Seeing the Resilience of Local Communities Established: Evidence from the local community in Southeast Sulawesi

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Abstract. This article describes the resilience of local communities living in two mining locations. Through the theoretical framework of resilience, the research reveals how local communities can survive social-ecological changes due to mining activities in two districts of Morosi and Moramo, Southeast Sulawesi. By using a mixture of quantitative and qualitative methods where the methods used surveys and focus group discussions/FGDs . This research reveals at a glance, the resilience of local communities in dealing with changes in mining areas can be seen from their adaptation to change and shifting jobs from agriculture/plantation to service workers. This transition is one way for local people to survive the change. Our study also reveals that the role of social capital in the community is an important factor in facing challenges from the changing environment of mining activities.

Keywords: adaptation; local resilience; local community; nickel mining; rock mining; social capital; social change; socio-ecology resilience

1   Introduction

The subject of resilience has a very complex meaning (Fischer & McKee, 2017; Gascón & Mamani, 2022). Community resilience includes aspects such as economic resilience, social resilience, and ecological resilience. Community resilience can be interpreted as the ability of a community group to interact and adapt to socio-ecological changes (van de Camp, 2016).

The most visible socio-ecological resilience is in the mining area where the mining sector is one of the sectors that has a significant socio-ecological impact. Mining activities often bring dramatic changes in the lives of local communities living around concession areas. These changes can include shifts in living space, livelihood patterns, and other spatial patterns.

This study uses a theoretical framework of resilience to explain how local communities in the two districts can survive the socio-ecological changes faced by mining activities. In Southeast Sulawesi, the concept of resilience was raised in the Bajo community, (Wianti &

Mcwilliam, 2023) seeing the resilience of the Bajo community in difficult times during the Covid-19 pandemic. Wiyanti sees resilience from a socio-economic aspect and focuses on the maritime-oriented Bajo community. Research on socio-ecological resilience is still limited in the mining sector. This study tries to see from the point of view of community adaptation, social capital that still exists in the community facing ecological changes due to mining activities.

Considering that the generation of knowledge regarding the protection of ecological aspects in mining areas invariably occurs within a specific social context, this process encompasses not only economic activities but also social and political dimensions (van de Camp, 2016; Xing & He, 2021)

Community resilience, particularly at the local level, can be understood through Norris' concept (Norris et al., 2008), and also Adger (Adger, 2000) also contribute significantly about social ecology concept. (Fischer & McKee, 2017) said community capacity or capitals is key factor to help local people more resilient. In which views communities as interconnected networks of adaptive capabilities that enable them to function and adjust in the face of damage or disruption. Resilience is a multifaceted concept that encompasses two key aspects: "resources" and the dynamic nature of these resources. The dynamism of resources can be further broken down into three dimensions:

     1.Resource Strength (Robustness): This dimension relates to the inherent power and durability of the resources available to a community.

     2.Substitution of Resources (Redundancy): Redundancy reflects the ability of a community to replace or complement its existing resources with alternative ones when needed.

     3.Speed of Resource Access and Mobilization (Rapidity): Rapidity pertains to how swiftly a community can access and put its resources into action in response to challenges.

Community resilience is fostered through the enhancement of adaptive capacities and transformability (Walker et al., 2004), including economic development, social capital, information and communication infrastructure, and community competence. These four elements work in concert to formulate a comprehensive "strategy" for addressing disturbances. Crafting effective strategies to bolster community resilience requires a prior assessment of the community's adaptive capacities within these four dimensions.

This research will review adaptation and the role of social capital in increasing community resilience. Social capital includes social networks, traditions, cultures and beliefs that exist among members of society. Our study will explore how this social capital can help local communities deal with the challenges of environmental change due to mining activities.

Through this research, we hope to provide a better understanding of how local communities in the two districts of Morosi and North Moramo, Southeast Sulawesi can survive and adapt to socio-ecological changes caused by mining activities. The information gained from this research can form the basis for more sustainable policy development and support the resilience of local communities in areas affected by mining.

