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CLIMATE VULNERABILITY AND LOCAL ADAPTATION STRATEGY: UNDERSTANDING CLIMATE CHANGE NORM ADAPTATION AND DYNAMICS COMMUNITY RESILIENCE IN BATULAPISI GOWA REGENCY, SOUTH SULAWESI

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Abstract

Climate change presents ecological and social challenges for rural areas, including Batulapisi Dalam, Tinggimoncong District, Gowa Regency, South Sulawesi. The region faces specific vulnerabilities that demand strategic responses to ensure the sustainability of residents' livelihoods. This research seeks to understand the dynamics of community resilience models through adaptive transformation approaches and the localization of climate norms. A qualitative case study was conducted at the research site using data collection techniques that include in-depth interviews, participatory observation, focus group discussions, and policy document analysis. Our study shows that, despite the intensification of climate impacts displacing planting and harvesting cycles, adaptation to climate-change norms at community levels remains limited. The agrarian pressures brought about by land conflicts and the conversion of agricultural areas into ecotourism sites have further exacerbated these challenges. As a response, farmers have employed agronomic adaptation strategies, especially crop rotation applied to the changing state of groundwater availability. This study proposes a hybrid model for adaptation strategy, integrating socio-ecological capital through livelihood diversification at the rural community level. We argue that linking local policy to national and international frameworks such as the Paris Agreement and the Village SDGs is important and must be pursued together with strengthening norm entrepreneurs who can promote greater local sustainable climate adaptation capacity.

Keywords: climate change, climate norms localisation, local adaptations, Batulapisi Dalam

INTRODUCTION

Since the 1960s, environmental norms have emerged as a defining force in global politics. Scholars of environmental communication have shown that a wide range of global norms has developed, from the belief that development must be sustainable to the conviction that environmentally harmful commercial activities are morally wrong. Global environmental norms tend to gain traction when scientific consensus about environmental risks strengthens and is accompanied by growing advocacy and resistance at the global level (Alger, 2019). Climate change is the most important global issue of this century, with impacts across sectors significantly influencing the environment, health, economy, and food security. International agreements like the Paris Agreement, which was ratified at the 21st Conference of the Parties (COP) in 2015, represent countries' joint initiatives to limit increases in global temperature to below 2°C, with the ideal target being below 1.5°C. This commitment had been further developed at subsequent COP meetings, covering Nationally Determined Contributions (NDCs) and climate justice. However, its implementation on the ground has several major challenges: capacity building, funding limitations, and coordination issues among various stakeholders in the framework of international cooperation. The United Nations Conference of Parties (COP) is annually held regarding climate change, following up on the results of the Paris Agreement, in order to assess progress and enhance commitments between countries (UNFCCC, 2021). COP-26, in Glasgow, 2021, underlined, among others, the urgency of accelerating clean energy transition, preventing ecosystem loss, and increasing financing for adaptation in developing countries. At the same time, though, this global rhetoric still has to be quite different from grass-root implementation. Climate change in Indonesia hits agricultural sustainability and national food security directly. Indonesia is an agrarian country with over 60% of the population

living in rural areas. Indonesia ratified the Paris Agreement through Law No. 16 of 2016, which provided a legal basis for the implementation of national agendas concerning climate. Indonesia's NDCs outline emissions reduction targets of 31.89% unconditionally and up to 43.2% conditionally with international assistance by 2030 (Ministry of Environment and Forestry, 2021). It continues to note that at the local level, this requires participatory and contextual approaches to policy implementation, specifically in relation to responses designed to enhance the welfare of small farmers and preserving the natural resource base. The climate crisis experienced in the tropical region, such as Indonesia, presents real effects, including shifting rainfall patterns, extreme temperatures, and the degradation of natural resources, which not only threatens the natural environment but also local food production systems. Batulapisi Dalam Neighbourhoods in Malino Subdistrict, Tinggi Moncong District, Gowa Regency, South Sulawesi, serves as a real illustration of an area experiencing ecological and social problems caused by climate change (BMKG, 2020). The residents highly rely on agriculture and customary forests, making climate adaptation an important premise for continuing the livelihood process. No less important for resilient capacities building is a lack of access to information, environment-friendly technology, and climate education.

