

DOI: 10.5281/zenodo.11425227

ENVIRONMENTAL ASSESSMENT AND CLIMATE VULNERABILITY IN COASTAL RURAL AREAS: CASE OF THE CANTAGALLO COMMUNITY IN JIPIJAPA, ECUADOR

Alex Joffre Quimis Gómez^{1*}, Yamel de las Mercedes Álvarez Gutiérrez², Augusto Rafael Fienco Bacusoy³, Debbie Pamela Amador Rios⁴, Lider Ian Miranda Quimis⁵

^{1,2,3,4,5}Universidad Estatal del Sur de Manabí, Facultad de Ciencias Naturales y de la Agricultura, Carrera de Ingeniería Ambiental, Grupo de investigación de Cambio Climático. Ecuador

¹<https://orcid.org/0000-0001-7434-0655>, ²<https://orcid.org/0000-0003-1509-9456>, ³<https://orcid.org/0000-0002-8390-1175>, ⁴<https://orcid.org/0009-0005-7528-2393>, ⁵<https://orcid.org/0009-0005-6455-3805>

Received: 11/11/2025

Accepted: 18/12/2025

Corresponding Author: Alex Joffre Quimis Gómez
(alex.quimis@unesum.edu.ec)

ABSTRACT

This study evaluated the environmental impacts, climate vulnerability, and adaptive capacity of the rural community of Cantagallo, located in the Puerto Cayo parish of the Jipijapa canton, Manabí, Ecuador. Technical-normative methodologies such as the Leopold and Vicente Conesa matrices were applied to identify and assess the environmental impacts on the physical, biotic, social and perceptual components. In addition, a participatory diagnosis of vulnerability and adaptation to climate change was carried out, considering local climate threats such as droughts, intense rains and landslides. The results indicated that the main negative impacts were related to soil degradation, loss of native vegetation, pressure on water resources and deficiencies in waste management. Regarding climate vulnerability, a medium-high level was determined, conditioned by geographical exposure and the limited adaptive capacity of the population, particularly in relation to access to basic services, health, food security and territorial planning. It was concluded that the community faces significant environmental risks and an insufficient level of preparedness in the face of the effects of climate change. In response, an Environmental Management Plan was proposed with measures aimed at ecological restoration, organizational strengthening and environmental awareness, as a basis for improving local resilience and promoting sustainable development.

KEYWORDS: Community Adaptation, Participatory Assessment, Environmental Management, Anthropogenic Impacts, Climate Resilience.

1. INTRODUCTION

The research demonstrated that phonological awareness is a critical component of early literacy development, particularly in educational environments where children come from families with limited resources and where family engagement in reading is minimal. The incorporation of this competence within a meticulously delineated curriculum serves to establish robust foundations for the acquisition of reading and writing skills, thereby aligning with the tenets of neuro-education and constructivism.

In the initial phase, the multidisciplinary review determined that phonological awareness does not develop independently but rather is interrelated with early stimulation and basic literacy. Theoretical results indicate that the implementation of a cohesive and systematic phonology teaching approach, complemented by authentic reading and writing experiences, yields more favorable outcomes in comparison to disparate programs or interventions that are executed with delay.

The subsequent phase centered on the systematization of educational practice, thereby demonstrating that strategies characterized by playfulness, which are progressive and pertinent to the context, engender greater progress in children when contrasted with conventional methods that prioritize repetition. A comprehensive review of nine years of teaching experience has demonstrated that learning is more enduring when phonological activities are integrated with narratives, symbolic games, and collaborative environments. The analysis revealed recurrent issues in the differentiation of phonemes and combinations of consonants, underscoring the significance of meticulous pedagogical approaches tailored to the developmental level of the children.

In the third phase, a comprehensive curriculum design was established that unites phonological awareness, early stimulation, and initial literacy. This design is supported by neuroeducation and constructivism. This initiative aims to address the absence of explicit guidelines within the official Colombian curriculum for the transition grade, proposing an educational approach that aligns with the unique characteristics of the Caldense territory. The integration of playful strategies and the utilization of information and communication technologies are imperative tools for enhancing motivation and facilitating substantial learning in children.

The triangulation of categories validated that early stimulation is the ideal environment to foster

phonological awareness, which in turn becomes a bridge to initial literacy. Neuro-education provides a scientific foundation that helps to understand the brain mechanisms that facilitate this process, while constructivism offers the pedagogical approach necessary to ensure social mediation and the active construction of knowledge.

