing activities in the spring area, which caused a decrease in the discharge of the Wai Lawe spring. The research aims to analyze the behavior of Puhu and Tapobali Village in utilizing and maintaining the sustainability of the Wai Lawe spring in the Kumah protected forest, East Adonara District, East Flores Regency. Data was collected using observation, interviews, and documentation and then analyzed descriptively and qualitatively. The research shows Puhu and Tapobali villagers' behavior in utilizing and maintaining the sustainability of the Wai Lawe spring can be seen from the conservation actions, which they believe that by planting and caring for plants, they have participated in maintaining the sustainability of the spring. Conservation actions are also shown by distributing water to the community fairly. Although there are still people who clear land for shifting cultivation, the villages of Puhu and Tapobali still have traditional cultures that strongly support spring conservation activities. People who obey the rules prefer to use the tumpang sari farming system without changing the function of the forest.*

Key words: *community behavior, East Adonara, East Nusa Tenggara, protected forest, spring*

### **INTRODUCTION**

The ecosystem environment is home to various living things, and we all depend on it for food, air, water, and other needs. Ecosystem environment management must comply with ecological principles to prevent environmental disasters (Zairin, 2016). Various environmental issues and the diminishing supply of natural resources, especially water, have made people aware of the importance of conservation activities. One strategy in dealing with environmental problems is to focus on the chain of causes (Karyanto, 2012).

One of the problems currently faced by the people of East Nusa Tenggara (NTT) is that the population is increasing, but the clean water supply is decreasing. Clean water supply in Indonesia is still problematic in various provinces, including NTT. Problems with water supply in NTT are caused by the availability of water sources, low rainfall, soil conditions, social culture, and the poor management of the Regional Drinking Water Company (Wardiha & Putri, 2013). One of the management of water resources is utilizing and adapting to local conditions and local wisdom in each region because each region has different characteristics (Reza & Hidayati, 2017). Local wisdom is the ancestral heritage maintained by the people who adhere to it. Local wisdom can be used as a proven strategy for protecting and preserving the natural environment in its sustainability efforts (Niman, 2019). The behavior of residents related to the preservation of springs is by carrying out greening around springs and hillsides, not cutting down trees, and working together

to clean roads and springs (Hidayati et al., 2019). This action is a form of environmental care behavior that aims to prevent existing springs from drying up and being able to support the surrounding area. The Wai Lawe spring is located in the Kumah protected forest area with an area of 141.41 hectares with two villages around the forest, namely Puhu and Tapobali Village.

Wai Lawe Spring is the primary water source in Puhu and Tapobali Village. However, the current problem is land clearing near springs. Land clearing is generally done by cutting down the forest and burning the biomass from slashing. Then the land will be used for several years and no longer be managed or known as shifting cultivation systems. From these problems, this study aims to analyze the behavior of Puhu and Tapobali Village in utilizing and maintaining the sustainability of the Wai Lawe spring in the Kumah protected forest, East Adonara District, East Flores Regency.

### **RESEARCH METHOD**

The research was conducted in the Wai Lawe spring, located in the Kumah protected forest and consists of two administrative areas, namely Puhu and Tapobali Village, East Adonara District, East Flores Regency (Figure 1). Field data collection was carried out in June - August 2022. The informant determination technique in this study used the snowball sampling technique. This method begins with selecting informants according to the researchers' needs in answering research objectives. After obtaining

information, the informant is asked to recommend another respondent who can also answer the research objectives, and so on, until the data reaches a saturation point (Parker et al., 2019). The implementation technique is where the sample is obtained on a rolling basis through one respondent to get the next respondent (Lenaini, 2021). In determining the model, the researcher chose two key informants, namely the Village Head from Puhu and Tapobali Village, and recommended the following sample or informant from the two respondents. And so this sampling process runs until sufficient information is obtained and the number of respondents is adequate and accurate to be analyzed to draw research conclusions (Nurdiani, 2014) and descriptive analysis to provide a description, explanation, and validation of a phenomenon studied (Ramdhan, 2021). By using the snowball sampling method, this study has a total of 20 respondents.

