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EVALUATION OF COMMUNITY SPRINGS FOR DOMESTIC WATER IN DODA BAHARI VILLAGE, CENTRAL BUTON

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ABSTRACT

This research aimed to evaluate the potential, utilization, maintenance and management of people's springs to ensure their sustainability in Doda Bahari Village, Sangia Wambulu District, Central Buton Regency. Data was collected through field observations, interviews and questionnaires to the community. Data analysis was conducted descriptively to describe the condition of the spring and its level of utilization. The results showed that the area of the spring is 209.14 m2 and the initial utilization was channeled to community homes in 2002, with the condition of vegetation around the spring still dense but sometimes there is logging and the presence of community plantations. In terms of physical parameters, namely smell, taste and color, the people's spring meets the physical parameters for consumption and the discharge obtained is 0.00347 m3/second with water utilization by the community covering domestic needs (drinking, cooking, bathing, washing, toilets and watering plants). The total use of community water is 25,026.6 m3/year, with the smoothness of water received in the community affected by the distance of the spring from the settlement. The main challenges in water utilization are water that does not flow during power outages, reduced discharge during the dry season, water that flows one day and does not flow another day and the presence of lime content when water is cooked based on community interviews. Spring maintenance is good and structural management like reservoir construction has been implemented. However, non-structural management remains suboptimal due to low public awareness and weak village regulations.

Keywords: *Management; Maintenance; People's Spring; Potential; Utilization*

INTRODUCTION

The environment is a unity of space with all objects, power, conditions and living creatures, including humans and their behavior, which affect nature itself, the continuity of life and the well-being of humans and other living creatures. The environment is a combination of conditions that include the use of biodiversity and conditions between natural resources (Sulistiani and Kanda, 2024). According to Kandari (2024a, Kandari 2024b), environmental problems are becoming a serious threat that is increasingly complex and dilemmatic, especially for the lives of living creatures along with population growth, development activities, technological advances, changes in consumption patterns and needs and human lifestyles. Various environmental problems such as global warming *and* climate *change*.

According to Kandari (2024b, Kandari 2024c) drought, forest fires, floods and landslides are related to global warming and climate change along with the increase in greenhouse gases (GHG) in the atmosphere. The impacts of global warming and climate change vary from region to region, but generally threaten environmental quality and food security. Increasing temperatures cause

water reserves in the air to increase, thereby reducing the availability of water in the soil, especially during the dry season (Subagiyo, 2021). According to Kandari (2024d) in various places, the availability of clean water is disrupted by the problem of climate change. Aquifers are over-pumped, although clean water is not completely pumped out, many clean water sources have been polluted so that they cannot be used as drinking water and for daily needs, agriculture and industry.

Water is an absolute necessity for human life; no life can survive without it. Humans obtain water from various sources, including rainwater, surface water, and groundwater. Springs are one of the primary sources of clean water used for various community activities, particularly in rural areas. The existence of springs is crucial for the community's benefit, as they also contribute to meeting basic human needs and the development process in the area (Maulana *et al*., 2017). Water availability can be affected by population growth and can also occur due to the lack of vegetation around springs and the rainfall that occurs in the area (Hamriani, 2018).

According to Sudarmadji *et al*., (2017) spring management needs to be carried out by involving the community, spring management describes efforts to maintain and improve spring management that can be done through collaboration between management components and the community around the spring area. One of the springs utilized by the Doda Bahari Village community is the People's Spring located in Doda Bahari Village, Sangia Wambulu District, Central Buton Regency. People's Springs have a very important role for the community, both as a source of life and as a vital element in the ecosystem. The existence of this spring provides access to clean water which is needed for various daily activities such as drinking, bathing and agricultural purposes.

Previously, the People's Spring was used individually by one of the community members who owned the land surrounding the spring. This led to its name, "People's Spring." However, with increasing population growth, the need for clean water has increased. This prompted the village government to manage the People's Spring. Population growth in Doda Bahari Village has increased the need for water. However, changes in land use for agricultural activities have altered the hydrological characteristics around the People's Spring. Increased use of natural resources indicates the community's economic need to exploit natural resources. The impact of increasing population growth in each region results in land use and land conversion (Sabar *et al*., 2024).

The increasing need for water by the people of Doda Bahari Village causes people to try to choose to take water in other villages or buy water, especially during the dry season, resulting in the People's Spring discharge being less and affecting the water needs of the people of Doda Bahari Village. The existence of this spring is dynamic or can change with changes in time and development activities, so that the People's Spring as a water source for the people of Doda Bahari Village needs to be evaluated for its potential, utilization, maintenance and management of the People's Spring in meeting the domestic water needs of the people of Doda Bahari Village.

