The Ecological Risk Mitigation Gap (A Phenomenological Study of Environmental Communication in Illegal C-Mining in Madura)

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Abstract. Illegal C-mining poses ecological risks with significant implications for community social conditions, livelihoods, and safety. However, ecological risk awareness does not necessarily translate into participation in mitigation. This study aims to analyze experiences and meanings of ecological risk, environmental communication practices, and the process through which risk awareness is transformed into mitigation participation. The study was conducted on Madura Island, East Java, encompassing Bangkalan, Sampang, Pamekasan, and Sumenep Regencies. Employing a qualitative phenomenological approach, data were collected through interviews, observations, and documentation involving environmental activists, journalists from *Jawa Pos Radar Madura* and *Media Jatim*, and academics. Data were analyzed through *epoché*, meaning clustering, description, and synthesis of the essence of experience. The findings indicate, first, that ecological risks are understood through lived experiences of land degradation, vegetation loss, dust, disrupted access, erosion, and the potential for floods and landslides, all of which intersect with livelihoods and community safety. Second, these experiences are communicated and acquire public meaning through interpersonal interactions, mass media, and academic knowledge production, which perform both constitutive and pragmatic functions in shaping and mobilizing risk awareness. Third, risk awareness does not automatically lead to participation because of a **participation gap**-the distance between recognizing risks, articulating concerns, and possessing the capacity to influence mitigation actions. This gap is shaped by fear of speaking out, unequal social positions, economic interests, limited information, and institutional barriers.

Keywords: environmental communication, participatory communication, participation gap, ecological risk, illegal C-mining, Madura.

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1 Introduction

On Madura Island, East Java, Indonesia, illegal C-mining activities are distributed across all four regencies. In Bangkalan, approximately 30 illegal mining sites have been identified, particularly in Bunajih Village, Labang District, and Tenggun Dajah Village, Klampis District, alongside activities extending into Geger District and Parseh Village, Socah District [1]. Sampang has an estimated 16-30 sites, with activities associated with disruption of local hydrological systems and increased flood risks, particularly in Banjar Tabuluh and Banjar Talela Villages, Camplong District; Gunung Rancak Village, Robatal District; and Tamberu Daya Village, Sokobanah District [2]. Pamekasan records an estimated 213 non-compliant mining sites, concentrated in Rek Kerrek, Angsanah, Akkor, and Larangan Badung Villages, Palengaan District, with further expansion toward the vulnerable coastal areas of Pasean and Batumarmar Districts [3]. Meanwhile, Sumenep is estimated to have approximately 220 sites, extending from inland areas to zones surrounding cultural heritage sites, including Kebonagung Village, Kota District; Rombasan Village, Pragaan District, where a fatal mining incident occurred; and Kasengan Village, Manding District [4].

Natural resource utilization can support development, create employment opportunities, and sustain local livelihoods [5]. However, uncontrolled extraction can generate social tensions and conflicts because its socio-ecological burdens are often disproportionately borne by communities living near extraction sites. Environmental problems, therefore, should not be reduced to technical assessments of land degradation or pollution. Ecological risks are not isolated phenomena; rather, they emerge through their interconnections with economic interests, everyday experiences, and power relations. Material extraction from hilly areas or specific land sites may generate economic benefits for various stakeholders [6]. At the same time, extraction activities can alter landscapes, reduce vegetation cover, accelerate erosion, generate dust, damage road infrastructure, disrupt water flows, and increase vulnerability to landslides.

These conditions not only transform the physical characteristics of the environment but also shift ecological functions that previously constituted part of communities' living spaces. Vegetation that once supported livelihoods may decline, while excavation activities and heavy-vehicle traffic can disrupt public access, comfort, and community safety. Ecological risks associated with illegal C-mining should therefore be understood as lived experiences connecting environmental change with social, economic, and safety conditions. The issue becomes more complex when ecological risk awareness is not accompanied by public action. Communities may recognize environmental changes through everyday experiences without necessarily having the courage to express concerns or report violations. In other words, a gap exists between knowing and experiencing risk and having the capacity and willingness to act upon it.

