Realizing the Right to a Healthy Environment through Customary Forest Conservation: A Local Wisdom Approach

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A B S T R A C T

This study examines how local wisdom-based conservation in the Wonosadi Customary Forest contributes to the fulfilment of the constitutional right to a good and healthy environment in Indonesia. Using a descriptive qualitative approach, data were collected through in-depth interviews, participatory observation, and document analysis conducted between February and June 2025. Fifteen informants were purposively selected, including traditional leaders, members of the forest management group, residents, and village officials. Data were analyzed thematically through coding, categorization, and interpretation, supported by methodological and source triangulation. The findings demonstrate that local values, such as *pamali* (customary prohibitions), rituals, and customary institutions, form a participatory governance system that effectively regulates forest use and maintains ecological balance. Conservation practices have improved vegetation cover, air quality, and spring water availability while reducing ecological risks such as floods and landslides. These efforts also support community welfare through agroforestry and the sustainable use of non-timber forest products. Overall, the model contributes to Sustainable Development Goals (SDGs) 3, 6, 13, 14, and 15, demonstrating that conservation rooted in local wisdom can serve as an effective and adaptive strategy for sustainable resource management. However, its long-term success depends on strong social institutions, intergenerational knowledge transmission, and cultural cohesion.

A. INTRODUCTION

A clean and healthy environment is recognised as a fundamental human right in both national and international legal frameworks. This right is explicitly guaranteed in Article 28H paragraph (1) of the 1945 Constitution of Indonesia. Law No. 32 of 2009 further reinforces the obligation of the state to ensure environmental protection as part of human rights fulfillment. Global instruments, such as the Stockholm Declaration, the Rio Declaration, and UNHRC Resolution No. 48/13, affirm the universality of environmental rights. These principles establish a strong normative basis for the state to prevent environmental degradation. However, the persistence of ecological pressures in Indonesia shows that the constitutional mandate has not yet been fully realised.

Indonesia continues to face serious environmental challenges that hinder the fulfillment of the right to a healthy environment. Deforestation rates have increased significantly, reaching 175,400 hectares in 2024 according to

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official government data. Waste management remains insufficient, as more than one-third of national waste is not properly handled. These environmental problems directly contribute to water, soil, and air pollution in many regions. Pollution also increases the incidence of environment-related diseases, ranging from respiratory infections to skin disorders. The deterioration of environmental quality thus affects health, livelihoods, and long-term sustainability.

Top-down environmental governance approaches have often failed to effectively address local ecological problems. These approaches tend to marginalise the knowledge, interests, and capacities of local communities. Many conservation policies have also facilitated extractive activities that threaten customary lands and environmental rights. Studies repeatedly show that externally imposed conservation models generate weak compliance and limited ecological outcomes. In contrast, participatory and community-based approaches demonstrate stronger long-term effectiveness. This necessitates exploring governance strategies grounded in local contexts and community values.

Local wisdom provides an important foundation for sustainable natural resource management within many Indonesian communities. It encompasses accumulated knowledge, value systems, and social norms developed through long-term interactions between humans and their environment. Customary rules such as *pamali* function as mechanisms of social control over resource access. Rituals and seasonal practices regulate ecological cycles and maintain ecosystem balance. Community deliberations reinforce collective responsibility for environmental protection. These culturally embedded mechanisms have tangible ecological benefits that support sustainability.

The Wonosadi Customary Forest represents a strong example of how local wisdom can support effective conservation practices. Historically degraded due to long-term exploitation, the forest has been rehabilitated through community-led initiatives since the late 1980s. Its management integrates spiritual values, customary prohibitions, and customary institutional structures. The forest, situated in a vulnerable karst ecosystem, now plays a crucial role in regulating hydrology and protecting biodiversity. Its 25-hectare vegetation cover serves as a buffer against drought and ecological risks. The forest's success also reflects the resilience of local cultural identity and social cohesion.

This study addresses the limited scholarly attention to the relationship between local wisdom-based conservation and the fulfilment of environmental rights. Existing research often focuses on ecological outcomes without examining implications for human rights and environmental justice. A rights-based lens is essential to understand how community governance contributes to broader social and legal protections. The Wonosadi case provides an empirical basis for analyzing how customary practices support the realization of the right to a healthy

environment. This study also evaluates the relevance of such practices to Sustainable Development Goals (SDGs). The findings aim to inform more participatory, equitable, and culturally grounded environmental governance frameworks in Indonesia.

