

Women's participatory communication in mangrove ecotourism for climate mitigation

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Abstract As a result of climate change, the Mulyorejo Village in Pekalongan is a coastal area that is frequently affected by tidal flooding (rob). In response, the community has initiated mangrove-based ecotourism initiatives to protect the environment and strengthen socio-ecological resilience. This study explores the role of women's participatory communication in driving these initiatives, examining how dialogic communication and community deliberation shape everyday ecological practices. A qualitative case study approach was employed to collect data through participatory observation, interviews with women's group leaders, ecotourism managers and community elders, and field documentation. The findings reveal that women play a central role in environmental education, ecotourism management and local policy advocacy. Key community innovations include the Mangrove School, which turns local knowledge into ecological action; the Kliwonan Market, which supports outreach and sales of mangrove-based products; and programmes such as aquaculture and the Waste Bank, which strengthen food security and recycle waste into mangrove fertiliser. These initiatives demonstrate how participatory communication can drive ecological democracy and inclusive sustainability through women's leadership and intergenerational collaboration.

Keywords: climate change mitigation; mangrove ecotourism; participatory communication, women

INTRODUCTION

Climate change is one of the most pressing global issues in the contemporary era (Rauf, 2025; Rusmadi, 2016) having significant and far-reaching impacts on human life (Julismin, 2013). Phenomena such as rising sea levels, increasing global temperatures, and extreme weather events pose serious threats to the environment, the economy, and the social fabric of communities (Sinaga & Harahap, 2023; Dewi A, 2022). Coastal regions are particularly vulnerable to these changes. Tidal flooding, which now occurs with increasing frequency, is no longer merely a seasonal natural phenomenon, but a real and prolonged symptom of the climate crisis (Wurarah, 2024) (Antarissubhi, 2023). In the context of Indonesia, particularly along the northern coast of Java, this problem is exacerbated by the combination of climate change, environmental degradation, and inadequate coastal spatial planning systems (Fahmi Setyanabi & Mulyanie, 2024; S. A. Iskandar, 2020).

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Mulyorejo Village, Tirto Subdistrict, Pekalongan District, has been one of the areas significantly affected (Sa'diyah, 2020). This region has experienced increasingly frequent and prolonged tidal flooding over the past several years. The flooding has not only inundated residential areas but has also caused damage to road infrastructure, educational facilities, as well as agricultural lands and community salt ponds (Kasbullah, 2014). Since the early 2000s, Mulyorejo Village has been subject to tidal flooding, which has led many residents to convert their land into aquaculture areas. Nevertheless, this initiative met significant obstacles when another severe tidal flood occurred in 2012. The ongoing saltwater intrusion has had a detrimental impact on the local economy, thereby significantly affecting the quality of life for residents. In such circumstances, coastal communities have been particularly impacted, with the most vulnerable members of society, including women and children, facing the greatest social and economic consequences (Sauda, 2019).

This crisis has acted as a catalyst for the emergence of resilient and adaptive local initiatives. The community of Mulyorejo Village has exhibited considerable social resilience through the establishment of Mangrove Ecotourism Mulyo Asri, a conservation and community empowerment area grounded in the preservation of the mangrove ecosystem (Supriyanto et al., 2025). This area functions not only as an environmental conservation space but also as a medium for community empowerment through educational activities, tourism, and creative economic ventures based on mangrove products (Arsyalina & Yuliani, 2024). Mangrove forests are recognised for their pivotal ecological functions, including the prevention of coastal abrasion, carbon sequestration, and the provision of habitats for marine life (Fitria & Dwiyanoto, 2021).

Therefore, community involvement in the management of mangrove-based ecotourism contributes not only to environmental conservation but also serves as a community-based strategy for climate change mitigation (Handayani et al., 2022). Nevertheless, while previous studies have examined community-based adaptation and women's participation in environmental initiatives, a significant gap remains in understanding how women's participatory communication functions as a fundamental mechanism for building social cohesion and driving sustainable environmental action. This study seeks to address that gap.

The presence of this developed mangrove ecotourism site is not merely a nature-based tourist destination but also carries a strong educational dimension. One initiative that exemplifies this is the establishment of the Mangrove School as an integral part of the ecotourism package. This programme is designed to provide direct understanding of the importance of mangrove ecosystems through activities such as planting mangroves, exploring coastal biodiversity, and fostering awareness of the harmonious relationship between humans and the environment. This initiative forms a framework for ecological education that addresses not only cognitive aspects but also emotional and axiological dimensions, particularly in cultivating environmental awareness among younger generations and visitors (Dewi A, 2022).

However, the social and geographical dynamics of Mulyorejo Village present unique challenges, especially for women, as they must interact with international environmental activists and foreign tourists participating in programmes such as World Camp, a homestay initiative that facilitates intensive cross-cultural engagement. Limited proficiency in foreign languages becomes a major obstacle to effective communication. Nevertheless, this situation has instead fostered the growth of communication adaptation and innovation. Local women have developed non-verbal communication strategies, drawn upon local narratives, and utilised coastal symbols and traditional hospitality as bridges for intercultural dialogue. In this way, limitations are transformed into opportunities for collective learning that strengthen social relationships grounded in empathy, simplicity, and openness.