METHOD

Study Area and Period

This research was conducted in Doda Bahari Village, Sangia Wambulu District, Central Buton Regency, Southeast Sulawesi Province, Indonesia, at coordinates 05°21'11.21" South Latitude and 122°37'57.16" East Longitude. This research was conducted from December 2024 to January 2025.

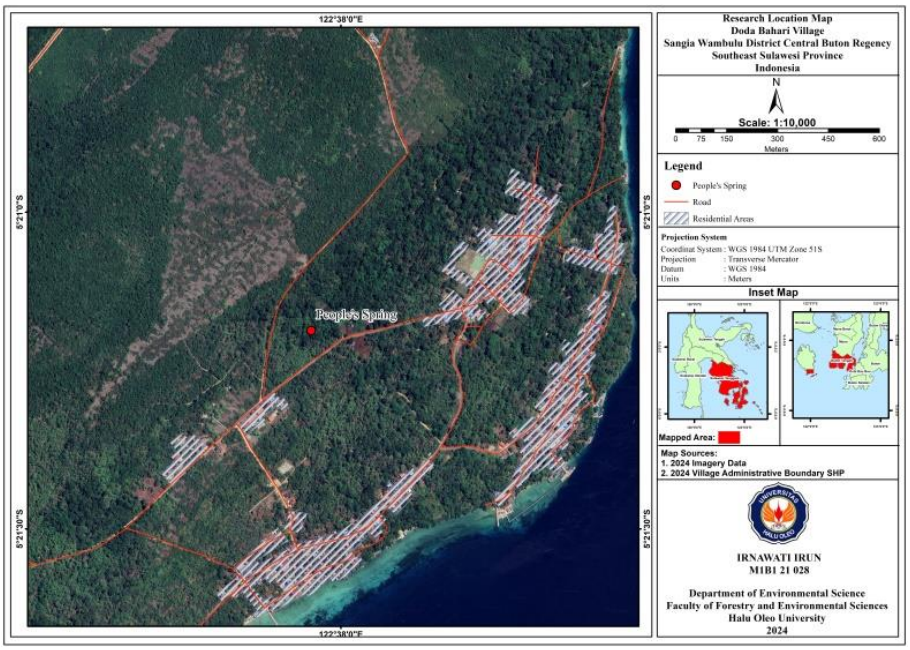

Figure 1. Research location in Doda Bahari Village, Sangia Wambulu District, Central Buton Regency, Indonesia

Materials and Equipment

The materials used in this study were worksheets to record the results of water discharge and the results of interviews with respondents. Respondents in this study were the people of Doda Bahari Village with a total of 72 respondents with the criteria of respondents being people who have used the People's Spring and are domiciled in Doda Bahari Village for the past 5-10 years. The tools used in this study were a camera, a container as a tool for measuring discharge, *a stopwatch* to measure time in determining discharge, a meter *roll* to measure the length and width of the spring area, a raffia rope as a tool for measuring the spring area, and *a Global Positioning System* (GPS).

Research Methods

The research procedure begins with a survey or initial observation at the research site to identify problems and obtain a general overview of the area's conditions. This is followed by determining the population and sample to be studied, developing a questionnaire containing relevant questions, applying for a research permit, and preparing the tools and materials needed for the research process. Next, direct observations are made of the vegetation and the physical characteristics of the spring water (such as odor, color, and taste) by taking water samples for observation. The measurement of the spring area was carried out by first conducting *snowball interviews* to determine the area used for spring maintenance by the community, which was then measured using raffia rope and a *tape measure* to determine the area directly in the field. Water discharge was measured in three ways , namely from the reservoir to the community, from community homes and from the spring to the reservoir using containers and stopwatches. In addition, further interviews were conducted to gather information about the history of the initial use of the spring, the type of use, distance from settlements, as well as the challenges of water utilization and maintenance and management of the spring both structurally and non-structurally. The research process was also documented, then the collected data was processed and analyzed to determine the potential, utilization patterns, and management systems of the People's Spring. Then finally with the preparation and presentation of a complete research report.