B. METHOD

This study used a descriptive qualitative design to analyse how local wisdom supports the fulfilment of environmental rights in the Wonosadi Customary Forest. This design was chosen because it offers contextual depth without the prolonged immersion of ethnography or the structural rigidity of a case study, allowing flexible exploration of cultural meanings, governance norms, and ecological practices.

Data were collected from February to June 2025 through semi-structured interviews, participatory observations, and document analysis. Informants were selected using purposive sampling based on three criteria: involvement in conservation activities, knowledge of customary traditions, and community recognition as credible knowledge holders. Fifteen informants participated, comprising traditional leaders, forest managers, nearby residents, village officials, and one environmental agency officer.

The researcher acted as an observer–participant, maintaining reflexivity through field notes and adhering to ethical procedures, including obtaining informed consent and respecting customary protocols. Observations followed a basic protocol, documenting conservation activities, community meetings, customary rule enforcement, and ecological indicators, all with permission.

Data were analysed thematically through open coding, categorisation, and interpretive synthesis, linking emergent themes with theories of commons governance and ecological justice. Credibility was enhanced through method triangulation (interviews, observations, documents), source triangulation across actor groups, and member validation with community representatives to ensure contextual accuracy.

C. RESULTS AND DISCUSSION

A. Conservation of Wonosadi Customary Forest Based on Local Wisdom

a. Socio-Ecological Profile of Wonosadi Customary Forest

Wonosadi Forest in Gunungkidul represents a community-based governance system where local wisdom serves as an ecological regulatory mechanism. Cultural narratives surrounding figures such as Onggoloco function as symbolic institutions that reinforce compliance with protection rules, particularly in

core forest zones and hydrological areas. These belief systems internalise environmental ethics and deter activities that may threaten forest integrity, reducing the need for coercive enforcement.

The translation of cultural norms into practice is reflected through mechanisms such as *pamali* (taboo-based restrictions), musyawarah (participatory deliberation), and sadranan (ritualised environmental maintenance). These institutions coordinate collective labour for habitat protection—including vegetation monitoring and spring preservation—while simultaneously strengthening social cohesion and shared responsibility.

Historical experiences of degradation, notably during the 1960s, have further shaped adaptive management responses. Community-led reforestation efforts and the designation of forest blocks under hamlet responsibility demonstrate how local knowledge evolves into structured governance arrangements aimed at sustaining ecological functions in a vulnerable karst landscape. Empirical observations confirm the effectiveness of this system: customary protection zones maintain higher canopy density, reduced surface runoff, and more stable spring discharge compared to adjacent non-protected areas. Thus, belief-informed governance in Wonosadi exemplifies how culturally embedded norms can operate as legitimate and measurable ecological regulation, contributing to long-term ecosystem resilience.

Local wisdom is also evident in the reforestation of Wonosadi Forest in 1966, following the forest's near destruction by looting during the 1960-1965 period. The community and village officials worked together to replant trees and divide the forest area into blocks of hamlet responsibility. This activity not only restored the forest ecosystem but also strengthened collective awareness of the importance of protecting the forest. The success of this reforestation is supported by local idioms such as "tekan" (earnestly), "teken" (instruction), and "tekan" (achieving the goal), which serve as community guidelines in forest management. Besides mythology and history, environmental wisdom in Wonosadi Forest is also shaped by empirical experiences of the community. For example, the landslides and droughts that followed the destruction of the forest in the 1960s became valuable lessons about the negative impacts of deforestation. Myths, such as the notion that houses collapse or illnesses are caused by breaking customary rules, also strengthen community compliance. Traditions such as *sadranan* (clean village) and belief in the concept of *sangkan paraning dumadi* (the origin of life) further bind the community spiritually and socially to preserve the forest (Ahsan Nurhadi, Bakti Setiawan, 2012).

The Wonosadi Forest management model combines aspects of mythology, reality, and customary institutions to create sustainability. Informal institutions, such as

caretakers from Onggoloco's descendants and Baladewi's formal institutions, play a crucial role in preserving local wisdom values. Public awareness of the benefits of forests, including their role as water sources, protection from disasters, and biodiversity, is a key factor in forest sustainability. Thus, local wisdom in Wonosadi Forest not only preserves nature but also serves as an example for sustainable forest management in other areas.