It is important to remember that the local context can play a significant role in responding to and dealing with mining impacts. Therefore, it is important to understand how local communities in the region cope with socio-ecological changes caused by mining activities and how factors such as adaptation and social capital play a role in increasing their resilience.

2   Method

In this study, we selected two sub-districts Konawe and Konawe Selatan, Southeast Sulawesi. This research is a case study involving scientific disciplines. In Konawe we chose Morosi sub-district which has been known as a nickel mining area. In South Konawe, we chose North Moramo sub-district, which is famous as a producer of mountain stone which is currently undergoing massive mountain stone mining. Another reason is that these two areas live local people both indigenous and migrating residents from South Sulawesi, Java island but have lived for decades. To measure the level of community resilience to socio-environmental changes, we collect data through field surveys, FGDs (Young & Ismail, 2019) and ecological quality tests, one of which is water quality.
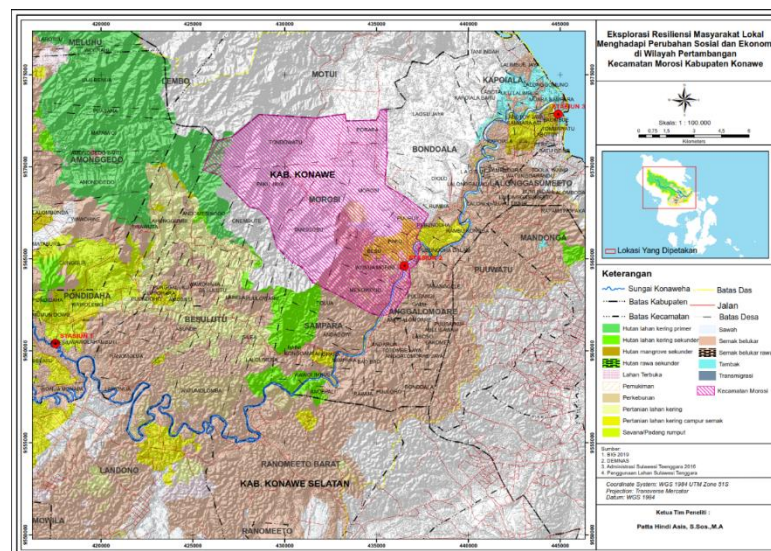

Figure 1: map of Konaweha water quality research and sampling area of research
(source: autors)

This study uses a mixed-methods approach to investigate community resilience. Quantitative methods, utilized for the collection and numerical analysis of structured data. Simultaneously, a qualitative-objective approach is employed, using a research instrument based on the four units of adaptive capacity related to community resilience. We use a Likert scale to measure respondent's answers, where 1 means strongly disagree with the question, 3 means neutral, while 5 means strongly agree. This instrument is administered to 163 households, and the resulting data are meticulously analysed within the framework of Microsoft Excel. The

primary objective of distributing the questionnaire is to gauge the local community's perspective on their level of resilience, especially in their role as central actors when addressing the social and ecological shifts occurring in mining areas. we use a mix of quantitative and qualitative methods, including surveys and focus group discussions (FGDs) with local community, sub-district government, village government.

To measure the ecological quality in the mining area, we only use the water quality test of the river Konaweha. The quality status of the waters will explain whether the waters are good, lightly polluted, moderately polluted or heavily polluted. The national quality standards and water quality classifications are as follows:

Table 1 Water Quality Status Classification

Klasifikasi	Status
$PI_j; \leq 1,0$	Meet quality standards (good condition)
$PI_j; 1,1-5,0$	Light contaminants
$PI_j; 5,1-10$	Medium containment
$PI_j; \geq 10,1$	Heavy polluted

Source: (Decree of the State Minister of Environmsent Number 115 concerning Guidelines for Determining Water Quality Status, 2003)

3   Result and Discussion

Morosi and Moramo Utara subdistrict: an overview

Morosi Subdistrict and North Moramo, situated in the southeast part of Sulawesi, those region have unique characteristics based on their economic and environmental landscapes.

