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Ethnoecological Study of Ndhas Gendhing Spring in Sukorejo Village, Magelang Regency, Province of Central Java

(Kajian Etnoekologi Mata Air *Ndhas Gendhing* di Desa Sukorejo, Kabupaten Magelang, Provinsi Jawa Tengah)

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Abstrak. Berita tentang krisis air dapat ditemukan di seluruh dunia, termasuk Indonesia. Sayangnya, pengetahuan generasi muda tentang pentingnya mata air, termasuk *Ndhas Gendhing*, masih rendah karena pengetahuan tersebut diwariskan secara lisan dan bukan tertulis. Pengetahuan adat tentang *Ndhas Gendhing* masih dijaga oleh masyarakat Desa Sukorejo. Tujuan dari penelitian ini adalah untuk mempelajari mata air *Ndhas Gendhing* dengan menggunakan prinsip-prinsip etnoekologi. Metode penelitian yang digunakan adalah penelitian lapangan. Terdapat empat jenis tumbuhan yang berpotensi melindungi mata air *Ndhas Gendhing*, yaitu *Preh (Ficus macrocarpa), Ringin (Ficus benjamina), Pring Jawa (Gigantochloa atter),* dan *Pring Petung (Dendrocalamus asper*). Terdapat sembilan jenis satwa air yang ditemukan di sumber mata air tersebut, yaitu *Lele lokal* (*Clarias batrachus*)*, Wader* (*Rasbora argyrotaenia*)*, Peto* (*Aplocheilus armatus), Nila* (*Oreochromis niloticus*)*, Yuyu* (*Parathelphusa convexa*)*, Melem* (*Rasbora caudimaculata*)*, Kotes* (*Channa limbate*)*, Deleg* (*Channa striata*)*,* dan *Pelus* (*Anguilla sp.*). Berdasarkan sifat fisik dan kimia, kondisi air tidak berbau dan jernih. Rata-rata pH adalah 6,92, dengan rata-rata TDS 117,6 ppm. Hal ini berarti kondisi air termasuk dalam kategori sangat baik. Air yang melimpah ini dapat digunakan untuk kebutuhan sehari-hari seperti mandi, mencuci pakaian, dan air minum PDAM. Bahkan, ada ritual khusus seperti *padusan* dan *kungkum*. Kesadaran generasi muda akan keberadaan mata air *Ndhas Gendhing* diharapkan dapat mendukung ketahanan air yang berkelanjutan.

Kata Kunci: Etnoekologi; Pengetahuan adat; Mata air; *Ndhas Gendhing*; Sukorejo.

Abstract. News of the water crisis can be found all over the world, including Indonesia. Unfortunately, the knowledge of the younger generation about the importance of springs, including *Ndhas Gendhing*, is still low because the knowledge is passed on orally rather than in writing. Indigenous knowledge about *Ndhas Gendhing* is still maintained by the people of Sukorejo Village. The aim of this research is to study *Ndhas Gendhing* Spring using ethnoecological principles. The research method was field research. There are four types of plants that have the potential to protect the *Ndhas Gendhing* spring, namely *Preh (Ficus macrocarpa), Ringin (Ficus benjamina), Pring Jawa (Gigantochloa atter),* and *Pring Petung (Dendrocalamus asper*). There are nine aquatic animal species found in the water source, namely *Lele lokal* (*Clarias batrachus*)*, Wader* (*Rasbora argyrotaenia*)*, Peto* (*Aplocheilus armatus), Nila* (*Oreochromis niloticus*)*, Yuyu* (*Parathelphusa convexa*)*, Melem* (*Rasbora caudimaculata*)*, Kotes* (*Channa limbate*)*, Deleg* (*Channa striata*)*,* dan *Pelus* (*Anguilla sp.*). Based on the physical and chemical characteristics, the water is odorless and clear. The average pH was 6.92, with an average TDS of 117.6 ppm. This means that the water condition is in the excellent category. The abundant water can be used for daily needs such as bathing, washing clothes, and PDAM drinking water. In fact, there are special rituals such as *padusan* and *kungkum*. It is hoped that the younger generation's awareness of the existence of the *Ndhas Gendhing* spring will support sustainable water security.

