



Socio-Cultural and Ecological Dynamics of Local Communities in the Face of Karst Transformation During the Anthropocene Era

(Case Study Rammang-Rammang Area of Maros)

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Abstract

This study aims to investigate the socio-cultural and ecological dynamics of local communities in adaptive mechanisms on Rammang-Rammang karst region in response to crises threat, aiming to offer significant understanding for the sustainable administration and preservation of biodiversity in the karst region of Rammang-Rammang Maros. The research employs a qualitative research methodology and adopts a case study technique, focusing the local community in Rammang-Rammang Maros is deeply connected to the preservation of cultural values and practices, which are rooted in their environment and beliefs. The indigenous community maintains a conservative approach towards the karst area, focusing on the preservation of their ancestors' cultural legacy through sacred rituals. The karst landscape serves as a repository of climatic data and a climate archive, and the local community plays a crucial role in preserving the karst landscape. The Anthropocene era has accelerated human impact on the environment, requiring a comprehensive approach to address social and ecological changes. The local community plays a crucial role in preserving the karst landscape, implementing measures to restore ecosystems and implement changes in governmental regulations. Cooperation among local populations, governments, and environmental groups is essential for ensuring the long-term viability and conservation of the Karst equilibrium in the Anthropocene age.

Keywords: Karst, Local Communities, Rammang-Rammang.

1 Introduction

Indonesia is an archipelagic nation rich in valuable natural resources. The presence of natural landscapes such as forests, marine biospheres, mountains, and karst regions is evident. Indonesia has the second-largest karst region globally. An area of significant significance is the Maros-Pangkep karst, which serves as a vital habitat for diverse flora and fauna, including unique species. Featuring a distinct and valuable element, it fulfils a crucial function within the local ecosystem, while also contributing to a distinctive cultural context that is unparalleled in any other ecosystem. The development of the karst area is significantly impacted by climatic elements, as well as tectonic and lithological ones. The creation of the Maros karst region is influenced by three elements. Based on the regional geological map [1], the primary rock formation in the Karst area of Maros is the carbonate rock of the Eocene-Miocene Tonasa Formation, which dates back around 15-16 million years. The Maros karst region is influenced by the geological structure that arises from the process of rock dissolution, leading to the formation of diverse surface features (exokarst) such as steep hills, valleys, springs, two sinkholes, as well as internal features (endokarst) including stalactites, stalagmites, flowstones, and underground river networks [2].

The Rammang-Rammang Maros karst region in South Sulawesi, Indonesia, has a remarkable environment and rich wildlife, serving as the longstanding habitat for indigenous populations. The communities' livelihoods are intricately connected to the distinctive karst environment, as they adjust to the natural dynamics and practice sustainable resource use. While the Rammang-Rammang Karst Area has distinct characteristics, it is not included within the protected zone of the Bantimurung Bulusaraung National Park (TNBB). Rammang-Rammang, with a potential marble content of up to 2.609 million tons, is being targeted by a mining business that aims to increase its concessions. Rammang-Rammang encompasses a comprehensive and intricate region. Rammang-Rammang is a geological formation characterized by a dense forest of karst rock mountains. In addition, this place is home to the residences of the inhabitants who reside in the Rammang-Rammang region and engage in several activities. The expansion of mining operations and the exponential growth of the population have led to a rise in the demand for land. When the availability of land is restricted, a procedure for transferring land takes place [3].

Given the significant environmental impact during this geological era, it is crucial for local communities in the karst area of Rammang-Rammang Maros to prioritize the sustainable management and preservation of the diverse ecosystem found in the Rammang-Rammang Maros karst. This is particularly important in the current era, which emphasizes the need for ecological awareness. The native populations residing in the Rammang-Rammang Maros karst area possess a profound comprehension of their surrounding environment and have developed traditional wisdom about the sustainable stewardship of natural resources. They preserve caves and karst hills as habitats for diverse species and supplies of water, establish agricultural systems with resource decentralization, and jointly manage space in non-destructive communities. Their significant reliance on the environment has propelled the

development of a local social order rooted on wisdom, which prioritizes communal management of resources and reverence for nature. In addition, consumerism has a huge impact on Karst Rammang-Rammang, often leading to substantial alterations in the exploitation and management of karst ecosystems, resulting in imprudent and drastic transformations of the karst terrain. Both outwardly and inside. It has an impact on both the ecological and geomorphological aspects of the region, as well as the social and economic dynamics of the local populations who rely on these resources. The research seeks to further investigate the socio-cultural dynamics of local communities and the ecological adaptation processes of the Rammang-Rammang Maros in response to a crisis. The outcomes of this study are anticipated to provide useful perspectives for the sustainable administration and preservation of biodiversity in the karst region of Rammang-Rammang, Maros. Additionally, it is relevant in an era of potential crises that need heightened ecological consciousness and sustainability.