This study conceptualizes this condition as a participation gap, namely the distance between ecological risk awareness, the articulation of concerns, and the capacity to engage in mitigative action. This concept is important because the effectiveness of mitigation depends not only on risk knowledge but also on communicative and institutional conditions that enable knowledge to be translated into participation. Environmental communication is particularly relevant for explaining this process because it shapes

how individuals and communities understand their environment and the risks they face. Cox conceptualizes environmental communication through two functions: constitutive and pragmatic. The constitutive function refers to communication as a process through which meanings, realities, and human-environment relationships are constructed. In contrast, the pragmatic function concerns the use of communication to educate, warn, persuade, advocate, and mobilize environmental action [7].

From this perspective, ecological risks can be understood through lived experience, social interaction, and communicative practices. Illegal C-mining is particularly relevant to Cox's framework when experiences of land degradation, vegetation loss, dust, road disruption, or landslide threats are communicated, exchanged, and articulated as shared concerns. Effective risk communication must clarify sources of hazards, potential consequences, and the groups likely to be affected. However, information does not necessarily generate uniform responses because risks are interpreted within different social and economic interests. Illegal C-mining may be perceived by some community members as an ecological threat, while by others as a source of income and livelihood. Risk communication should therefore be understood as a process of negotiating the meanings of risk, competing interests, and possible courses of action [8].

From the perspective of development communication, Servaes conceptualizes communication as a dialogical process through which communities become subjects of development rather than merely recipients of messages or objects of policy [9]. This perspective helps explain why ecological awareness does not necessarily result in participation. Individuals may understand the impacts of illegal C-mining yet remain silent because of their limited social position, fear of consequences, low trust in institutions, or the perception that their voices will not produce meaningful change. Participatory communication is therefore closely associated with equal opportunities to speak, be heard, and influence decision-making processes.

Research on mining in Indonesia has been extensive, but studies specifically addressing illegal C-mining remain relatively limited. Andhita and Shokhikhah [10], for example, highlight weak law enforcement and structural oversight as factors enabling illegal sand and stone extraction. From a governance perspective, Panjaitan and As'ari [11] demonstrate the importance of effective interinstitutional collaborative governance in addressing regulatory problems and conflicts. Meanwhile, Fitriyana, Sugiono, and Malia [12] emphasize technical instruments, including environmental impact accountability and reporting mechanisms, as mitigation measures. Although these studies provide important insights, they do not examine how ecological risks are experienced and interpreted by affected subjects and how such experiences may be transformed through communication into participatory mitigation.

This study addresses this gap by examining the subjective and communicative dimensions of ecological risk. A phenomenological approach is employed to explore informants' lived experiences and interpretations of ecological risks associated with illegal C-mining in Madura. Phenomenology is a qualitative approach designed to understand subjective experiences and the meanings individuals attribute to events they directly encounter [13]. Accordingly, the study addresses three questions: First, how are ecological risks associated with illegal C-mining in Madura experienced and interpreted? Second, how do environmental communication practices reveal and articulate

the risks of illegal C-mining? Third, how does participatory communication function as a practice of ecological risk mitigation?

To address these questions, the study integrates Cox's constitutive and pragmatic functions of environmental communication [7] with risk communication and Servaes's dialogical-participatory principles [9]. This integration enables the study to examine participatory communication as a social infrastructure that connects ecological risk awareness with collective mitigation action.

2 Method

This study employed a qualitative approach using Moustakas's descriptive phenomenological design to understand how local actors experience, interpret, communicate, and respond to ecological risks associated with illegal Category C extraction in Madura [13]. Rather than measuring the extent of ecological degradation, the study examined how environmental changes are experienced as meaningful realities, constructed through communication, and shaped by social and communicative conditions that enable or constrain the transformation of risk awareness into participation in mitigation. The unit of analysis was local actors' communicative experiences in interpreting risks, articulating environmental concerns, and engaging in mitigation communication. The study was conducted in Bangkalan, Sampang, Pamekasan, and Sumenep. Informants were purposively selected based on their experience, involvement, and substantive knowledge of environmental issues and Category C extraction. They comprised Moh. Romli and Zahiratul Mukarromah as environmental activists; Anis Billah and Arif Muhammad as journalists; and Moh. Zuhdi as an academic. The informants were not treated as statistically representative of the Madurese population but as local actors providing perspectives on ecological experiences, advocacy, journalistic practices, knowledge production, and risk communication.

