

Coastal Erosion in the Aftermath of the Mount Pinatubo Eruption: An In-Depth Study of the Socioeconomic Conditions in Barangay Sto. Niño, Municipality of San Felipe, Zambales

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ABSTRACT

This study investigates the socioeconomic impact of coastal erosion in Barangay Sto. Niño, Municipality of San Felipe, Zambales, following the Mount Pinatubo eruption. The eruption in 1991 significantly altered the coastal landscape through the deposition of volcanic materials, leading to long-term geomorphological changes that intensified shoreline retreat and erosion. Using a mixed-method approach combining field observation, household surveys, and key informant interviews, the research examines the interplay between environmental degradation and the livelihood, housing stability, and adaptive capacity of local residents. Findings reveal that coastal erosion has resulted in loss of agricultural land, displacement of families, and declining fishing productivity, which collectively weakened the community's economic resilience. Moreover, the study highlights the limited access to government support and sustainable livelihood programs, underscoring the need for integrated coastal management strategies and community-based adaptation initiatives. The results emphasize the urgent call for comprehensive interventions addressing both the environmental and social dimensions of post-eruption recovery and resilience-building in coastal communities.

Keywords: Coastal Erosion, Mount Pinatubo Eruption, Socioeconomic Impact, Environmental Degradation, Community Resilience

INTRODUCTION

Coastal erosion has become an escalating environmental and socioeconomic challenge in the Philippines, particularly in regions affected by major geological events such as the 1991 Mount Pinatubo eruption. The eruption deposited immense volumes of lahar and pyroclastic materials, which over the years have been transported downstream into river systems leading to coastal zones. In Zambales, sediment deposition continues to alter shoreline morphology, contributing to both accretion and subsequent erosion. Recent reports indicate that coastal barangays including Liwliwa and Sto. Niño in San Felipe have been severely affected, with residential and tourism areas losing portions of land and property to the encroaching sea (Cruz, 2025).

The socioeconomic consequences of coastal erosion are evident through declining tourism income, displacement of families, and loss of livelihood opportunities. In San Felipe, resort owners and fisherfolk have reported significant decreases in earnings due to receding coastlines and damaged infrastructure. Erosion has also undermined residential safety, forcing several households to relocate inland to avoid further destruction. Studies emphasize that such environmental changes disproportionately affect low-income families who depend on fishing and small-scale tourism for survival (Dela Cruz, 2024). Furthermore, human activities such as sand dredging and unregulated construction have intensified shoreline instability, reducing the resilience of the community (Reyes, 2025).

Local government units and national agencies have begun to address these challenges by enforcing

stricter zoning and construction regulations along Zambales' vulnerable shorelines. The Mines and Geosciences Bureau clarified in 2025 that coastal erosion in San Felipe was exacerbated by both natural and anthropogenic factors, including historical lahar deposits and sediment movement from river mouths (Santos, 2025). Governor Hermogenes Ebdane Jr. has since implemented policies restricting construction within identified danger zones and called for the review of land titles on accreted lands that have become unstable (Villanueva, 2025). These initiatives highlight the government's attempt to balance coastal development with environmental protection, though enforcement remains inconsistent at the barangay level.

Environmental conditions in coastal Zambales are further influenced by heavy monsoon rains, typhoons, and the continuous reworking of lahar sediments from the Pinatubo highlands. Recent events, including Typhoon Carina in 2024, have accelerated erosion processes, destroying seawalls, dikes, and portions of the coastline (Torres, 2024). Reports from the Inter-Agency Committee Technical Working Group have classified several areas in San Felipe, including Sto. Niño, as moderately to highly vulnerable to coastal hazards. These findings underscore the need for long-term monitoring and the establishment of coastal defense structures to safeguard communities from further land loss (Garcia, 2024).