The Wonosadi Customary Forest in the karst region of Gunungkidul illustrates the effectiveness of community-based ecological restoration in biophysically vulnerable landscapes. The transition from degraded land to a productive forest ecosystem reflects adaptive strategies that mitigate drought and erosion hazards. Research in the region confirms that agroforestry substantially improves vegetation cover, soil fertility, and water availability in karst environments (Sulistiyowati et al., 2023), demonstrating that locally driven conservation approaches play a significant role in enhancing ecosystem resilience.

The governance of Wonosadi is grounded not only in ecological objectives but also in the community's cultural and spiritual values. Customary prohibitions, periodic rituals, and participatory deliberation constitute an adaptive and legitimate governance structure that regulates resource use and maintains social cohesion. Previous studies emphasise that integrating social forestry with local cultural values strengthens biodiversity conservation outcomes (Gunawan et al., 2022), while social capital—expressed through collective labour, deliberation, and traditional leadership—forms a critical foundation for the sustainability of community forest management (Oktalina et al., 2022).

Local wisdom in Wonosadi functions as a socio-ecological regulatory mechanism rather than merely a normative belief. The *pamali* system restricts extractive activities in ecologically sensitive zones and embeds compliance through moral and spiritual sanctions. Empirical observations reveal that areas under these restrictions exhibit denser canopy cover, higher litter biomass, and more stable spring discharge, indicating measurable ecological effects. Rituals such as sadranan operate as institutionalised maintenance cycles, facilitating habitat monitoring, invasive species control, and watershed protection. These practices demonstrate that cultural norms and social participation are integral to forest regeneration and long-term ecological stewardship.

b. Community-Based Forest Management and Social Capital

These findings illustrate that the effectiveness of *pamali* and ritual practices lies in their dual function: as moral regulation and as collective environmental management. The Wonosadi case thus provides empirical evidence that culturally embedded rules can yield measurable ecological outcomes through mechanisms of

social control, community participation, and repeated ritual-based maintenance.

This is in line with the findings of (Jamalludin et al., 2023) which show that customary rituals in Hutan Adat play an important role in forest conservation. Customary practices, such as the pamali system and religious rituals, have served as social regulatory mechanisms in sustainable natural resource utilization. *Pamali*, as a social control tool that incorporates custom-based prohibitions, plays a role in preventing exploitative actions that have the potential to damage forest ecosystems. Meanwhile, religious rituals strengthen the spiritual bond between the community and the natural environment, encouraging responsible conservation behavior. Research (Yasir et al., 2022) revealed that local wisdom-based environmental communication systems including the concept of Rimbo Larangan in Riau, showed significant effectiveness in forest conservation efforts. Similar findings by Abas et al. (2022) identified various spirituality-based conservation methods, such as the Sasi and Kasse tanda systems practised by the Tobaru community in Eastern Indonesia.

Wonosadi communities play a central role in forest management, acting as guardians of the implementation of customary rules and as mediators in conflict resolution related to the utilization of forest resources. This active role ensures that forest management is collective and oriented towards local values. Studies by Purba & Mardawani (2023) confirm that customary institutions are key pillars in maintaining the sustainability of customary forests. Similar findings were reported by Hakim et al. (2021), who confirmed that community participation in local wisdom-based decision-making is able to reduce forest degradation and preserve nature (Asteria et al., 2024)

Formal recognition of local wisdom in forest management faces complex challenges. Law No. 41/1999 on Forestry explicitly recognises the existence of customary forests; however, the implementation of this policy in the field still shows various structural weaknesses, and there is a need to strengthen the legal status of local wisdom so that it can be effectively integrated into national forestry policy (Helmi et al., 2023). The integration of local wisdom in forestry policy requires an adaptive and participatory approach. Top-down policies are often incompatible with local realities and can ignore knowledge and practices that have developed over generations. Therefore, a bottom-up approach that involves customary peoples in policy formulation is crucial.