Keywords: Ethnoecology; Indigenous knowledge; *Ndhas Gendhing*; Spring water; Sukorejo.

INTRODUCTION

The issue of water crises occurs in parts of the world and even in Indonesia, usually during the dry season. In fact, there is an issue that says that the island of Java will experience water scarcity in 2040 (Lestari et al., 2021). This water crisis is caused by drought. One of the areas affected by drought is Kabupaten Magelang (Hanafi et al., 2019). The drought in Magelang Regency occurred in the Bompon watershed (Hanafi et al., 2019) and Kecamatan Grabag (Margono et al., 2019). Data from the Pusdalops BPBD in Magelang district showed an increase in drought disasters from 2017 to 2019 consecutively, namely 3, 25, and 52 (Fatimah & Panjawa, 2021). The phenomenon of the water crisis requires mutual attention.

Water is an essential source of human life. Due to the dry season, the people of Magelang regency are experiencing a shortage of clean water (Margono et al., 2019). The water crisis will certainly affect the lives of living beings on earth, especially humans (Lestari et al., 2021). The emerging water crisis will directly affect the activities of citizens, as almost all daily activities cannot be separated from the use of clean water (Herzanita et al., 2023). The clean water crisis may also threaten future wars over water security (Bahan Pembelajaran Proxy War, 2020).

Unfortunately, people, including the younger generation, still do not care about the importance of water sources, especially in areas with excess water. Imagine that many areas that have never been short of water are now short of water. The problem of water scarcity stems from the acquisition of deteriorating clean water sources and also from the availability of depleting water sources. The depletion of clean water availability is triggered by several factors, namely climate change and increasing population (Lestari et al., 2021). One of the raw materials used to obtain water is water from springs.

Magelang Regency has several springs as it is surrounded by Mount Sumbing, Mount Merbabu, Mount Merapi, and Mount Tidar. However, not all of these springs continue to flow during the dry season. Uniquely, there is one spring that still releases water despite the long, dry season. This spring is called *Ndhas Gendhing* by the locals. *Ndhas Gendhing* is located in Ganjuran hamlet, Sukorejo village, Kabupaten Magelang. The villagers and people from outside the village use the spring for bathing, washing, drinking water, and other traditional rituals. The villagers protect the source of *Ndhas Gendhing* with their indigenous knowledge.

Previous research has investigated water sources in Kabupaten Magelang. A study by Hanafi et al. (2019) examined strategies to overcome drought in the Bompon watershed of Sumbing Slope. Margono et al. (2019) on drought emergency response in Grabag. Research on *Ndhas Gendhing* by Lestari et al. (2021) on the conservation of *gending* springs through community participation in preserving local wisdom. However, these studies were not examined through an ethnoecological lens.

An attempt to promote the importance of spring conservation is to study the *Ndhas Gendhing* Spring using ethnoecological principles. Ethnoecology is the study of ethnicity and ecology. The study of ethnoecology focuses on human interaction with nature (Hilmanto, 2010). In the ethnoecological approach, researchers study the knowledge of rural residents about various aspects of ecology (Iskandar & Iskandar, 2018).

The aim of this research is to study *Ndhas Gendhing* Spring using ethnoecological principles. The importance of studying the source of *Ndhas Gendhing* using ethnoecological principles is to promote indigenous knowledge or local wisdom about ecology from an ethnic perspective. In addition, not many have studied the importance of springs in the curriculum.

There has been a reduction of material in the curriculum, especially on environmental issues. It is therefore important to explore the relationship between water and the environment from an ethno-ecological perspective.