The research indicates that the pedagogy of phonological awareness should be characterized by clarity, organization, integration across various disciplines, and contextualization. This approach considers the social and cultural realities of the students. This approach has been demonstrated to not only enhance reading skills in the early stages of education but also play a pivotal role in mitigating educational inequalities within disadvantaged communities. Consequently, it ensures more equitable opportunities for future academic success.

The study underscores the significance of integrating theoretical concepts with educational practices, demonstrating that the structuring of teaching experiences can serve as a reliable source of knowledge for curriculum development. In this manner, the research makes a significant contribution to both the academic field and educational implementation. It proposes a model that can be applied in other early education settings in Colombia and Latin America.

2. MATERIALS AND METHODS

2.1. General Study Approach

The present study was developed under a mixed approach (quantitative-qualitative) with a non-experimental design and a descriptive-analytical type. This combination enabled the characterization of the components of the local environment, the evaluation of impacts derived from anthropic activities, and the analysis of the vulnerability and climate adaptation capacity of the community of Cantagallo, Puerto Cayo parish, Jipijapa canton.

The following is a characterization of the study area A multidisciplinary team of researchers conducted a comprehensive data collection process, encompassing physical-natural, biotic, and socioeconomic information. This endeavor involved fieldwork, direct observation, community interviews, and a thorough review of secondary sources. The study incorporated a range of variables, including geology, land use, climate, vegetation cover, water quality, health, basic services, and environmental perception. Geo-referencing was conducted using GPS technology, and the cartographic base was processed with GIS software (QGIS 3.22). This facilitated the generation of

thematic maps and environmental zoning (Marzouk & Azab, 2024).

2.2. Environmental Impact Assessment

Two consolidated matrices were applied to identify and assess environmental impacts: the Leopold matrix, which relates project factors to environmental components (Conesa, 2015), and the Vicente Conesa matrix, which allows impacts to be assessed according to extension, duration, reversibility, synergy, and importance. The application of these matrices to each environment (physical, biotic, socioeconomic, and perceptual) was carried out with the involvement of key community members.

2.3. Diagnosis of Vulnerability and Adaptation to Climate Change

The assessment of climate vulnerability was based on the IPCC criteria (2023), considering three dimensions: exposure (e.g., presence of hazards such as droughts, extreme rainfall, and erosion), sensitivity (e.g., dependence on agriculture, scarcity of basic services), and adaptive capacity (e.g., community organization, access to technical and financial resources). Structured surveys were administered in 28 households, and interviews were conducted with community leaders to characterize these dimensions.

The adaptation analysis was supplemented by a SWOT matrix and the identification of current and potential adaptation practices. The triangulation of sources was instrumental in constructing a territorial climate risk profile and formulating strategic axes for the Environmental Management Plan.

2.4. Methodological Integration Criteria

The integration of EIA with vulnerability analysis responds to emerging approaches that propose to strengthen territorial planning in the face of future climate scenarios (Mayembe et al., 2023; Loza & Fidélis, 2022). A progressive methodological structure was employed, integrating conventional tools (impact matrices) with participatory and spatial analysis (GIS), consistent with the recommendations of recent studies (Corregidor-Fonseca et al., 2024; Wende et al., 2020).

3. RESULTS

The results obtained enabled the characterization of the environmental components of the Cantagallo community and the evaluation of the current anthropogenic impacts, as well as their degree of vulnerability to climate change. The Cantagallo

community is situated at elevations ranging from 200 to 800 meters above sea level. The region is characterized by a tropical climate, with temperatures typically ranging from 18°C to 24°C. According to Ayón y Delgado (2023), "the influence of the cold Humboldt current creates a humid tropical and dry tropical microclimate" (p. 199).

The prevailing climatic characteristics of the area have led to the predominance of an agricultural-based economy among most of the population. The remaining population engages in other activities. Even though the Cantagallo Protective Forest bears the name of the community, it does not benefit from it.