Education and community awareness are important aspects in strengthening local wisdom-based conservation. The integration of local knowledge in the education curriculum can improve the younger generation's understanding of the importance of protecting forests. A systematic review (Sihombing et al., 2025) demonstrates that integrating local wisdom into environmental education can enhance students' ecological literacy. Research by Nur et al. (2022) demonstrates that the local wisdom of customary peoples can serve as a valuable learning resource in education, thereby strengthening students' ecological literacy. The study by Hasan & Muzainah (2022) confirms that environmental education based on local wisdom can increase community awareness and participation in forest conservation. The role of women in local wisdom-based forest conservation also deserves attention. In some areas, women are actively involved in forest patrols and other conservation activities. Their involvement not only strengthens forest conservation efforts but also empowers women in decision-making related to natural resource management.

The primary challenges in preserving local wisdom stem from economic pressures and the dynamics of social change that have the potential to undermine the sustainability of traditional systems. Modernisation and globalisation processes often result in the erosion of traditional values that underpin community-based forest management. This requires the development of innovative adaptation strategies that enable the dynamic transformation of local wisdom, while preserving its core principles and essential values. Studies by Hasbiah (2015) emphasise the importance of forest protection through local wisdom as an effective conservation strategy. In addition, research by Wenno et al. (2021) highlights the importance of forest protection through local wisdom as an effective conservation strategy.

Collaboration between customary communities, government, academia, and non-governmental organisations is essential to strengthening forest conservation based on local wisdom. Such partnerships facilitate the integration of local and scientific knowledge into policy design, ensuring that forest governance aligns with the socio-cultural aspirations of indigenous communities. Evidence from various regions confirms the effectiveness of collaborative governance: cooperative management in Kerinci enhances customary forest protection (Erika Novianti & Hariyadi, 2022), while stakeholder collaboration has resolved tenure conflicts and restored social relations in Lombok (Nindyatmoko et al., 2022). Customary institutional involvement is also shown to be vital in forestry conflict management across Indonesia (Fisher et al., 2017). Aligning with these findings, Wonosadi's conservation practices require sustained multi-stakeholder engagement to strengthen their role as a resilient governance model that can be adopted within broader policy frameworks (Sunjaya et al., 2024).

Within Wonosadi, the customary institution serves a dual function as both conflict-resolution authority and supervisor of customary rule enforcement. Disputes over forest access and utilisation are resolved through consensus-based deliberation, ensuring decisions remain embedded in collective values and ecological priorities.

This approach exemplifies collaborative governance, where multi-level actors contribute to maintaining social cohesion and ensuring resource sustainability. Such mechanisms reinforce the strategic role of customary institutions as key actors in forest governance and conflict resolution throughout Indonesia (Fisher et al., 2017; Nindyatmoko et al., 2022).

Analysing local wisdom in the Wonosadi Customary Forest through a political ecology perspective reveals the dynamics of power and political relations in human-environment interactions. Customary practices in this context operate as an ecoregulatory mechanism that regulates natural resource utilisation autonomously from formal state structures. This phenomenon proves the capability of local communities to manage natural resources effectively through a system of social norms and regulations that have been institutionalised for generations. Research by Hasan and Muzainah (2022) confirmed that the local wisdom model in forest management in Central Kalimantan represents a community-based sustainable environmental management system. In parallel, the findings of Nur et al. (2022) highlighted the crucial role of local wisdom among customary peoples in conserving forest resources and its potential as a knowledge base in the education curriculum.

The concept of commons management, developed by Elinor Ostrom (Kusumawati & Abisono, 2023), offers a relevant analytical framework for understanding the Wonosadi Customary Forest management model. The local community in Wonosadi proved its ability to effectively manage common resources through autonomous institutions that developed endogenously, without the need for external intervention. Customary institutions and social practices, such as the pamali system and religious rituals, function as collective regulatory mechanisms that ensure the sustainability of the forest ecosystem. Research (Liani et al., 2016) reveals the success of participatory models in customary forest management, which is based on strict customary rules for maintaining forest sustainability. Consistently, Undri's (2016) findings highlight the crucial role of the local wisdom of the Tabala Jaya Village community in South Sumatra in maintaining the sustainability of forest management through a knowledge system transmitted across generations.

The integration of local wisdom in national forestry policy still faces challenges, especially in terms of the formal recognition of customary peoples' rights. Although Law No. 41/1999 on Forestry recognises the existence of customary forests, its implementation in the field often encounters obstacles. Research by Hasan & Muzainah (2022) indicates that the recognition of customary peoples' rights in forest management remains limited, necessitating further efforts to strengthen their legal position. Studies by Undri (2016) also emphasise the importance of formal recognition of local wisdom in forest management to support environmental sustainability and the welfare of customary peoples.

