

SPATIAL DISTRIBUTION AND CONSERVATION BASED ON LOCAL WISDOM OF EPICARST SPRINGS IN DONOROJO DISTRICT, PACITAN REGENCY

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ABSTRACT

The spring in Donorojo has neighborhood astuteness that capabilities to safeguard the spring. Neighborhood insight that is applied to turn into the primary fort is kept up with and springs stream to meet the day to day needs of inhabitants. Nearby insight means quite a bit to be examined and protected locally to keep up with balance and can be a method for saving the climate. The collected data technique used purposive sampling. Respondents comprised of the top of the villa, the top of the RT/RW, and the neighborhood local area. In the wake of deciding the respondent, the following stage is to direct top to bottom meetings and lead a subjective illustrative examination. The aftereffects of this study are: 1) The dispersion of springs in the review region from the hydrogeological sub-arrangement of the Gungsewu karst region, specifically the Donorojo-Pringkuku sub-framework where springs are found to shape waterway streams; 2) The kinds of springs in the review region can be gathered into: perennial springs, diminishing springs, climbing springs, and rising springs. The order of springs in the review region in view of the release is remembered for class six with a release of 0.1 to 1 liter/second; 3) the utilization of nearby springs is utilized to address the issues of families, animals, industry and mostly for farming; 4) every region that has neighborhood insight on springs, can be utilized as a work to preserve springs at the nearby level.

Keywords: Conservation; Spring; Epikarst; Local Wisdom

INTRODUCTION

Water is a vital part that is needed to fulfill the needs of living things (Penny et al., 2023). For humans, water can be helpful in survival. Humans need water in the household, industrial, agricultural, livestock, and power generation sectors (Goldscheider et al., 2020). Without water, all sectors of human activity

cannot run. The benefits of water are enormous for human life; it is necessary to apply wisdom and prudence in managing and utilizing it (Beisner et al., 2023). The environment around human life needs to be protected from pollution and destruction by human activities (Li et al., 2022; Ravbar et al., 2021).



Maintained environment will have an impact on the sustainability of springs. If management and utilization are not wise and prudent, it will affect dry springs.

Karst aquifer is different from other landform aquifer. The soil layer in the karst area is very thin (Zhu et al., 2023), and the bottom is karst rock which is hard rock and difficult to penetrate by water. Surface water that enters the karst can enter the subsurface through conduits and cracks in the karst rock (Ravbar et al., 2021).

Pacitan Regency is an area dominated by solutional landforms with many karst mountains. The karst area is a dry and barren area due to the different irrigation systems in the karst area. Very young karst rocks allow water to pass through so that the soil does not maximally absorb rainwater that falls. This impacts the difficulty of getting clean water in karst areas, especially during the dry season (Jiang et al., 2021). Karst area characterized thin soil layer, it is impact to water storage capacity in that area (Zeng et al., 2023).

Administratively, Donorojo District is included in the Pacitan Regency. Geographically, the Donorojo District is dominated by limestone. However, the availability of clean water in several

villages in the Donorojo District is sufficient. This is because, in several towns in the Donorojo District, springs flow from the karst mountains. Residents use the existing springs to meet their daily needs, especially household needs. The springs that can be utilized certainly require good management as well (Sudarmadji et al., 2016). Noviana et al., (2023) in her research, describes that the diversity of adaptation patterns to the environment that exists in society is passed down from generation to generation to become a guideline for managing environmental sustainability, known as local wisdom. Local wisdom is essential to study and preserve in a society to maintain balance and can be a means of protecting the environment (Vitasurya, 2016). Local wisdom is an ancestral heritage in the values of life that are integrated into the form of religion, culture, and customs (Asmal et al., 2023). The springs in the Donorojo District have local wisdom that functions to protect springs. The local knowledge that is applied is the main fortress that is maintained, and the springs flow to meet the daily needs of the residents. Therefore, it is necessary to research the use and management of springs based on local wisdom in Donorojo District.