## RESULT AND DISCUSSION

### 1. Wai Lawe Springs

Wai Lawe Spring is one of the springs located in the Kumah Protected Forest area. The Wai Lawe spring has a diameter of 45 cm. The soil structure of the Wai Lawe spring is a mixture of sand and clay, with various plants around it, such as silk tree (*Albizia falcataria*),

banyan (*Ficus benjamina*), candlenut (*Aleurites moluccanus*), mahogany (*Swietenia mahagoni*), betel (*Piper betle*), coconut (*Cocos nucifera*), cocoa (*Theobroma cacao*), and bamboo (*Bambusa sp.*). Common species found around the location of springs, such as bamboo (Yuliantoro & Frianto, 2019; Yulistyarini, 2011), banyan (Azizah, 2017; Yuliantoro & Frianto, 2019), and mahogany (Azizah, 2017). Banyan has solid roots and is often found around springs (Agustina & Arisoelaningsih, 2013). Wai Lawe springs flow continuously throughout the year. So it is classified as a perennial (chronic) spring; it flows constantly throughout the year and is infected by rainfall (Anam et al., 2021). The spring water temperature ranges from 22° to 25° Celsius with a relatively small difference in value. Based on the temperature, the springs in the study area used as samples are usual (non-thermal or ordinary temperature springs), namely, springs whose water temperature is almost the same as the surrounding air temperature (Ashari & Widodo, 2019). Based on the data obtained from the East Adonara Clean Water Management Group, the results of measuring the discharge of the Wai Lawe spring from 2015 to 2021 were obtained. A description of the data is presented in Figure 2.