Morosi Subdistrict is renowned for its thriving nickel mining industry. The region is rich in nickel deposits, making it a hub for extraction and processing. This industry has provided employment opportunities for the local community and migrant worker. However, it also raises environmental concerns due to the potential for social and ecology disruption associated with mining operations.

Meanwhile, Moramo Utara subdistrict stands out for its stone mining activities. The area is abundant in various types of stone production. The stone mining industry plays a pivotal role in the local economy, as these materials are widely used in construction and infrastructure projects.

Both regions showcase the intertwined between economic prosperity and environmental sustainability, as they grapple with the challenges posed by mining activities. Since the last ten years, these two locations have been connected to each other due to the need for 5x8 centimetre stone as raw material for burning smelter furnaces.

The results of the survey and FGD show that most local communities in Morosi and Moramo have experienced significant changes in their living space and livelihoods. Most of

those who previously worked in agriculture or plantations have switched to mining-related service sectors or no longer rely entirely on agriculture, plantations, and fisheries as their livelihoods, but adapted to the changes of working in mining. This adaptation is one of the main strategies in maintaining the resilience of local communities to environmental and economic changes.

River water ecosystem factors are appointed to measure the quality of water quality and its influence on community resilience. Water is an important element in physical ecology to measure the resilience of a society or community (Moench, 2014). Water is one of the needs of living things to survive because water is the main source in the lives of humans and other living things, therefore water must be maintained and processed properly for the survival of the present and the future for the survival of humans and other living things, therefore it is also necessary to save and preserve water resources, therefore it is required for water users not to cause source damage natural power and most importantly the water so that it is not polluted.

The value of clean water is becoming increasingly important as demand grows, but the quantity and quality of water is declining in many areas. Many components affect the quantity and quality of water in an area, both natural and human factors.

Table 2. Water quality status of Konaweha river

Letter Lokasi Research	Pollution Index	Quality Status
Stasiun I	3,064	Mild Contaminants
Stasiun II	3,159	Mild Contaminants
Stasiun III	4.560	Mild Contaminants

Source: Primary Data (2023)

This research conducted at three different stations that assessed water quality using the Pollution Index method and compared the results with the class 2 quality standards outlined in Government Regulation Number 22 of 2021. At Station I, most parameters met the standards, except for Total Suspended Solids (TSS) and Biochemical Oxygen Demand (BOD), which were elevated due to agricultural activities and domestic waste disposal. At Station II, parameters met the standards, except for BOD, influenced by agricultural and mining activities, causing an excess of organic matter in the water. At Station III, parameters complied except for Chemical Oxygen Demand (COD) and BOD, with organic matter originating from various sources like agriculture and household waste, leading to elevated pollution levels. In all three stations, certain parameters exceeded the class 2 quality standards, highlighting the impact of local activities on water quality.

The results of water quality research show that the level of water quality in mining areas based on ministry standards is mild.

Mining and community adaptation

Mining is an important economic activity, but it also has a significant impact on the local communities living around the mining site. The socio-ecological impacts of mining can include environmental damage, changes in people's lifestyles, and uncertainty in livelihoods. Previous research has shown that local communities often become vulnerable to these changes (Ahmad et al., 2022). Community resilience understanding how local communities can cope with mining impacts. Community resilience includes economic, social, and ecological resilience. Various studies have identified factors that influence community resilience in the mining context, including adaptation to changing livelihoods, the role of social capital, and participation in decision-making (Adger, 2000; Norris et al., 2008)

One of the key aspects in the resilience of local communities in mining areas is their ability to adapt to changes in livelihoods including environmental and social change (Zander et al., 2023), (Young & Ismail, 2019) called this as adaptive strategy. In many cases, mining activities can replace other sectors such as agriculture or plantations, and local people often have to switch to other jobs. Previous research has shown that adaptations like these can be an important strategy for improving community resilience (Ahmad et al., 2022)

The community continued to cultivate the gardens and rice fields as before the mine entered amid the threat of crop failure while looking for additional work as stone miners, manual laborers in factories and opening a food stall, rental houses and opening cleaning services, and selling telephone credit. When the harvest period comes. Mining practice changes land tenure (Young & Ismail, 2019).

