

Etnophysics and Water Conservation Values in the Ruwat Ritual of Jolotundo Temple toward SDG 6

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Article Info

Article history:

Received: 5 January 2026
Revised: 12 January 2026
Accepted: 19 January 2026
Available Online: 30 January 2025

Keywords:

Etnophysics
Ruwat ritual
Jolotundo temple
Water conservation
SDG 6

ABSTRACT

This study explores the concept of ethnophysics in the context of the *Ruwat* ritual at the *Jolotundo* Temple, focusing on its relevance to Sustainable Development Goal 6 (Clean Water and Sanitation). The *Ruwat* ritual, a traditional Javanese purification ceremony centered around sacred water, embodies deep physical, ecological, and spiritual values. Through qualitative ethnographic methods this research identifies the implicit physics concepts underlying the ritual practices. The findings reveal that the *Ruwat* ritual not only represents a form of cultural heritage but also reflects indigenous knowledge systems that align with sustainable water management practices. By interpreting these local traditions through an ethnophysical lens, the study emphasizes the importance of integrating cultural wisdom into science education and environmental conservation. This integration provides a contextualized learning model that strengthens students' understanding of physics concepts while fostering awareness of sustainability and cultural identity. The research concludes that the *Ruwat* ritual of *Jolotundo* Temple serves as a living example of how local culture can contribute to global sustainability goals, particularly in promoting responsible water use and conservation ethics.



INTRODUCTION

Water is universally recognized as the foundation of life on Earth, indispensable for biological, ecological, and human systems. Conserving water resources is vital to ensure the survival of ecosystems, human health, and future generations. Water is the primary medium for biochemical reactions, making up 60–90% of living organisms and enabling metabolism, nutrient transport, and cellular structure (Frenkel-Pinter et al., 2021). Water sustains biodiversity, supports food production, regulates climate, and provides ecosystem services such as purification, flood control, and recreation (Albert et al., 2021; Saccò et al., 2024). Only about 0.3% of Earth's water is easily accessible freshwater, making it a scarce and precious resource (Jung et al., 2023; Razmjoo et al., 2020). Human activities are depleting and polluting water sources, leading to biodiversity loss, ecosystem degradation, and health risks (Qadri et al., 2020). Effective water management, conservation, and restoration are crucial for maintaining ecosystem health, supporting human needs, and achieving global sustainability goals.

Sustainable Development Goal 6 (SDG 6) is central to the United Nations 2030 Agenda,

aiming to ensure the availability and sustainable management of water and sanitation for all. Its importance as a global agenda is multifaceted and foundational for sustainable development. SDG 6 is interconnected with many other SDGs, including poverty eradication, hunger, health, education, gender equality, and environmental sustainability. Progress in water and sanitation accelerates progress in these areas (Cai et al., 2021). Water security is described as a "shining star" that guides progress across the entire SDG framework (Irannezhad et al., 2022). SDG 6 goes beyond basic access, addressing water quality, wastewater management, water-use efficiency, ecosystem protection, and governance, making it relevant for all countries, not just developing ones. It includes eight global targets covering the entire water cycle, reflecting the complexity and universality of water challenges (Sadoff et al., 2020)

Local knowledge and traditional rituals play a powerful role in shaping community habits (Utami et al., 2024). These practices embed ecological values, sustainable resource management, and respect for nature into daily life, often more effectively than external regulations or modern policies. Local wisdom serves as educational tools, passing down knowledge about ecosystem balance, biodiversity, and sustainable practices to younger generations, fostering a sense of stewardship and cultural identity (Fernández-Llamazares et al., 2021). Taboos, sacred sites, and communal rituals create social norms that discourage environmentally harmful behaviors, such as overharvesting or polluting, and encourage collective responsibility (Maru et al., 2020; Sinthumule & Mashau, 2020). When integrated with scientific approaches, traditional knowledge enhances conservation outcomes by aligning with local values and practices, increasing community participation and resilience

Jolotundo Spring, a heritage site from the Majapahit era in East Java, stands out for its unique blend of cultural, spiritual, and ecological values that directly support water conservation. Jolotundo is not only a natural spring but also a sacred site with deep historical roots, revered since the Majapahit Kingdom. This heritage status elevates its importance and fosters a strong sense of community stewardship. The community's high awareness of the spring's value is rooted in local traditions and beliefs, which emphasize the importance of maintaining water quality, environmental cleanliness, and cultural heritage (Rahmawati, 2025; Widodo et al., 2024)