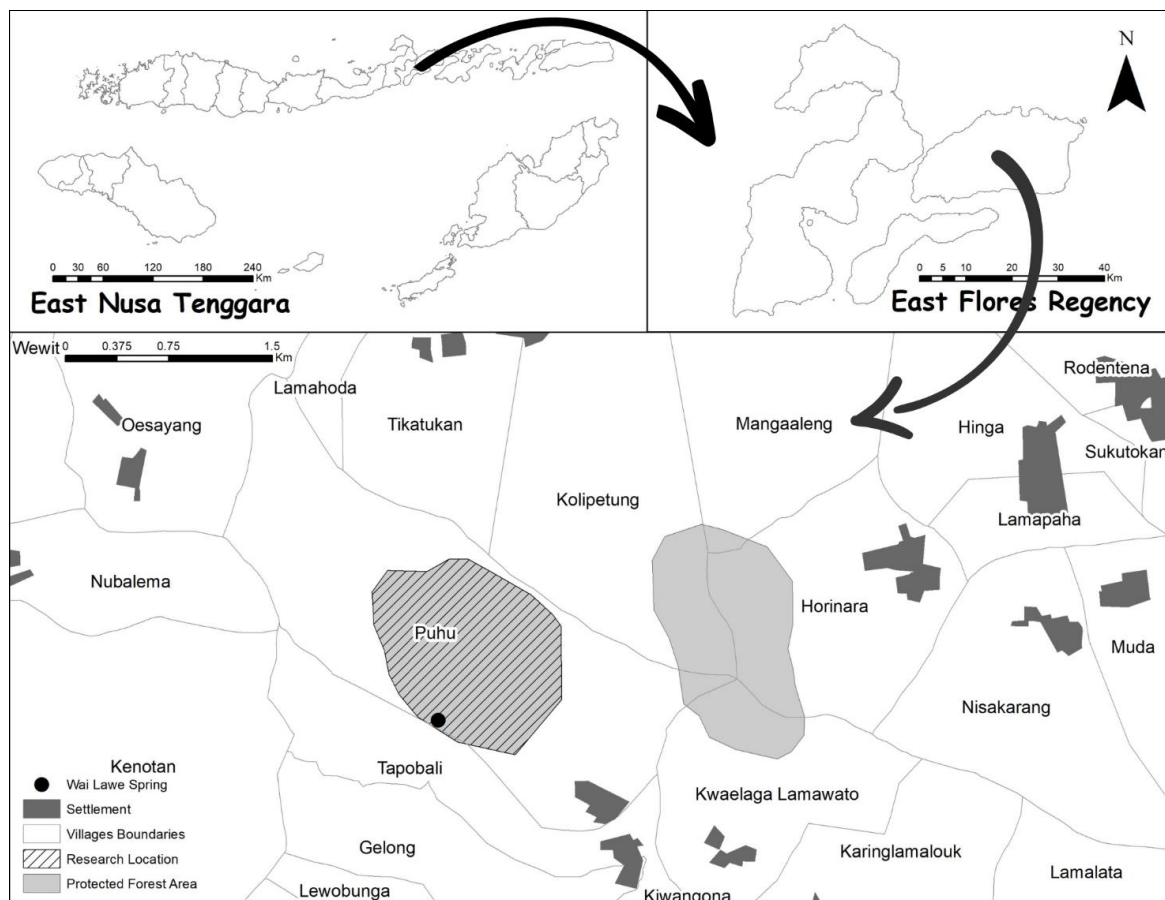


Figure 1. Map of research location

Based on Figure 2, it is known that the discharge of the Wai Lawe spring has continued to change from 2015 to 2021. The release of the Wai Lawe spring experienced the highest increase in 2018 but continued to decrease until 2021, and the trendline line can see this on the graph, which decreases with a value of  $R^2$  ( $R$  square) = 0.0456. According to Retno (2017), The changing water discharge is caused by the critical land level, erosion, land cover, and climatic conditions.

The local community and several Puhu and Tapobali village officials reported that the Wai Lawe springs had decreased discharge caused by indiscriminate land clearing, which resulted in a lack of water catchment areas. According to Widiyanto et al. (2004), land use change can result in changes in the structure and composition of vegetation and a decrease in soil quality. The reduction in the spring discharge has caused the distribution of water to the community to be limited. Previously, the water distribution to the community was daily, but now it is limited to three times a week. Furthermore, Wiryono (2013) stated that an increased population could reduce spring discharge due to increased land conversion activities to meet human needs.

The Wai Lawe spring is first utilized by collecting the water in a reservoir close to the spring before channeling it. Accommodating springs, which are then directed to the community's needs, is the management

of springs as household water providers (Sudarmadji et al., 2016). The utilization of domestic water is divided into four components: drinking, bathing, cooking, and washing. The quality of the still-maintained springs can be used for bathing, washing, irrigating, rituals, medicine, and drinking directly (Hidayati et al., 2019). Furthermore, Aulia & Dharmawan (2010) stated that water sources could be used for religious activities, drinking water, bathing, washing, and toilets and can help improve the community's economy. Based on the data obtained from the clean water management group in the East Adonara sub-district, the consumption for each component is shown in Table 1.

According to SNI (Indonesian National Standard), the standard for domestic water needs for urban areas is 42 litres/day/capita, while for rural areas, it is 36 litres/day/capita. The results of a study on the consumption patterns of the people in Puhu and Tapobali Village show that the volume of water needed to carry out their domestic activities is 57.8 and 56 litres/day/capita, respectively. Generally, the water consumption of the local community in Puhu and Tapobali Village is higher due to community bathing activities. Almost 50% of respondents reported bathing activity more than three times daily. This causes the rainfall pattern on the island of Flores to be a monsoon rain pattern influenced by monsoon winds and La Nina and El Nino phenomena (Lesik et al., 2020).