Highland regions carry unique ecological characteristics and vulnerabilities: generally speaking, in this area, agriculture is subsistence-based and highly dependent on local resources. At the same time, local knowledge from generation to generation possesses great potential in terms of ecosystem-based adaptation strategies (Adger et al., 2011). National climate policy often does not fully recognize the importance of integrating modern scientific knowledge with local wisdom in addressing environmental challenges. As a socio-ecological entity, villages take part in playing an important role in carrying out NDCs and envirnmental preservation. However, community involvement remains highly limited in climate policy formulation (UNDP, 2016). Consequently, the mainstreaming of community-based climate adaptation education at the village level will have to be constructed through participatory and interdisciplinary means that respect local culture and knowledge.

Batulapisi Dalam Neighbourhoods, part of Malino Village, Tinggimoncong District, has a quite distinctive geographic and social character. A long history of community harmony with nature has resulted in developing a traditional knowledge base concerning natural resource management. However, with the increasing impact of climate change, it becomes important that village adaptive capacity be enhanced through proper policy and training programs (Ministry of Village, 2020). In this context, village communities' climate change education is urgent. Education here is not merely perceived as a formal process but as community empowerment toward recognizing and understanding climate change. Community-based climate education may enable the strengthening of adaptive capacity, food resilience, and collective awareness about environmental preservation (UNESCO, 2019).An important foundation in tackling the climate crisis and maintaining food security is through sustainable agriculture. This concept involves environmentally friendly practices, efficient water use, soil conservation, and crop diversification (FAO, 2018). The implementation of sustainable agriculture within Batulapisi Dalam can be a concrete strategy, not only aligned with climate adaptation but also improved in the long run for farmers' welfare.

As part of the implementation of the Sustainable Development Goals, Indonesia has been promoting a village SDGs approach, stipulated in Ministerial Regulation Number 13 of 2020, concerning Village Fund Priorities. Environmental, climate adaptation, and food security have been added as indicators of village development success. Transforming villages towards sustainability represents strategic momentum to align global policies with local practices (Minister of Village Regulation No. 13 of 2020). Climate change has become the defining issue of human development. As international climate change commitments progressively prioritise adaptation, climate change adaptive capacity and resilience-enhancing activities are increasingly being directed toward addressing adaptation needs. How this adaptation programming is designed and implemented, positions the experiences that local communities have with climate adaptation development interventions. Despite how wide-reaching adaptation needs and programming are globally, there has been limited attention given to understanding the local-level experiences of the translation of international adaptation policy and finance into adaptation interventions directed at instilling adaptive capacity and resilience to climate change (Walker, 2021). The urgency for the development of the climate change adaptation model at the village level must integrate local knowledge, sustainable agricultural strategies, and adaptive education as based on the community. It is in accordance with the principle of sustainable development and SDGs Desa (BAPPENAS, 2021). Localization of climate norms in the village requires deliberative and inclusive processes that enable local wisdom to blend with the national regulatory framework.

METHOD

This study employs a descriptive qualitative approach to deeply understand how climate-change norms originating at the global level such as adaptation, mitigation, climate resilience, and sustainability are received, interpreted, and adjusted by the community in Batulapisi, Malino. The descriptive qualitative approach was chosen because it can produce detailed and factual descriptions of norm localization processes, especially when the phenomenon being studied is highly contextual, involves social experience, and requires tracing meaning based on local community perspectives. This approach was selected because it allows the researcher to capture social dynamics, adaptation practices, and the internalization of norms that develop within the farming community throughout the research period. Qualitative research is a process of inquiry that emphasizes systematic and critical independent investigation to find answers to a problem (Creswell, 2013). This process involves exploring information in depth, critically, analytically, and argumentatively using scientific steps. The aim is to obtain a more comprehensive understanding of the problem being studied. This approach enables intensive data collection in a limited timeframe while maintaining depth of analysis regarding the socio-cultural context of the research subject.

We conducted data collection using three main techniques: semi-structured interviews, field observation, and document study. Semi-structured interviews were used to explore community understanding of climate change, their acceptance of adaptation or mitigation norms, and how these norms were adjusted to local conditions. Field observations conducted to directly observe community adaptation practices, such as water management, planting patterns, soil conservation, or reforestation activities. Researchers also observed social dynamics, community interactions, and relevant physical environmental conditions. Documentation included collecting photos, community activity records, and government documents related to environmental programs or climate adaptation in Batulapisi Dalam. Data analysis was conducted continuously following the steps of data reduction, data presentation, and conclusion drawing. In the data reduction stage, the researcher selected relevant data, made field notes, and identified initial themes such as norm acceptance, norm adjustment, barriers, local actors, and adaptation practices. Data presentation involved organizing findings into patterns and categories to facilitate understanding of relationships between themes. In the final stage, the researcher developed interpretations and conclusions about how the norm localization process occurred in Batulapisi, including driving factors, obstacles, and forms of adaptation developing within the community.