The increasing number of domestic and international tourists visiting the Mangrove Mulyo Asri ecotourism area serves as concrete evidence that this local initiative has gained recognition and demonstrated sustainability. Interaction with tourists provides the community with valuable opportunities to share their cultural narratives, local wisdom, and everyday struggles in facing the impacts of tidal flooding (rob). However, the intensity of these cross-cultural encounters also demands improved communication capacities among community members particularly women, so they can build more meaningful, equitable, and mutually enriching relationships. In this context, participatory communication is not merely about speaking, but also about listening, respecting differences, and bridging diverse cultural perspectives in the spirit of sustainability (Dewi A, 2022).

Amid the dynamics of ecotourism management, women have emerged as significant actors in various environmental and social activities. In Mulyorejo Village, women are actively involved in delivering environmental education to schoolchildren and tourists, as well as in producing mangrove-based products such as syrup, pidada fruit candy, nila fish crackers, and mangrove batik. Beyond that, they also play a role in tourism promotion through social media and local cultural performances.



Figure 1. Production of mangrove-based processed products
Source: Management document of Mangrove Ecotourism Mulyo Asri (2025)

These diverse forms of women's involvement in mangrove-based ecotourism are visually depicted in Figure 1, which illustrates their active participation in the production of mangrove-based processed products as part of local livelihood strategies. The figure highlights how women transform environmental knowledge into tangible economic practices that support both household income and environmental conservation. This visual representation demonstrates the integration of ecological awareness, community-based economic activities, and women's agency within the mangrove ecotourism framework.

This participation illustrates that women are not merely objects of development or victims of ecological disasters (Anggraheni et al., 2024; Alonso-Epelde et al., 2024), but have become active subjects in the process of sustainable development. Their active engagement represents a concrete form of participatory communication, where women are involved in decision-making processes, information dissemination, and collective action to preserve the coastal environment.

The management of ecotourism has evolved beyond being merely a tool for environmental education, it has become a means of women's empowerment (Aulia & Savitri, 2024). Women in Mulyorejo are actively involved in designing educational modules and learning systems, facilitating field activities, and serving as the primary hosts for both domestic and international visitors. This involvement reflects a shift in the role of women from passive beneficiaries to key actors in the management of environmental knowledge and communication. Through participatory communication practices, they are able to establish equitable relationships in environmental education processes and articulate local narratives as part of broader efforts in conservation and sustainable development.

Women in Mulyorejo also play an active role in other initiatives that strengthen socio-ecological resilience while promoting sustainable economic development in the village. For instance, the Kliwonan Market, held every Jumat Kliwon in the mangrove area, not only introduces the mangrove ecosystem to residents and visitors but also serves as a platform for marketing mangrove-processed products. In addition, women's involvement in aquaculture, social service activities, and waste management through the Waste Bank reinforces both community solidarity and environmental sustainability. Thus, the participatory communication nurtured through these activities strengthens women's roles as agents of change, driving the sustainable and climate-adaptive management of mangrove ecotourism.

However, the development of mangrove ecotourism in Mulyorejo Village is not without significant social challenges. One of the main obstacles lies in the uneven understanding and awareness among community members regarding the importance of ecotourism as a long-term strategy for addressing climate change. Some residents still perceive ecotourism as an exclusive project, disconnected from their immediate daily needs. In some cases, there are even beliefs that tidal floods bring blessings in the form of government attention and external aid. This reality

reveals a gap between short-term perspectives and long-term visions, highlighting the urgent need for a more inclusive and grounded participatory communication approach. As such, educational efforts and social dialogue become key strategies in aligning viewpoints and fostering a shared sense of ownership over the ecotourism movement.

The concept of participatory communication is also highly relevant in explaining how the women of Mulyorejo construct narratives and collective strategies in the face of climate change. Communication is not merely understood as the transfer of information, but as a dialogic process that builds trust, strengthens social networks, and formulates shared agendas. In Mulyorejo, such communication occurs organically across various spaces both formal, such as neighbourhood meetings and village deliberations, and informal, such as women's groups, weekly religious gatherings, and everyday interactions. Women use these spaces to share local knowledge, devise action strategies, and reinforce social solidarity as a crucial asset in the management of ecotourism.

Participatory communication driven by women also strengthens social cohesion and builds community resilience in facing the challenges of climate change. In Mulyorejo, collaboration has emerged among women's groups, youth, and community leaders to develop educational facilities such as mangrove tracking paths, environmental learning centres, and creative environmental campaign media. These activities not only enhance the area's appeal as an educational tourism destination but also foster ecological awareness across generations. The communication that takes place is not one-directional, but participatory, open, and adaptive to the social dynamics of the local community (Servaes, 2008).