METHODS

The research method is field research. Field research was conducted to collect information through observation, interviews and documentation. The research was conducted in *Dusun* Ganjuran, Sukorejo Village, Magelang Regency. The term "Dusun" is used to describe an area that is smaller than a village. "Kabupaten" is the same level as a regency under a province. The village is located at $110^{0}20$ East Longitude and $7^{0}55$ South Latitude. The research location map was created using Google Earth Pro and QGIS3 applications.

Data collected included villagers' indigenous knowledge about spring maintenance, plants that have the potential to maintain springs, animals found in springs, and physical and chemical properties of water. Interviews were conducted with two key informants, residents of *Dusun* Ganjuran, Sukorejo village, who were aware of the existence of the spring. The data were analysed descriptively and qualitatively. The research location is shown in **Figure 1.**

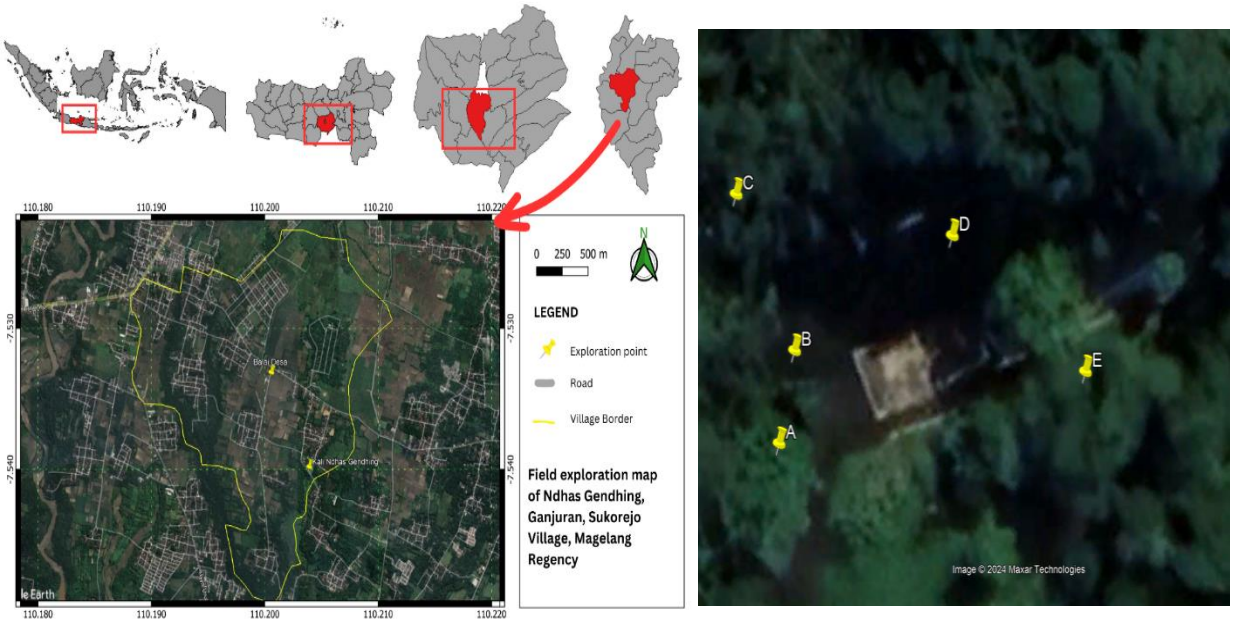

Figure 1. The field research location is Dusun Ganjuran, Sukorejo Village, with the main point at *Ndhas Gendhing* spring.

RESULTS AND DISCUSSION

Mata air or springs are usually found at the feet of mountains. Springs are essentially a discharge of groundwater that flows naturally to the surface of the soil or rock (Yulistyarini et al., 2009). Research by Ashari & Widodo (2019) found a pattern of spring distribution on the southwest slope of Mt. Merbabu at the boundary of the volcanic slope with the foot of the volcano and the foot of the volcano with the volcanic foot plain. Research by Aurita & Purwantara (2017) has shown that the springs studied originate from the landform of the volcano foot plain. One of the foothill springs is the source of *Ndhas Gendhing*.