The adaptation to the environment is that the people around the mine are no longer allergic to dust. North Moramo, for example, faces dust every day but never wears masks or personal protection from dust. People consider it to be 'daily food'. This pattern is also seen in Morosi, where the surrounding communities affected by dust do not protect themselves.

The results of this study underscore the importance of local communities' adaptation to livelihood change as a key strategy to increase their resilience in mining areas. When traditional livelihoods such as agriculture or plantations are disrupted by mining activities, the ability of local communities to shift to mining-related jobs or develop new skills becomes key in maintaining their survival.

The role of social capital

From the perspective of social, the behaviour attitude of the mining area is impacted by the social circumstances (Xing & He, 2021). Social capital, which includes social networks, social norms, and trust between individuals, also has an important role to play in increasing the resilience of local communities. In mining area, in particular in Morosi and Moramo Utara sub-district are agree that people have strong social capital in community. Local people tend to cope the risk situation because they have social capital each other. People be better able to cope with socio-ecological changes and work together to find sustainable solutions (Athamneh & Jais, 2023)

Figure 2: Local community the local community is carrying out community service in Moramo sub-district (source: local informan, 2023)

The results showed that community adaptation to livelihood change was the main strategy in increasing their resilience in both districts. Most respondents in the survey indicated that they have experienced a change in their livelihoods since the activity mining is increasing. For example, many have moved from traditional agriculture or plantations to service jobs related to the mining industry, such as transport, food supply, or construction. In addition, interviews revealed that local communities have developed new skills to compete in mining-related employment sectors. They are also actively looking for business opportunities around mining activities, such as selling photocopying services, rental houses, and opening street sales. These results show that adaptation to changing livelihoods has become one of the main ways for local communities to survive in the face of mining impacts.

In Wayanad community resilience in Kerala India, revealed that resilience influenced by existing bonding, bridging and bridging social capital (Koshy & Smith, 2023). Our study found that the role of social capital is critical in dealing with the challenges of environmental change due to mining activities. Local communities that have strong social networks are better able to gain access to resources and economic opportunities such as community services. Social capital also helps in collaborating with related parties and participating in mining-related decision-making (Torso et al., 2020).

This research also looks at the role of social capital in improving the resilience of local communities. The survey results show that communities that have strong social networks, especially in terms of interpersonal cooperation and social support, tend to be better able to cope with the socio-ecological impacts of mining activities. Those involved in community groups or local organizations also reported higher levels of life satisfaction.

The results of interviews and surveys at the research site revealed that strong social norms in society can play an important role in supporting resilience (Torso et al., 2020) . For example, values such as mutual aid and helping each other in the community help local communities face challenges together (Torso et al., 2020) . This social capital also allows them to unite and participate in decision-making that affects their territory. No less important is that people still believe in the sub-district government and village government.

Strong social capital in supporting community resilience is very important. Strong social networks, positive social norms, and participation in local organizations can help communities cope with the socio-ecological impacts of mining (Xing & He, 2021). This allows them to support each other, share information, and unite in efforts to deal with environmental change.

Ecological aspects

Ecological aspects sometimes involve production of knowledge in mining sectors. (Xing & He, 2021) stated these aspects with knowledge production of mining. Several knowledge productions in mining area not only about economic but also social and political. So, ecological aspect related with social, and pollical aspects. A socio-ecological system is a complex and dynamic adaptive system in which the flow and use of resources such as natural, economics and cultural is regulated by a combination of social and ecological network (van de Camp, 2016).
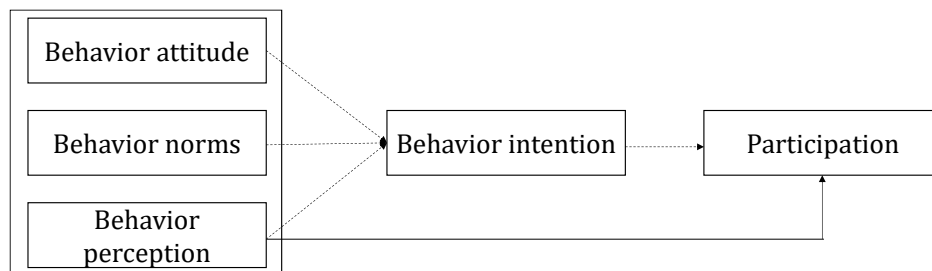
Planned Behavior Theory (PBT)(Xing & He, 2021)