Despite increasing awareness, community adaptation remains limited due to socioeconomic constraints and insufficient institutional support. Many residents lack access to sustainable livelihood programs, affordable relocation options, and formal land ownership rights. The loss of beachfront property has also affected tourism-dependent enterprises, leading to job insecurity and financial instability. According to recent assessments, more than 30 resort owners in San Felipe reported substantial property damage and income loss caused by severe coastal erosion between 2023 and 2025 (Mendoza, 2025). Such impacts emphasize the need for a comprehensive and inclusive coastal management approach that integrates environmental rehabilitation and social protection.

Given this context, Barangay Sto. Niño represents a critical case for examining the intersection of environmental degradation and community resilience. Its proximity to the Sto. Tomas River and reliance on coastal resources make it particularly vulnerable to post-eruption sedimentation and subsequent erosion. This study seeks to analyze the socioeconomic conditions of residents in Sto. Niño, focusing on livelihood impacts, displacement, and adaptive measures. By documenting local experiences and institutional responses, the research aims to provide policy insights that support sustainable coastal management and community-based resilience initiatives in Zambales and other lahar-affected regions of the Philippines (Lopez, 2025).

LITERATURE REVIEW

Coastal erosion, a growing environmental concern, has profound implications for coastal communities, especially in regions affected by significant natural disasters like the Mount Pinatubo eruption. Studies examining coastal erosion in the Philippines, particularly in areas like Zambales, have emphasized the destructive impacts of this environmental process on both the natural environment and local economies (Garcia, 2023; Delgado, 2023). In these regions, erosion has led to the loss of beachfront areas, decreased property values, and damage to infrastructure, affecting tourism and fishing-based livelihoods (Cabrera, 2022). As a result, coastal erosion has become a major driver of socioeconomic instability, displacing families and reducing job opportunities for local residents (Reyes, 2023).

The economic impacts of coastal erosion are particularly significant for communities dependent on fishing and tourism, with many families experiencing a decline in income due to the destruction of the shoreline (Lopez, 2022). Studies have noted that the erosion of coastal areas has forced residents to

relocate, leading to significant community displacement and disruption of social structures (Torres, 2023). The erosion process also affects local businesses, with many resort owners reporting substantial financial losses due to damage to their properties (Mendoza, 2025).

From an environmental perspective, coastal erosion is exacerbated by human activities, such as sand dredging and construction in vulnerable areas (Santos, 2025). The effects of climate change, including rising sea levels and increased frequency of typhoons, further contribute to the rapid deterioration of coastlines, complicating efforts to mitigate the damage (Zhao, 2023). Volcanic lahars from the Mount Pinatubo eruption have also played a significant role in altering sediment dynamics, which has had long-lasting effects on coastal morphology (Delos Santos, 2022).

Adaptation and mitigation strategies, such as government interventions, coastal restoration projects, and community-based programs, are critical in addressing these challenges. However, the effectiveness of these initiatives depends largely on the coordination between local governments, businesses, and communities. While there are signs of progress, such as increased focus on sustainable practices and community resilience (Cabrera, 2022), gaps remain in the provision of adequate support for displaced families and those who have lost their livelihoods (Fernandez, 2023).

The literature suggests that effective coastal management requires an integrated approach that combines environmental conservation, economic diversification, and social support. Moreover, focusing on long-term strategies, such as the promotion of ecotourism, sustainable livelihoods, and community resilience, can help mitigate the impacts of coastal erosion (Torres, 2023). This study aims to contribute to the growing body of literature by exploring the socioeconomic conditions in Barangay Sto. Niño and offering insights into the effectiveness of current strategies in promoting sustainable coastal management and recovery for affected communities.

MATERIALS AND METHODS

The study employed a descriptive-correlational research design to examine the relationship between coastal erosion and the socioeconomic conditions of residents in Barangay Sto. Niño, Municipality of San Felipe, Zambales, following the Mount Pinatubo eruption. The descriptive component was utilized to characterize the demographic and socioeconomic profiles of the affected population, including livelihood sources, income levels, and patterns of displacement. It also aimed to describe the extent and manifestations of coastal erosion and its perceived effects on community welfare and stability. The correlational component was applied to determine the statistical relationships between the degree of coastal erosion and various socioeconomic indicators such as income loss, livelihood disruption, and adaptive capacity. This design was deemed appropriate as it allows for the analysis of relationships among variables in their natural setting without manipulation, providing a clear understanding of how environmental degradation influences the economic and social resilience of coastal communities.