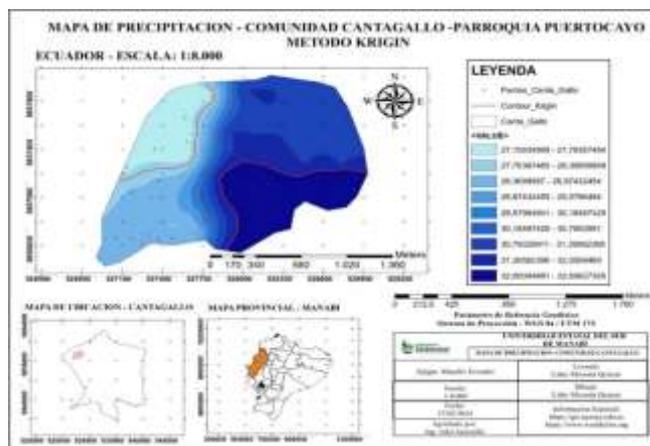


Figure 1: Caption.

The map in Figure 1 shows maximum temperatures in the Cantagallo community, the Kriging method has been used to accurately highlight the maximum and minimum values throughout a year.

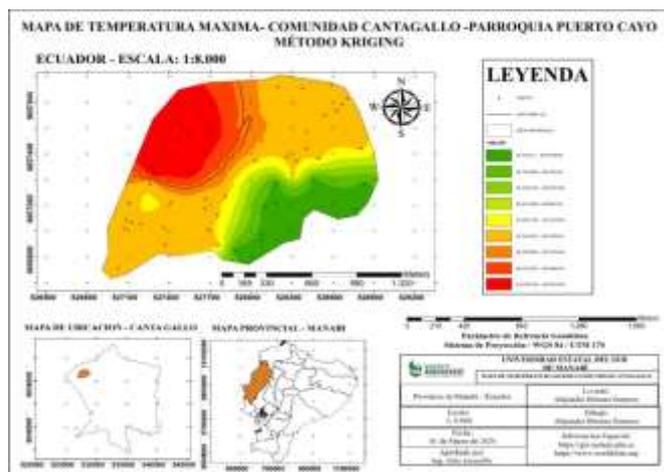


Figure 2: Caption.

The map in Figure B shows rainfall, which was carried out using the Kriging method, allowing estimating rainfall values in locations where no direct

measurements have been made.

The visual depiction of Figure 1 indicates that the maximum temperature of 29.10°C is represented by the color red, while the minimum temperature of 28.75°C is represented by the color green. This analytical approach provides a nuanced understanding of thermal variability. Concurrently, it utilizes a contour, thereby facilitating a more comprehensive appreciation of the area under consideration. As illustrated in Figure 2, the rainfall map of the Cantagallo community demonstrates that, due to variations in microclimate, there is a range of precipitation levels. The map indicates that the minimum recorded rainfall is an average of 27.21 millimeters, while the maximum recorded rainfall is 32.72 millimetres.

A thorough examination of the physical-natural diagnosis revealed significant pressures on soil resources. These pressures are evidenced by several indicators, including soil compaction, laminar erosion in sloped areas, and loss of organic matter in

sectors that have been impacted by agricultural activities. The native vegetation cover was fragmented and replaced in more than 70% of the area by grasslands and annual crops, generating loss of biodiversity and reduction of ecosystem resilience. A decline in water flow and an increase in water contamination were observed in the water component. These phenomena are attributed to inadequate waste management practices.

The application of the Leopold matrices revealed medium and high negative impacts on the physical and biotic environments, as well as moderate social effects, associated with inadequate territorial planning and the insufficiency of fundamental services. The most severe impacts included the following: loss of vegetation cover, alteration of micro-watersheds, deterioration of the landscape, impact on water quality, and sanitary vulnerability due to poor management of domestic waste.

Table 1: Negative Impacts on Environmental Factors.

Factors	Conditions Affected	Impacts with respect to magnitude
Improper waste and waste management	9	-16
Cutting down trees	9	-12
Septic tanks	9	-10
Noise generation	6	-9
Water wells for drinking	6	-6
Human settlements	10	-4
Piggy Banks	10	-4
Planting corn	9	-2
Planting pink and yellow dragon fruit	9	-2
Total	77	-65

Source: Authors' elaboration based on information from the Leopold Matrix.

A subsequent examination of the data obtained from the positive impacts in relation to environmental factors identified a total of 21 conditions that stand out for their positive contribution.