To maintain data validity, this research used triangulation techniques, both source and methodological triangulation by comparing interview, observation, and document data. Researchers conducted member checking to confirm data with informants and applied reflexivity to recognize potential biases in interpretation. Throughout the process, the research team adhered to ethical standards by obtaining informed consent, maintaining confidentiality, and respecting local community values. Through this approach, the study provides a comprehensive understanding of how global climate norms are translated, adjusted, and reinforced within the social context of Batulapisi Dalam. The findings show not only how local actors interpret climate change but also how they develop adaptation practices that align with local values, thereby enriching International Relations scholarship on the interaction between global norms and grassroots community action.

RESULTS AND DISCUSSION

The localization of climate-change norms is important because it indicates that there are no global norms which can be passively received by any local actor; they do require some degree of adjustment to fit into local values, practices, and needs. For climate change, this means that globally set guidelines such as ecosystem-based adaptation or mitigation of greenhouse gas emissions must be rearticulated via local languages, interests, and capacities if they are ever to be put into practice in a sustainable way. A wide literature in this area on climate-change adaptation emphasizes that the effectiveness of adaptation policies is strongly shaped by the degree of local acceptance, which can only be achieved through norm localization. Indeed, studies like those by Adger et al. accentuate how adaptation is not just a technical issue but a process deeply situated in diverse social, cultural, and political contexts across different communities. Therefore, global norms of climate adaptation must integrate with local knowledge, traditional practices, and existing institutional frameworks to yield adaptation strategies pertinent and feasible in the local environment. The notion of adaptation itself has a long history and has undergone considerable expansion since it came, along with mitigation, into the purview of climate research and action in the late 1980s-with the creation of two pivotal institutions, namely the Intergovernmental Panel on Climate Change and the United Nations Framework Convention on Climate Change. Since then, adaptation has become part of a larger set of global frameworks on environmental governance and sustainable development (Orlove, 2022).

Acharya (2004, 2011) presents a more detailed analysis of how norms diffuse by introducing two concepts: localization those politics in and through which local actors "import" foreign norms and reshape them to make them resonate with existing local discourses and knowledge systems and subsidiarity those politics in and through which local actors reject foreign norms and instead "export" local norms to challenge or redefine global ones (Acharya 2011, pp. 97–99). Empirical studies across regions, for instance, the work of Lebel et al. (2011) on adaptation governance in Southeast Asia, demonstrate that norm localization enables communities to participate more actively in framing climate adaptation agendas. This not only enhances policy legitimacy but also local ownership, in that communities become co-creators of norms rather than simple recipients. Localization bridges global norms into local practices to ensure that climate responses are more inclusive and set upon community realities, and hence more sustainable over the long term. Simultaneously, it provides an analytical lens to understand specific vulnerabilities at the local level.

Community Realities of Climate Change

The perceptions of climate change among residents of Batulapisi Dalam were not formed through formal meteorological definitions but internalized through empirical experiences of drastic shifts in seasonal cycles. Climate change, in this context, is identified by the community as the "irregularity" of planting patterns that have traditionally guided local agricultural cycles. For example, whereas a decade ago October was a reliable marker for the onset of the rainy season, today heavy rainfall typically occurs only in January or February. This temporal shift altered farmers' understanding of the planting calendar, forcing repeated adjustments in the field to avoid material losses caused by crop failure. Empirical conditions at the site show extreme hydrometeorological phenomena impacting the stability of agricultural land directly in the highlands. Rainfall often triggers small-scale landslides in hillside farming areas, which are used for horticulture. Bundu Beta, Head of Batulapisi Dalam Neighbourhoods, shared the following historical comparison of seasonal shifts:

> **"**Jaman dulu orang-orang tua itu patokannya bulan. Jika masuk bulan Oktober mereka sudah langsung menurunkan benih tanaman. Kalau sekarang kadang-kadang bulan Januari baru masuk hujan deras" (Wawancara, 1 Oktober 2025).
>
> [In the old days, elders relied on the months. When October arrived, they immediately planted their seeds. Now, sometimes the heavy rain only starts in January." (Interview, 1 October 2025)]

Thus, the three-month delay of the rainy season has been forcing repeated adjustments in agrotechnical practice that risk disrupting the seedling phase. Productive agricultural areas have been significantly reduced, while physical damage to natural irrigation infrastructure is evident. Stronger winds and heavy rainfall have also cumulatively damaged short-season vegetable crops and sharply reduced crop quality.