MATERIALS AND METHODS

The research location regarding the conservation of epikarst springs based on local wisdom is in a spring in Donorojo District. The site of the spring is a spring that residents have used to meet their need for water. Based on field surveys, five springs have been utilized in Gendaran Village and Cemeng Village. The data of distribution of springs and types of springs in Donorojo District were collected by field surveys. Researcher did field surveys all around Donorojo District with map of geology in that area. Collected data for utilization of springs in Donorojo District were used indepth interview. The respondents in this study used a purposive sampling technique, in which the intended respondents understood information about springs (stakeholder). The author determines the respondents, including the head of the hamlet, the head of the RT, and residents who use the springs. To find out the physical characteristics of springs, an observation sheet is needed, and to find out the spatial variations in conservation efforts and the use of springs by the community, an FGD (Focus Group Discussion) is carried out, bearing in mind that each region has different wisdom and ways of

managing it from other places. While the research sampling technique was through in-depth interviews using interview guidelines which included management systems, utilization systems, distribution systems, restrictions on springs, sanctions for violating the prohibition, community participation, and conditions for using springs.

The type of research used by the author is case study research. Because this research uses a qualitative approach and is included in an analysis focusing on causal relationships. Therefore, the research results are analytical-descriptive in the form of written or oral narratives of the observed behavior and are related to how local wisdom in spring management affects the sustainability of water resources in Donorojo District, Pacitan Regency.

RESULTS AND DISCUSSION

Distribution of Springs in Donorojo District

The availability and distribution of springs in the Donorojo District are inseparable from the influence of rock-forming geology and the hydrological system in the karst area. The presence of springs in karst areas is unique. It has



different characteristics from the company of springs in other areas, bearing in mind that there is an uncommon occurrence in the aquifer process where tunneling activity is found. The distribution of springs in the study area is still included in the Gunungsewu karst area, located in the hydrogeological unit in the form of the Donorojo-Pringkuku Sub-system. This sub-system shows the overall southward flow of groundwater. The limestone in this sub-system is generally shallower than the central part of the Gunungsewu Karst area, composed of the Wonosari Formation (Sitinjak et al., 2019). This phenomenon results in an external groundwater table where it appears as

springs that form streams in some places which is influenced by slope of the karst hill (C. Li et al., 2022). So that the presence of these springs can be easily identified, the company of springs is usually right below or at the foot of the karst hill, where the mountain is the place where the karst aquifer system takes place, which has the leading role as a Water Catchment Area (DTA). The following **Figure 1** shows the hydrogeological units of the Gunungsewu Karst area which influence the availability and distribution of springs in the research area..

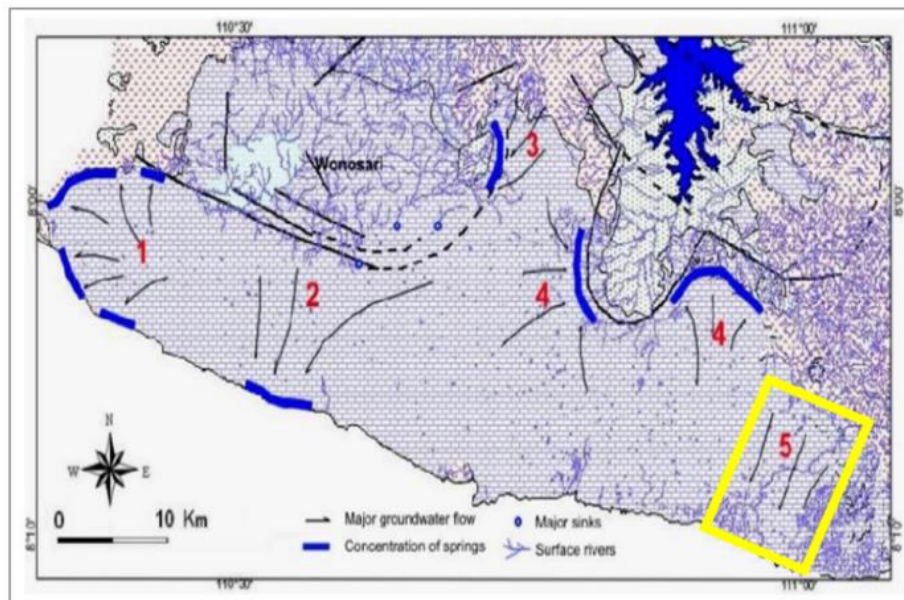


Figure 1. Gunungsewu Karst Area Hydrogeological Unit

Based on field observations, it can be seen that the distribution of springs used

by the community in Donorojo District, Pacitan Regency. The springs used by

the local community were obtained from five springs spread over two villages, namely Gendaran Village consisting of three springs (Joro Spring, Dringo Spring, and Cedak Kali Spring) and

Cemeng Village, consisting of two springs (Petung Spring, and Kali Sikut Spring). The spatial distribution of these springs can be represented in the spring distribution map depicted in **Figure 2**.