2 Research Methods

This study employs a qualitative research methodology [4] using a case study technique [5]; [6]The qualitative research process uncovers a question by examining the basic inquiries about social phenomena [7]; [8]; [9] specifically focusing on research that investigates socio-cultural dynamics in response to the ecological crisis in the karst region of Rammang-Rammang, South Maros Sulawesi. This is achieved by gathering data that is specific to the Rammang-Rammang local community, which is the subject of the research. It serves as a repository of information used to gather data and input in order to uncover research challenges. This study examines the socio-cultural dynamics involved in ecological adaptation mechanisms in response to the crisis threat in the Rammang-Rammang karst region, Maros. There are no other factors at play, since the local community remains very traditional, united, and unwavering in their efforts to protect the ancient legacy of sustainable resources in the Karst area. The researchers will utilize objective data to explain the conservative patterns of ethical principles in the social culture of the Karst area by the local population in Rammang-Rammang, Maros. The study utilizes observations, in-depth interviews, and documentation to collect data on the local population in the socio-culturally dynamic karst area of Rammang-Rammen, Moros. The aim is to understand the adaptive mechanisms employed to address the ecological crises at the micro level.

3 Preliminary Results/Results/Critical Review

3.1 Effects of Transformation in the Karst Region

The preservation and sustainable management of the abundant natural resources and biodiversity is essential, although economic pressures pose a challenge to their effective stewardship. The strains and dangers emerge from the influence of using biodiversity assets and habitat values within the limestone forest ecosystem itself. The mining industry's operations provide a significant and substantial hazard due to the extraction of cement, marble, and other construction materials like sand and materials used for

constructing homes and roadways. The Tonasa and Bosowa cement facilities are now operational, using karst or limestone as their primary supply of raw materials. Both sectors are causing significant damage to ecosystems, both on the surface (exokarst) and in underground caves (endokarst), via activities like as explosions, cutting, and disassembly during the extraction of raw materials. The devastation had a significant impact on the ecosystem, disrupting the natural habitat of many aquatic and terrestrial organisms such as fish, shrimp, insects, butterflies, and other fauna [10]. The karst transformation in Rammang-Rammang Maros, caused by external concessions and extensive expansions, will significantly affect ecosystems, altering landscapes and natural environments. This transformation poses a threat of ecological crises, leading to changes in hydrological patterns and the degradation of water resources' quality, as well as the loss of biodiversity. The prospect of a catastrophe will be triggered by the immediate influence of human activities on the karst environment. Andrew Vayda and Roy Rappaport subsequently popularized the human ecology concept, which is widely regarded as crucial for comprehending the interactions between humans and their environment. In terms of human ecology, this refers to the 1980s. Andrew Vayda subsequently presented progressive contextualization as one of his methodologies [11].

It is crucial to comprehend the social and dynamic impact of changes in the exploitation of karst ecosystems on local populations. This include alterations in means of subsistence, disputes over resources, and modifications in indigenous customs and traditions. The implications that local communities encounter due to this alteration. The karst region is an exceptional and invaluable natural asset, serving a crucial function in the local ecology while also embodying cultural and environmental traits. Nevertheless, since the Anthropocene epoch, characterized by significant human impact on the environment, the presence and alteration of karst formations in the Rammang-Rammang Maros region have become more significant and intricate. Karst areas are advantageous regions characterized by ecosystems that include natural and environmental resources, such as scientific and environmental entities, cultural circumstances of populations, and unique habitats for flora and animals [12]. Within societies, it is crucial to prioritize the preservation of ecosystems and the well-being of the life they support. This entails implementing measures for conservation, maintaining stability, undertaking recovery initiatives, and establishing steadfast laws to safeguard the existence of both ecosystems and societies.

3.2 Indigenous Knowledge and Adaptive Mechanisms

The local community plays an essential role in implementing the cultural values (such as traditions, customs, and social systems) developed by people and groups in response to the environment and the community's own beliefs, in relation to the karst region. Ultimately, the intellectual capacity of the area encompasses both concrete and abstract aspects. The importance of knowledge has been passed down from previous generations and continues to exist in the present. Local wisdom is seen by local communities as a kind of knowledge and practices that are specific to their location. However, its purpose extends beyond local boundaries, aiming to address the challenges given by global perspectives and have a beneficial effect on other areas [13]. The residents of Rammang-Rammang are really genuine. Their primary focus is to the preservation of

culture and the treatment of karst forest artifacts amidst the process of transition. The indigenous community of Rammang-Rammang adheres to their own ideas of conservation. Essentially, they uphold the cultural legacy of their predecessors, who reside in the Rammang-Rammang karst forest, through the practice of sacred rituals in the traditional framework. This includes safeguarding the karst hill as the spiritual focal point for their ancestors, who are believed to reside there and oversee their daily existence. The local populations have consistently aimed to maintain a very conservative approach towards the karst region as a means of adapting and implementing an ecological plan to prevent the potentially exploitative nature of spatial management. The karst hills were called, taking into account their potential sources of power, resulting in many variants. The central hill of the karst forest, known as Bulu Barakka', then Bulu Ballang is believed by some villages to be the primary water source that nourishes the surrounding ecosystems. It is also considered to be the hill that ensures the local community's prosperity by maintaining homeostatic stability. In addition, Bulu Barayya feathers serve as homes for flora and animals, while cattle are collected to maintain balanced and sustainable life cycles. The decentralization of resources within the karst ecosystem is a distinct and useful feature that plays a significant role in both local ecosystems and as a cultural and environmental trait.