Given this background, Mulyorejo Village represents a socio-ecological context where local communities continuously negotiate the challenges of climate change through collective adaptation and innovation. The development of mangrove-based ecotourism in this area reflects an emerging model of community empowerment that integrates environmental conservation with social and economic resilience. The involvement of women in environmental education, ecotourism activities, and local decision-making highlights how communication and participation become essential components in sustaining community initiatives. In this regard, Mulyorejo offers a relevant site to explore how participatory communication, particularly women's leadership, contributes to shaping community-based climate change mitigation practices. Understanding this process is essential for advancing inclusive and locally grounded approaches to environmental governance.

METHODOLOGY

This study employed a qualitative method with a case study approach (Wahyuningsih, 2013) to gain an in-depth understanding of women's participatory communication practices in climate change mitigation through the development of mangrove-based ecotourism. The research site is Mangrove Ecotourism Mulyo Asri, located in Mulyorejo Village, Tirto Subdistrict, Pekalongan District, a coastal area highly vulnerable to tidal flooding but notable for its successful community-based environmental management initiatives. The case study approach was chosen because it allows the researchers to explore holistically and contextually the social dynamics within a distinct system (Haryono, 2020), such as the mangrove ecotourism management community. This research not only aims to describe women's participation but also to examine how communication, collaboration, and empowerment unfold in a complex, real-life setting.

Table 1. Data of informants

Name	Location	Profession	Date
Informant 1	Pekalongan	Environmental conservation worker	26 April and 7 June 2025
Informant 2	Pekalongan	Environmental education facilitator	26 April and 7 June 2025
Informant 3	Pekalongan	Mangrove ecotourism manager	20 March, 27 April, 7 June 2025
Informant 4	Pekalongan	Mangrove ecotourism manager	20 March and 27 April 2025
Informant 5	Pekalongan	Community leaders	27 April 2025

Source: Researchers (2025)

Key participants in this study were women who are actively involved in the management of mangrove-based ecotourism, particularly in environmental conservation, education, and tourism-related activities. Additional informants included ecotourism managers and community

leaders. Participants were selected using purposive sampling to identify key informants and snowball sampling to reach additional participants through community networks (See Table 1).

Data were collected through participatory observation, semi-structured in-depth interviews, and documentation. The observation was conducted over a four-month period (March–June 2025) to capture the dynamics of interaction and women’s participation in ecotourism activities. The interviews explored women’s experiences, perceptions, and communication practices related to climate change mitigation. Documentation included visual archives, programme reports, and coverage from local media.

The data were analysed using a thematic analysis approach through three stages: data reduction, data display, and conclusion drawing, as developed by Miles, Huberman, and Saldana (Miles et al., 1994; Mezmir, 2020). The validity of the data was strengthened through source and method triangulation, as well as member checking with key informants to ensure that the researcher’s interpretations accurately reflected the participants’ lived experiences.

RESULTS AND DISCUSSION

The strategic role of women in participatory communication for climate change mitigation

In tidal flood-affected areas such as Mulyorejo Village, women play an active role as key drivers of participatory communication processes to address the challenges of climate change. This role emerges from the urgent need for direct community involvement in responding to the tangible impacts of the climate crisis. When the area is struck by tidal flooding, women are not merely passive victims but instead take on active roles in recovery efforts and environmental education. Within the context of Mangrove Ecotourism Mulyo Asri, they are deeply involved in activities such as seedling cultivation and mangrove planting, as well as in the planning of educational tourism programmes. This reflects a paradigm shift in which women are now recognised as agents of both social and ecological transformation.



Figure 2. Mangrove seedling cultivation and planting
Source: Management document of Mangrove Ecotourism Mulyo Asri (2025)

These practices are visually illustrated in Figure 2, which depicts women’s active involvement in mangrove seedling cultivation and planting activities within the Mangrove Ecotourism Mulyo Asri area. The figure demonstrates how women’s participation extends beyond symbolic engagement to encompass hands-on environmental action aimed at strengthening coastal resilience against tidal flooding. Through seedling preparation and collective planting, women translate participatory communication into concrete climate change mitigation practices, reinforcing their role as key actors in sustaining mangrove ecosystems and reducing the impacts of coastal environmental degradation.

Women’s involvement in mangrove-based ecotourism has opened up more inclusive and educational spaces for ecological communication. This participation is essential, as women maintain strong social and emotional ties to their living environments, which are increasingly under threat. Through both interpersonal and group communication, women initiate dialogues of change that prioritise care and sustainability. For instance, in the Mangrove School programme, which is part of the educational tourism package, women serve as facilitators who convey conservation values to students and visitors. As one of them explained:

"At the Mangrove School, we teach visitors and children about the meaning of mangroves, not only how to plant them, but why they protect us" (Informant 3, 27 April 2025).