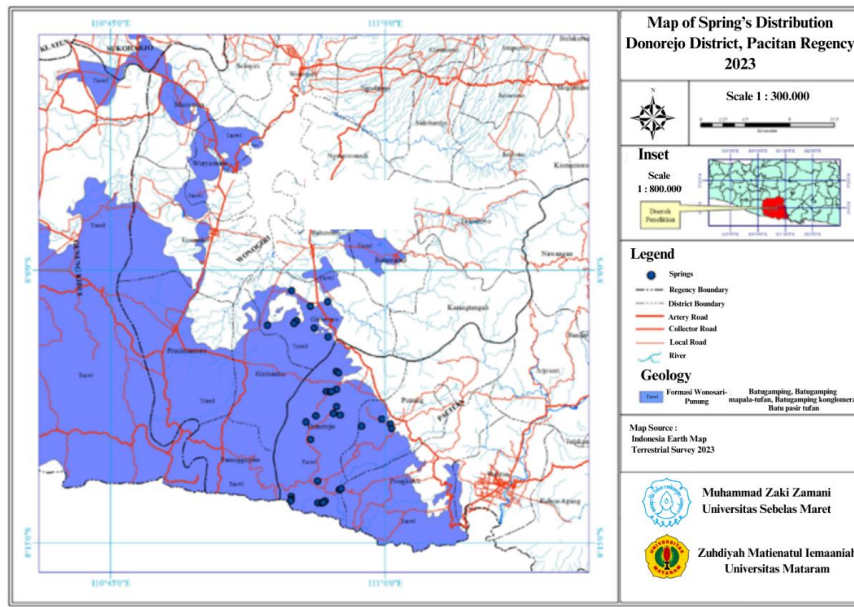


Figure 2. Map of Spring Distribution of Donorejo-Pringkuku District

Type of Springs in Donorejo District

Some of the uniqueness found in karst springs is that springs with the same discharge, temperature, and hardness can also be found elsewhere. Another uniqueness is the characteristics of karst springs which are very dependent on the level of karstification of an area. Based on field observations, the types of springs in the study area based on the flow period are included in perennial springs because they continue to flow throughout the year. Meanwhile, the type of springs in the study area based on

their geological structure are included in descending springs, where springs come out because there is a conduit passage with a downward flow direction, such as Joro Springs and Dringo Springs (see **Figure 3**). As for ascending springs, this is due to a conduit passageway with the flow direction upwards, such as in Petung Springs, Kali Sikut Springs, and Kali Cedak Springs. In addition, the type of springs in the study area regarding the origin of groundwater flow is included in emergence springs, where springs have a relatively large discharge. Still, there

needs to be more evidence regarding the catchment area.

Springs have varying discharge, both in terms of the location of the springs and in terms of temporal or seasonal. Springs are classified based on their flow discharge (Olarinoye et al., 2022). Where the springs in the study area have the classification of class six (6) springs because the flow rate ranges from 0.1 to 1 liter/second. The average flow rate in the springs in the study area has the same average and is consistent throughout the year.

In general, the springs in the study area are included in epic arts. Epikarts is the central reservoir zone where water is concentrated from rainwater infiltration (Jones, 2013). The epic art zone has permeability and porosity due to the widening of the dissolution gap (Klimchouk, 2004). So it is a good

storage zone because it contributes to the main recharge of underground rivers during the dry season. Epicarst springs are known to have advantages in terms of 1) water quality because the water that comes out is very diverse because the sediment has been trapped in filling material or fractures and through a diffuse type karst aquifer system which has undergone filtration during dissolution; 2) stable discharge, where water can flow three to four months after the rainy season with a relatively stable flow rate; and 3) easy to manage, due to the existence of epicarst springs which generally appear at the foot of hills which are accessible for the community to reach in meeting their need for water.



Figure 3. Clear Water from Dringo Springs, Gendaran Village

Utilization of Springs in Donorojo District

The use of water from springs by residents in parts of Donorojo Subdistrict is as follows: Utilization of water sourced from springs in parts of Donoroji Subdistrict for Mata Joro, Dringo, Kali Cedak, Petung, and Kali

Sikut is mainly used for drinking water, cooking, bathing, washing clothes, washing cooking utensils is 100%, so this water is used for daily needs. The process of distributing water from the spring to each resident's house can be seen in the scheme in **Figure 4**.