Although the Jolotundo Temple has been extensively studied from historical, archaeological, and spiritual perspectives, research specifically integrating ethnophysics, cultural rituals, and water conservation perspectives remains limited. Most existing studies emphasize the religious or cultural significance of the Ruwat ritual without exploring the potential traditional scientific knowledge embedded within the practice, particularly regarding hydrological systems, water flow behavior, and local ecological principles. Furthermore, few studies have examined how the water conservation values within this ritual can be contextualized within a global sustainability framework such as SDG 6. This gap highlights the need for a new, more interdisciplinary approach to understanding the relationship between ritual practices, traditional physical knowledge, and environmental conservation strategies.

Research on the ethnophysics and value of water conservation in the Ruwat Jolotundo ritual is important because it can make a significant contribution to cultural preservation while strengthening the environmental sustainability agenda. Revealing traditional communities' understanding of water, the rules for its use, and the symbolism of its sanctity can serve as a basis for developing environmental education that is contextual and relevant to local communities. Furthermore, this research has the potential to provide applicable recommendations for the sustainable management of water resources, particularly in addressing the challenges of water quality and quantity degradation in various regions. By linking it to SDG 6, this study can serve as a bridge between modern science and local wisdom, expanding approaches to water conservation rooted in cultural values, while enriching strategies for achieving sustainable development goals at the local and national levels.

RESEARCH METHOD

This study employed a qualitative library research design, focusing on news texts and literature related to the Ruwat Jolotundo ritual. This design aimed to understand the cultural meaning, water conservation values, and ethnophysical concepts represented through media and written sources. This approach was descriptive-interpretive, emphasizing deepening meaning over numerical measurement. The analysis process combined three analytical models: content analysis, discourse analysis, and ethnography, to capture the ritual's representation and ecological values more comprehensively.

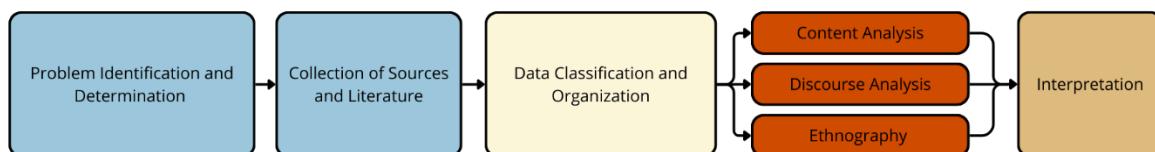


Figure 1. Research method

a. Problem Identification and Determination

The researcher identified key issues regarding water conservation values and ethnophysical elements in the Ruwat Jolotundo ritual and their relevance to SDG 6. This stage included the formulation of the problem, objectives, and research questions.

b. Collection of Sources and Literature

The researcher collected written sources in the form of online news, scientific articles, books, cultural documents, and archives related to Jolotundo and the Ruwat ritual. The collection was conducted systematically, taking into account the relevance of the content, publication timeframe, and source validity.

c. Data Classification and Organization

All collected data was categorized based on the type of information, such as descriptions of rituals, narratives about springs, community perspectives, or ethnophysical explanations. The data was then organized into documentation tables to facilitate the analysis process.

d. Analysis Process

The analysis stage was conducted using three complementary approaches:

1. Content Analysis to identify themes and patterns of representation in news texts.
2. Discourse Analysis to examine the construction of meaning, media narratives, and how language frames rituals and water conservation.
3. Ethnography (Document-Based) to interpret cultural values and ethnophysical elements through available documentation, even without direct field observation.

e. Interpretation

The results of these three analyses are integrated to produce a final interpretation of the relationship between ethnophysics, water conservation values, and the ritual's contribution to SDG 6.

Because this research is library-based, the data sources are not direct human participants, but rather online news from national, local, cultural, and religious media reporting on the Ruwat Jolotundo ritual, digital documents in the form of reports on ritual activities, community archives, or local government publications. Supporting by scientific articles on ethnophysics, water conservation, traditional rituals, and SDG 6, books and academic studies related to the history of the Jolotundo Water Temple and official websites of cultural or village institutions containing ritual information.

RESULTS AND DISCUSSION

The Ruwat Pertirtaan Jolotundo tradition is a ritual with profound meaning related to water as the source of life. In this tradition, the community mixes water from 33 springs on the slopes of Mount Penanggungan as a symbol of manunggaling tиро (water unification). They interpret

water as a symbol of blessing, a source of prosperity, and life that must be preserved and appreciated from generation to generation. Water is considered sacred and vital, flowing not only as a source of irrigation for rice fields but also as a gift from God Almighty. This ritual is an expression of gratitude for the abundance of natural blessings and a commitment to preserving water sources and the surrounding environment (Lestari et al., 2021).