This statement illustrates how women use participatory and dialogic communication to translate ecological knowledge into shared understanding. By combining storytelling, demonstration, and reflection, they transform conservation into a communicative practice rooted in local experience. This programme provides women with a platform to express themselves and build their capacity to communicate environmental narratives from a local perspective. Their role in this form of informal education strengthens social cohesion while also broadening the reach and impact of climate change mitigation campaigns.



Figure 3. Mangrove School activities

Source: Management document of Mangrove Ecotourism Mulyo Asri (2025)

These communicative practices are visually represented in Figure 3, which captures a range of Mangrove School activities facilitated by women as part of the ecotourism-based education programme. The figure illustrates interactive learning processes in which women engage participants through storytelling, demonstration, and experiential dialogue to convey mangrove conservation and climate change awareness. By situating environmental knowledge within everyday experiences, the activities shown in the figure reinforce women's roles as informal educators and mediators of ecological knowledge within the community.

Women also serve as key actors in transforming public perception of tidal flooding from a threat into an opportunity for education. This transformation is driven by a collective awareness that disasters can be mitigated through knowledge and active engagement. Women draw on cultural narratives and lived experiences to foster community consciousness about environmental adaptation. Through educational storytelling, experiences of tidal flooding are reframed to introduce climate change as a tangible phenomenon that is closely connected to everyday life. As one facilitator stated:

"We explain climate change through stories from floods and erosion to how mangroves protect the coast. The children understand better because they play and plant directly." (Informant 1, 26 April 2025)

This statement illustrates how dialogic and experience-based learning enables the community to internalise climate knowledge and translate it into ecological action. This approach is not fear-based, but rather empowering anchored in stories and practices. In doing so, women assert their role in shaping environmental awareness rooted in local experience.

Cross-cultural communication in the World Camp programme further highlights women as bridges between the local community and international visitors. Despite language barriers, they are able to build dialogue through symbolic and cultural approaches. Gestures, hospitality, and visual narratives are used to convey messages about conservation and local wisdom. International participants who stay in local homes during the World Camp gain firsthand experience through these interactions. Women help organise the activities, provide meals, and

explain the programmes sometimes through local interpreters but personal warmth and authenticity remain central. In this context, women practice a form of environmental diplomacy grounded in cultural exchange.



Figure 4. Examples of World Camp activities

Source: Management document of Mangrove Ecotourism Mulyo Asri (2025)

These cross-cultural interactions are visually represented in Figure 4, which depicts World Camp activities involving close engagement between local women and international participants. The figure illustrates how everyday practices such as informal conversations and guided environmental activities function as communicative spaces for exchanging conservation values and local ecological knowledge. Through these interactions, women facilitate mutual understanding and trust, positioning themselves as key mediators in cross-cultural environmental communication within the ecotourism setting.

Women's initiatives in mangrove seedling cultivation and planting also reflect their concrete contribution to climate mitigation through collective action. Their persistence in nurturing mangrove seedlings from nursery to planting demonstrates a high level of consistency and commitment to environmental sustainability. Women are also involved in documenting activities, reporting, and scheduling planting cycles. These are not merely technical tasks but processes rich in communication and coordination. Such activities are not carried out sporadically but are organised through participatory community deliberation. This affirms that women's involvement in the technical management of ecotourism is also an integral part of structured climate communication.

The strategic role of women is further evident in the fields of agriculture and conservation. Women not only lead these efforts but also serve as agents for spreading eco-friendly technological innovations within their communities. At Mangrove Ecotourism Mulyo Asri, women actively adopt and teach organic farming techniques, such as the use of compost and liquid organic fertilizer derived from household organic waste. They also promote the reduction of chemical pesticides by replacing them with natural pest control solutions, making agricultural produce healthier and more environmentally friendly. Additionally, women facilitate the transformation of organic waste into effective fertilisers, which in turn strengthens mangrove ecosystem sustainability and enhances community well-being. Thus, women's role in participatory communication is key to disseminating sustainable farming practices and community-based climate change mitigation.

From the perspective of intergenerational relationships and communication, women play an essential role in transmitting environmental knowledge to children and youth. Programmes such as the Mangrove School serve as intergenerational learning spaces led by local women using communicative, interactive teaching methods. They guide children in learning through play, introducing them to different mangrove species, explaining their ecological functions, and engaging them in nursery and planting activities. In these settings,

women serve as teachers, guides, and role models. Young participants actively engage, develop a sense of belonging, and form early bonds with nature. This approach lays a strong foundation for shaping environmentally conscious future generations.

Culturally, women also integrate traditional values with principles of conservation. They relate environmental preservation to local moral teachings such as mutual cooperation, harmony with nature, and gratitude. During traditional ceremonies and community gatherings, women embed environmental messages into prayers, songs, and cultural symbols. This reinforces the spiritual dimension of conservation as an integral part of life, not merely a technical obligation. In this way, women internalise ecological values within local culture, passing them down across generations. The combination of indigenous wisdom and local intelligence makes environmental communication more holistic and deeply rooted.