Data were collected through in-depth interviews, observation, and documentation. Interviews explored experiences of ecological change, risk interpretations, environmental communication practices, participation barriers, and responses and mitigation efforts. Observation was used to contextualize social and environmental conditions, while documentation supplemented and cross-checked the interview data. Claims, perceptions, assumptions, or allegations that could not be independently verified were analyzed as informants' constructions of meaning rather than empirical facts. Data analysis followed Moustakas's procedures of epoché, horizontalization, clustering of meanings and themes, textural and structural descriptions, and synthesis of the essence of experience [13]. Cross-informant comparison was used to identify convergent and divergent patterns. The findings were subsequently interpreted through Robert Cox's environmental communication framework, risk communication, and Jan Servaes's participatory communication perspective [9], which functioned as interpretive frameworks rather than predetermined analytical categories. Credibility was strengthened through source and methodological triangulation, member checking, and an audit trail. The analysis focused on the relationship between experiences of ecological change, the in-

terpretation and communication of risk, and the gap between risk awareness and mitigation participation. Phenomenology thus served to explain how experience, communication, and social conditions shape the possibility of transforming risk awareness into participatory mitigation.

3 Result and Discussion

3.1 Experiences and Interpretations of Ecological Risks Associated with Illegal C-Mining in Madura

Ecological risks associated with illegal C-mining are experienced by Madurese communities through changes in the environment, livelihoods, everyday comfort, and perceptions of safety. From a phenomenological perspective, these risks emerge through lived experiences in everyday life. Illegal C-mining is therefore not merely an extractive activity but a phenomenon that reshapes how communities understand their socio-ecological environment. This is evident in the account of Romli, an environmental activist in Pamekasan, who has observed extraction activities since childhood:

"*My first experience of knowing about illegal extraction was when I was still a child. At that time, I was quite surprised and concerned because the activity occurred at several locations in my village on a relatively large scale. To this day, the activity is still continuing*" [14].

This account indicates that illegal C-mining is understood through prolonged ecological exposure. The repeated visibility of extraction from childhood into adulthood constructs awareness of environmental change not as an isolated event but as an ongoing transformation. In Moustakas's phenomenological framework, such experience is significant because consciousness of a phenomenon emerges through the relationship between the subject and the reality experienced. Romli's concern derives not from abstract information but from repeated exposure to environmental changes in his immediate surroundings. This meaning becomes more concrete when he connects the changes to soil and vegetation:

"*The environmental change I feel most strongly is that the soil has become increasingly dry and degraded. The vegetation that previously grew there has declined, affecting the availability of livestock feed for the community*" [14].

Ecological change thus becomes meaningful when connected to everyday needs. Drying soil and declining vegetation are not perceived merely as ecological indicators but as changes affecting livestock feed and livelihood sustainability. Consequently, the relationship among soil, vegetation, and livelihoods shapes how ecological risk is recognized. In this context, ecological risk perception is shaped primarily by observable, directly experienced changes rather than by technical assessments of environmental conditions [15]. This interpretation is consistent with Cox's constitutive function of environmental communication, through which meanings of the environment and human-environment relationships are constructed [7]. Yet, at the level of lived ecological experience, such meaning is initially rooted in the subject's direct encounter with envi-

ronmental change. Drying soil, declining vegetation, and reduced livestock feed become risks because they disrupt previously established relationships between people and their environment.

Risk interpretation is also intertwined with perceptions of safety, as a previously familiar living environment may come to be perceived as increasingly vulnerable to hazards [16]. Among the informants, this vulnerability appears across interconnected dimensions. The ecological dimension involves land degradation and vegetation loss; the livelihood dimension concerns disruptions to economic activities and resource availability; and the safety dimension concerns potential disasters. These dimensions demonstrate that risk acquires meaning through the relationship between ecological change and its consequences for social life [17]. Romli further emphasizes this relationship:

"*In my view, the environmental changes caused by illegal C-mining are not only ecological in nature because they also affect the social life of the community*" [14].

Environmental change becomes a social problem when it affects how communities use space, access resources, and sustain everyday activities. The ecological meaning of change is therefore shaped by its accompanying social consequences. Experiences of risk are not uniform because individuals' social positions and relationships with their environments influence which dimensions of change become most salient in their awareness [18]. This variation is particularly evident in the account of Zahiratul Mukarromah, an environmental activist in Sumenep. Unlike Romli, who has observed extraction in relation to land-use change and livelihoods since childhood, Mukarromah describes quarrying as an activity that has become embedded in the everyday landscape:

"*There is also stone mining in my area that is used to produce bricks. Here, the extraction area is called 'tobetoh.' So I have become accustomed to seeing it*" [19].