Figure 2. the procession of carrying out the Ruwat Pertirtaan Jolotundo
(Source: <https://radarmojokerto.jawapos.com>)

The quote emphasizes that Mount Penanggungan is viewed as sacred by the community. This demonstrates a strong spiritual and cultural connection to nature.

"One of the cultural stakeholders, Sujoko, stated that the community believes Mount Penanggungan is a sacred mountain that must be maintained. This is expected to maintain the integrity and balance of nature and culture. Water is an absolute necessity for humanity."

Reported on: <https://xtimenews.com/2019/09/08/ruwatan-sumber-pertirtaan-jolotundo-tradisi-turun-temurun-setiap-tahun-di-bulan-suro/>

The belief that the mountain must be "preserved" embodies environmental conservation values rooted in local culture. This statement emphasizes the hope for integrity and balance, confirming that the community views nature and culture as an interconnected whole. This is further emphasized by the phrase "Water is an absolute necessity for humanity," indicating that water conservation is considered important not only from an ecological perspective but also from a humanitarian perspective.

The word "sacred" creates a discourse that nature is not just a resource, but also an entity of spiritual value that must be respected. The use of the terms "maintained" and "balance" constructs a narrative of conservation as a moral and cultural obligation, not simply a technical responsibility. The final statement about water reinforces the discourse that water conservation is a fundamental human need, thus giving rituals or conservation actions ethical legitimacy.

Belief in the sacredness of Mount Penanggungan reflects a local belief system that positions nature as a "subject" that must be protected. The concept of nature-culture balance aligns with ancient Javanese values that emphasize harmony. The statement about water as an absolute necessity demonstrates that the Jolotundo spring is not only a place for rituals, but also a place to fulfill daily life needs.

"The source of life is inseparable from water. During the month of Suro, water from this sacred spring is collected from 33 springs beneath Mount Penanggungan"

Reported on: <https://xtimenews.com/2019/09/08/ruwatan-sumber-pertirtaan-jolotundo-tradisi-turun-temurun-setiap-tahun-di-bulan-suro/>

The narrative links two concepts there are (1) water as a source of life, and (2) sacred water as an entity that must be treated with respect. This constructs a discourse that environmental care is not only an ecological act, but also a moral and spiritual one. The statement "The source of life is inseparable from water" affirms the universal concept that water is a fundamental element for the survival of humans, nature, and culture. The context of "sacred spring" indicates that the Jolotundo spring and the springs at the foot of Mount Penanggungan hold a high spiritual status

in local culture. The collection of water during the month of Suro indicates a ritualistic practice structured according to the Javanese cultural calendar, where the month of Suro is associated with purification, contemplation, and salvation.

"The highlight of the Ruwat Agung Patirtaan is the mixing of water from 33 springs on the slopes of Mount Penanggungan, along with a cultural procession. The philosophical meaning of the Ruwat Agung Patirtaan also serves as a manifestation of the community's gratitude for the abundance of spring water on the slopes of Mount Penanggungan,"

Reported on: <https://radarmojokerto.jawapos.com/mojokerto/821801980/ruwat-agung-patirtaan-jolotundo-mojokerto-merawat-tradisi-dan-penghormatan-terhadap-alam>

The ritual's culmination, the mixing of water from 33 springs, demonstrates that the community is not simply celebrating a tradition but also engaging in a symbolic act of conservation. Water from various sources is collected and combined, reflecting the importance of maintaining the sustainability of all springs in the area. Ethnologically, this action affirms the community's understanding of the Penanggungan Mountains' hydrological system and the interconnectedness of springs within a single ecosystem.

During the ritual cleansing process, the community is also encouraged to maintain the sustainability of the water sources, flora, and fauna around the Jolotundo Water Temple with full respect and reverence for their ancestors and nature. They believe that preserving the purity of the water source is part of their ecological responsibility, passed down through generations. The Jolotundo Bathing Pool ritual, in addition to being a cultural ritual, also serves as a means of education and a means of preserving nature for the continued well-being of the local community.