Another form of women's involvement is seen in Kliwonan Market, held every Kliwon Friday (The Javanese Custom Day for Mystic) in the mangrove ecotourism area. This market not only functions as a platform to introduce the mangrove ecosystem to residents and visitors but also as a space for marketing mangrove-based products such as pidada syrup, traditional sweets, and more. The event is complemented with activities such as health exercises and acoustic performances, creating an atmosphere that is both engaging and educational. Through Kliwonan Market, social and economic communication among villagers is strengthened, fostering solidarity and collective awareness about the importance of mangrove conservation as a shared source of well-being amid the challenges of climate crisis mitigation.



Figure 5. Kliwonan Market activities in the mangrove ecotourism area
Source: Management document of Mangrove Ecotourism Mulyo Asri (2025)

These activities are visually represented in Figure 5, which depicts the vibrant atmosphere of Kliwonan Market as a community-based space that integrates economic exchange, social interaction, and environmental education. The figure highlights women's active roles in managing stalls, interacting with visitors, and promoting mangrove-based products within an informal yet meaningful communicative setting. Beyond commercial transactions, the market functions as a site of participatory communication where conservation messages are conveyed through everyday practices, cultural performances, and collective engagement, reinforcing women's roles as facilitators of social cohesion and local environmental awareness.

In addition, fish farming has become an integral part of food security strategies and the development of mangrove-based culinary practices in Mulyorejo Village. Women play a central role in this activity, particularly in food preparation, maintaining hygiene, and customer service. Their involvement in fish farming not only contributes to household and community income but also reinforces their role as agents of change in the sustainable use of natural resources. Through these practices, narratives of environmental and economic sustainability are interwoven into the everyday lives of the local community.

In the social domain, women actively participate in communal work to repair sea walls that serve as the village's primary defence against saltwater intrusion. This involvement demonstrates that women are not merely recipients of climate-related impacts, but also vital actors in environmental adaptation efforts. Their role in carrying out social activities strengthens

the community's social fabric and builds collective resilience to disasters. The spirit of communal work reflects enduring local cultural values such as solidarity and cooperation that remain embedded in daily life. This cultural foundation acts as social capital that enhances the village's capacity to withstand the threats of climate change, especially the frequent tidal flooding in coastal areas. Thus, women's participation in communal work becomes a crucial element in advancing community-based climate crisis mitigation.

Moreover, waste management has become a key concern in preserving the mangrove ecosystem. Through the Waste Bank Programme, women take on a central role in processing organic and liquid waste. The collected organic waste is transformed into natural fertiliser for mangrove plants, creating a green economic cycle that supports ecosystem regeneration. Women's involvement in waste management underscores the community's commitment to implementing holistic and participatory sustainability practices, while also enhancing the community's adaptive capacity in the face of climate change.



Figure 6. Waste Bank Management in the mangrove ecotourism area
Source: Management document of Mangrove Ecotourism Mulyo Asri (2025)

These waste management practices are visually illustrated in Figure 6, which depicts women's active participation in Waste Bank activities within the mangrove ecotourism area. The figure highlights how routine practices such as waste sorting, processing, and recycling function as communicative and educational processes that promote environmental responsibility at the community level. Through the Waste Bank Programme, women not only manage waste but also disseminate knowledge and encourage behavioural change, positioning waste management as an integral component of community-based climate change mitigation.

Overall, women's participation in climate change mitigation through mangrove ecotourism is not merely symbolic, but strategic. They stand at the forefront across various dimensions, educational, technical, and cultural. This role underscores that the success of conservation programmes greatly depends on the meaningful and equitable involvement of women. To overlook their contributions is to ignore the most significant potential within coastal communities to confront climate change.

Taken together, these findings reveal that the mechanisms of participatory communication in Mulyorejo are grounded in dialogic interaction, experiential learning, and collective action that connect ecological awareness with everyday life. Women act as communicative bridges linking knowledge, culture, and practice through storytelling, demonstration, and collaborative work within programmes such as the Mangrove School, World Camp, and Kliwonan Market. Their communicative agency transforms environmental issues from abstract concerns into lived, shared experiences that nurture both ecological understanding and social solidarity. Through these dialogical and culturally embedded processes, participatory communication in Mulyorejo emerges not merely as information exchange, but as a dynamic system of co-creation where women's voices, actions, and local wisdom generate sustainable responses to climate change.

Mangrove School and the transformation of community-based environmental education

The Mangrove School within the Mangrove Ecotourism area of Mulyo Asri represents a collective community response to increasingly evident ecological threats, namely, tidal flooding and coastal environmental degradation. This programme emerged from the urgent need to offer community-based solutions in addressing the impacts of climate change, particularly for coastal populations who are among the most vulnerable. Through an environmental education approach embedded in the daily lives of residents, the Mangrove School does more than introduce conservation science; it cultivates ecological awareness and a sense of collective responsibility for the preservation of coastal ecosystems.