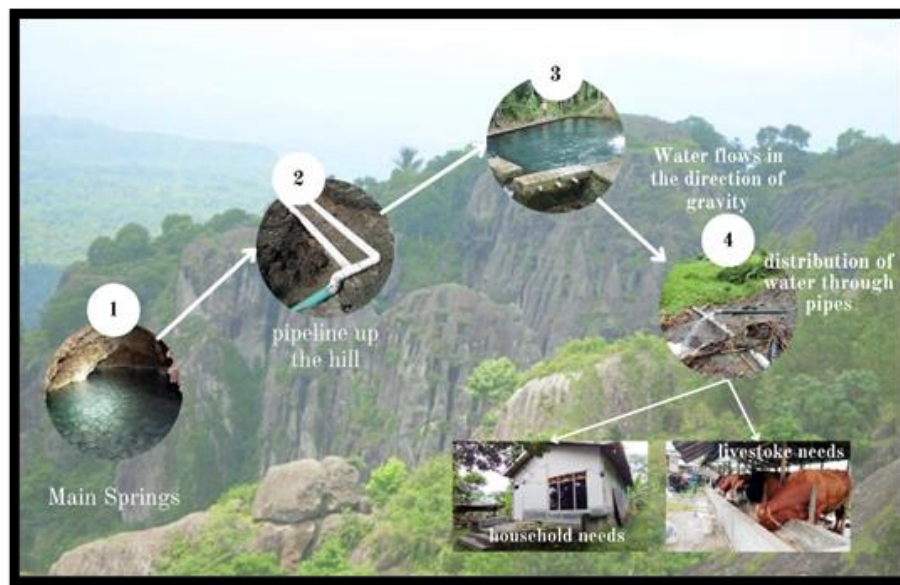


Figure 4. Schematic use of springs

Water from springs used for irrigation and agriculture is only used by residents with paddy fields or dry fields around the five springs. This is because daily primary needs only need to be saved—utilization of water sources for livestock in the Elbow and petting river springs. The livestock there are chicken and cattle farms owned by individual residents. The use of water for industry only exists in the Kali Elbow Spring.

This is intended for tofu and tempeh processing home industries.

Spatial Variation of Local Wisdom in Spring Conservation

Each spring location in the study area has elements of local wisdom that are different from one another. Given that the elements of local wisdom occur locally with certain regional boundaries. In general, the local wisdom regarding springs is to pay homage to these springs

by maintaining behavior not to use water indiscriminately to maintain the cleanliness of the spring environment (Murhaini & Achmadi, 2021). Remembering springs as a provider of clean water needs to support the sustainability of life (Tóth et al., 2022). The local wisdom the local community possesses is contained in village clean-up activities held after the main harvest (Gai et al., 2023). In the clean-up activities of the village, offerings (offerings) are given in several springs for Danyang or those who have a bahu reason in the spring.

If viewed from the spatial variation of the region, of course, in protecting the existence of springs as the primary source of meeting the community's water needs in each region, it has its own unique and distinctive way. Usually, local wisdom is preserved in various regions through fairy tales or word of mouth. However, over time the local wisdom of the community begins to fade due to the development of modern society and the need for more literacy from older residents regarding local wisdom in the local area, which is related to the presence of springs.

Every region with local wisdom regarding springs can be used to

conserve springs at the local level. Where elements of local wisdom are also presented as a form of regulation so that people respect and care for the existence of springs as a support for life's necessities (Noviana et al., 2023). In addition to prioritizing elements of locality, local wisdom in each region. Each existing region can collaborate and elaborate on technical management and wise use of springs to form a resilient community in creating regional water resource resilience.

CONCLUSIONS

Based on the results of the analysis contained in the discussion, it can be seen that the distribution of springs in the study area is still included in the Gunungsewu karst area, which is located in the hydrogeological unit in the form of the Donorojo-Pringkuku Sub-system. This sub-system shows the overall southward flow of groundwater. In general, the limestone in this sub-system is shallower than the central part of the Gunungsewu Karst area. This results in a shallow groundwater table where it appears as springs that form streams in some areas. The types of springs in the study area can be grouped into perennial springs, descending springs, ascending



springs, and emergence springs. The classification of the springs in the study area based on their discharge is included in class six, with a discharge of 0.1 to 1 liter/second. Local springs are utilized to meet household needs, livestock, industry, and partly for agriculture. Spatial variations of local wisdom in each region regarding springs can be used to conserve springs at the local level.

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