Communities and mining long before the entry of mining factories, especially stone mining in North Moramo, managed stone with wisely. Picking up stones with a crowbar without using heavy equipment. In the last ten years everything has changed because it has used heavy equipment for the stone industry. One of the FGD participants who is also the village head described:

Before the massive stone mining here before the factory came in, we managed this mining wisely and empowered the community (local community)

Nowadays, mining activities, particularly those involving nickel and stone mining pose a grave threat to ecosystems and the environment, with devastating consequences for agriculture and aquaculture only one decade.

Fertile rice fields, once a source of sustenance for local communities, are now marred by pollution caused by haphazardly discarded mining waste. This contamination permeates the soil

and water, eroding fertility and jeopardizing agricultural yields. Consequently, communities reliant on these once-fertile fields face not only economic losses but also food insecurity. Additionally, the pollution resulting from mining activities extends to aquatic environments. Ponds that were once vibrant and productive have succumbed to ineffectiveness due to pollution and dust from burning mining furnaces. Moreover, freshwater and marine ecosystems surrounding mining sites face severe peril. Pollutants infiltrate the water, wreaking havoc on marine life and disrupting delicate ecological balances. Furthermore, mining dust, carried through the air, damages plants and animals in the vicinity of mining areas, further exacerbating the environmental impact. The cumulative effect of these mining activities poses a significant threat to the sustainability of both the environment and local community.

Figure 3: picture (a) and (b), fish and shrimp ponds of local community that are no longer productive in Porara village after the opening nickel mining industry (source: authors, 2023)

5   Conclusion

This research reveals that the resilience of local communities in facing socio-ecological changes due to mining activities can be seen from their adaptation to changes in how to overcome the declining carrying capacity of their living space in the agriculture, plantation and fisheries sectors and the social capital owned by communities that are still closely intertwined seems to be the capital of local community resilience.

Transitional lifestyle changes and strengthening social capital are two main components in maintaining the resilience of local communities. It is important for governments, mining corporations and other stakeholders to work together to support local communities in facing these changes and maintaining sustainable lives for local communities.

In the policy context, the results of this study highlight the need to support the adaptation of local communities and strengthen social capital in mining areas. Governments and non-governmental organizations can play a role in providing training and support to help local communities develop new skills. In addition, they can also promote the formation of community groups and organizations that strengthen social capital in society. The importance of understanding the local context must also be emphasized, as each mining area has different characteristics. The transition of employment from agriculture or plantations to mining-related service sectors is important in maintaining the resilience of local communities. This shows the flexibility and adaptability of society in the face of economic changes. However, it should be

noted that this transition can also bring risks, such as job uncertainty and complex social changes, therefore serious joint efforts are needed to minimize the impacts and risks due to socio-ecological changes in mining communities in the future.

To mitigate socio-ecological crisis, urgent and comprehensive action is imperative. Strategies such as improved waste management, stringent monitoring protocols, and strict law enforcement are essential to safeguard this fragile ecosystem from irreparable damage. Without immediate intervention, the long-term consequences could be irreversible, jeopardizing not only local communities but also the broader ecological integrity of the region.