The summation of these conditions results in a cumulative impact that is of considerable magnitude, reaching a value of 10. The "Peasant Insurance Medical Unit" emerges as the predominant factor within the community. This aspect presents an impact aggregation magnitude of 5, together with the presence of 10 interrelated conditions.

The "Medical Unit of the Campesino Insurance" factor has been demonstrated to exert a positive influence on the community in terms of health and well-being. The significance of this unit within the study area is paramount, particularly in light of its remote location, where access to medical resources may be constrained. The provision of aid has been demonstrated to contribute to socio-economic development by improving the health of the population, reducing the burden of disease, and increasing the productivity of farmers and field workers.

Table 2: Positive Impacts on Environmental Factors.

Factors	Conditions	Impacts with respect to magnitude
Electrical energy	2	5
Medical Unit of the Campesino Insurance	10	5
Planting bananas	9	3
Total	21	13



Figure 3: Impact Assessment Summary.

In the assessment of climate vulnerability, the data demonstrated high exposure to extreme events, particularly prolonged droughts and intense rainfall, accentuated by the influence of the El Niño phenomenon. The region's social sensitivity is evidenced by its heavy reliance on traditional agricultural practices and its limited access to essential services, including drinking water and sanitation. These factors contribute to the system's vulnerability in the face of climate change.

The community's adaptive capacity was evaluated as being low, a condition attributable to several factors. These include deficiencies in community organization, restricted access to technical information, and an absence of institutional mechanisms for preparedness and response to extreme events. The risk matrix applied enabled the identification of numerous vulnerabilities in community infrastructure, with a particular focus on housing, sports fields, and bridges. These elements are particularly susceptible to damage from severe weather events.

The elevated vulnerability of residential structures to substantial precipitation poses a substantial threat to the well-being, habitation, and stability of households. This susceptibility can result in the displacement of families and the deterioration of social cohesion. The impact on recreational spaces,

such as courts, has the effect of limiting access to environments that are essential for interaction and community health. The structural fragility of bridges has been demonstrated to compromise local connectivity and access to essential services. This, in turn, has been shown to intensify the social and economic impacts in climate emergency situations.

3.1. Climate Risk Management and Administration Assessment

Climate risk management at the municipal level is a critical component of enhancing territorial resilience to the impacts of climate change. This approach enables the identification of strengths and weaknesses in various domains of local governance. Employing a systematic approach, the matrices utilized facilitate a comprehensive evaluation of key criteria, thereby identifying deficiencies in territorial planning regulations. The allocation of resources and adaptation strategies are discussed, with a focus on the potential for enhancement in the integration of public policies, community participation, and the implementation of ecosystem-based solutions. The analysis of these indicators furnished inputs and criteria for decision-making in climate risk management at the local level, thereby contributing to the development of more effective strategies.

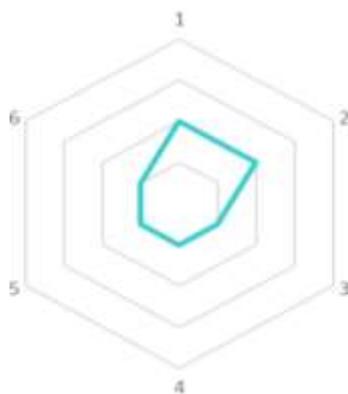


Figure 4: Indicator 1: Administration and Management of the GAD.

The initial indicator, centered on the administration and management of the Decentralized Autonomous Government (GAD), was examined, and both areas of potential enhancement and substantial strengths that necessitated meticulous evaluation and strategic actions were identified.

The identified deficiencies in criteria 3, 4, 5, and 6 suggest potential shortcomings in the municipality's readiness to confront the challenges posed by climate change. These critical aspects ranged from the

absence of specific plans and regulations to adapt to climate change to the necessity to allocate adequate financial resources for mitigation.

It is important to acknowledge the enhancement observed in criteria 1 and 2, which demonstrates the GAD's capacity to acknowledge the impact of extreme weather events on its services and the existence of regulations that incorporate climate risk into territorial planning and infrastructure development. However, these initiatives lacked sufficient support from the GAD or order.