RESULTS AND DISCUSSION

1. What is the extent of coastal erosion in Barangay Sto. Niño in terms of:

1.2 Extent of erosion;

1.3 Erosion rate;

1.3 Impact on infrastructure; and

1.4 Sediment dynamics?

Table 1 presents the extent of coastal erosion in Barangay Sto. Niño, focusing on observable land loss and its impacts on the community. The overall average mean of 3.03 with a standard deviation of 0.79, interpreted as Agree, indicates that respondents recognize coastal erosion as a significant concern

affecting the area. This finding implies that visible changes along the coastline, such as shrinking beachfronts and receding land, are increasingly evident to residents, highlighting both environmental and socio-economic implications for the community (Angnuureng, 2025).

The highest mean score of 3.15 corresponds to the statement “Coastal erosion has caused the destruction of essential infrastructure along the shoreline.” This indicates that residents perceive the effects of erosion not only on the natural landscape but also on vital structures, emphasizing the vulnerability of local infrastructure to environmental hazards. Such impacts underline the importance of proactive measures, including protective and restoration efforts, to safeguard both community property and essential services (Dong, 2024).

Moreover, the lowest mean score of 2.92, though still Agree, is associated with the statement “The coastline in Barangay Sto. Niño has experienced noticeable land loss in recent years.” This suggests that while the general perception acknowledges land loss, the severity may vary depending on individual experiences or proximity to the shoreline. Overall, the findings highlight the urgent need for comprehensive coastal management strategies that address environmental, residential, and ecological concerns to mitigate the ongoing effects of erosion (Lopez, 2024).

Table 1
The Extent of Coastal Erosion in Barangay Sto. Niño in terms of Extent Erosion

Indicators	Mean	SD	Description
The coastline in Barangay Sto. Niño has experienced noticeable land loss in recent years.	2.92	0.83	Agree
There has been a significant reduction in beachfront areas.	2.93	0.78	Agree
Coastal erosion has caused the destruction of essential infrastructure along the shoreline.	3.15	0.78	Agree
The current level of erosion is a major threat to residential properties in the area.	3.02	0.79	Agree
Erosion is visibly affecting the natural landscape and habitats along the coastline.	3.13	0.77	Agree
AVERAGE MEAN	3.03	0.79	Agree

Legend: (4) Strongly Agree, (3) Agree, (2) Disagree, (1) Strongly Disagree

Table 2 presents the extent of coastal erosion in Barangay Sto. Niño in terms of erosion rate. The overall average mean of 3.00 with a standard deviation of 0.78, interpreted as Agree, indicates that respondents perceive the rate of coastal erosion as significant and accelerating. This finding implies that changes in the shoreline are increasingly noticeable, highlighting both environmental and social risks for the local community. Natural disasters, human activities, and climatic conditions contribute to the perception of rapid erosion, emphasizing the urgency for monitoring and preventive measures (Walsh, 2023).

The highest mean score of 3.17 corresponds to the statement “Frequent storms and heavy rains have contributed to the faster erosion of the coastline.” This indicates that respondents recognize the impact of extreme weather events on accelerating erosion, affecting both the natural landscape and human settlements. Such observations align with studies suggesting that increased rainfall and storm frequency significantly exacerbate coastal degradation, highlighting the need for climate-resilient strategies and infrastructure (Santos, 2022).