The expression "become accustomed" is phenomenologically significant because it indicates that extractive activity has become embedded in the informant's spatial experience and is therefore not necessarily perceived as extraordinary. Such normalization does not imply an absence of awareness of its consequences. When describing the changes she observes, Mukarromah identifies concrete environmental impacts:

"*The environmental change I see is that the roads have become dusty, disturbing people who pass by because the mining site is located right beside the road. The area has also become somewhat drier because trees were cut down to make space for mining*" [19].

Her account shows that ecological risks are recognized through visible and tangible changes in public space. Dust signifies a direct decline in environmental quality; road disruption reflects consequences for mobility; and tree loss and increased dryness indicate changes in vegetation and local environmental conditions. Romli's experience connects ecological degradation more strongly to livestock feed and livelihood continuity, whereas Mukarromah emphasizes comfort, accessibility, and landscape transformation. This difference demonstrates that ecological experience is contextual: the same phenomenon can take on different meanings depending on how individuals are connected to their environment. This interpretation develops further into an assessment of ecological imbalance:

"*I think this has a major impact because it can disrupt the balance of nature. The environment that was once well maintained has now become full of holes because of the excavation*" [19].

This statement reveals a temporal comparison between the environmental conditions of the "past" and those of the "present." An environment previously perceived as "well maintained" has acquired a new meaning, characterized by excavation pits resulting from illegal C-mining. Risk awareness thus emerges partly through the subject's ability to compare environmental conditions across time. The experiential accounts of the activists are complemented by the perspective of Moh. Zuhdi, an academic at UIN Madura, explains the broader ecological consequences of illegal C-mining:

"*Illegal C-mining is an activity that not only violates regulations but also has the potential to cause serious ecological damage, such as land degradation, erosion, blockage of river channels, and even the potential risks of floods and landslides*" [20].

Zuhdi's account extends the localized and directly experienced dimensions of risk into a more systematic understanding of ecological interconnections. Land degradation, erosion, disrupted waterways, flooding, and landslides indicate that changes in one environmental component can generate interconnected consequences. However, this academic perspective does not replace the activists' lived experiences; rather, the two represent different positions in the construction of risk meanings. Zuhdi further emphasizes that the consequences extend beyond the physical environment:

"*This damage affects not only the physical condition of the environment but also other aspects, including the social and economic dimensions of communities that depend on natural resources*" [20].

This observation reinforces the pattern emerging from Romli's and Mukarromah's accounts: ecological degradation becomes socially significant when it disrupts communities' relationships with the resources that sustain their lives. Ecological risk is therefore multidimensional. Environmental change becomes a social risk when it reduces resource access, disrupts everyday activities, or increases vulnerability to hazards. This interpretation supports the view that environmental degradation cannot be separated from the social and economic conditions of communities dependent on natural resources [21]. Across the informants, both shared patterns and differences in emphasis emerged. Romli experienced illegal C-mining as a long-term ecological transformation, associated with soil dryness, vegetation loss, livestock feed shortages, and community conditions. Mukarromah experienced it through dust, road disruption, tree loss, increasing dryness, and changes in a landscape once perceived as orderly. Zuhdi, meanwhile, articulated the consequences more systematically, linking land degradation, erosion, disrupted water flows, flooding, and landslides to broader socio-economic impacts. The commonality lies in their recognition of environmental change, while their differences reflect the aspects of everyday life most closely connected to their respective positions.

Ecological risks associated with illegal C-mining, therefore, do not constitute a single category perceived uniformly. For informants directly connected to local land and resources, changes in soil and vegetation are interpreted as threats to livelihoods. For those encountering extraction through public spaces, dust and road deterioration become indicators of disrupted comfort and safety. From an academic perspective, these

changes are understood as interconnected ecological processes with potentially broader consequences. Such variations reinforce the view that ecological experience is shaped by the subject's social position and relationship with the environment [18].