By contrast, the dry season brings about different challenges, particularly in the reduction of river water discharge used as the main source of irrigation. Malino's highland topography allows for occasional rain even in the dry season, but drought stress from July to August remains significant for farmers dependent on technical irrigation. The reduced water discharge affects the intensity of rice field cultivation. Observations show rice farmers strongly depend on stable river flows; reduced discharge increases the risk of crop failure. (puso) threatens household food security. Ecological awareness among Batulapisi Dalam residents has intuitively formed through what can be referred to as a sense of climate variability. The community can read the natural signs-changes in heat intensity, unusual wind patterns-as early warning indicators. However, such knowledge remains individually held, not institutionalized into a communal climate information system. The lack of collective knowledge validation forums means that interpretations of natural signs remain subjective and fragmented, prohibiting the forming of a unified community response towards climate-related hazards.

Agrarian Dynamics and Spatial Transformation Driven by Tourism Pressure

Climate vulnerabilities run in parallel with broader structural threats, particularly rapid spatial transformation triggered by massive tourism expansion. The conversion of productive farmland into villas, guesthouses, and commercial restaurants has increased sharply over the last decade. Land prices reaching one to four million rupiah per square meter provide an economic incentive difficult to resist for residents. This has triggered widespread voluntary land release, with residents being transformed from land-owning farmers into wage laborers in their own homeland. Over the past decade, Batulapisi Dalam has undergone significant land-use transformation. Agricultural land dominated by rainfed rice fields, mixed gardens, and horticultural plots has slowly turned into nature-based tourism areas. The growth of homestays, panoramic restaurants, and other supporting facilities for tourism drives

changes in farmland to commercial zones. Such a process generally takes place in stages, starting with renting farmers' land to local investors and progressing up to the sale of land, which, after ten years, eventually results in a sharp decline in agricultural land. These changes have remolded the physical landscape of Batulapisi, from an agrarian system to a tourism-based service economy.

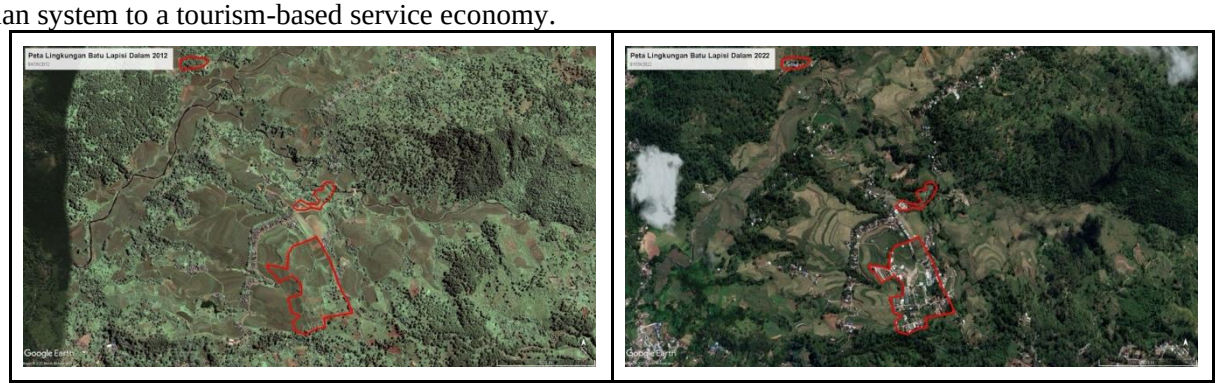

Figure 1. Comparison of Satellite Maps of Batulapisi Dalam (2012–2022)

The land conversion in Batulapisi Dalam carries ecological consequences that directly relate to the community's adaptive capacity with respect to climate change impacts. Agricultural land previously functioned as a hydrological buffer, supporting rainwater absorption and surface runoff regulation. As these areas are transformed into built-up spaces, the landscape's ability to respond to increasingly unpredictable rainfall patterns exacerbated by climate change is significantly weakened. Agrarian dynamics are further exacerbated by unclear status and common disputes over land tenure. Many residents cultivate land without legal certificates or later find plots they have cultivated reclassified as state forest areas. Such legal uncertainty weakens farmers' bargaining positions when dealing with external investors or land speculators. Consequently, disputed or uncertified land is sold cheaply and converted into private, exclusive areas barred to the community for agricultural use.