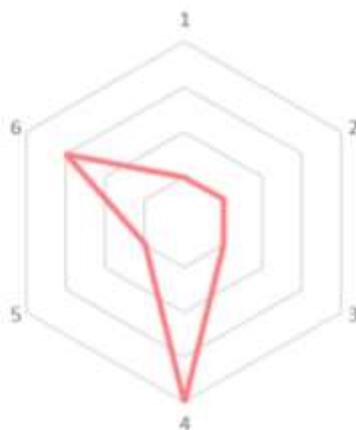


Figure 5: Indicator 2: Health and Safety.

The second indicator, which focused on health and security in the face of climate change, was deepened, revealing aspects of vulnerability and strength that require strategic attention. The identified deficiencies in criteria 1, 2, 3, and 5 suggest a deficiency in preparedness and an inadequate response to the potential impacts of climate change

on community health.

In contrast, criteria 4 and 6 demonstrated a robust comprehension of the tangible consequences of climate change on public health and the efficacious dissemination of information regarding risks and health to the community. The community itself functioned as the conduit for this dissemination.

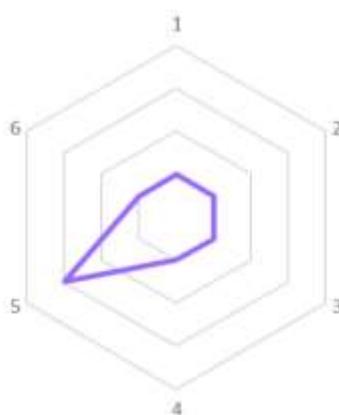


Figure 6: Indicator 3: Local Economy.

A thorough review of the third indicator, which emphasizes the economic ramifications of climate change, revealed that the deficiencies identified in criteria 1, 2, 3, 4, and 6 signaled a municipality's inadequate preparation and capacity to address the

financial consequences of climate change.

This phenomenon ranged from a dearth of knowledge about local economic impacts to a lack of adequate investment in measures to mitigate and protect local means of production in the face of

natural disasters. As indicated by criterion 5, local businesses have demonstrated an understanding of their vulnerability to climate change and the risks

associated with it. This suggests a solid foundation for understanding and addressing climate challenges from a business perspective.

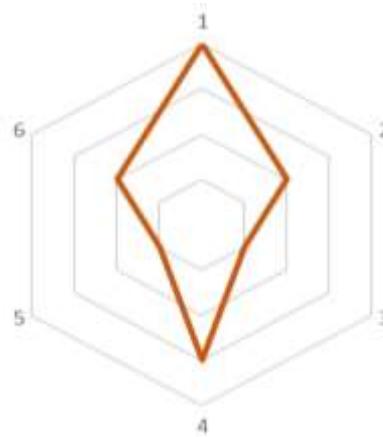


Figure 7: Indicator 4: Community & Lifestyles.

The fourth indicator was subjected to a more thorough analysis, which revealed various areas of opportunity and strengths that necessitate a comprehensive evaluation and the development of specific strategies. The identified deficiencies in criteria 2, 3, 5, and 6 indicate the municipality's potential inadequacies in comprehending and adequately addressing challenges pertaining to public health and climate change. These critical areas

can range from a lack of contingency plans for extreme weather events.

Conversely, the strengths delineated in criteria 1 and 4 signaled a commendable comprehension of the potential ramifications of climate change on the health of the population and an acute awareness of the repercussions of extreme weather events on the populace.

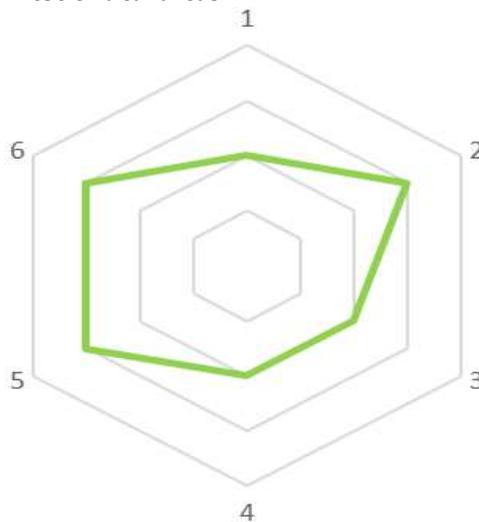


Figure 8: Indicator 5: Local Ecosystems.

Source: Own elaboration based on climate risk management and administration assessment.