Moreover, the lowest mean score of 2.82, though still Agree, is associated with the statement “The rate of coastal erosion in Barangay Sto. Niño has increased significantly since the Mount Pinatubo eruption.” This suggests that while historical events are acknowledged as contributing factors, residents may perceive more immediate causes—such as recent storms and rainfall—as having a

greater impact on current erosion rates. Overall, the findings underscore the importance of implementing comprehensive coastal management strategies to mitigate environmental threats and protect community stability (Reyes, 2024).

Table 2
The Extent of Coastal Erosion in Barangay Sto. Niño in terms of Erosion Rate

Indicators	Mean	SD	Description
The rate of coastal erosion in Barangay Sto. Niño has increased significantly since the Mount Pinatubo eruption.	2.82	0.91	Agree
The erosion process has accelerated over the past five years.	2.85	0.78	Agree
Frequent storms and heavy rains have contributed to the faster erosion of the coastline.	3.17	0.69	Agree
The erosion rate in Barangay Sto. Niño is higher compared to neighboring coastal areas.	3.05	0.79	Agree
Coastal erosion is occurring at an alarming rate, threatening community stability.	3.10	0.75	Agree
AVERAGE MEAN	3.00	0.78	Agree

Legend: (4) Strongly Agree, (3) Agree, (2) Disagree, (1) Strongly Disagree

Table 3 presents the extent of coastal erosion in Barangay Sto. Niño in terms of its impact on infrastructure. The overall average mean of 3.05 with a standard deviation of 0.73, interpreted as Agree, indicates that respondents recognize the significant effects of erosion on both public and private structures. This finding implies that coastal degradation threatens community stability, accessibility, and economic activities, emphasizing the need for proactive strategies to protect essential infrastructure (Delgado, 2023).

The highest mean score of 3.22 corresponds to the statement “Local resorts and tourism-related businesses have been severely impacted by coastal erosion.” This indicates that respondents perceive substantial economic consequences, particularly in tourism-dependent sectors. Such observations align with studies showing that coastal erosion can disrupt business operations, reduce income, and affect local employment, highlighting the importance of sustainable coastal management and investment in protective measures (Cabrera, 2022).

While the lowest mean score of 2.85, though still Agree, is associated with the statement “Erosion has caused damage to public facilities, making them less accessible.” This suggests that while all infrastructure is affected, residents perceive public facilities as moderately impacted compared to private and tourism-related properties. Overall, the findings emphasize the critical need for integrated coastal management strategies to mitigate infrastructure loss, safeguard investments, and ensure community resilience (Torres, 2024).

Table 3
The Extent of Coastal Erosion in Barangay Sto. Niño in terms of Impact on Infrastructure

Indicators	Mean	SD	Description
Coastal erosion has damaged or destroyed critical infrastructure, including roads and piers, in Barangay Sto. Niño.	3.08	0.72	Agree
Local resorts and tourism-related businesses have been severely impacted by coastal erosion.	3.22	0.67	Agree
Erosion has caused damage to public facilities, making them less accessible.	2.85	0.80	Agree
The erosion of the coastline has led to the loss of private properties near the shore.	3.07	0.78	Agree
Government and private investments in coastal infrastructure have been rendered ineffective due to erosion.	3.02	0.70	Agree
AVERAGE MEAN	3.05	0.73	Agree

Legend: (4) Strongly Agree, (3) Agree, (2) Disagree, (1) Strongly Disagree

Table 4 presents the extent of coastal erosion in Barangay Sto. Niño in terms of sediment dynamics. The overall average mean of 3.14 with a standard deviation of 0.67, interpreted as Agree, indicates that respondents recognize significant changes in sediment flow and distribution along the coastline. This finding implies that both natural processes and human activities are altering the shoreline, affecting its stability and ecological balance (Navarro, 2023).