3.2 Environmental Communication Practices in Revealing the Risks of Illegal C-Mining

Communication about illegal C-mining in Madura occurs through layered networks of actors and communicative spaces. Ecological experiences do not remain individual knowledge but circulate through interpersonal conversations, environmental advocacy, media reporting, and academic knowledge production. Through these processes, localized experiences are transformed into information that can be shared, interpreted, and brought into the public sphere. Environmental communication can therefore be understood not merely as message transmission but as a process of producing, circulating, and legitimizing knowledge about environmental risks [22]. At the most immediate level of everyday life, illegal C-mining is communicated through informal interpersonal interactions. Romli explained:

"*Initially, this issue was more often discussed informally through word of mouth within the community*" [14].

This account indicates that environmental knowledge does not necessarily originate from formal institutions. Local experiences and observations can become initial sources of information that circulate through interpersonal relationships. Communication thus connects individual experiences with shared concerns. Experiences of dust, road damage, and changes in local spaces become more than private observations when discussed with others and recognized as collective problems. Environmental risk knowledge consequently emerges from repeated observation and experience and acquires meaning through interaction with others [23]. Interpersonal communication, therefore, does not provide all information about risk but serves as an important foundation for articulating environmental concerns. Informal conversations constitute an initial stage in the formation of environmental attention before issues enter the public sphere. The content of these conversations is grounded in consequences directly relevant to residents' everyday lives:

"*This activity is disliked because, besides causing dust pollution from vehicles transporting materials, some mining sites also cut off road access in hilly areas that were previously used by the community to collect livestock feed and carry out other activities*" [14].

The statement articulates the risks of illegal C-mining not through abstract environmental categories but through concrete consequences experienced by local communities. Communication makes the relationship between extraction activities and their consequences intelligible in terms of everyday life. This reflects the constitutive function of environmental communication identified by Cox, whereby communication helps construct how environmental conditions are recognized and interpreted as environmental problems [7]. As environmental concerns move beyond interpersonal exchanges, environmental activists engage in more deliberate communicative practices. Romli described his approach:

"*The form of communication I undertake is still simple: discussing and reminding the surrounding community about the negative impacts of illegal C-mining on the environment*" [14].

This practice reflects a shift from the exchange of experiences toward environmental education and awareness-building. By explaining the consequences of illegal C-mining, activists encourage communities to consider its broader implications. In Cox's framework, such practices represent the pragmatic function of environmental communication because communication is used to educate, warn, and encourage attention to ecological problems [7]. Activist communication also extends beyond immediate consequences by highlighting potential long-term impacts, thereby shifting attention from present conditions toward environmental sustainability and future generations. This intergenerational orientation can strengthen the sustainability dimension of environmental communication [24]. Beyond interpersonal and activist networks, media serve as important intermediaries for expanding the circulation of environmental information. Mukarromah's experience illustrates that knowledge of illegal C-mining is not always acquired through direct community interaction:

"*I have never heard people discussing this issue, but it is often discussed through news reports and social media*" [19].

This account demonstrates that media constitute an alternative pathway for the formation of environmental knowledge. Whereas interpersonal communication moves from local experience toward immediate social networks, media extend information to individuals who may not participate directly in community conversations. Environmental communication consequently operates through interconnected spaces involving interpersonal communication, social media, and mass media [25]. This mediating role is illustrated by Arif Muhammad, a journalist with mediajatim.com:

"*As journalists at mediajatim.com, we have a specific responsibility to investigate the impacts of C-mining, from nearby residents to the concerns expressed by environmental activists*" [26].

The statement reflects journalism's role as an intermediary of ecological experience. Journalists connect the experiences of residents living near extraction sites with the perspectives of activists articulating environmental concerns. Media, therefore, do more than expand the reach of information; they also select, verify, and frame experiences before presenting them to the public. Media communication also carries an educational dimension. Muhammad described the message used in public communication:

"*Taking care of Madura means taking care of the future of our children and grandchildren*" [26].