The source of *Ndhas Gendhing* is located in Dusun Ganjuran, Sukorejo village, Kabupaten Magelang. According to Geoportal (2024), this source or spring has a water discharge of 300 with a clear quality. The source of *Ndhas Gendhing* is located at the foot of Mount Tidar. It is also surrounded by Mount Merapi, Mount Merbabu, and Mount Sumbing. The location of the *Ndhas Gendhing* spring is shown in **Figure 2.**

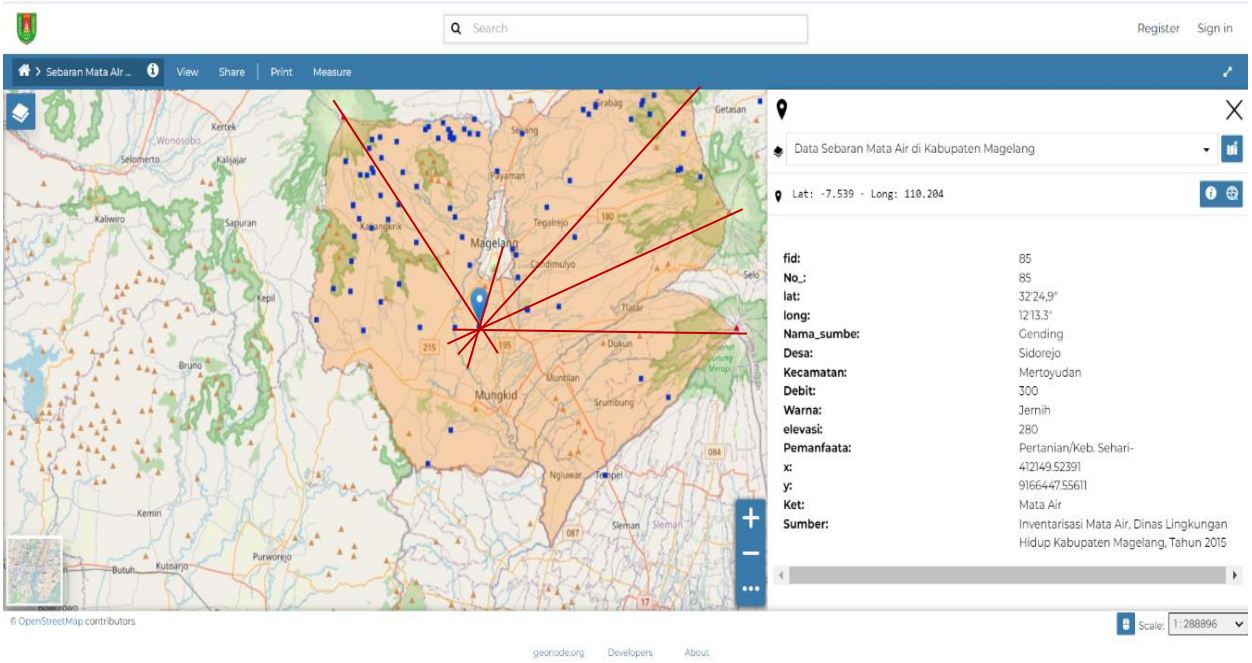

Figure 2. The position of the *Ndhas Gendhing* source surrounded by several mountains

The source of *Ndhas Gendhing* has its own significance. This source is called Ndhas because it is considered the head of the water source that flows through the river to the Progo River. *Ndhas* means head in Javanese. In addition, in ancient times, this place was a place to plant *gendhing* (a term used by the Javanese people to refer to the form of musical composition of the *Karawitan*). We can also find the tomb of Pepundhen, or ancestors, above the source of *Ndhas Gendhing*. The tomb can also be used as a pilgrimage site for believers. *Ndhas Gendhing* is often referred to as *Kali Gendhing*. The condition of the *Ndhas Gendhing* spring is shown in **Figure 3.**

Figure 3. The condition of *Ndhas Gendhing* Spring. (A) *Ndhas Gendhing* top view; (B) *Ndhas Gendhing* utilised by the residents.