Observation Variables

The variables observed in this study consist of two groups: primary variables and supporting variables. The primary variables and their respective parameters are as follows:

1. The potential of the People's Spring includes: the area of the spring and the initial use of the spring by the community, vegetation conditions, changes in the physical properties of the water in the form of color, smell and taste that can be measured physically and water discharge.
2. Utilization of People's Springs includes: types of spring utilization, distance of springs from settlements and challenges in utilizing springs.
3. Maintenance and Management of People's Springs include:
   a. Spring maintenance includes: cleaning the reservoir, replacing damaged pipes, removing wild plants that interfere with water flow and maintaining the condition of the vegetation around the spring.
   b. Structural management includes: reservoirs, water distribution pipes, water pumps and the construction of other supporting infrastructure.
   c. Non – structural management includes: water management institutions, community training, water management regulations and local wisdom in managing springs.

The supporting variables in this study are climate data for the last 5 years and supporting characteristics.

Data Analysis

The analysis used is qualitative descriptive analysis and quantitative analysis. Qualitative descriptive analysis consists of:

1. Explanation of the initial use of springs by the community.
2. Vegetation conditions.
3. Physical properties of spring water (smell, color and taste).
4. Types of use of springs by the community.
5. Challenges in utilizing springs.
6. Maintenance of springs, structural management and non-structural management of People's Springs.

In the quantitative data analysis, the distance of springs from residential areas was analyzed by directly interviewing residents and measuring them using a geographic information system. Other parameters analyzed included:

1. Calculation of the area of the People's Spring area

   The area of the People's Spring will be calculated manually. Since the spring is approximately rectangular, the area calculation will use the area formula for a rectangle, taking into account the land contour or slope. The area formula for a square is as follows:

   Area = L x W
   Where:
   Area = Area (m^2)
   L = Length (m)
   W = Width (m)

2. Calculation of the People's Spring discharge

   Water discharge calculation formula (Wijaya and Masitoh, 2024):

   $$Q = \frac{V}{t} \quad \text{.....} \quad (1)$$

Where:
Q = Water discharge (m^3/second)
V = Volume of container (m^3)
t = Time required to fill the container (seconds)

3. Calculation of the volume of water use by the community

   The volume of water used for household needs can be calculated using the following formula (Mando *et al*., 2024):

   TPA = $\frac{PA\ x\ 30}{n}$x Population x 12 ..... (2)
   Where:
   TPA = Total water use for households (m^3/family/year)
   PA = Water use (m^3/KK/day)
   30 = Number of days in a month
   12 = Number of months in a year
   n = Number of respondents (per household)
   Population = Number of families

RESULTS AND DISCUSSION

Potential of People's Springs

Spring potential refers to the utilization and use of water from a spring, which is closely related to its quantity (flow) and quality as a source of water used to meet the community's water needs. Analyzing spring potential will yield information about water availability balanced by water demand, thus enabling future water availability to be identified or determined.

a. Area of the Spring Area and the Beginning of the Utilization of the People's Spring

The measured area of the spring is 209.14 m^2, which has important implications for determining the spring's potential through water absorption capacity or infiltration into the soil. According to Gibran and Kholid (2020), the spring maintenance area is an area used to maintain the spring's continued function as a vital water source. The area of this area varies depending on environmental conditions, topography and spring capacity.

Human activities occurring in forests have caused changes in biodiversity. This condition reduces the forest's capacity to provide services as intended (Rahawarin *et al*., 2021). According to Nurdin et al., (2022), vegetation growing around springs significantly impacts the quality and quantity of water flowing from them. Healthy and diverse vegetation offers various benefits, such as maintaining stable spring flow, preventing pollution, and ensuring sufficient water availability to meet the needs of the surrounding community. The rate of forest degradation, which is currently in poor condition, is due to the high impact of human activities on the environment which can endanger the existence of the environment itself (Purwanti *et al*., 2022).

The spring area which is a maintenance area as a supplier of spring water sources needs to be conserved using various types of vegetation to maintain water availability. This is because vegetation plays a crucial role in conserving water and soil resources through plant parts such as root systems, crowns, and stems. Vegetated soil maintains stable water flow. The deteriorating condition of forests is caused by humans focusing solely on economic gain, ignoring aspects of ecosystem balance. This situation is further exacerbated by the increasing population. From the increase in population, there is an increasing need to fulfill life and land use (Mando *et al*., 2020).