Table 4
The Extent of Coastal Erosion in Barangay Sto. Niño in terms of Sediment Dynamics

Indicators	Mean	SD	Description
The erosion in Barangay Sto. Niño has caused significant changes in sediment flow and deposition.	3.07	0.71	Agree
Volcanic lahars from Mount Pinatubo have contributed to the shifting of coastal sediments.	3.28	0.52	Strongly Agree
Dredging activities in the area have worsened the sediment imbalance along the coast.	3.00	0.80	Agree
Coastal erosion has altered the natural sediment distribution, impacting shoreline stability.	3.15	0.63	Agree
There has been a disruption in the natural replenishment of coastal sediments due to human activities.	3.20	0.68	Agree
AVERAGE MEAN	3.14	0.67	Agree

Legend: (4) Strongly Agree, (3) Agree, (2) Disagree, (1) Strongly Disagree

The highest mean score of 3.28 corresponds to the statement “Volcanic lahars from Mount Pinatubo have contributed to the shifting of coastal sediments.” This indicates that respondents perceive historical volcanic activity as a major factor influencing sediment movement. Such observations align with studies showing that volcanic lahars can significantly alter coastal morphology and sediment transport patterns, emphasizing the long-term environmental impacts of geological events (Delos Santos, 2022).

The lowest mean score of 3.00, though still Agree, is associated with the statement “Dredging activities in the area have worsened the sediment imbalance along the coast.” This suggests that human interventions, such as dredging, are recognized as contributors to sediment disruption, although their impact is perceived as slightly less significant than natural factors. Overall, the findings underscore the importance of sustainable coastal management practices, including careful monitoring of sediment dynamics, to maintain shoreline stability and protect community and ecological interests (Martinez, 2024).

2. What are the socioeconomic conditions of the residents in Barangay Sto. Niño in terms of:

2.1 Livelihood impact;

2.2 Employment changes;

2.3 Community displacement;

2.4 Social well-being; and

2.5 Economic benefits?

Table 5 presents the socioeconomic conditions of residents in Barangay Sto. Niño in terms of livelihood impact. The overall average mean of 3.04 with a standard deviation of 0.74, interpreted as Agree, indicates that respondents perceive coastal erosion as having a significant effect on the community’s economic well-being. This finding implies that both natural and human-induced shoreline changes are disrupting income sources, emphasizing the vulnerability of residents who depend on coastal resources for their livelihoods (Garcia, 2023).

The highest mean score of 3.13 corresponds to the statement “The erosion of beachfront areas has led to a decline in tourism-related income.” This indicates that respondents recognize the direct economic consequences of coastal degradation on tourism-dependent businesses. Such impacts align with studies demonstrating that shoreline loss and environmental degradation can reduce tourism revenue, affect employment, and hinder local economic development (Lopez, 2022).

Furthermore, the lowest mean score of 2.95, though still Agree, is associated with the statement “Many families in Barangay Sto. Niño have lost their primary source of income because of coastal erosion.” This suggests that while income loss is acknowledged, its severity may vary among households depending on their reliance on coastal activities. Overall, the findings highlight the urgent need for community-based adaptation strategies and livelihood diversification programs to mitigate the socioeconomic impacts of coastal erosion (Torres, 2023).

Table 5
The Socioeconomic Conditions of the Residents in Barangay Sto. Niño in terms of Livelihood Impact

Indicators	Mean	SD	Description
Coastal erosion has significantly affected the livelihood of local fishermen in Barangay Sto. Niño.	3.03	0.80	Agree
The erosion of beachfront areas has led to a decline in tourism-related income.	3.13	0.65	Agree
Local businesses dependent on coastal resources have suffered due to the destruction of the coastline.	3.10	0.68	Agree
Many families in Barangay Sto. Niño have lost their primary source of income because of coastal erosion.	2.95	0.81	Agree
There has been a noticeable increase in unemployment in Barangay Sto. Niño as a result of coastal erosion.	2.98	0.75	Agree
AVERAGE MEAN	3.04	0.74	Agree

Legend: (4) Strongly Agree, (3) Agree, (2) Disagree, (1) Strongly Disagree

Table 6 presents the socioeconomic conditions of residents in Barangay Sto. Niño in terms of employment changes. The overall average mean of 2.97 with a standard deviation of 0.69, interpreted as Agree, indicates that respondents perceive coastal erosion as contributing to a decrease in local employment. This finding implies that the degradation of the coastline has disrupted job availability, particularly in sectors dependent on coastal resources, highlighting the vulnerability of the community’s workforce (Fernandez, 2023).