Plant species that have the potential to protect *Ndhas Gendhing* spring water

The geographical location of *Ndhas Gendhing* at the foot of the mountain is also supported by the ecological conditions around the source of *Ndhas Gendhing*. During the long dry season last year, the source of *Ndhas Gendhing* did not dry up but only decreased by about 50%, or about 30 cm from the surface. Researchers suspect that this condition is influenced by some vegetation that supports the existence of the spring. Vegetation that has the potential to be a source of *Ndhas Gendhing* is listed in **Table 1.**

Table 1. Plant species that have the potential to protect *Ndhas Gendhing* spring water

No.	Local name	Species	Genus	Family	Order	Clade
1	Preh	*Ficus microcarpa*	Ficus	Moraceae	Rosales	Eudicots
2	Ringin	*Ficus benjamina*	Ficus	Moraceae	Rosales	Eudicots
3	Pring Jawa	*Gigantochloa atter*	Gigantochloa	Poaceae	Poales	Monocots
4	Pring Petung	*Dendrocalamus asper*	Dendrocalamus	Poaceae	Poales	Monocots

Based on field observations, four plant species were found to have the potential to store water, namely *Preh (Ficus microcarpa*), *Ringin* (*Ficus benjamina*), *Pring Jawa* (*Gigantochloa atter*), and *Pring Petung (Dendrocalamus asper). Preh* and *Ringin* belong to the *Ficus* group. *Ficus* roots that are strong and in the soil are able to absorb water well, making them optimal for absorbing and storing water in the soil (Zaharah et al., 2017). In addition, the conservation of bamboo allows degraded land to return to its proper function in a relatively short period of time, so that the natural resources of forest, land, and water can be used effectively and successfully for present and future generations (Mudawaroch et al., 2021). Vegetation with great potential to protect the *Ndhas Gendhing* spring is shown in **Figure 4**.

Figure 4. Vegetation that has great potential to protect *Ndhas Gendhing* spring water. (A) *Preh (Ficus microcarpa)*; (B) *Ringin (Ficus benjamina)*; (C) *Pring Jawa (Gigantochloa atter);* and (D) *Pring Petung (Dendrocalamus asper)*

Preh *(Ficus microcarpa)* has strong roots; banyan trees can also store groundwater and prevent drought in the dry season (Mudawaroch et al., 2021). Due to the high confidence in this water provisioning ability, the presence of *Ficus* spp. (*beringin-beringinan*) trees is well maintained in water source areas (Baskara & Wicaksono, 2013). The potential of bamboo can be used as a plant for soil and water conservation (Trimanto et al., 2020). A healthy bamboo clump can store large amounts of water and regulate surface water well, and its canopy structure can withstand heavy raindrops that can damage the soil (Propeat, 2022).

Aquatic animal species found at *Ndhas Gendhing* spring

Several species of aquatic animals are also found around the *Ndhas Gendhing* spring. Based on interviews with fishermen and those who frequently use the spring, many species of fish and other aquatic animals have been found. The presence of these aquatic animals indicates that the condition of the spring is still clean and

unpolluted. It also indicates a healthy flow of energy in the ecosystem.

Bioindicators are organisms or biological processes that indicate changes in environmental conditions and can be used to identify and/or measure the impact of pollutants on the environment (Manickavasagam et al., 2019). Fish are frequently employed as bioindicators for the purpose of monitoring pollution levels and water quality, given their sensitivity to environmental changes (Komberem et al., 2022). In addition, other animals, such as freshwater crabs, also have the potential to serve as bioindicators of environmental pollution (Riady et al., 2014). Data on aquatic animal species are given in **Table 2.**