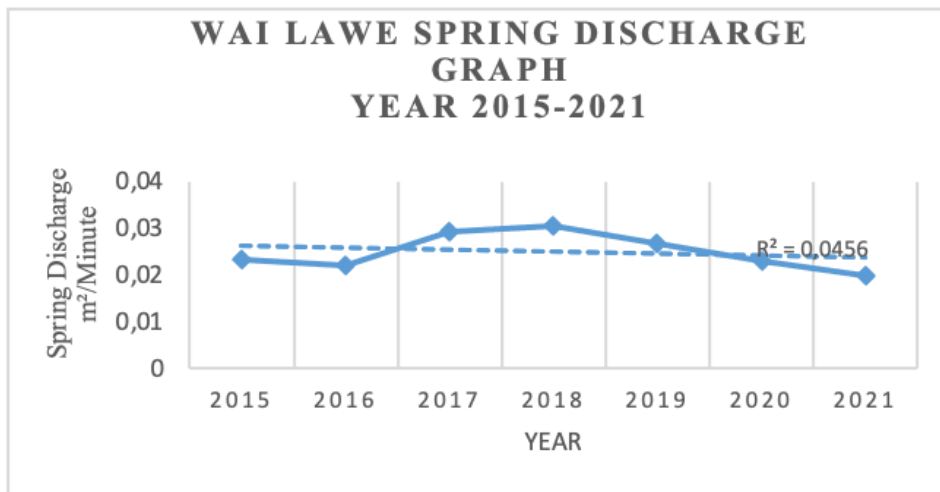


Figure 2. Wai Lawe Spring discharge trendline from 2015-2021

Table 1 The domestic water consumption of the communities of Puhu and Tapobali Village

Domestic Activities	Puhu Village				Tapobali Village			
	litres/day/household	(%)	litres/day/capita	(%)	litres/day/household	(%)	litres/day/capita	(%)
Drink	12,1	7,28	1,8	3,11	11,8	7,48	2,0	3,51
Bath	52,0	31,30	36,0	62,28	49,0	31,05	34,0	59,65
Cook	35,0	21,07	8,0	13,84	34,0	21,55	8,0	14,04
Wash	67,0	40,34	12,0	20,76	63,0	39,92	13,0	22,81
Total	166,1	100,00	57,8	100,00	157,8	100,00	56,0	100,00

Furthermore, Lesik et al. (2020) stated that the distribution of monthly rainy and dry season periods is U-shaped. Ambi et al. (2020) note the highest average temperature in East Flores occurs in November, which is 29.9°C. The highest average rainfall in East Flores is 338 mm, and the lowest in August is 2 mm (Ambi et al., 2020). Furthermore, Lesik et al. (2020) stated. The average annual rainfall at locations with an altitude of 0-300 meters above sea level on the Flores Islands (Larantuka, Maumere, Labuan Bajo, and Paupanda) is 851.75, or an average monthly rainfall of 70.98 mm.

The results of interviews with the head of the Adonara Timur clean water management group stated that there was no significant difference between the domestic consumption pattern in the dry and rainy seasons. The difference is only found in the water source used by the community for their household activities. These traditional rainwater reservoirs help meet the needs of the community. Furthermore, Pelani et al. (2011) stated that water availability would be abundant during the rainy season, but water availability would be very short during the dry season. Collecting rainwater is an alternative to the management of water sources (Marni, 2019; Sarbidi, 2015).

## **2. Technology in the Utilization of Wai Lawe Springs**

In utilizing springs, several ways are carried out according to the springs' conditions starting from where the springs appear to the consumer. Springs that appear naturally are usually challenging to reach, so technology is needed to utilize these springs (Sudarmadji et al., 2016). The research results show that the technology for using the Wai Lawe spring is collected from the Wai Lawe spring in the traditional water reservoir made of cement before it is distributed to the public. The reservoir protects water from pollution (Sudarmadji et al., 2016). The container measures 270 cm x 90 cm x 450 cm with a capacity of 10,935 m<sup>3</sup> or 10,935 litres.

Maintenance of the storage tanks is carried out by using contributions from each community to repair buildings or replace damaged pipes. The clean water management group will discuss all problems in water management in East Adonara District with the people of Puhu and Tapobali Village. Making a reservoir is a spring catchment structure that can protect springs from pollution or triggering factors from human activities and other environmental disturbances, such as the presence of landslides that can interfere with the appearance of springs, the quantity and quality of the water (Gibran & Kholid, 2020). Maintenance of water catchment areas is an effort to maintain and conserve these water sources (Subekti, 2012).