Local wisdom has a significant role in supporting the success of critical land rehabilitation through the integration of traditional knowledge and community participation. A concrete example can be seen in the practice of Huyula in Indonesia, which applies the principle of gotong royong and customary norms, proven to increase the effectiveness of critical land recovery in agroforestry systems (Suparwata, 2024). Active community involvement in local wisdom-based conservation activities not only accelerates ecosystem recovery but also strengthens a sense of ownership and collective responsibility for the environment. Studies by Abas et al. (2022) confirm that the local wisdom of customary peoples plays a crucial role in nature conservation and ecosystem sustainability. Local wisdom makes a significant contribution not only to land rehabilitation but also to the ecosystem and social resilience of communities. Traditional ecological knowledge facilitates community adaptation to environmental change and supports sustainable management of natural resources. The integration of traditional ecological knowledge into the habitat restoration process can improve long-term social-ecological resilience while strengthening strategies to fulfill the community's needs. (Haq et al., 2023).

Figure 1. Integration of Local and Traditional Knowledge in Community Development

B. Fulfilment of the Right to a Healthy and Clean Environment

a. Right to Health in Wonosadi Conservation

Wonosadi forest conservation based on local wisdom represents the real implementation of the right to a good and healthy environment as mandated in Article 28H paragraph (1) of the 1945 Constitution and Article 65 of Law No. 32/2009. The fulfillment of the right to a good and healthy environment is a fundamental aspect of natural resource management, which is effectively realized through locally wisdom-based conservation in the Wonosadi Customary Forest. Customary practices rooted

in local wisdom values have been able to sustainably maintain forest cover, water quality, and ecosystem balance. One indicator of the success of this conservation is the significant increase in vegetation cover, which has a direct impact on the surrounding air quality. Research by Wróblewska & Jeong (2021) demonstrates that vegetation, including trees and other green infrastructure, is effective in reducing particulate matter (PM) in the air, thereby contributing to improved air quality and public health. The study by Zhang et al. (2021) revealed that forests can remove about 874 tonnes of PM2.5 per year, demonstrating the significant role of vegetation in improving air quality. Similarly, a study by Abhijith et al. (2017) confirmed that vegetation can effectively reduce the concentration of air pollutants, especially fine particulate matter (PM2.5) and nitrogen dioxide (NO_2), through natural deposition and filtration processes. The reduction of air pollution through vegetation reduces the risk of respiratory and cardiovascular diseases, thus fulfilling the right to health (right to the highest attainable standard of health in ICESCR Article 12). Studies by Nowak (n.d.) show that trees are capable of removing 22.4 million tonnes of air pollution, which has a positive impact on human health and lowers the burden of disease due to air pollution, indirectly fulfilling the right to a healthy life. A report from IUFRO (2022) confirms that forests help mitigate health risks by filtering pollutants from the air and providing space for physical activity, which is essential for both mental and physical well-being. Ecologically managed vegetation can significantly reduce the burden of air pollution, with direct impacts on people in the form of improved health.

b. Right to Water and Spring Water Availability

Wonosadi Customary Forest conservation, based on local wisdom, has significantly contributed to the recovery of springs that previously experienced decreased discharge or even drought, thereby becoming an important element in providing clean water for the surrounding community. Increasing forest cover through community-based conservation plays a crucial role in maintaining the local hydrological cycle and enhancing the capacity of water infiltration into the soil. Research by Huaraca Huasco et al. (2021) revealed that fine root dynamics in pantropical tropical rainforest ecosystems play a crucial role in the water cycle, with longer and thinner roots enhancing water uptake capacity and water use efficiency in plants. In addition, a study by Ceolin et al. (2025) demonstrated that root growth responses to rapid and localized changes in soil moisture can influence root allocation and growth dynamics, thereby contributing to plant water use efficiency. Research by Huang et al. (2024) emphasises that tree root structure plays a role in soil water dynamics, with deep-rooted species increasing water storage capacity in the soil and supporting drought resistance. The study suggests that root adaptation to drought conditions

contributes to the sustainability of the clean water supply. In this context, the conservation of the Wonosadi Customary Forest not only maintains the sustainability of the forest ecosystem but also plays a strategic role in supporting the community's right to clean and safe water in a sustainable manner, while strengthening ecosystem and social resilience to climate change and environmental stress.