Table 2. Species of aquatic animals found at *Ndhas Gendhing* spring

No.	Local name	Species	Genus	Family	Order	Clade
1	Lele lokal	*Clarias batrachus*	Clarias	Clariidae	Siluriformes	Actinopterygii
2	Wader	*Rasbora argyrotaenia*	Rasbora	Cyprinidae	Cypriniformes	Actinopterygii
3	Peto	*Aplocheilus armatus*	Aplocheilus	Aplocheilidae	Cyprinodontiformes	Actinopterygii
4	Nila	*Oreochromis niloticus*	Oreochromis	Cichlidae	Cichliformes	Actinopterygii
5	Yuyu	*Parathelphusa convexa*	Parathelphusa	Gecarcinucidae	Decapoda	Malacostraca
6	Melem	*Rasbora caudimaculata*	Rasbora	Cyprinidae	Cypriniformes	Actinopterygii
7	Kotes	*Channa limbata*	Channa	Channidae	Perciformes	Actinopterygii
8	Deleg	*Channa striata*	Channa	Channidae	Anabantiformes	Actinopterygii
9	Pelus	*Anguilla sp.*	Anguilla	Anguillidae	Anguilliformes	Actinopterygii

Analysis of physical and chemical parameters of water at *Ndhas Gendhing* spring

The physical and chemical condition of water is one of the benchmarks for whether it is suitable for use and consumption. Based on Permenkes RI Number 32 of 2017, the environmental health quality standards for water media for sanitary hygiene purposes include physical, biological, and chemical parameters, which can be mandatory or additional (Arma et al., 2018). Water sampling points are shown in **Figure 1.**

The physical parameters showed that the water quality at the *Ndhas Gendhing* spring was odorless and clear. Good water quality is odorless and clear (Sari et al., 2023). Unfortunately, we do find some plastic drinks being used by irresponsible visitors. This needs to be a common concern for visitors and local villagers. The plastic conditions will also pollute the spring water source if allowed to continue. Although a rubbish bin has been provided at the site.

Chemical parameters showed an average pH between 6.8 and 7.4, with an average of 6.9. The pH was measured using a digital pH meter and a universal indicator. The pH is the sum of the concentration of hydrogen ions (H+) in a solution, which expresses its acidity and basicity (Ngafifuddin et al., 2017). Consumed water should have a neutral pH (pH = 6.5–8.5) (Revansyah et al., 2023). Another physical property is the total dissolved solids (TDS), which indicates the amount of soluble solids in water (Dewa & Sasmoko, 2016). The results showed that the TDS ranged from 113 to 120 ppm. According to the WHO (World Health Organization), drinking water suitable for consumption has a TDS value of < 300 ppm (parts per million) (Zamora et al., 2016).

Utilisation of *Ndhas Gendhing* spring by local villagers

The *Ndhas Gendhing* spring is used for the daily needs of the villagers and even outside the village. The villagers use it for bathing and washing. Although they wash their clothes at the spring, the spring is not polluted because the water flows through the river. However, from an ecological point of view, we can see that there are aquatic plants around the river. This could be an indication of eutrophication. Using this source for washing and bathing is not a problem if it is done properly. Therefore, efforts should be made to ensure that the river originating from the *Ndhas Gendhing* spring is not polluted.

Before there were toilets, people used the river around *Ndhas Gendhing* for defecation. The water flow in the river does not go to the spring but to the Progo River. In addition, when the water supply from the PDAM (Drinking water company) is cut off, many residents take water from the *Ndhas Gendhing* spring as a solution. Currently, PDAM has built a water reservoir at the *Ndhas Gendhing* spring, which will be channeled to several *dusun* in Sukorejo village, so that the residents of Sukorejo village do not lack clean water. *Dusun* is a smaller part of a village led by a *Dusun* chief.