The water collected in the reservoir is channelled to the people through pipes. Previously, water distribution was carried out using local materials in the form of bamboo. Still, most water distribution used

pipes when this research was carried out. In the reservoir, there is an inlet pipe and an outlet pipe. The inlet pipe functions as a unit for water to enter the pool, and the outlet pipe operates to remove water from the reservoir. The slope and the distance from the reservoir to the community have been considered in channelling water using tubes because the water distribution process uses a gravity system. The selection of transmission pipelines in the implementation of clean water network development projects needs to pay attention to the topography of the area along the path through which the transmission line passes (Endrayoga & Hakim, 2022).

The primary function of the drinking water distribution system is to send the required water supply discharge to all parts of the service area with a proper pressure level. A pressure pipe is a pipe that is filled with water (Mokoginta & Mangangka, 2015). Distribution of water to households: The research results in the field show that the technique of distributing water from the Wai Lawe spring to the community is applied by the community based on the same hydraulic pressure, namely by making an outlet hole in the reservoir with the same height. From these holes, it is channelled using pipes to the community. With the same size, the pressure from the water will be the same to produce the same water discharge. According to Fan et al. (2014), water flow regulation is one of the considerations for sustainable use in meeting domestic needs. People who need it can only distribute it from the reservoir by connecting a plastic pipe or hose to their homes. This technology applies the principle of fairness in obtaining clean water sources.

Umar (2009) explained that the principle of justice talks more about how humans should behave towards one another concerning the universe and how the social system must be regulated to impact environmental sustainability positively. In this case, the principle of justice mainly talks about equal access for all groups and members of society in determining policies for managing natural resources, preserving nature, and enjoying the utilization of natural resources or the universe.

## **3. Community Behavior in Environmental Preservation Efforts (Wai Lawe Springs)**

The community has the right to obtain and use clean water from the Wai Lawe Spring, with the obligation to care for, protect and preserve the Wai Lawe Spring. Keeping springs is an action to maintain the existence, characteristics, function, and sustainability of sufficient quality and quantity to meet community needs (Sulistiyorini et al., 2016). The community's obligation to preserve the Wai Lawe Spring is carried out through conservation actions. The results of the interviews show that the society consistently perceives that conservation actions need to be carried out to preserve the forest and its ecosystem,

including the Wai Lawe spring. This conservation action is important to minimize the damage caused by human activities. Furthermore, Rahmawati & Retnaningdyah (2015) stated that eight springs in Malang Regency were no longer suitable for the drinking needs of the people forced of human activities

The behavior of the people of Puhu and Tapobali Village towards conservation actions is based on the community's understanding of planting and caring for plants or trees in the forest, regardless of their type, planting period, and harvesting period means the community has participated in forest conservation, which positively impacts the Wai Lawe spring in the Kumah Protected Forest area. According to Badami et al. (2018), Enrichment planting is one of the actions to maintain the sustainability of springs. Following Hidayani et al. (2019) statement, the behavior of local people tends to preserve the quality of water sources by carrying out greenery around springs. Umar (2009) stated that community involvement in managing forests for the fulfillment of welfare can automatically guarantee the community to monitor and maintain the sustainability of forest ecosystems because it involves people's livelihoods.

Community conservation actions are often limited due to several constraints. The results of the interviews indicated that the existing conditions related to physical and economic barriers, such as inadequate road access to springs, lack of procurement of plant seeds for reforestation around springs, and unscheduled conservation activities. In addition, Puhu and Tapobali villagers are clearing land using a shifting cultivation system. According to Fauzi et al. (2020), shifting cultivation is one of the causes of damage and conversion of forest land. Likewise, what happened in the villages of Puhu and Tapobali, shifting cultivation was the only activity threatening the existence of the Wai Lawe spring. There are two community-owned lands within a radius of 200 meters from the center of the spring, which are the result of logging activities for shifting cultivation activities. This certainly has an impact on reducing the discharge of the Wai Lawe spring in 2018-2021. This result is supported by the statement of Todd & Mays (2004) that springwater discharge will be affected by the catchment area and the amount of groundwater recharge.