Acknowledgment

References

[1] Adger, W. N. (2000). Social and ecological resilience: Are they related? *Progress in Human Geography*, *24*(3), 347–364. https://doi.org/10.1191/030913200701540465

[2] Ahmad, F., Chowdhury, R., Siedler, B., & Odek, W. (2022). Building community resilience during COVID-19: Learning from rural Bangladesh. *Journal of Contingencies and Crisis Management*, *30*(3), 327–338. https://doi.org/10.1111/1468-5973.12405

[3] Athamneh, M. H. A., & Jais, J. (2023). Factors affecting human resource agility: A literature review and future research directions. *Cogent Business and Management*, *10*(1). https://doi.org/10.1080/23311975.2023.2193181

[4] Fischer, A., & McKee, A. (2017). A question of capacities? Community resilience and empowerment between assets, abilities and relationships. *Journal of Rural Studies*, *54*, 187–197. https://doi.org/https://doi.org/10.1016/j.jrurstud.2017.06.020

[5] Gascón, J., & Mamani, K. S. (2022). Community-based tourism, peasant agriculture and resilience in the face of COVID-19 in Peru. *Journal of Agrarian Change*, *22*(2), 362–377. https://doi.org/10.1111/joac.12447

[6] Keputusan Menteri Negara Lingkungan Hidup Nomor 115 Tentang Pedoman Penentuan Status Mutu Air, Jakarta : Menteri Negara Lingkungan Hidup 1 (2003). http://medcontent.metapress.com/index/A65RM03P4874243N.pdf

[7] Koshy, M., & Smith, D. (2023). Community resilience implications for institutional response under uncertainty: Cases of the floods in Wayanad, India and the earthquake in Port-au-Prince, Haiti. *Sustainable Development*, *June 2022*, 1–16. https://doi.org/10.1002/sd.2678

[8] Moench, M. (2014). Experiences applying the climate resilience framework: Linking theory with practice. *Development in Practice*, *24*(4), 447–464. https://doi.org/10.1080/09614524.2014.909385

[9] Norris, F. H., Stevens, S. P., Pfefferbaum, B., Wyche, K. F., & Pfefferbaum, R. L. (2008). Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness. *American Journal of Community Psychology*, *41*(1–2), 127–

150. https://doi.org/10.1007/s10464-007-9156-6

[10] Torso, K., Cooper, C. M., Helkey, A., Meyer, C., Anne, L., Wardropper, C. B., Torso, K., Cooper, C. M., Helkey, A., & Meyer, C. (2020). Participatory research approaches in mining- impacted hydrosocial systems ABSTRACT. *Hydrological Sciences Journal*, *65*(14), 2337–2349. https://doi.org/10.1080/02626667.2020.1808218

[11] van de Camp, E. (2016). Artisanal gold mining in Kejetia (Tongo, Northern Ghana): a three-dimensional perspective. *Third World Thematics: A TWQ Journal*, *1*(2), 267–283. https://doi.org/10.1080/23802014.2016.1229132

[12] Walker, B., Holling, C. ., Stephen, R. C., & Ann, K. (2004). Resilience, Adaptability and Transformability in Social– ecological Systems. *Ecology and Society*, *9*(2), 5. https://www.ecologyandsociety.org/vol9/iss2/art5/

[13] Wianti, N. I., & Mcwilliam, A. (2023). *Sama Bajo Resilience in the Time of COVID*. *93*(2), 179–190. https://doi.org/10.1002/ocea.5368

[14] Xing, Q., & He, G. (2021). Mining area ecological protection: knowledge production from the perspective of planned behavior theory. *Geomatics, Natural Hazards and Risk*, *12*(1), 244–260. https://doi.org/10.1080/19475705.2020.1869590

[15] Young, H., & Ismail, M. A. (2019). Complexity, continuity and change: livelihood resilience in the Darfur region of Sudan. *Disasters*, *43*(S3), S318–S344. https://doi.org/10.1111/disa.12337

[16] Zander, K. K., Sibarani, R., Abunyewah, M., Erdiaw-Kwasie, M. O., Moss, S. A., Lassa, J., & Garnett, S. T. (2023). Community resilience across Australia towards natural hazards: an application of the Conjoint Community Resiliency Assessment Measurement. *Disasters*. https://doi.org/10.1111/disa.12590