The use of the *Ndhas Gendhing* spring is also associated with local wisdom in the form of spirituality. *Padusan* is one of the traditional rituals performed at the beginning of the fasting month. Residents from within and outside the village flock to bathe at the spring. The aim is to purify themselves. In addition to *padusan*, some people still perform spiritual rituals in the form of *kungkum*, or soaking. They perform semedi rituals at the spring while praying and meditating. The use of the *Ndhas Gendhing* spring is shown in **Figure 5.**

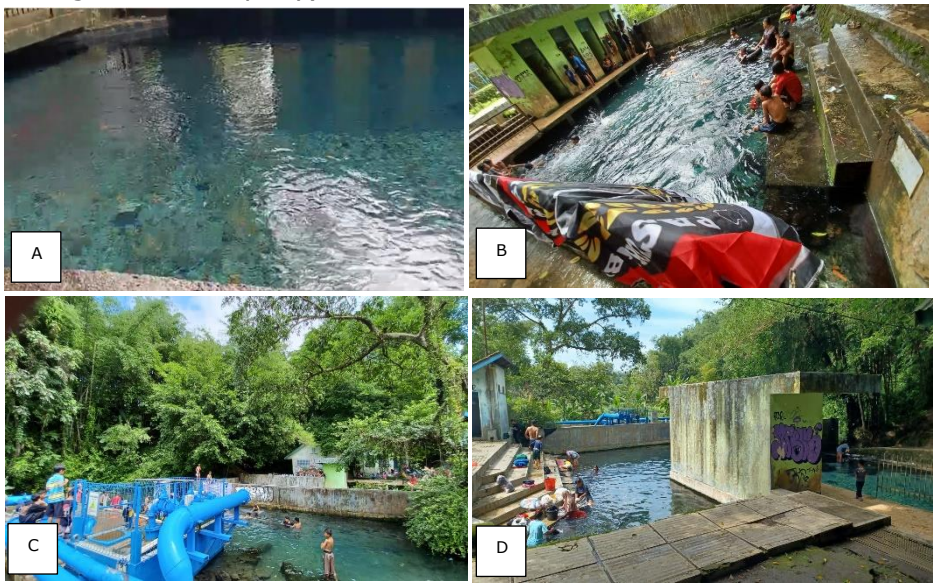

Figure 5. Utilisation of *Ndhas Gendhing* source by residents. (A) The clear water of the *Ndhas Gendhing* source; (B) *Padusan*; (C) Utilisation for PDAM; (D) Washing and bathing.

Indigenous knowledge of villagers in preserving *Ndhas Gendhing* spring water

Ndhas Gendhing is owned by the village, but its management is in the hands of the people of Dusun Ganjuran, Sukorejo Village. The people of the Dusun Ganjuran, especially Karang Taruna, are responsible for its cleanliness and maintenance, including the construction of facilities such as changing rooms, toilets and so on around the spring. However, this maintenance should not be the responsibility of the hamlet alone, but of all people who use the spring facilities. The condition of the water, which never recedes, can deteriorate and become polluted if it is not maintained. The hamlet has written rules for residents and

visitors to dispose of rubbish and change clothes in the right place.

Traditionally, menstruating women are not allowed to bathe in the spring. In addition, those who use the spring are required to avoid profanity. There are three pools at the spring, separated by a wall. However, the wall is hollow at the bottom to allow the water to flow into the river or *Kali Gendhing*.

There used to be a company that wanted to work with the source of the *Ndhas Gendhing* for a drinking water company and water tourism. However, the latest information on its ownership or management is unknown, perhaps due to illness or death. This gives the impression that the spring is only for the benefit of the community and is not used for profit or business.

Another indigenous knowledge related to vegetation is that residents are forbidden to cut down the large trees around the spring, namely the *Preh* and *Ringin* trees. The locals believe that these trees should not be cut down carelessly. A tornado once brought down a branch of the tree. At that time, it was only allowed to cut the branch so as not to disturb people. There are also certain traditional rituals involved in cutting the branches. The local people's belief that trees should not be cut down carelessly is very noble, as it allows water to be stored longer in the roots of the tree. The pools are shown in **Figure 6.**

Figure 6. Division of the bathing pools at the *Ndhas Gendhing* spring. (A) male and female pool areas; (B) male pool area; and (C) female pool area.