#### **4. Local Wisdom of the Community in the Management of Wai Lawe Springs**

According to Reza & Hidayati (2017), local wisdom is a system of political, social, economic, and cultural life and the environment that lives in a dynamic local community. Furthermore, according to Siswandi & Purnaweni (2011), local wisdom consists of local knowledge, genius, understanding, and traditions.

The Puhu and Tapobali Village communities have a process of interaction with the environment, which

has been passed down from generation to generation and has been used as a tradition and rules that serve as guidelines in utilizing natural resources, namely Lamoholot local wisdom. That can be seen in one customary institution organization described in the following table.

Based on Table 2, it is known that the Puhu and Tapobali Village communities have a customary institutional structure in which *Ata Mua* plays a role in clan traditional ceremonies starting from marriage, ceremonial customs, distribution of customary land rights and other related activities with forest and its contents such as Wai Lawe springs. The results of interviews with *Ata Mua*, it is known that the local wisdom that is still being preserved in the management of the Wai Lawe Spring in Puhu and Tapobali Village is as follows:

- 1) The village community prohibits cutting down plants that grow naturally around the Wai Lawe spring, such as the Old Banyan tree, where spirits live.
- 2) *Bau Lolon* ceremonial is the traditional *Lamaholot* ritual of giving offerings as a *Tuak* drink (a typical drink of the *Lamaholot* people). *Bau Lolon* is carried out to invoke the presence of the spirits of the ancestors to help in blessing all matters so that things go well. This ritual is performed around the Wai Lawe spring to summon rain. Routines are performed around the springs because the springs are believed to have the potential to bring rain during the rainy season when the field crops start to flower and the rain no longer falls.
- 3) Customary sanctions, village communities are prohibited from burning forests for land clearing, including in the Wai Lawe spring area. If they violate it, they are subject to sanctions for handing over livestock (in the form of pigs) for customary ceremonial purposes.

According to Angin & Sunimbar (2020) in Watowara Village, Titehena District, East Flores Regency, the local wisdom practiced by the people of Watowara Village had a positive impact in the form of growing respect for their ancestors and playing a role in efforts to preserve forests and conserve water resources. Based on the results of field observations, In addition to the community clearing land for shifting cultivation, people who obey customary rules have conservation values through conventional farming systems with the concept of intercropping plants and have annual crops consisting of tall tree stands found in community gardens. These yearly plants provide economic and ecological benefits, namely maintaining forest functions.

Table 2 Organizational structure of the culture in Puhu and Tapobali village.

Traditional Order	Description and Function
Name of tribe/customary unit	<i>Lamaholot</i>
The name of the customary institution	<i>Lango bele</i> (a gathering place for all customary affairs; and a gathering place before heading to another site)
Traditional title	<i>Ata Mua</i> (leading traditional figure)
The primary function of customary institutions	As executor of various types of traditional ceremonies and maintaining land alliances
Elements of customary institutions	
a. <i>Ata Mua</i> (leading traditional figure)	As a guardian of traditional houses and executor of traditional rituals
b. <i>Niri Nue Lare</i>	As a spokesperson for <i>Ata Mua</i> (the leading classic figure) to deliver messages/information

## CONCLUSION

The behavior of the Puhu and Tapobali villagers in utilizing and maintaining the sustainability of the Wai Lawe spring can be seen from the conservation actions, which they believe that by planting and caring for plants, they have participated in maintaining the sustainability of the spring. Conservation actions are also shown by distributing water to the community fairly. Although there are still people who clear land for shifting cultivation, the villages of Puhu and Tapobali still have traditional cultures that strongly support spring conservation activities. People who obey the rules prefer to use the tumpang sari farming system without changing the function of the forest.

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