The beginning of the utilization of the People's Spring was influenced by the increase in population, which also increased the community's need for water. Population growth resulted in

an increase in the need for water, so that alternative water sources were needed to meet water needs, both for domestic, agricultural and commercial needs (Sulistyani and Irianto, 2018). According to interviews with the community, namely La Agudu, Aludin, Abdul Hanis Anto, Samria, La Jai to Muhuddin, the beginning of the utilization of the People's Spring occurred in 1997 which began with traditional use, such as taking water directly by the local community for daily needs. This spring at that time did not have supporting infrastructure, so water access was limited to the community around the People's Spring location. At that time, some people also used the spring in Doda Bahari Village, but the taste and smell of the water had a brackish taste. Setianto *et al.,* (2016) also stated that the main problem faced by water sources was the inability to meet the need for water which continued to increase in terms of quantity and the decline in water quality, especially for domestic needs. At that time, the community also utilized the springs on Kalilia Island, namely the Kampenalo Spring, which is located on the island next to Doda Bahari Village, so that the community spent more time and energy to utilize the water at that time.

This problem has encouraged the Doda Bahari community to utilize the People's Spring further. In 2002, the spring water began to be distributed to the community through a piped network. The distribution process from the spring to homes requires adequate facilities and infrastructure. This step demonstrates improvements in water resource management, with the goal of expanding the reach of clean water users (Subekti *et al.,* 2022).

b. Vegetation Conditions

The condition of the vegetation around the spring shows a diversity of vegetation types that reflect adaptation to the local environment. The types of vegetation and their growth rates around the People's Spring are presented in Table 1.

The types of vegetation around the People's Spring are teak, cashew, areca nut, mango, kapok, soursop, pineapple, fern, coconut, matoa, awar-awar, suweg and water clover.

*Table 1. Types of Vegetation and Their Growth Rates (*Habitus) Around the People's Spring*

No	Local name	Scientific name	Growth Rate (*Habitus)
1.	Teak	*Tectona grandis*	Tree
2.	Betel nut	*Areca catechu*	Tree
3.	Mango	*Mangifera sp.*	Tree
4.	Kapok	*Ceiba pentandra*	Tree
5.	Cashew nuts	*Anacardium occidentale*	Tree
6.	Soursop	*Annona muricata*	Pole
7.	Matoa	*Pometia pinnata*	Stake
8.	Coconut	*Cocos nucifera*	Stake
9.	Pineapple	*Ananas comosus*	* Shrub
10.	Suweg	*Amorphophallus paeoniifolius*	* Shrub
11.	Awar-awar	*Ficus septica*	* Shrub
12.	Water Clover	*Marsilea crenata*	* Herbs
13.	Nail	*Polypodiophyta sp.*	* Nails

Source: Primary Data Analysis, Processed 2025

According to Binsasi *et al*. (2022), cashew trees located around springs have the potential to support water availability. This vegetation, through its fallen leaves, can protect soil degradation by rain because it can help water infiltration into the soil. Rudin *et al*. (2020) also explained that the falling leaves of teak trees can affect the infiltration process that occurs around teak trees. Mango, kapok, areca nut, coconut trees, as well as water clover and ferns on the floor can increase the infiltration process. These trees can maintain soil moisture and reduce the risk of drought, where the higher the level of the tree, the more water can be absorbed by the soil through

the tree roots and the floor plants can provide benefits in reducing erosion, improving soil quality and supporting ecosystem sustainability (Fajri *et al*., 2024). Nugroho *et al*., (2021) stated that one of the good trees around the spring is *Ficus benjamina* or the banyan tree which has great potential in water storage, but there is no such vegetation around the People's Spring.

The vegetation conditions around the People's Spring are surrounded by trees and grass. However, the area around the spring has a community plantation area about 100 meters from the spring source, as well as a community teak plantation where some people cut down trees for sale, which impacts the soil's absorption capacity. Vegetation cover can influence rainwater infiltration into the soil (Rudin *et al*., 2020).

This shows that the condition of vegetation in Doda Bahari Village needs to be evaluated so as not to threaten the sustainability of the People's Spring, in line with that based on PUPR Ministerial Regulation No. 28 of 2015 that within a radius of 200 m from the spring source is a spring protection area that needs to be maintained so as not to threaten the existence of this People's Spring, which can later make this spring dry and cannot be used again in the future. According to Nurdin *et al*., (2022) vegetation that grows around the spring has a significant impact on the quality and quantity of water flowing from the spring.

c. Physical Properties of Water

A healthy lifestyle also depends on the quality of the water consumed. Therefore, as humans who need water, we must maintain its quality. Clean drinking water can be physically identified as odorless, colorless, tasteless, and free of sediment at the bottom. The results of observations of the physical properties of water at the People's Spring are presented in Table 2.