Aspect 5 was subjected to meticulous scrutiny. The deficiencies identified in criteria 1, 3, and 4 imply a potential absence of integration and a comprehensive grasp of the municipality's significance and the management of natural hazards. These critical areas included the need for greater coherence between urban/rural development and ecosystem

conservation, as well as the lack of commitment to the maintenance and protection of population-related ecosystem services.

Conversely, the strengths delineated in criteria 2, 5, and 6 signify a robust restoration, protection, and sustainable management of ecosystem services, complemented by the proactive involvement of the

private sector in the execution of environmental management strategies. Moreover, there is a

cognizance of the quality of the ecosystems in the region.

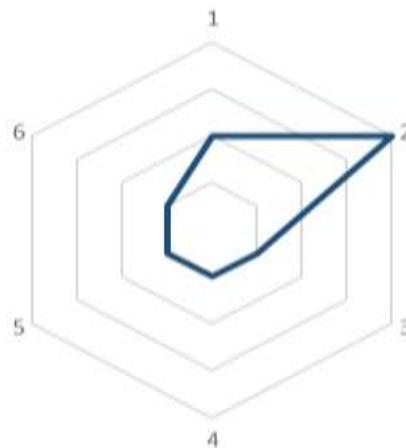


Figure 9: Indicator 6: Institutional Capacity.

An evaluation of institutional capacity revealed that the municipality exhibited a single notable strength in criterion 2. However, the remaining criteria (1, 3, 4, 5, 6) indicated potential areas of weakness that necessitate attention. The ability to comprehend the repercussions of climate change on the community is a pivotal strength, underscoring the necessity of grasping how it impacts the local level.

However, the identified deficiencies in other

criteria suggest the need for immediate remediation. Despite their documented existence, these elements are not implemented, and the dissemination of these programs or objectives to the community is not occurring. The ability to adapt to anticipated impacts, maintain municipal services during natural disasters, secure economic resources to adapt to climate change, and ensure effective access to relevant technologies are all areas of concern.

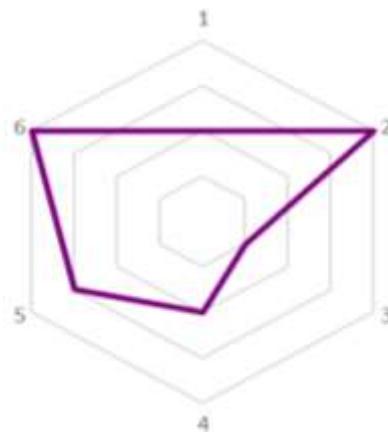


Figure 10: Indicator 7: Human Security and Community.

The analysis of the aspect of human security and community was deepened, both the strengths and weaknesses of the different criteria evaluated being apparent. It is evident that criteria 2, 5, and 6 are particularly salient in identifying areas of strength. These areas include the integration of adaptation measures by the local private sector, the presence of cooperative relations between communities, the private sector, and local authorities, and the existence

of social networks for coordination between the municipality and its neighbors.

Nonetheless, deficiencies were ascertained in criteria 1, 3, and 5. These deficiencies included, but were not limited to, the following: inadequate coordination between health and climate change initiatives; constrained access to municipal information by the community; and an absence of collaboration between communities, the private

sector, and local authorities to mitigate risk.

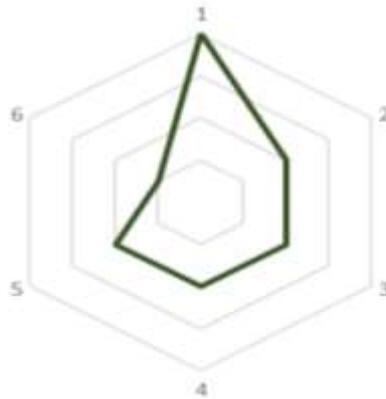


Figure 11: Indicator 8. Local Water Management.

An analysis was conducted to assess the Local Water Management (LWM) system. The analysis revealed deficiencies in all of the following criteria: 2, 4, 5, and 6. These deficiencies manifest in various forms, including the inability to negotiate water efficiency in municipal services, the absence of adoption and promotion of novel technologies, the dearth of explicit water efficiency criteria in municipal policies, the inadequacy of capacity to ensure water supply in emergency scenarios, and the absence of effective coordination between the municipality and water management communities.