Women's participation is a key element in this educational movement. In Mulyorejo, women are not merely supporters, but central figures driving conservation programmes, mangrove seedling cultivation, and the processing of mangrove-based products. They are actively involved in training sessions, community discussions, and the structured planning of conservation activities. Empirical evidence from the interviews reveals this commitment. As one participant explained:

"We started planting mangroves not just to protect the coast, but because we realized it's about protecting our future" (Informant 2, 26 April 2025)

This statement illustrates how women in Mulyorejo interpret conservation not merely as an ecological activity but as a moral and intergenerational responsibility. It reflects a key mechanism of participatory communication, in which meaning and motivation emerge through shared dialogue and collective reflection rather than external instruction. Their awareness of sustainability becomes a driving force behind concrete economic initiatives. For instance, in the production of mangrove-derived goods such as syrup, *pidada* sweets, and other food products, women serve as both the main producers and local innovators. This finding demonstrates how participatory dialogue empowers women to transform environmental knowledge into creative and sustainable economic practices, turning communication into a medium of empowerment.

The educational transformation brought about by the Mangrove School also targets younger generations through interactive activities such as educational field trips, mangrove forest excursions, and hands-on experiences in seedling and planting. These initiatives immerse students from diverse backgrounds in direct ecological engagement, strengthening the affective and practical dimensions of the learning process. In an informal yet meaningful environment, students are introduced to the critical role of mangrove ecosystems in climate change mitigation. This represents a model of environmental education that emphasises not only cognitive development, but also empathy and a sense of environmental advocacy from an early age.



Figure 7. Examples of Mangrove School activities by students
Source: Management document of Mangrove Ecotourism Mulyo Asri (2025)

These learning activities are visually illustrated in Figure 7, which depicts students' participation in Mangrove School programmes within the mangrove ecotourism area. The figure highlights experiential learning processes, where students engage directly with mangrove ecosystems through observation, exploration, and practical conservation activities. By situating learning outside the classroom, the Mangrove School fosters emotional connections with nature, reinforcing environmental values and encouraging pro-environmental behaviour among younger generations.

However, despite these various achievements, sustainability remains a critical challenge that must be addressed. As of now, Mangrove Ecotourism Mulyo Asri has not yet been officially registered as a designated tourism site contributing to the village's locally generated revenue. As a result, its existence relies heavily on communal solidarity and grassroots initiative. The absence of formal policy support poses a risk to the long-term development and operational stability of the programme. Nevertheless, the core strength of the Mangrove School lies precisely in the self-reliance of the community, rooted in the social and cultural values of the coastal society in Mulyorejo.

The interactive spaces established through the Mangrove School function not only as ecological learning environments but also as social arenas where solidarity and community cohesion are nurtured. Activities such as seedling cultivation, planting, and product processing are carried out collectively, involving people of all ages and social groups. These processes enable intergenerational knowledge transfer, with parents sharing lived experiences and children learning through observation and participation. Local values such as mutual cooperation, togetherness, and patriotism are gradually revitalised in contextual and practical ways.

Women's participation in this context reflects the dynamic transformation of gender roles within coastal communities. Women now play active roles in decision-making, programme management, and product innovation based on local resources. They have become subjects of change, initiating, designing, and implementing community-based climate change mitigation strategies. This indicates that gender equality is not merely a normative issue but an integral part of adaptation and sustainable development strategies at the grassroots level.

Participatory communication is the foundation of the programme's success. The communication process is dialogical, open, and inclusive, allowing all community members to be meaningfully involved in each stage of the activities. Decision-making takes place through deliberation and group discussions that respect every voice, including women and marginalised groups. This approach not only strengthens the sense of ownership over the programme but also enhances the community's capacity to adaptively respond to environmental dynamics.

Furthermore, the Mangrove School serves as a platform for fostering collective awareness about the urgency of adapting to climate change. Residents have begun to understand the direct link between the degradation of mangrove ecosystems and the increased intensity and frequency of tidal flooding. This awareness has inspired collective action in the form of conservation efforts, coastal area management, and behavioural changes in environmental practices. Here, environmental education functions as a transformative tool not only informing but also mobilizing social change.

Through its educational, conservation-oriented, and productive programmes, the Mangrove School in Mulyorejo offers a best-practice model that is worth replicating in other coastal regions facing similar challenges. The success of this initiative lies not only in its contextual approach, but also in its ability to harmoniously integrate ecological, social, economic, and cultural dimensions. By placing women at the centre of participation, the Mangrove School has elevated the role of gender in conservation while simultaneously strengthening household economies through the sustainable use of local resources.

Taken together, the findings illustrate that the Mangrove School in Mulyorejo functions as an integrated model of participatory environmental communication that unites education, empowerment, and collective action. Through dialogic and inclusive communication processes, ecological knowledge is co-created and disseminated across generations, transforming residents from passive beneficiaries into active agents of change. Women's leadership, community solidarity, and the revitalisation of local values such as mutual cooperation serve as the social mechanisms that sustain this transformation. The Mangrove School demonstrates that environmental education, when rooted in everyday life and participatory dialogue, becomes a catalyst for resilience, strengthening ecological stewardship, promoting gender equality, and fostering a culture of shared responsibility toward sustainable coastal living.