3.3 Anthropocene Context and Conservation Sustainability

It is crucial to contemplate the influence of the Anthropocene era's background on all these facets. Given the substantial influence of human activities on the environment throughout this era, it is crucial to consider the worldwide challenges related to the potential catastrophe while comprehending and overseeing social and ecological transformations in Rammang-Rammang Maros. Karst landscapes do not just serve as a representation of human cultural past. According to Oliver Heil, a German speleologist, Karst serves as a climatic repository. The karst caverns include a diverse array of stalactites. Every layer has data about the variations in temperature and vegetation throughout its creation. Furthermore, the researchers propose that karst serves as a climate safeguard, in addition to its function as a climate archive. The presence of carbon-binding rocks in natural karst makes it a significant carbon absorber, since cartification is a process that sequesters carbon [14]. These results indicate a strong correlation between the perception of local knowledge and the traditional methods used by the people of Rammang-Rammang to preserve the environment. This connection is deeply rooted in their family history, as they have consistently shown a commitment to sustainable practices and preventing significant crises in karst regions.

Hence, apart from the menace of mining that intermittently enlarges concessions and devastates karst, it is imperative to also address the substantial impact of human population growth on boosting knowledge about the equilibrium of ecosystems and resources in karst regions. The local community plays a crucial role in preserving the karst terrain. To ensure the sustainable use of karst regions and their surrounding ecosystem, it is imperative that policymakers and resilient local populations engage in collaborative and steadfast efforts. Encompasses initiatives aimed at preserving natural resources, restoring ecosystems, or implementing changes in governmental regulations. UNESCO has designated the shifting Karst Rammang-Rammang region as a geopark

region of the world, acknowledging the crucial role of local people in its preservation. However, it may also prompt considerations on the management's role in the Karst Area ecology, which may initiate a shift in the equilibrium of natural resources. The difficulty of complexity arises from the processes of modernization, globalization, and cross-culturality. The utilization of resources, preservation of nature, and significant human impact on the environment in light of the impending anthropogenic crisis or era necessitate careful consideration with an awareness of stability and homeostasis, leading to a fair and sustainable ecological and ecosystem equilibrium for future generations. According to the American Indians, contemporary culture does not receive the planet as a permanent possession from its predecessors, but rather temporarily borrows it from future generations. The underlying premise is that contemporary culture does not inherently possess the capacity to maintain nature, but instead relies on future generations, such as those in the Karst Area of Rammang-Rammang, to preserve nature in a sustainable manner.

4 Conclusion

The local inhabitants and natural habitats in Rammang-Rammang Maros will be significantly affected by a landscape transformation prompted by the karst exploitation dilemma. This study offers valuable insights into the dynamics of socio-cultural and ecological transformations occurring at the local level throughout the Anthropocene epoch, characterized by increasing human impact on the environment. The findings indicate that alterations in the use of karst ecosystems have resulted in social difficulties, including disputes over resources and the proliferation of both external and internal variables, shifts in livelihoods, and cultural ramifications. The local communities of Rammang-Rammang Maros have encountered the difficulty posed by this transition, however some remain steadfast in preserving their indigenous knowledge and cultural practices to ensure the protection and equilibrium of their environment amidst this development. Furthermore, the research emphasizes the pressing need to conserve the karst environment and the progressively imperiled species. The presence of adverse effects, such as ecological harm, alterations in hydrological patterns and water resource quality, and the extinction of endemic species, highlights the necessity for more robust conservation measures and stricter regulations to safeguard the Rammang-Rammang karst area from any potential catastrophic ecological crisis. The result underscores the significance of cooperation among local populations, governments, and environmental groups to guarantee the long-term viability and equilibrium of karst conservation in Rammang-Rammang, Maros. Key strategies for addressing the karst transition of the Antroposan age include public participation and involvement in decision-making, environmental education, and the adoption of consistent and sustainable policies that prioritize societal well-being and avoid harm. This study has significantly advanced our knowledge of the intricate interplay between humans and the environment in the Karst area, particularly in terms of maintaining a stable equilibrium. Moreover, it has laid the groundwork for more effective conservation initiatives in the times to come.

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