The scarcity of water is evidenced by the fact that the community is supplied through wells, which are currently contaminated. Conversely, the community's familiarity with water was identified as a salient positive attribute within the criterion framework. This is due to the fact that water is a fundamental element of their environment.

A comprehensive Environmental Management Plan was devised, encompassing five core priority axes: (1) the restoration of vegetation cover; (2) the protection and rational utilization of water resources; (3) the enhancement of community capacity; (4) the promotion of environmental education and awareness; and (5) the integration of climate adaptation into local planning. The findings of this study provide a foundation for the implementation of a territorial environmental management strategy that is oriented towards rural resilience and sustainability.

4. DISCUSSION

The findings in the Cantagallo community substantiate the existence of manifold environmental pressures associated with unplanned agricultural expansion, loss of vegetation cover, and degradation of water resources. These elements have been

extensively documented in analogous studies in rural coastal communities in Ecuador (Vásquez et al., 2020; Pauta et al., 2023). This reality is indicative of a state of ecological and social vulnerability, exacerbated by increasing exposure to extreme weather events, including droughts and floods. This phenomenon has been documented in the IPCC report (2023) and in regional studies of community adaptation (MAE, 2018).

The Leopold and Conesa matrices were used to identify medium to high intensity environmental impacts, which demonstrated that anthropic effects are overwhelming the resilience capacity of the local ecosystem. The present study's findings align with the observations of Corregidor-Fonseca et al. (2024), demonstrating that the integration of traditional matrices and qualitative assessment criteria facilitates a more comprehensive interpretation of environmental degradation, particularly in contexts characterized by high territorial complexity.

In terms of climate vulnerability, the community exhibits analogous characteristics to other rural areas in the Global South, where adaptive capacity is constrained by factors such as structural poverty, limited institutional capacity, and deficiencies in fundamental services (Pauline & Lema, 2024; Sietz et al., 2012). This pattern aligns with the findings of Mayembe et al. (2023), who emphasize that, while numerous countries have made strides in integrating climate change mitigation aspects into environmental impact assessments (EIAs), the adaptation dimension—which is crucial in vulnerable territories—remains in its initial stages or is even absent.

The methodological approach of this study, which combines impact assessment, spatial analysis, and participatory diagnosis, aligns with recent trends that promote a more robust and integrated EIA to the

climate context (Loza & Fidélis, 2022; Marzouk & Azab, 2024). The application of Geographic Information Systems (GIS) facilitated the accurate visualization of the areas most affected by erosion processes and degradation of cover. The implementation of the IPCC approach to characterize vulnerability enabled the prioritization of intervention sectors and the development of specific adaptation strategies.

It is important to acknowledge that the Environmental Management Plan outlined in this study aligns international recommendations concerning community strengthening and ecological restoration as pivotal components of local adaptation (Wende *et al.*, 2020; IPCC, 2023). The identified actions seek to mitigate current impacts and to anticipate future scenarios, thus contributing to transforming the EIA into a strategic instrument for territorial climate management.

The findings of this research underscore the imperative to transition towards a climate-informed Environmental Impact Assessment (EIA), which integrates participatory tools, spatial analysis, and adaptation principles, particularly in highly exposed rural communities such as Cantagallo. The systematic incorporation of these methodologies has the potential to enhance local environmental governance and contribute to the socio-ecological resilience of the territory.

5. CONCLUSION

The environmental assessment conducted in the Cantagallo community revealed substantial impacts resulting from unsustainable anthropogenic activities and increasing exposure to extreme weather events. The observed effects include intensive pressure on soils,

the progressive loss of vegetation cover, the deterioration of water resources, and a high level of health vulnerability. These effects directly impact the ecological functionality and socio-environmental well-being of the territory.

The results indicate concerning levels of climate vulnerability, compounded by the community's constrained adaptive capacity. This scenario necessitates comprehensive structural interventions from local environmental planning. This study corroborates the notion that the incorporation of conventional impact assessment methodologies with tools such as spatial analysis, participatory diagnosis, and the climate vulnerability approach facilitates the generation of more comprehensive, contextualized, and useful knowledge for decision-making in rural territories.

It is concluded that a climate-informed Environmental Impact Assessment (EIA) must go beyond conventional mitigation measures, incorporating specific adaptation strategies that strengthen the resilience of vulnerable communities to climate change. The systematic incorporation of vulnerability and adaptation analysis in EIA processes represents a substantial advancement in sustainable environmental management and territorial security.