c. Protection against Ecological Disasters

Wonosadi Customary Forest Conservation plays a crucial role in fulfilling the right to a healthy environment, including protecting communities from the risks of ecological disasters such as floods, landslides, and droughts, while ensuring the realization of a safe, healthy, and sustainable environment. Forest conservation is proven to play a crucial role in mitigating these risks by maintaining soil stability and regulating local hydrological cycles. Forest vegetation and strong roots help prevent erosion and landslides, while the canopy reduces the direct impact of rainfall. Studies by Liu et al. (2022) demonstrate that reforestation in hilly areas enhances slope stability and substantially reduces landslide occurrences. In addition, research by Jia et al. (2022) confirmed that good forest cover acts as an ecological buffer, mitigating flood impacts and maintaining river water quality. Research by Nugraheni et al. (2022) supports these findings by showing that community-based conservation in disaster-prone areas reduces the frequency and impact of floods and landslides. This approach integrates local wisdom values in environmental management to strengthen the social-ecological resilience of communities. In addition, McVittie et al. (2018) reveal that healthy forest ecosystems can serve as a natural buffer against extreme climate change, strengthening communities' resilience to disaster risks.

d. Environmental Quality Management Supporting Wonosadi Conservation

Ensuring the right to a clean and healthy environment in the Wonosadi Customary Forest area requires a holistic approach that addresses environmental quality components beyond forest protection alone. Waste mismanagement in surrounding settlements risks contaminating springs and soil, potentially undermining the ecological benefits of community-led conservation efforts. Implementing community-based waste governance, such as TPS 3R, is therefore essential to safeguarding forest ecosystem functions. Empirical studies confirm that TPS 3R contributes to reducing waste volume and producing compost that enhances agroforestry productivity in Wonosadi (Muhamad et al., 2024; Putri & Purnomo, 2023). The sustainability of TPS 3R operations depends on strong institutional capacity, active participation, and effective governance—principles aligned with Wonosadi's collective environmental stewardship model (Made Wahyu Widyarsana et al., 2024; Lupiyanto et

al., 2023). Thus, participatory waste management serves as a strategic extension of Wonosadi's customary conservation practices to prevent environmental degradation originating from residential areas.

Acoustic comfort also constitutes a critical dimension of environmental well-being for communities living adjacent to conservation zones. Excessive noise levels have been shown to negatively affect mental health and quality of life, as evidenced by findings in industrial and urban environments where noise exceeds safety thresholds (Meilasari et al., 2025; Nurmaningsih et al., 2019). Forest vegetation serves as an ecological noise buffer, absorbing and reducing sound propagation, thereby contributing to healthier living conditions for surrounding residents. Maintaining and enhancing vegetation cover in Wonosadi consequently supports biodiversity conservation while simultaneously mitigating noise disturbances. Such a multifunctional conservation strategy reinforces the forest's role in delivering ecosystem services—ecological, social, and health-related—while aligning with policy directions that emphasise vegetation-based noise control (Meilasari et al., 2025).

C. Fulfillment of Other Social Rights through a Healthy Environment

The implementation of local wisdom-based conservation in Wonosadi Customary Forest strengthens the social dimension of environmental management. The active participation of the community in maintaining and utilising the forest sustainably creates a sense of belonging and shared responsibility. Research by Hakim et al. (2025) shows that a local wisdom-based education approach increases community awareness and skills in biodiversity conservation. Similarly, a study by Wulandari et al. (2023) confirms that community participation in conservation partnerships significantly contributes to the recovery of the Bunder swamp ecosystem. Overall, the Wonosadi forest conservation model not only ensures the right to a healthy and clean environment but also serves as an exemplary best practice in community-based natural resource management. This approach aligns with the principles of sustainable development and can be replicated in other areas with similar conditions. The study by Yumantoko, Triyono, and Suharko (2024) emphasises the urgency of community participation in environmental conservation through the implementation of social forestry. In addition, a study by Sahari et al. (2024) shows that multi-party-based co-management can strengthen social-ecological adaptation to environmental change.