The highest mean score of 3.13 corresponds to the statement “Coastal erosion has caused a shift in employment patterns, with fewer people working in coastal industries.” This indicates that respondents recognize a noticeable change in occupational trends, where residents are moving away from traditional coastal livelihoods such as fishing and tourism. Such patterns align with studies suggesting that environmental degradation can force communities to adapt their employment strategies, often seeking alternative income sources outside their immediate locale (Cruz, 2022).

Additionally, the lowest mean score of 2.83, though still Agree, is associated with the statement “The government has not been able to provide sufficient job opportunities to replace those lost due to erosion.” This suggests that residents perceive limited institutional support in mitigating employment losses. Overall, the findings emphasize the need for comprehensive livelihood programs, government intervention, and skill development initiatives to address the employment challenges posed by coastal erosion (Morales, 2023).

Table 6
The Socioeconomic Conditions of the Residents in Barangay Sto. Niño in terms of Employment Changes

Indicators	Mean	SD	Description
The employment rate in Barangay Sto. Niño has decreased due to coastal erosion.	2.95	0.72	Agree
Many workers in the tourism and fishing industries have lost their jobs due to the erosion of the coastline.	2.97	0.69	Agree
Coastal erosion has caused a shift in employment patterns, with fewer people working in coastal industries.	3.13	0.60	Agree
The government has not been able to provide sufficient job opportunities to replace those lost due to erosion.	2.83	0.74	Agree
Many residents in Barangay Sto. Niño are now seeking employment outside their community due to the economic impact of coastal erosion.	2.98	0.72	Agree
AVERAGE MEAN	2.97	0.69	Agree

Legend: (4) Strongly Agree, (3) Agree, (2) Disagree, (1) Strongly Disagree

Table 7 presents the socioeconomic conditions of residents in Barangay Sto. Niño in terms of community displacement. The overall average mean of 2.82 with a standard deviation of 0.76, interpreted as Agree, indicates that respondents recognize coastal erosion as contributing to the relocation of some community members. This finding implies that shoreline degradation is not only an environmental issue but also a social concern, affecting housing stability and long-term community planning (Reyes, 2023).

The highest mean score of 2.95 corresponds to the statement “The threat of coastal erosion has caused anxiety among residents about their long-term habitation in the area.” This indicates that respondents perceive the psychological and emotional impacts of coastal erosion, highlighting how environmental hazards influence residents’ sense of security and well-being. Such observations align with studies showing that environmental risks can trigger stress, uncertainty, and challenges to community cohesion (Cabrera, 2022).

Table 7
The Socioeconomic Conditions of the Residents in Barangay Sto. Niño in terms of Community Displacement

Indicators	Mean	SD	Description
Coastal erosion has forced some residents in Barangay Sto. Niño to relocate to safer areas.	2.87	0.77	Agree
The threat of coastal erosion has caused anxiety among residents about their long-term habitation in the area.	2.95	0.72	Agree
Some families in Barangay Sto. Niño have lost their homes due to the erosion of the coastline.	2.82	0.79	Agree
The local government has provided insufficient assistance to families displaced by coastal erosion.	2.73	0.76	Agree
There has been a significant increase in the number of displaced families in Barangay Sto. Niño due to erosion.	2.75	0.75	Agree
AVERAGE MEAN	2.82	0.76	Agree

Legend: (4) Strongly Agree, (3) Agree, (2) Disagree, (1) Strongly Disagree

Whereas, the lowest mean score of 2.73, though still Agree, is associated with the statement “The local government has provided insufficient assistance to families displaced by coastal erosion.” This suggests that residents perceive limited institutional support in addressing the challenges of displacement. Overall, the findings underscore the urgent need for stronger government intervention,

disaster preparedness programs, and community support initiatives to mitigate the social impacts of coastal erosion (Torres, 2023).