This message extends the meaning of extraction beyond immediate economic activity to encompass questions of environmental sustainability and intergenerational responsibility. Media thus perform a pragmatic function through public education while simultaneously serving a constitutive function by constructing a meaningful relationship between present ecological conditions and the community's future (Davari et al., 2025). At this point, the media do not simply communicate facts but also contribute to constructing public understandings of illegal C-mining as an environmental problem. This is consistent with the view that media messages perform a dual function: providing information while shaping interpretation [27]. Consequently, the selection of sources,

the experiences represented, and the framing of an issue can influence how ecological risks are understood by the public. However, the expansion of public attention through the media does not mean that the production of environmental information is free from constraints. Anis Billah, a journalist with Jawa Pos Radar Madura, described the conditions encountered when reporting from mining sites:

"*Covering C-mining in Madura always requires extra vigilance. In the fields, the sight of eroding limestone hills, heavily trafficked and dusty village roads, and passing heavy trucks is an everyday reality. However, the most difficult part is not the geographical terrain but access and intimidation. When entering illegal mining sites, journalists are often met with suspicious looks from workers and field supervisors*" [28].

This experience demonstrates that environmental knowledge production is shaped by the social conditions in which information is obtained. Access to sites, relationships with actors on the ground, and the potential for intimidation determine the extent to which journalists can obtain information directly. Media, therefore, should not be equated with unrestricted access to information, particularly when reporting on illegal C-mining, which journalists regard as a sensitive issue. As a MediaJatim journalist emphasized:

"*Covering the issue of illegal extraction in Madura is quite sensitive because various influential parties are also involved in it*" [26].

This sensitivity indicates that environmental communication takes place within an arena shaped by competing interests and power relations. Environmental information is subject to social negotiation concerning access, credibility, and legitimacy. Consequently, producing environmental information requires caution in source selection and verification to ensure that information presented to the public can be substantiated [29]. Media organizations also face institutional barriers when seeking information and confirmation regarding illegal C-mining:

"*The challenges in covering C-mining do not only occur in the field. We also have difficulty obtaining detailed confirmation when contacting relevant institutions or law enforcement agencies. Sometimes institutions shift responsibility to one another, and handling the issue is often complicated by conflicts of authority*" [28].

This account indicates that environmental information flows can be constrained by institutional fragmentation. When authority and responsibility are difficult to trace, verification becomes more challenging. Information that could clarify the issue may consequently be difficult to obtain. Information asymmetry, therefore, occurs not only between communities and extraction actors but also between the media and institutions responsible for environmental governance. Barriers to information access demonstrate that public attention is shaped by the social and institutional structures governing the production and accessibility of knowledge [29]. Academics constitute another important actor in environmental communication. Whereas activists provide experiential knowledge and media mediate information into the public sphere, academics contribute conceptual and analytical knowledge that connects local experiences to broader ecological consequences. Zuhdi stated:

"*Good communication also functions as an early warning system for potential environmental damage*" [20].

This statement indicates that environmental communication is not merely retrospective, explaining damage that has already occurred, but also anticipatory. Timely and appropriate communication can help local actors recognize potential hazards before they develop into more severe impacts. At this level, communication becomes part of mitigation through increased awareness, vigilance, and preparedness. Environmental communication thus reveals interdependence among actors: activists generate and articulate experiential concerns, media expand their public visibility, academics provide knowledge and interpretation, while public institutions are expected to translate such knowledge into policy and action [30]. Environmental communication can therefore be understood as a knowledge ecosystem in which different actors perform complementary functions. However, broader knowledge production does not necessarily generate uniform changes in attitudes or behavior. Romli noted that some community members recognize the ecological impacts of illegal C-mining, whereas others continue to perceive extraction as an economic opportunity. This finding demonstrates that the effectiveness of communication depends on how information is negotiated within existing socio-economic interests [8]. Here, the boundary between information and action becomes apparent.

Communication can generate knowledge and awareness, but translating knowledge into action requires social conditions that enable recipients to articulate their positions and make decisions. The central challenge of environmental communication, therefore, is not simply a lack of information. Overall, environmental communication surrounding illegal C-mining operates through a multilayered pattern. First, local experiences become initial sources of knowledge through interpersonal communication. Second, activists articulate these experiences as environmental concerns and warnings. Third, media expand and mediate information into the public sphere. Fourth, academics provide analytical knowledge that strengthens understanding of ecological risks. Together, these practices demonstrate that environmental risk awareness is produced through interconnected communicative processes rather than through a single source of information.