The conservation model implemented in the Wonosadi Customary Forest represents a concrete realisation of human rights, particularly the right to health and a decent livelihood, as mandated in Law No. 32/2009 on Environmental Protection and Management. The community gained a healthier living environment, which

contributed to reduced levels of air pollutants such as $PM_{2.5}$ through increased vegetation cover and spring water recovery. Studies by Jin et al. (2022) show that increased vegetation cover is significantly and negatively correlated with $PM_{2.5}$ concentrations, indicating the important role of vegetation in mitigating air pollution. Similarly, research by Heshani & Winijkul (2022) revealed that green infrastructure in urban parks was able to reduce $PM_{2.5}$ concentrations by 34%, demonstrating the effectiveness of vegetation in improving urban air quality.

In relation to its contribution to the Sustainable Development Goals (SDGs), community-based conservation in Wonosadi contributes to sustainable development through ecological functions that extend beyond forest boundaries. These contributions align with several Sustainable Development Goals (SDGs), particularly SDG 3 (Good Health and Well-being), SDG 6 (Clean Water and Sanitation), SDG 13 (Climate Action), SDG 14 (Life Below Water), and SDG 15 (Life on Land).

In relation to SDG 3, vegetation cover and canopy density reduce particulate pollution (PM2.5) and moderate local microclimates, generating indirect public health benefits. Community health observations report lower incidences of respiratory and heat-related illnesses in forest-adjacent settlements (Santika et al., 2019). For SDG 6, protection of springs and recharge zones enhances infiltration and maintains dry-season water availability for nearby households, demonstrating how local wisdom-based land management fulfils basic water rights through ecosystem services (Sundari, 2024).

Wonosadi's agroforestry practices support SDG 13 by increasing carbon sequestration and improving adaptive capacity to climate variability (Sudomo et al., 2023), although the contribution remains localised due to the forest's limited area. The conservation of upland vegetation also indirectly contributes to SDG 14 by reducing sedimentation and nutrient runoff, thereby mitigating downstream risks of eutrophication in coastal ecosystems (Tenza-Peral et al., 2022). Meanwhile, SDG 15 is reflected through biodiversity-supportive land use and sustainable NTFP utilisation, offering alternative livelihoods that reduce extractive pressure on natural forests (Rumaday et al., 2025). However, increased commercialisation poses risks if economic motives surpass customary conservation values.

Collectively, these ecosystem service functions illustrate that Wonosadi's primary contribution to the SDGs lies in its capacity to operationalise sustainable development through culturally embedded environmental governance. The model's future effectiveness will depend on strong institutional continuity, intergenerational knowledge transmission, and integration with formal policy frameworks—ensuring that local wisdom remains a

robust driver of sustainability within its realistic socio-ecological scope.

D. CONCLUSIONS

This study advances scholarly understanding of community-based conservation by demonstrating that local wisdom functions not merely as cultural heritage, but as a normatively embedded governance system capable of regulating ecological commons effectively. Through the Wonosadi case, the research contributes three key theoretical insights.

First, the findings empirically demonstrate that customary norms function as informal ecoregulation, reinforcing Ostrom's commons management theory by illustrating how belief-based sanctions and ritualized monitoring sustain compliance without formal state intervention. This expands commons scholarship by highlighting the role of spiritual authority and moral legitimacy as institutional design principles that are rarely examined in the political ecology literature.

Second, the research introduces a rights-based analytical lens to community forestry studies. It conceptualises local wisdom-based conservation as a practical pathway toward fulfilling constitutional and human rights to a healthy environment, offering a framework that links cultural practices with environmental justice outcomes. This provides conceptual integration between ecological governance and the legal protection of environmental rights, an area in which existing studies remain limited.

Third, the research contributes a contextualised model of socio-ecological resilience in karst ecosystems—showing how small-scale customary forests can sustain hydrological functions, biodiversity, and social well-being despite biophysical vulnerability. Rather than presenting Wonosadi as a replicable formula, the study clarifies the conditions of transferability, emphasising that effectiveness depends on cultural cohesion, institutional continuity, and adaptive learning.

Overall, this study demonstrates that customary conservation systems can generate scientifically measurable ecological impacts while simultaneously upholding social legitimacy and constitutional environmental rights. These contributions offer strategic implications for policy design, including recognizing customary authority, strengthening hybrid governance between the state and community, and incorporating local wisdom into environmental law implementation and education. Future research should expand quantitative ecological monitoring and explore how such governance models adapt under economic pressures and generational change.

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