Table 8 presents the socioeconomic conditions of residents in Barangay Sto. Niño in terms of social well-being. The overall average mean of 2.88 with a standard deviation of 0.75, interpreted as Agree, indicates that respondents perceive coastal erosion as negatively affecting the quality of life in the community. This finding implies that ongoing shoreline degradation contributes to social stress, uncertainty, and challenges in maintaining a stable living environment (Delgado, 2023).

The highest mean score of 2.97 corresponds to the statement “Coastal erosion has created significant uncertainty regarding the future of the community’s well-being.” This indicates that respondents are concerned about long-term implications for health, security, and communal stability. Such observations align with studies showing that environmental hazards can reduce community cohesion and negatively affect mental and social well-being (Navarro, 2022).

Table 8
The Socioeconomic Conditions of the Residents in Barangay Sto. Niño in terms of Social Well-being

Indicators	Mean	SD	Description
The mental health of residents in Barangay Sto. Niño has been negatively impacted by the stress of coastal erosion.	2.93	0.71	Agree
Coastal erosion has created significant uncertainty regarding the future of the community’s well-being.	2.97	0.69	Agree
The erosion of the coastline has led to a decline in the overall quality of life for many families.	2.93	0.76	Agree
Local schools have been affected by coastal erosion, impacting educational opportunities for children.	2.68	0.87	Agree
There is a sense of insecurity and instability in the community due to the ongoing effects of coastal erosion.	2.87	0.75	Agree
AVERAGE MEAN	2.88	0.75	Agree

Legend: (4) Strongly Agree, (3) Agree, (2) Disagree, (1) Strongly Disagree

Also, the lowest mean score of 2.68, though still Agree, is associated with the statement “Local schools have been affected by coastal erosion, impacting educational opportunities for children.” This suggests that while social well-being is broadly impacted, the effects on educational infrastructure are perceived as moderately significant compared to other social concerns. Overall, the findings highlight the need for comprehensive community support programs, mental health interventions, and educational continuity planning to mitigate the social impacts of coastal erosion (Torres, 2023).

Table 9 presents the socioeconomic conditions of residents in Barangay Sto. Niño in terms of economic benefits. The overall average mean of 2.92 with a standard deviation of 0.75, interpreted as Agree, indicates that respondents perceive some positive economic outcomes resulting from efforts to mitigate coastal erosion. This finding implies that local government support, coastal restoration, and adaptive initiatives have provided opportunities for financial recovery and community resilience (Delgado, 2023).

The highest mean score of 2.95 corresponds to the statements “The challenges posed by coastal erosion have led to the development of ecotourism, which has brought additional revenue to the local businesses” and “The community has successfully diversified its sources of income beyond fishing and tourism due to the changes brought by coastal erosion.” This indicates that respondents recognize the adaptive strategies and innovative responses of the community, where environmental challenges are transformed into economic opportunities. Such observations align with studies showing that

communities affected by environmental degradation can benefit from diversification and ecotourism development, thereby strengthening local economies (Cabrera, 2022).

The lowest means score of 2.90, though still Agree, is associated with statements regarding local government programs and coastal restoration projects. This suggests that while respondents perceive these interventions as beneficial, the effects are moderate and may require further enhancement to maximize economic gains. Overall, the findings highlight the importance of sustained government support, strategic investment, and community-based initiatives to optimize the economic benefits of coastal management efforts (Torres, 2023).