The KPA (Agrarian Reform Consortium) together with PPSS (South Sulawesi Farmers' Union) in Malino has documented agrarian conflicts since the 1970s, starting with the designation of the pine forest area by the Suharto administration to ongoing disputes of land control between the local landlords and the Batulapisi Dalam community. Since 2019, at least 32 cases of criminalization were reported involving PPSS member farmers in Batulapisi Dalam (KPA, 2024). These landscape changes threaten to weaken the cultural identity of Batulapisi as a community of independent, food-sovereign farmers. As agricultural land declines and concrete tourism buildings grow, local knowledge systems related to planting cycles and water management steadily lose their relevance. Residents who sell their land face the risk of long-term marginalization since tourism-sector employment is typically seasonal and lacks the security afforded by the ownership of agricultural assets. The effect of this transformation is the creation of new vulnerabilities, which will weaken the food resilience of the community and heighten dependence on external supply chains.

It is considered the role of village officials and community leaders to introduce responsive and sustainable regulatory interventions that can slow uncontrolled land conversion. Indeed, protective policies such as one that limits land sales to outsiders and one that promotes land-leasing mechanisms are required to maintain land ownership among local residents, while ensuring that tourism development is attuned to the principles of environmental sustainability and does not undermine the agricultural foundation of village life.

Institutional Gaps and the Urgency for Structured Climate Education

A key challenge in constructing climate resilience within Batulapisi lies in the absence of local institutions that facilitate collective and organized adaptation actions. Thus far, there is no available village-level forum or working group on climate mitigation or adaptation. The knowledge of adaptation still remains fragmented in the individual farmers' experiences and has not been consolidated into a broader strategy of the community. This institutional void constrains effective knowledge sharing on weather predictions or appropriate agricultural technologies, hence slowing down the diffusion of adaptation innovations. Local government roles remain administrative and advisory in disaster-related aspects. Empowerment programs currently available, such as stunting reduction or classical agricultural extension, seldom integrate climate issues as cross-sectoral concerns. Such a policy vacuum results in a mismatch between the farmers' actual needs for comprehensive adaptation advice and the government services that are provided. The integration of climate issues into village development planning is of high importance to ensure targeted budgeting toward environmental resiliency. Organized and participatory climate

education is urgently needed. At least, youth groups and women farmers hold great potential to be agents of dissemination in climate literacy. Climate field schools or regular discussion forums should be established to bridge technical extension knowledge with that of farmers' local wisdom. Such educative means are not purely based on information but aim to build critical awareness at the community level of their environmental rights and agrarian sovereignty amidst tourism-driven land pressures. Farmer groups or agricultural organizations hold strategic importance as norm entrepreneurs because they serve as local actors who can transform knowledge on adaptation to climate change into daily practices. According to Acharya (2004), in the norm localization theory, norm entrepreneurs are actors who advance the acceptance of new norms through processes of framing, translation, and institutionalization such that these norms resonate within particular social contexts. Accordingly, research by Adger et al. has identified that the adaptation process depends on the local knowledge and social networks at the community level. These enhance collective capacity in identifying risks and devising responses that relate to actual community needs.

Farmer organizations function not just as recipients of climate norms but as agents that translate and disseminate such norms to fit local values, seasonal patterns, cultural practices, and capacities. Thirdly, research in different parts of the world, such as Southeast Asia and Indonesia, proves that one of the most effective forms of institutions at the local level to promote community-based adaptation involves farmer organizations. Lebel's work reveals that, from the perspective of strengthening adaptation governance, collective learning, climate information sharing, and sustainable agricultural experimentation all lie at the heart of knowledge and institutions at the local level. This mode of action has a normative character that goes beyond simply adopting adaptation norms; farmer organisations reconstruct norms in such a way that they gain acceptance within the community, promote collective action, and put pressure on local governments to receive technical support and climate-responsive policies. Such is the case with how farmer organisations are framed as key players in the localization of climate adaptation norms and in bringing in both ecological and socio-economic resilience. In the setting of Batulapisi Dalam, the presence of the PPSS Malino farmer organisation provides a bridge between global climate-change narratives and local adaptive farming practices, while playing an important political instrument in broader agrarian conflicts.