Table 2. Results of Observations and Interviews on the Physical Properties of Water in Community Springs

No	Physical Properties of Water	Observation Method	Observation and Interview Results
1.	Smell	Smell	Odorless
2.	Flavor	Tasted without swallowing	No Taste
3.	Color	Visual	Colorless

Source: *Primary Data Analysis, Processed 2025*

Water from the People's Spring is odorless, in line with this, Lintong *et al.,* (2015) stated that water is categorized as good for consumption if it has no odor. Water that has an abnormal odor, such as a fishy or rotten odor, indicates that the water is not good and can be dangerous to health. Water from the People's Spring is colorless, as explained by Wardoyo and Hutapea (2024) that good water for consumption is clean and must be clear or colorless. Accessibility to water, particularly clean water, is one of the components that significantly impacts an individual's quality of life. Drinkable water is clean, meaning it has no taste or odor.

d. People's Spring Water Discharge

Water discharge is the volume of water flowing in a specific unit of time, such as liters/second or m^3/second. Water discharge can be influenced by various factors, such as rainfall, catchment area size, and topographic conditions (Mawardin and Aryan, 2024). Water discharge is a benchmark or yardstick in water resource management to maintain quality and quantity. The results of water discharge measurements in this study are presented in Table 3.

Table 3. People's Springs Discharge

No	Volume (m^3)	Time Seconds)	Debit				Information
			m^3/second	m^3/day	m^3/month	m^3/year	
1.	50	14,400	0.00347	299.81	8,994.24	107,930.88	From spring to reservoir
2.	0.012	54.69	0.00022	19,008	570.24	6,842.88	From the reservoir to the community
3.	0.012	78.14	0.00015	12.96	388.8	4,665.6	In people's homes

Source*: Primary Data Analysis*, *Processed 2025*

The water discharge obtained varied, using three measurement methods to show the process of water flow from the spring to the community's homes. The discharge from the spring to the reservoir was 0.00347 m³/second. This value describes the amount of water flowing from the spring to the reservoir, reflecting the spring's capacity to provide water for the community's needs. The discharge from the reservoir to the community was 0.00022 m³/second. This measurement indicates the amount of water flowing from the reservoir to the distribution system leading to the community's homes. The discharge at one community home was recorded at 0.00015 m³/second, indicating the amount of water reaching and used by the community at the household level. This significant decrease in discharge can be caused by factors such as pipe leaks, the distance of the spring from the settlement, and the difference in height between the spring and the community's homes.

The discharge obtained from the three methods is different, in each method of measuring the discharge obtained, namely 0.00347 m³/second, 0.00022 m³/second and 0.00015 m³/second which according to Sukmawati *et al*., (2023) based on the discharge that the discharge results are classified as class VI in the classification of water discharge. The discharge obtained from the People's Spring to the community at the time of the study was 0.00022 m^3/second, so the water discharge in a day was 299.81 m^3/day or 8,994.24 m^3/month and 107,930.88 m^3/year.

Utilization of People's Springs

The amount of water on earth is always constant, but the quality of water changes along with the growth of the human population and the activities that accompany it. The level of water needs in each region is definitely different due to the level of use and population in that area.

a. Types of Utilization

Domestic water use in Doda Bahari Village is divided into water use for drinking, cooking/eating, bathing, washing/sanitation, toilets and watering plants. The volume of water use by the Doda Bahari Village community is presented in Table 4.

Table 4. Volume of Water Use by the Community

No	Type of Use	Total Community Water Use		
		Day (m^3/day)	Month (m^3/month)	Year (m^3/year)
1.	Drink	1.70	50.9	610.9
2.	Eat/cook	3.31	99.2	1,190.0
3.	Bathe	19.84	595.1	7,141.2
4.	Wash/sanitize	27.92	837.7	10,052.1
5.	Toilet	15.06	451.9	5,422.9
6.	Water the Plants	1.69	50.8	609.6
Total		**69.52**	**2,085.6**	**25,026.6**

Source*: Primary Data Analysis*, *Processed 2025*

Water use for drinking purposes was recorded at 1.70 m³/day, or equivalent to 179.6 m³/month and 2,155.0 m³/year. The low volume of drinking water use is due to the fact that drinking water is usually only used in small volumes and some people around 11 families from the research sample of 72 families. Water used for eating or cooking reached 3.31 m³/day, equivalent to 99.2 m³/month and 11,190.0 m³/year. These activities require a larger amount of water than drinking, because they include various activities such as washing food ingredients, cooking, and cleaning cooking utensils. Bathing is an activity that uses water with a volume of 19.84 m³/day, 595.1 m³/month and 7,141.2 m³/year. Water used for washing or sanitation was recorded as the highest at 27.92 m³/day, equivalent to 837.7 m³/month and 10,052.1 m³/year. Water requirements for toilets reached 15.06 m³/day, 451.9 m³/month and 5,422.9 m³/year. Plant watering activities required the lowest water requirements at 1.69 m³/day, or 50.8 m³/month and 609.6 m³/year. This volume is considered low because not all households have plants that require regular watering.