Table 3. Linking *Ndhas Gendhing* Spring Water to SDG Goal 6

SDGs National target goal number 6	Function of *Ndhas Gendhing* spring
Raw water supply for households, urban areas, and industries.	• It is used for bathing and washing by both villagers and outsiders. In fact, it was found that people from Magelang City were washing and bathing in the spring because, according to these people, the water in the city was not clean enough. • *Ndhas Gendhing* spring is used for PDAM so that people can easily utilize it for their daily needs.
Improvement and repair of the condition and function of water reservoirs and other water sources	• The preserved vegetation serves to keep the spring water flowing even during the dry season.
Provision of facilities and infrastructure for irrigation	• The *Ndhas Gendhing* spring flows from Sukorejo Village to Kalinegoro and empties into the Progo River. The source successfully provides irrigation facilities for surrounding farms.

Based on the Analytical Framework for Integrating the Sustainable Development Goals (SDGs) with Human Rights Fulfilment Obligations for Indonesia (UNESCO, 2017) goal number 6, the connection of the *Ndhas Gendhing* source for harvesting water is in accordance with **Table 3.**

In addition to SDG Goal 6, the *Ndhas Gendhing* resource also supports SDG Goal 5, which is biodiversity and life on land. Good conditions for biodiversity will support food security. If food security is achieved, the global community will not experience hunger, and other goals in the SDGs can be achieved by 2030.

The limitation of this study is the lack of in-depth investigation of the vegetation, as it is limited to vegetation that has the potential to store water. In addition, the water parameters used are still incomplete. The condition of the *Ndhas Gendhing* spring, which is often used for daily needs, needs innovation so that it does not pollute the soil and the river flow, causing eutrophication. In addition, the results of this research have not been used in school education. The content of the *Ndhas Gendhing* spring is actually suitable for biology, physics, chemistry, geography, and environmental science subjects. However, teachers need to use an indigenous knowledge or local wisdom approach to design such learning knowledge and culture (Adinugraha, 2020, 2022; Adinugraha et al., 2021). More specifically, it can be included in biology education because it is consistent with the learning outcomes of biodiversity, ecosystems, and the environment.

Integrating local wisdom or indigenous knowledge with biology subjects through ethnobiological studies such as ethnobotany, ethnozoology and ethnoecology has the potential to explore local wisdom and cultural approaches (Adinugraha, 2022). Learning by sharing indigenous knowledge about the importance of species in sustaining springs is expected to support students' awareness of the importance of biodiversity values. Making students aware of the importance of biodiversity values is the first step in preventing biodiversity loss.

CONCLUSION

The ethnoecological study of the *Ndhas Gendhing* spring includes vegetation, aquatic fauna, physical and chemical properties of the water, community knowledge of water protection, use of the spring, and do's and don'ts at the spring. There are four plant species that have the potential to protect the *Ndhas Gendhing* spring, namely *Preh, Ringin, Pring Jawa*, and *Pring Petung*. The presence of trees with roots that store water is very important for the existence of the spring. There are nine species of aquatic animals found in the *Ndhas Gendhing* spring, namely *lele lokal, wader, peto, nila, yuyu, melem, kotes, deleg*, and *pelus*. The abundance of fauna proves that the water source is not polluted. Based on the physical and chemical characteristics carried out at 5 stations, namely A, B, C, D, and E, the water condition is odorless and clear. The average pH was 6.92, with an average TDS of 117.6 ppm. This puts the water quality in the excellent category. The abundant water conditions can be used for daily needs such as bathing, washing clothes, and PDAM drinking water. In fact, there are special rituals such as *padusan* and *kungkum*. The villagers still maintain the vegetation because they cannot cut down large trees carelessly. Even if it is cut down because it is exposed to the wind. In fact, certain rituals are performed when the branches of the tree are cut. It is hoped that the younger generation's awareness of the existence of the *Ndhas Gendhing* spring will promote sustainable water security. Local people can benefit from the water if they continue to preserve the surrounding biodiversity.

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