3.3 Participatory Communication as a Practice of Ecological Risk Mitigation

Communication does more than transmit information about environmental impacts; it provides spaces for communities to share experiences, negotiate interests, exercise social oversight, and develop collective responses. Ecological risk mitigation, therefore, unfolds through communicative processes that connect knowledge, social positions, and collective action [31]. However, ecological risk awareness does not automatically translate into participation. Field findings indicate that some informants understand the impacts of illegal C-mining but lack sufficient social capacity to articulate their awareness openly. Mukarromah acknowledged:

> "*Honestly, I have never discussed the implications of illegal C-mining. However, I am aware of the issue; I simply do not have the courage to express my opinion. As a young person without social status, I am still afraid to speak*" [19].

This statement indicates that the principal barrier to participation is not the absence of awareness but the capacity to transform awareness into a public voice. Social position, perceived safety, and expectations regarding whether one's views will be accepted influence decisions to participate. Participatory communication should therefore not be assessed merely by the existence of formal forums or opportunities to speak. It must also be evaluated in terms of whether actors have meaningful opportunities to express their experiences and views without social pressure or intimidation [9]. Journalists' experiences reinforce this in seeking testimony from affected residents:

"*Journalists also often have difficulty obtaining sources from residents affected by C-mining activities. Many residents are actually affected, but they are reluctant to speak because they fear miners or local figures who support the mining activities*" [28].

The account demonstrates that reluctance to speak is not simply an individual choice but a structural condition of communication. When residents directly experience environmental impacts but remain silent because they fear actors perceived as more powerful, public communication cannot fully represent the diversity of community experiences. Participatory communication, therefore, requires socially safe spaces in which affected groups can speak and have their knowledge recognized as legitimate. In Servaes's perspective, participation requires communicative relationships that position communities as subjects of development rather than objects of policy [9]. Ecological risk mitigation consequently depends on the creation of socially safe communicative spaces. The gap between awareness and participation becomes more pronounced because illegal C-mining also has an economic dimension. Mitigation should therefore avoid framing environmental protection and economic needs as mutually exclusive alternatives. An environmental activist from Sumenep explained:

"*Economic needs are important, but the environment must also be protected so that they do not create greater impacts and cause greater losses for nearby residents in the future*" [19].

This statement reflects a non-binary form of ecological awareness. The informant does not deny economic needs but incorporates them into a broader consideration of long-term ecological consequences. Mitigation communication, therefore, requires negotiation among competing interests rather than simply communicating prohibitions. Communication that ignores economic needs may lose social legitimacy, whereas communication that emphasizes only economic benefits may overlook ecological burdens [32]. Dialogue consequently becomes a mechanism for bringing different forms of knowledge and interests into interaction. Participatory communication does not require all actors to reach identical conclusions; rather, it creates opportunities to understand competing interests and their consequences. This principle is consistent with Servaes's view of dialogue as a two-way communicative process in shaping decisions that affect people's lives [9].

Participatory communication in mitigation does not replace law enforcement or imply that majority preferences should prevail. Its role is to create deliberative spaces in which ecological, economic, and social interests can be considered transparently before decisions are made. Participation becomes more concrete when communication gener-

ates advocacy and social oversight. Activists and community organizations, for example, have expressed opposition through demonstrations and public demands, demonstrating how communication can move from interpersonal spaces toward collective action. At this stage, individual experiences are consolidated into agendas directed toward public institutions. This process reflects the pragmatic function of environmental communication identified by Cox, particularly its advocacy and mobilization dimensions [7]. Communication thus connects localized experiences with demands for institutional responses. Such advocacy, however, requires a credible knowledge base to ensure that public claims can be substantiated. The media, therefore, play an important role in extending local experiences into the public sphere. Billah described the conditions encountered in the field:

"*Covering C-mining in Madura always requires extra vigilance. In the fields, the sight of eroding limestone hills, heavily trafficked and dusty village roads, and passing heavy trucks is an everyday reality*" [28].

This account illustrates how journalistic experience can document ecological conditions occurring on the ground. For such information to generate institutional consequences, mechanisms are needed to connect field findings, community voices, and responsible authorities. Communities can provide information about environmental changes, submit complaints, monitor activities, and advocate for their interests, while government institutions retain responsibility for regulation and law enforcement. This division is essential to prevent participation from becoming a mechanism for shifting state responsibilities onto communities.