Overall, the total volume of water used by the people of Doda Bahari Village reaches 69.52 m³/day or 2,085.6 m³/month equivalent to 25,026.6 m³/year. With progress and population growth, the need for water will also increase, including the use of water for domestic needs every day per capita (Saputra *et al*., 2020). From the total community water use, the community water use is 273.7 m³/day/household with an average water use per individual of 0.0684 m³/day/individual. Where from the volume of individual water use, in accordance with individual water use based on clean water planning criteria according to the Directorate General of Human, Public Works Agency (1996) that water use for a population of <20,000 as a rural category is 60 to 80 liters/person/day or 0.06 to 0.08 m³/person/day.

The criticality index of water used by the Doda Bahari Village community based on the available water discharge and the amount of water used on various time scales, namely daily, monthly and annually, is presented in Table 5.

Table 5. Criticality Index of Community Water Use

No	Water Discharge (m^3/day/month/year)	Water Usage (m^3/day/month/year)	Criticality Class	Information
1.	299.81 m^3/day	69.52 m^3/day	23.18	Not critical
2.	8,994.24 m^3/month	2,085.6 m^3/month	23.18	Not critical
3.	107,930.88 m^3/year	25,026.6 m^3/year	23.18	Not critical

Source: *Primary Data Analysis, Processed 2025*

Based on Table 5., the criticality index is 23.18%. This criticality index is the ratio between the amount of water used and the available water flow. According to Patandianan (2018), a criticality index value <50% is included in the "non-critical" category. This category indicates that the amount of available water is still sufficient for needs, with a relatively low level of utilization. This indicates that water resources have the potential to meet all the needs of the Doda Bahari Village community.

b. Distance of Springs from Settlements

The distance from the spring significantly influences the flow of water received by the community, influenced by the presence of community pipes and the distance to the community's homes. The total number of respondents was 72 families, divided into five distance categories. Five families lived within a 400 to 500 m radius of the People's Spring. This short distance allows water to flow at a rate of 0.00022 m^3/s, indicating that the community received water more smoothly than other distance groups.

A total of 28 families live within a 500 to 600 m radius, with a water discharge of 0.00020 m^3/s, making it the highest number of families. This distance is still close enough to ensure adequate water flow through the pipeline. With optimal water pressure, communities within this distance are

likely to receive an adequate and stable water supply for their daily needs. Twenty-six families reside within 600 to 700 m with a water discharge of 0.00018 m^3/s. Despite the slightly greater distance, the water pressure through the pipes within this radius is still quite adequate. However, the flow quantity begins to decrease slightly compared to closer distances, especially if the pipe infrastructure is poorly maintained or there are technical obstacles such as leaks. Only six families reside within a radius of 700 to 800 m with a water discharge of 0.00017 m^3/s. At further distances, the water pressure through the pipes can decrease, especially if the land elevation is higher or if the pipe infrastructure is inadequate. As a result, communities within this radius may begin to experience disruptions such as inconsistent water flow or reduced volume. Seven families reside at the furthest distance from the spring, 800 to 900 m with a water discharge of 0.00015 m^3/s . Within this radius, people are at higher risk of experiencing water flow disruptions due to weakened water pressure or distribution obstacles.

Argo *et al.,* (2024) explain that the distance of springs from residential areas significantly influences the smooth flow of water received by residents. The farther the springs are from residential areas, the greater the challenges in water distribution, especially if they are not equipped with adequate supporting infrastructure such as pipes, pumps, or gravity systems. In addition, long distances also increase the risk of leaks or damage to distribution lines, which can impede water flow. Therefore, to ensure a smooth water supply, careful planning is necessary, such as placing reservoirs at strategic points and using appropriate technology so that water can be optimally distributed to residential areas.

c. Challenges in Utilizing Springs

Challenges in utilizing the People's Spring in Doda Bahari Village include water that stops flowing during power outages, reduced flow during the dry season, water that flows on and off, and the presence of lime when the water is boiled. The challenge of water that stops flowing during power outages is that many rural areas experience difficulties in providing water, as the community's primary source of energy is electricity. Therefore, it is necessary to find and develop an adequate technology model, using appropriate, efficient and economical technology. Reliance on electrically operated water pumps causes water distribution to stop during power outages. Based on the observation results, to overcome the problem of water not flowing during a power outage, most people have large storage tanks in their homes and this is also one of the supporting factors for the Doda Bahari Village government to carry out structural management in the form of providing water tanks for people who do not have storage tanks so that they can become a place to provide water reserves.