"The philosophy of the Ruwat Agung Patirtan ritual is that the community asks for blessings from God Almighty, meaning that the water sources (springs) will flow smoothly and even increase.... The community's goal is to carry out this activity as a form of gratitude for the abundance of blessings, the blessings of nature and ancestors."

Reposted on <https://jatim.tribunnews.com/2023/07/20/mengenal-tradisi-ruwat-agung-patirtan-jolotundo-mojokerto-penyatuhan-33-mata-air-lereng-penanggungan>.

The meaning of water in this tradition is closely linked to the concepts of life, purity, and blessings. Water symbolizes the spiritual and physical connection between humans, nature, and God, manifested through the ritual of uniting water from various sources. This tradition reflects the community's cultural awareness of the importance of water as a vital element that must be protected and respected to sustain sustainable life.

"The purpose is to seek blessings from the Jolotundo spring, which has long been a source of life for the people of Biting Hamlet. Mukade explained that the water from Jolotundo has symbolic significance as a source of prosperity. With the water from Jolotundo spring, the community can live a prosperous life. This water is used for economic, social, and daily needs. The water from the purification ritual is then distributed to the surrounding community and visitors"

Reposted on: <https://beritajatim.com/ruwat-agung-petirtaan-jolotundo-warga-trawas-mojokerto-syukuri-limpahan-air-kehidupan>.

Physically, water is understood as a material composed of H_2O molecules with scientific characteristics that enable life to exist on Earth. Water has a high heat capacity, capable of absorbing energy without a significant increase in temperature, thus playing a vital role in maintaining climate stability and environmental temperature. In the hydrological cycle, water undergoes repeated processes of evaporation, condensation, and precipitation, providing a supply of fresh water for living things. Water is also involved in various physical and geophysical processes, such as erosion, sediment transport, and the formation of soil structure and mountain slopes. Thus, from a scientific perspective, water is a basic element that operates according to the laws of physics, yet has a very important ecological function for the sustainability of life and the balance of nature.

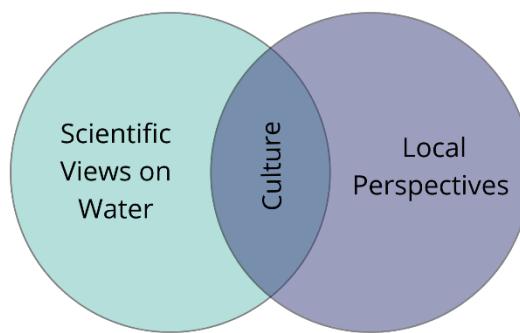


Figure 3. The Meaning of Water from a Physical and Social Perspective in the Ruwat Patirtaan Ritual

For the people around Mount Penanggungan, water has a meaning that goes far beyond its biological function. In the Ruwat Patirtaan ritual, water is seen as a source of spiritual life and a symbol of ancestral purity. Water drawn from 33 springs is treated as a sacred entity that brings blessings, protection, and balance to humans and nature. The process of mixing water from various springs not only signifies the diversity of natural resources but also conveys a message about the importance of maintaining the continuity of each water source to maintain harmony. The community interprets water as a manifestation of gratitude and a reminder that environmental sustainability, especially in mountain and forest areas, is a moral and spiritual obligation. Thus, water in this ritual serves as a medium connecting humans with nature, traditions, and Javanese cosmological values.

The meaning of water in the world of physics and in the cultural traditions of society actually complement each other and show a strong connection.

Table 1. The Relationship Between the Physical and Cultural Meanings of Water in the Perspective of Ethnophysics

Aspect	Scientific/Physical	Cultural/Spiritual	Connection in Ethnophysics Perspective
Nature of Water	A substance (H_2O) with measurable physical properties such as density, surface tension, freezing and boiling points.	A sacred entity, a source of purity, blessing, and protection.	Empirical understanding of water's unique properties is translated into symbolic sacredness.
Water's Primary Function	Supports biological life, regulates temperature, and maintains ecosystem balance.	Supports spiritual life, purifies body and soul, and maintains harmony between humans and nature.	Biological functions are enriched by symbolic meaning, reinforcing ecological awareness.
Water Role in Nature	A key component of the hydrological cycle and geophysical stability of mountains.	A component of local cosmology, linked to the harmony of mountains, forests, and ancestral spirits.	The water cycle is interpreted as a manifestation of human-nature interconnectedness.
Observed Physical Phenomena	Water discharge changes with seasons; quality is influenced by forest conditions and land cover.	Abundant springs are viewed as blessings that must be honored and protected.	Observations of natural changes become the basis for traditional conservation values.
Water Conservation Perspective	Sustainability depends on land cover, infiltration, and scientific environmental management.	Conservation is seen as a moral-spiritual duty: protecting the mountain means protecting life.	Sacredness produces social norms aligned with scientific water conservation principles.