Participatory communication as a foundation for mangrove-based ecotourism management

Participatory communication serves as the primary foundation for building sustainable and inclusive ecotourism management (Islamia, 2025). In the context of Mangrove Ecotourism Mulyo Asri in Mulyorejo Village, such communication bridges local knowledge with the community's collective vision for environmental sustainability. Communication practices that are open, egalitarian, and rooted in deliberation create collaborative spaces that engage all residents, particularly women. Through dialogue forums, community members actively contribute ideas, consider diverse perspectives, and jointly determine strategic actions. This participatory process not only strengthens ecological aspects but also shapes a social structure resilient to the pressures of climate change. Therefore, participatory communication is not merely a tool; it is the heart of community-based ecotourism management.

Community-based ecotourism management requires the active involvement of local residents in every stage of planning, implementation, and evaluation (Keliwar, 2013). In Mulyorejo, such participation emerges from the ground up, through an ongoing process of dialogue and consensus-building. The Banawa Sekar Farmers Group, for instance, is the result of a community initiative to establish a collective platform for mangrove conservation and ecotourism development. The community deliberation forum serves as a key space for voicing aspirations, exchanging knowledge, and making decisions that reflect the community's collective voice. Rather than being dominated by a single party, the process is deliberative and inclusive, engaging various social groups and resulting in a governance structure that reflects both social legitimacy and shared ownership of the ecotourism programme.

Participatory communication also serves as a vital means of empowering women in environmental management (Gicheru et al., 2024; Widjanarko, 2019). In the context of Mulyorejo, women are no longer positioned on the margins but instead play a central role in sustaining mangrove ecotourism. Their involvement is evident in activities such as mangrove seedling cultivation, environmental education for visitors, and the processing of forest products like syrup and mangrove-based food items. Women now occupy spaces of dialogue and decision-making that were once dominated by men. This transformation demonstrates that women are not merely complementary actors, but key drivers of environmental development.

Women's participation is reinforced by a communication approach that prioritises equality, openness, and recognition of their strategic roles within the community (Saleh, 2022). Communication is understood not merely as the act of conveying messages, but as a space for the convergence of ideas, empathy, and social solidarity (Usia et al., 2017). Women's involvement in community meetings, decision-making processes, and conservation programme implementation shapes a dialogical process that enriches ecotourism management practices (Widjanarko, 2019). This experience demonstrates that when communication is embraced inclusively, local potential naturally emerges and sustains itself over time.

Local values such as mutual cooperation, openness, and togetherness serve as the foundational pillars strengthening participatory communication practices (Nofrion et al., 2025). These traditions have long been embedded in the coastal culture of Mulyorejo and have now been adapted into social capital for managing ecotourism. The culture of deliberation is employed to formulate development strategies, resolve internal issues, and reinforce relationships among groups within the community. Discussions take place in informal, open atmospheres characterised by mutual respect, enabling ideas to emerge without hierarchical barriers. These spaces facilitate communication as a collective process that touches upon the emotional and relational aspects of the residents, so that the success of ecotourism lies not only in technical programmes but also in the strength of the communication culture thriving within the community.

The participatory communication model also facilitates the emergence of social innovation in ecotourism management (Nofrion et al., 2025). When every individual feels heard and valued, the potential for innovation arises spontaneously from various community layers. One example is the youth initiative to develop an educational tourism trail that highlights the importance of mangroves for climate change mitigation. This project is supported by collaboration among the community, academia, and government through open and cooperative communication processes. Such innovation not only enhances the tourism appeal but also

serves as a medium for environmental education. Thus, participatory communication not only creates a space for dialogue but also stimulates social creativity with tangible impact.

Informal communication serves as a crucial pillar in the practice of participatory communication within the community (Sari et al., 2024). Beyond formal forums, the residents of Mulyorejo utilise everyday communication spaces as platforms for information sharing and building solidarity. Mechanisms such as weekly meetings, small group discussions, and the use of local social media, particularly WhatsApp are employed to convey agendas, organise socio-economic activities, and respond collectively to urgent needs. This practice demonstrates how the flexibility of informal communication can accelerate decision-making and strengthen social bonds among community members. Thus, participatory communication not only manifests in grand ceremonies but also grows and takes root in the daily life of the community.

The sustainability of participatory communication largely depends on the role of adaptive and inclusive local leaders (Naibaho & Siregar, 2023). These leaders do not merely act as message transmitters but also safeguard the communication space to remain open, egalitarian, and democratic. In Mulyorejo Village, women leaders, especially those active in the Banawa Sekar Farmers Group, a tourism advocacy group, play a strategic role as mediators in community forums. They build trust by promoting narratives of togetherness, turning diversity into a source of creativity, and preventing domination in collective decision-making. In this context, transformative leadership becomes a key factor to ensure that participatory communication remains relevant and responsive to shifting social dynamics. Thus, local leaders serve as crucial nodes in maintaining the quality and sustainability of collective participation within the community.