According to Juliasih *et al.,* (2017), Indonesia's geographical location in a tropical climate means it experiences two seasons a year: the dry season and the rainy season. These seasonal conditions can affect the hydrological cycle due to differences in rainfall and temperature across Indonesia. The impacted hydrological cycle can have a direct impact on water conditions. Some springs may begin to experience reduced water flow during the dry season. This decreased flow can affect the infiltration process in the soil, and water flow will increase during the rainy season. One impact of global warming and climate change is reduced rainfall and water flow during the dry season, as well as an increase in the length of the dry season (*drought*) (Kandari, 2024b). The dry season presents a significant challenge, as spring water flow tends to decrease. This limited water source results in an insufficient water supply for community needs.

This intermittent pattern of water flow limits the community's ability to access water consistently, requiring them to adjust their household activities to the water schedule. Water in Doda Bahari Village contains high levels of lime, which, according to interviews with residents, limits their water use.

This also encourages some people to buy gallon water to meet their drinking water needs. According to Kaihena *et al*., (2024), water quality with high lime content is something that needs to be considered. When water is boiled, lime content is often visible as sediment, which can disrupt people's use of water. Challenges in water utilization are increasingly pressing along with increasing pressure from climate change, population growth and rapid urbanization, challenges that always present in the form of water quality degradation, decreasing water quantity, and conflicts of interest between stakeholders in water utilization.

Maintenance and Management of Community Springs

Sustainability in spring management is essential because it encompasses not only the utilization and maintenance of springs but also the prevention of pollution and destruction, ensuring their sustainable use. This concept of sustainability is crucial because it can serve as a form of environmental preservation for future generations and improve the quality of life today.

a. Spring Maintenance

Spring maintenance is an effort to manage water resources sustainably through protecting groundwater catchment areas, planting vegetation, controlling erosion, using water efficiently and protecting water quality. Changes in land cover can reduce the soil's ability to absorb air, thereby reducing the function of infiltration areas and the availability of groundwater. Therefore, identification and protection of catchment areas is an important step in maintaining the hydrological balance of an area (Wahyuni *et al*., 2017). The form of maintenance of the spring by the Doda Bahari Village community is in the form of cleaning the reservoir and the spring area through mutual cooperation, as well as repairing damaged pipes.

Based on interviews with the community, cleaning the reservoir and the spring area is one way to maintain the spring. According to Gaspersz *et al.,* (2024), regularly cleaning the reservoir and the area around the spring can maintain the cleanliness and quality of the water used. Cleaning the spring area prevents pollution from leaves, mud, or other materials that can disrupt the cleanliness of the water source. Good plumbing is essential to ensure smooth water distribution throughout the household. Pipe damage, such as leaks or blockages, can disrupt water flow and lead to water waste. Maintenance to protect the quantity and quality of People's Springs involves the same elements as non-structural management of People's Springs.

b. Structural Management of Springs

Structural management of the People's Spring in Doda Bahari Village is carried out through the construction of important infrastructure to support the distribution and sustainable use of water. These efforts include the provision of reservoirs, pipes, protective fences in spring areas and the provision of water tanks for people who do not have reservoirs at home.

The procurement of a reservoir tank shows structural management in the form of a reservoir tank in Doda Bahari Village. There are 3 reservoirs, where 1 reservoir is a reserve and 2 reservoirs are used for distribution to the community. Asrasal and Hasiyah, (2023) explain that a water reservoir is a building that functions as a clean water *reservoir* sourced from springs then distributed to service units or used directly as a connection between people's homes and users of the pipe network. Here are some of the pipelines in Doda Bahari Village.

Pipelines are also a crucial element in ensuring water is distributed evenly to people's homes. The provision of these pipes allows people to access clean water without having to draw it directly from springs, increasing efficiency in time and energy. This infrastructure is a crucial foundation for ensuring sustainable water distribution. The construction of a protective fence in the spring area is intended to protect the spring from disturbance by animals or humans. The protective

fence for the People's Spring was only built in 2017. The protective fence in the spring area is intended to protect the spring from external disturbances such as humans and animals.