Aspect	Scientific/Physical	Cultural/Spiritual	Connection in Ethnophysics Perspective
Water Implications for Society	Water must be managed scientifically to ensure sustainable resources.	Water is honored through collective rituals and symbolic practices such as Ruwat Pertirtaan.	Local wisdom functions as a culturally grounded strategy to support water sustainability

This table explains how the Ruwat Pertirtaan Jolotundo tradition is not only a spiritual and cultural ritual, but is also closely related to real efforts to conserve and preserve water resources in the region.

Table 2. Aspects of the Jolotundo Ruwat Pertirtaan Ritual and Their Relation to Water Conservation

Aspects of the Jolotundo Ruwat Pertirtaan	Relation to Water Conservation
Unification of 33 Springs	Symbolizes the importance of preserving multiple water sources, which function as key catchment areas.
Ritual of Gratitude for Water	Encourages community awareness to value and care for water sources as a precious blessing.
Environmental Preservation around Water Sources	Promotes cleanliness and protection of the flora and fauna surrounding Jolotundo, helping maintain a healthy water ecosystem.
Respect for Ancestors and Nature	Instills ecological responsibility to preserve water and the surrounding environment for future generations.
Cultural Educational Medium	Educes the community about the importance of water conservation through tradition and local wisdom.

The Ruwat Pertirtaan Jolotundo tradition strongly correlates with the Sustainable Development Goals (SDGs), particularly SDG 6, which addresses the provision and sustainable management of clean water and sanitation for all. This tradition instills the values of respect, preservation, and sustainable management of water sources in the cultural and spiritual realms of local communities, aligning with SDG 6's target of ensuring the availability and sustainable management of clean water.

The Ruwat Pertirtaan ritual, through the unification of springs and the maintenance of the environment around water sources, contributes to collective community awareness of maintaining the cleanliness, sustainability, and purity of water as a source of life, which is also central to water conservation efforts under SDG 6. The education and community participation in maintaining and managing water sources in this tradition align with SDG target 6.b, which emphasizes the importance of supporting and strengthening local community participation in water and sanitation management.

This description and practice demonstrate how Ruwat Pertirtaan Jolotundo is not only a cultural ritual, but also an effective way to conserve water resources that directly contributes to the achievement of SDG 6. These practices increase access to clean water, maintain water quality from pollution, protect aquatic ecosystems, and encourage active community participation in sustainable water conservation.

Table 3. Water Conservation Practices in the Jolotundo Ritual and Their Alignment with SDG 6

Water Conservation Practice	Description	SDG 6 Target Point
Unification of water from 33 springs	The ritual of mixing water collected from various springs on the slopes of Mount Penanggungan, symbolizing the protection and sustainability of multiple water sources.	6.1: Ensure universal and safe access to clean drinking water
Maintaining the cleanliness of water sources	Cleaning and preserving the surrounding area of the sacred bathing site to maintain water quality and prevent contamination.	6.3: Improve water quality and reduce pollution

Conservation of surrounding vegetation and fauna	Protecting plants and animals around the water springs to sustain a balanced and healthy water ecosystem.	6.6: Protect and restore water-related ecosystems
Community education and awareness	Raising community awareness and participation in protecting water sources as both cultural heritage and essential resources for life.	6.b: Support and strengthen community participation in water management
Rituals of gratitude and reverence for water	Honoring water as the source of life through rituals that cultivate spiritual and social values for sustaining water resources.	Strengthens all SDG 6 targets holistically

CONCLUSION

This study concludes that the Ruwat Patirtaan tradition at Jolotundo embodies a culturally embedded system of water conservation that integrates physical understanding of water with local spiritual and ecological values, effectively addressing the research problem of how ethnophysics intersects with cultural rituals to support SDG 6. The findings imply that cultural practices can serve as powerful social instruments for promoting sustainable water management when aligned with scientific perspectives. However, the study is limited by its reliance on secondary sources, particularly news-based literature, which may not fully capture the depth of community interpretations and on-site ecological dynamics. Future research should expand by incorporating field observations, ethnographic engagement, and hydrological assessments to further develop a more comprehensive understanding of how traditional rituals contribute to water sustainability within broader environmental and educational frameworks.

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