Amid the plurality of interests, social conflict within communities is an inevitable reality (Rohani & Purwoko, 2020). Rather than being viewed solely as a disruption, conflict can serve as a valuable space for deepening dialogue, fostering empathy, and shaping shared consensus. In the context of ecotourism management, tensions may arise around issues such as benefit distribution, rotation of responsibilities, or differing visions of development. Yet, in Mulyorejo, participatory communication has become the community's central mechanism for navigating these challenges. Through collective deliberation, open dialogue, and restorative practices grounded in values of justice and solidarity, conflicts are addressed not through coercion but through mutual understanding. This approach not only resolves disputes but also nurtures social cohesion and resilience in the face of difference. In this way, participatory communication emerges not merely as a tool for conflict resolution but as the ethical backbone of a socially sustainable community.

The socio-ecological transformation in Mulyorejo affirms that participatory communication transcends its practical function by fostering a more just and democratic social order. This approach enables communities to move beyond dependency on external interventions and become autonomous stewards of their own ecosystems. Within this process, women have assumed a central role as drivers, mediators, and guardians of dialogic spaces that unify diverse perspectives and collective aspirations. Their active involvement in community forums, ecotourism management groups, and mangrove conservation efforts illustrates a significant shift toward more equitable and inclusive power relations. Women do not merely express aspirations; they participate in strategic decision-making and embed the values of sustainability within the community. Thus, participatory communication serves as a catalyst for the emergence of a new social structure that is responsive and resilient in the face of climate challenges.

The collective experience of Mulyorejo demonstrates that participatory communication is not a temporary strategy but a continuous process that requires long-term commitment and persistence. This process demands sustained dialogue among actors, consistent capacity building among residents, and a willingness to learn and adapt. The Mulyorejo community exemplifies this through regular training, open deliberations, and evidence-based practices grounded in local knowledge and lived experience. Social resilience is cultivated when communication becomes a shared learning space one that welcomes critique and encourages improvement. Within such a dynamic, socio-ecological challenges are addressed in ways that are contextual, progressive, and rooted in collective values. In this sense, participatory communication is not merely an instrument of change, it is the fertile ground upon which a community-based civilisation may grow.

Participatory communication in Mulyorejo has also proven to be a strategic pillar in managing inclusive and sustainable mangrove-based ecotourism. This approach fosters the active involvement of residents in planning, implementing, and evaluating ecotourism programmes, thus nurturing a strong sense of ownership and accountability. Women, as members of the driving community force, are not passive recipients but initiators of change, both in tourism management and environmental conservation. The results are tangible: increased household income, the preservation of mangrove vegetation, and intergenerational social solidarity. Innovations such as the educational mangrove trail and digital promotion rooted in local narratives have emerged from these inclusive dialogic spaces. Therefore, participatory communication has evolved into a vital bridge connecting local knowledge with ecologically just transformation.

Taken together, the findings reveal that the mechanism of participatory communication in Mulyorejo operates through a dynamic interplay of dialogue, inclusion, and local values. Communication does not occur merely as message transmission but as a dialogic process that integrates community knowledge, emotional solidarity, and collective learning. Women's active involvement, adaptive local leadership, and the revitalisation of traditional values such as mutual cooperation serve as interlocking components that sustain the process. Through continuous dialogue, open decision-making, and everyday communication practices, the community transforms ecological challenges into opportunities for collaboration and innovation. Thus, participatory communication in Mulyorejo emerges not only as a strategy for managing ecotourism but as a living mechanism that nurtures social cohesion, empowers marginalised voices, and reinforces the community's ecological and cultural resilience.

CONCLUSION

This study reaffirms that women's participatory communication plays a strategic role in climate change mitigation through the management of mangrove-based ecotourism in Mulyorejo Village. Women are not merely recipients of climate impacts but emerge as initiators, facilitators, and communicators who bridge local knowledge, spiritual values, and conservation discourses into collective community action. In this way, the initiative has fostered ecological learning spaces that strengthen social solidarity, intergenerational awareness, and community-based resilience.

Nevertheless, the study is not without its limitations. As a single-case study, the findings cannot be generalised across all coastal contexts with different socio-ecological conditions. Persistent challenges also remain, such as uneven levels of community awareness, the lack of formal policy support, and funding sustainability that relies heavily on grassroots solidarity. These tensions suggest that while the Mulyorejo experience is inspiring, it continues to face complex dynamics that must be critically acknowledged.

Future research should therefore expand to comparative cases in other coastal areas, explore the roles of men and youth in participatory environmental communication, and examine institutional mechanisms that may better sustain such initiatives. Rather than being uncritically replicated, the principles of participatory communication with women at the centre should be adapted to local socio-cultural contexts. In doing so, the Mulyorejo case offers both scholarly contributions and practical insights for designing more inclusive, equitable, and sustainable climate adaptation policies.

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