Therefore, it is recommended that instruments employed in the fields of environmental planning and management incorporate participatory climate diagnoses, the intensive use of Geographic Information Systems (GIS), and management strategies aimed at ecological restoration. These instruments should also include strategies that strengthen community capacities and consolidate local governance with an adaptive and participatory approach.

Acknowledgement: The authors of this article are grateful for the collaboration of the Faculty of Natural Sciences and Agriculture of the Universidad Estatal del Sur de Manabí.

Funding: The research was conducted independently by the researchers, and no funding was received.

REFERENCES

- Ayón, L., & Delgado, N. (2023). Tourism development plan for Cantagallo, Jipijapa canton. *UNESUM Journal - Sciences*, 7(2), 196–205. <https://doi.org/10.47230/unesum-ciencias.v7.n2.2023.196-205>
- Conesa, V. F. (2015). *Methodological guide for environmental impact assessment*. Mundi-Prensa.
- Corregidor-Fonseca, H., Aguirre-Ramírez, N., & Cifuentes-Ortiz, L. (2024). Unified methodological proposal for the assessment of environmental impact on water resources: Application in the Chicamocha River. *Colombian Journal of Environmental Sciences*, 56(1), 45–62. <https://doi.org/10.22201/revca.2024.561045>
- DUDE. (2018). *Ecuador's National Plan for Adaptation to Climate Change*. Ministry of the Environment of Ecuador.
- IPCC. (2023). *Sixth Assessment Report: Impacts, Adaptation and Vulnerability*. Intergovernmental Panel on Climate Change. <https://www.ipcc.ch/report/ar6/wg2/>
- Loza, D. A., & Fidélis, T. (2022). Integrating climate change adaptation into EIA: Insights from hydropower projects in Canada, Portugal and Oman. *Impact Assessment and Project Appraisal*, 40(5), 399–411. <https://doi.org/10.1080/14615517.2022.2088693>

- MAATE. (2021). *National Biodiversity Strategy and Action Plan to 2030*. Ministry of the Environment, Water and Ecological Transition of Ecuador. <https://www.ambiente.gob.ec>
- Marzouk, M., & Azab, S. (2024). Coastal climate change impact assessment using GIS and AHP for urban planning in Egypt. *Environmental Impact Assessment Review*, 103, 107120. <https://doi.org/10.1016/j.eiar.2023.107120>
- Mayembe, M., Snell, C., Pope, J., & Bond, A. (2023). How is climate change being addressed in Environmental Impact Assessment? A review of global EIA systems. *Environmental Impact Assessment Review*, 100, 106949. <https://doi.org/10.1016/j.eiar.2023.106949>
- Pauline, G., & Lema, L. A. (2024). Integrating climate change into environmental impact assessment processes in Tanzania: A policy and practice analysis. *Environmental Impact Assessment Review*, 102, 107102. <https://doi.org/10.1016/j.eiar.2023.107102>
- Pauta, M., Jiménez, J., & Vinueza, C. (2023). Evaluation of community environmental management in rural areas of the coastal region of Ecuador. *Ecuadorian Journal of Environmental Sciences*, 14(1), 45–62. <https://doi.org/10.18537/recac.v14i1.1234>
- Sietz, D., Boschütz, M., & Klein, R. J. T. (2012). Mainstreaming climate adaptation into development assistance: Rationale, institutional barriers and opportunities in Mozambique. *Environmental Science & Policy*, 25, 62–69. <https://doi.org/10.1016/j.envsci.2012.08.007>
- Ulibarri, N., & Han, J. (2022). The role of climate change in environmental impact statements in the United States. *Environmental Impact Assessment Review*, 95, 106799. <https://doi.org/10.1016/j.eiar.2022.106799>
- Vásquez, A., Molina, D., & Pérez, E. (2020). Environmental and social problems in rural coastal communities of Ecuador. *Latin American Journal of Environmental Studies*, 6(2), 89–104.
- Wende, W., Bond, A., Bobylev, N., & Stratmann, L. (2020). Climate change mitigation and adaptation in strategic environmental assessment – Opportunities and limits in the context of transport infrastructure planning. *Environmental Science & Policy*, 105, 69–78. <https://doi.org/10.1016/j.envsci.2019.12.005>