Hybrid Adaptation Strategies: Integrating Socio-Ecological Capital and Local Knowledge through Livelihood Diversification

In response to climate pressures, Batulapisi residents have developed adaptive survival mechanisms through hybrid strategies that meld together local knowledge and economic pragmatism. Agronomic adaptation practices cover crop switching depending on water availability. During drought periods when water is in short supply, farmers that cultivate rice or leafy vegetables shift to corn and tubers that are more resilient to drought. These agronomic decisions reflect rational calculations aimed at minimizing production losses while maintaining land productivity year-round. Adaptation strategies go beyond agriculture into diversified livelihood structures. Many of the residents now engage in dual livelihoods: construction laborers or tourism during the day and farming afterward. This serves as an economic buffer during periods of reduced yields in agriculture occasioned by climatic shock to ensure stable household income.

Gender roles involved, especially women and youth participation, are significant in maintaining agrarian resilience. Active participation by women farmers and youth groups in all aspects of horticulture, right from preparation of seeds to marketing, signals that Batulapisi's farming community is undergoing generational renewal despite tourism pressures. Social capital ensures continuity in the transmission of agricultural knowledge and ongoing refinement of their adaptation practices. However, adaptation is compromised by ecological threats from outside the community, with particular reference to damaging upstream forests through illegal extractive activities. Inappropriate tapping for pine resin has seen widespread tree mortality, which increases the risks of wildfires during the dry season, reducing soil water retention capacity. This anthropogenic ecological degradation exacerbates farmer vulnerabilities, as reduced forest cover destabilizes microclimates and the availability of groundwater for downstream agriculture. Based on the analysis of perceptions, adaptation strategies, and structural challenges, Batulapisi's community resilience model can be defined as adaptive socioecological resilience built on three pillars: Agronomic flexibility underpin by local knowledge; Economic diversification through dual livelihoods; Strong kin-based social solidarity. These elements interact synergistically to create a safety net that enables residents to resist compound pressures from climate change and market-driven land transformation.

This resilience is not a static asset but rather a dynamic process negotiated continuously in daily life. Strong individual adaptive capacity among farmers is reflected in their ability to "read" nature and adjust practices accordingly. Sustainability, however, relies significantly upon the protection of agricultural land the community's main asset against land conversion. Without agrarian security, social capital and local knowledge run the risk of losing their base, with resilience potentially collapsing into widespread vulnerability. This calls for strengthening such resilience through government support that can integrate land protection with climate adaptation planning. If this is synergized with strict spatial regulations, inclusive climate education, and local economic empowerment, it will transform Batulapisi from merely a "surviving" village into a genuinely "resilient" and sustainable one.

CONCLUSION

The resilience model of the Batulapisi Dalam community is a hybrid adaptation system that integrates agronomic flexibility with pragmatic economic diversification. These mechanisms of survival emerge organically from farmers' accumulated empirical experiences in interpreting seasonal anomalies, which are then translated into decisions such as crop rotation and shifting labor to the tourism sector. However, this socio-ecological resilience remains fragile because it depends largely on individual initiatives without strong institutional protection capable of consolidating collective community action. The absence of secure land tenure and the widespread conversion of agricultural land are structural threats undermining long-term adaptive capacity. Transformation of village space from an agrarian area into commercial tourism without protective regulation threatens to sever farmers' access to their primary means of production: the land. This situation confirms that climate adaptation at the local level is not exclusively a technical meteorological issue but is deeply intertwined with agrarian sovereignty and equitable access to sustainable living space.

RECOMMENDATIONS

Because of the rapid conversion of productive farmland in the Malino area, the Gowa Regency Government should immediately institutionalize regulations on the protection of sustainable agricultural land. There is an urgent need to deploy strong spatial planning interventions in order to secure community land rights and avoid farmers' marginalization due to uncontrolled tourism expansion. Indeed, agrarian protection provides a basic foundation to maintain community livelihoods with increasingly aggressive and speculative land market pressures. The capacity of village institutions urgently needs to be strengthened, among others, through the establishment of a climate adaptation forum integrated within the local governance structure. Formal and informal educational institutions should facilitate climate field schools that link technical extension knowledge to farmers' local wisdom in a dialogical method. The cross-sector synergy aims at transforming fragmented adaptive knowledge into a solid collective strategy aligned with the targets of the Village SDGs and National Action Plan for Adaptation to Climate Change.

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