Providing reservoirs for communities that do not have reservoirs is an important step in the structural management of springs, with the presence of these reservoirs helping communities in providing water reserves in case of challenges in utilization such as water not flowing during power outages, reduced discharge during the dry season and water flowing with a pattern of flowing one day and not flowing one day. For communities that do not have reservoirs at home, the need for management that includes the provision of water reservoirs as an alternative.

The structural management of the People's Spring in Doda Bahari Village focuses on providing infrastructure that supports the distribution, protection and community access to clean water. Reservoirs and pipes ensure efficient water distribution, protective fences maintain water cleanliness and quality, while water tanks provide a solution for communities without reservoirs.

c. Non-Structural Management of Springs

Alfin *et al.,* (2022) explained that non-structural management can take the form of policies, laws, regulations, and even local wisdom. These instruments are held by the government for regulatory purposes. All of these instruments are used to monitor and supervise activities related to springs, including water resource development. Non-structural management of the People's Spring in Doda Bahari Village includes the presence of a People's Spring manager and regulations to maintain environmental cleanliness around the spring. The manager of this spring is from the VCB (Village Consultative Body) Doda Bahari. From the Doda Bahari VCB only the chairman, Mr. La Ode Hayadi, and the deputy chairman, Mrs. Murnia, take a role in managing the spring. The cost of using this People's Spring is Rp. 3,000 per cubic meter, with community water usage fees ranging from Rp. 17,000 to Rp. 140,000 per household per month.

Overall, community involvement is crucial because they possess knowledge about water conditions and are direct users of springs. Empowering the community helps raise awareness and willingness to conserve springs. However, at Mata Air Rakyat, the lack of community involvement indicates a lack of awareness regarding spring sustainability. Non-structural management of the People's Spring does not include management such as planting vegetation. In fact, according to Nabu *et al.,* (2024), the diversity of vegetation, both trees and floor plants, can be an indicator for determining the quality of water resources. Vegetation affects the soil's ability to store water. However, with the low level of responsibility and public awareness of the sustainability of this People's Spring, efforts are needed from the village government, academics and the community itself to ensure that this spring needs to be conserved or its vegetation maintained around it because it can threaten the sustainability of this People's Spring.

Non-structural management in the form of outreach and education to the community is an important aspect in efforts to conserve water resources. However, at Mata Air Rakyat, no formal outreach activities or educational programs have been found. Based on the interview results, local people implement rules not to throw garbage around the springs in order to maintain cleanliness and environmental sustainability. However, these rules were only conveyed verbally from one citizen to another and had not been put into written regulations or structured socialization. This condition shows that public awareness in preserving springs already exists, but is not yet supported by systematic and sustainable non-structural management.

Erwin (2024) explained that the concept of spring water management should be implemented holistically and in an integrated, community-based manner. This implies the importance of thorough planning involving various elements and stakeholders *in* spring water management. Non-structural spring water management in Doda Bahari Village needs to be improved, such as

planting vegetation around the springs, providing education on the importance of maintaining spring sustainability, and having structured and effective spring water management.

CONCLUSION AND SUGGESTIONS

The Community Spring in Doda Bahari Village, Sangia Wambulu District, Central Buton Regency has an area of 209.14 m² and has been utilized by the local community since 1997, initially through direct water collection from the source and later, since 2002, through a pipe distribution system that supplies water to residents' homes. The surrounding vegetation, including teak, kapok, cashew, mango, areca nut, soursop, pineapple, coconut, matoa, suweg, awar-awar, water clover, and ferns, contributes to maintaining the sustainability of the spring, although teak tree cutting still occurs within community plantations around the area. The spring water quality remains good, being odorless, tasteless, and colorless, with a discharge of 0.00347 m³/second. The water is used for drinking, cooking, washing, sanitation, bathing, toilet needs, and watering plants, with a total annual consumption of 25,026.6 m³/year. The distance between the spring and residential areas affects water distribution, where settlements located closer to the spring receive a higher water discharge than those farther away. Challenges include water interruptions during power outages, reduced flow during the dry season, intermittent supply, and high lime content when boiled. Maintenance and management efforts involve cleaning the reservoir and spring area, repairing pipelines, providing supporting infrastructure, and implementing management rules to protect the spring. Therefore, improved water distribution management, stronger collaboration between the government and community, public awareness on spring conservation, and further studies on spring sustainability are recommended.

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