The findings further confirm that participatory communication is shaped by institutional structures. A journalist from Jawa Pos Radar Madura explained:

"*Sometimes institutions shift responsibility to one another, and handling the issue is often complicated by conflicts of authority. Behind the mining activities, there are officials, local figures, and businesspeople. So sometimes there is interference in the production of news about C-mining*" [28].

This statement demonstrates that the participation gap extends beyond individuals and communities to relationships among communities, media, and institutions. When institutional responsibilities are unclear or information production is subject to interference, the capacity of communication to generate policy responses becomes constrained. Communication effectiveness is therefore determined not only by message quality or citizens' willingness to speak but also by institutions' capacity to receive, verify, and respond to information. Transparency consequently becomes an integral component of mitigation. Government institutions need accessible information and clear complaint mechanisms; media provide social oversight through verified reporting; academics contribute evidence-based knowledge; and communities contribute experiential knowledge, monitoring, and articulation of their needs. Such differentiated roles enable communication to function as a collaborative network that connects multiple sources of knowledge and capacities for action [33].

The findings indicate that no single actor possesses all the capacities required to address the ecological risks of illegal C-mining. Communities possess experiential knowledge; activists have advocacy capacity; media provide mediation and information dissemination; academics contribute analytical expertise; and government institutions

possess formal authority. Effective mitigation, therefore, requires relationships that allow these complementary capacities to interact. From this perspective, participatory communication means more than simply "letting communities speak." It involves connecting voices, knowledge, and authority. Communities can report experiences and monitor environmental changes; media can verify and amplify information; academics can interpret risks using evidence; activists can organize advocacy efforts; and government institutions can translate information into institutional responses. Communication thereby functions as a social infrastructure supporting ecological risk mitigation.

This interpretation is consistent with Servaes's perspective that development communication should enable communities to participate in defining the problems and solutions that affect their lives [9]. At the same time, Cox's pragmatic function explains how meanings established through communication can be directed toward education, warning, advocacy, and mobilization [7]. Participatory communication consequently operates across three interconnected levels. At the micro level, communication enables residents to express experiences, develop confidence, and build shared awareness. At the meso level, it connects communities with activists, media, academics, and social organizations. At the institutional level, it provides channels through which public information and demands can enter processes of oversight and decision-making. The interaction among these levels determines whether ecological awareness can develop into mitigation action. The central question, therefore, is why the wider circulation of environmental information does not automatically produce equal participation. The findings reveal a distance between recognizing risk, having the confidence to express concerns, possessing the capacity to advocate, and having opportunities to influence institutional responses.

The gap is produced by interconnected conditions, including unequal social positions, fear of actors perceived as powerful, competing economic interests, limited access to information, and weak connections between public voices and institutional responses. Participation is therefore not simply a matter of individual willingness but a form of social capacity that requires supportive communicative and institutional conditions. Meaningful ecological risk mitigation requires dialogue, communicative safety, information access, and responsive institutional mechanisms that enable awareness to be translated into collective and institutional action.

4 Conclusion

This study concludes that ecological risks associated with illegal C-mining in Madura are lived and interpreted through the interplay of environmental change, socio-economic conditions, and communication processes. First, risks are recognized through experiences of land degradation, vegetation loss, dust, disrupted access, erosion, and potential floods and landslides, which are interpreted in relation to livelihoods, safety, and community sustainability. Second, these experiences are communicated through interpersonal networks, environmental activism, mass media, and academic knowledge, which collectively shape, extend, and legitimize public understandings of ecological risks. Third, participatory communication enables risk awareness to be

translated into dialogue, advocacy, monitoring, and collective action. However, this process remains constrained by a participation gap arising from unequal social positions, fear of speaking, competing economic interests, limited information, and weak communication with institutions. Risk awareness, therefore, does not automatically produce participation. Its transformation into action depends on access to information, meaningful spaces for dialogue, communicative safety, and opportunities to influence decision-making. The study's principal contribution lies in conceptualizing the participation gap as a critical link between ecological risk awareness and mitigation. Ecological mitigation consequently requires more than regulatory enforcement or information dissemination. It requires an inclusive, transparent, dialogical, and responsive communication ecosystem connecting communities, activists, media, academics, and government institutions. Participatory communication thus functions as a social infrastructure through which risk awareness can develop into collective action and sustained institutional responses.

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