Table 9
The Socioeconomic Conditions of the Residents in Barangay Sto. Niño in terms of Economic Benefits

Indicators	Mean	SD	Description
The local government's support programs have significantly helped businesses and residents recover financially from the effects of coastal erosion.	2.90	0.71	Agree
The efforts to restore the coastline, such as building sea walls and other protective measures, have created new employment opportunities in the community.	2.90	0.82	Agree
The challenges posed by coastal erosion have led to the development of ecotourism, which has brought additional revenue to the local businesses in Barangay Sto. Niño.	2.95	0.70	Agree
The community has successfully diversified its sources of income beyond fishing and tourism due to the changes brought by coastal erosion.	2.95	0.77	Agree
Coastal restoration projects funded by external organizations have improved local infrastructure, created new business opportunities and boosted economic activity in the area.	2.90	0.77	Agree
AVERAGE MEAN	2.92	0.75	Agree

Legend: (4) Strongly Agree, (3) Agree, (2) Disagree, (1) Strongly Disagree

3. What is the impact of coastal erosion on the socioeconomic conditions of the residents in Barangay Sto. Niño, Municipality of San Felipe, Zambales?

Table 10 presents the test of significant impact of coastal erosion on the socioeconomic conditions of the residents in Barangay Sto. Niño, Municipality of San Felipe, Zambales. The regression model yielded an Adjusted R^2 of 0.575, indicating that approximately 57.5% of the variance in socioeconomic conditions can be explained by the combined influence of the four predictors—extent of erosion, erosion rate, impact on infrastructure, and sediment dynamics. The overall model is highly significant ($F = 18.633$, $p = .000$), demonstrating that collectively, these factors meaningfully relate to residents' socioeconomic conditions. This finding underscores the interconnectedness of environmental degradation and community well-being, consistent with the observations of Delgado (2023) that coastal processes significantly influence livelihoods, income stability, and social resilience in coastal communities.

When evaluating individual predictors, none were found to be statistically significant, with p-values exceeding the 0.05 threshold (extent of erosion, $p = .121$; erosion rate, $p = .116$; impact on infrastructure, $p = .233$; sediment dynamics, $p = .099$). This suggests that while each factor contributes to residents' experiences of socioeconomic change, their independent effects may not directly predict these outcomes without considering combined or contextual influences. These results align with the

findings of Navarro (2022), who emphasized that socioeconomic impacts of coastal erosion often arise from cumulative and interacting environmental and social factors rather than a single dominant cause.

Overall, the regression results suggest that the socioeconomic conditions of residents are influenced by coastal erosion in a holistic sense, but no single aspect of erosion alone significantly drives the outcomes. The findings highlight the importance of comprehensive community interventions, including livelihood support, infrastructure protection, and sediment management, to address the multifaceted effects of erosion. This supports the view of Torres (2023) that integrated strategies combining environmental, economic, and social approaches are necessary to enhance resilience and adaptive capacity in erosion-affected coastal communities.

Table 10
The Test of Significant Impact of Coastal Erosion on the Socioeconomic Conditions of the Residents in Barangay Sto. Niño, Municipality of San Felipe, Zambales

Predictors	Unstandardized Coefficients		Stand Coeff	F-value	p-value	Decision on Ho
	B	SE				
(Constant)	0.090	0.384		0.234	0.816	
Extent of erosion	0.192	0.122	0.208	1.575	0.121	<i>Not Significant</i>
Erosion rate	0.241	0.151	0.243	1.595	0.116	<i>Not Significant</i>
Impact on infrastructure	0.186	0.154	0.191	1.207	0.233	<i>Not Significant</i>
Sediment dynamics	0.307	0.183	0.222	1.677	0.099	<i>Not Significant</i>

Significant if P-value < 0.05

Note: Adjusted R² = 0.575

ANOVA for Regression: F18.633, p = .000

CONCLUSION

The study revealed that coastal erosion in Barangay Sto. Niño has become a significant environmental concern, visibly altering the coastline and causing land loss. Residents observed a reduction in beachfront areas, destruction of infrastructure, and changes in natural habitats, indicating that erosion is not only a physical phenomenon but also a growing threat to the community's stability and livelihood. The findings underscore the pressing need for proactive measures to manage and mitigate the ongoing degradation of coastal areas.

Erosion has particularly affected the structural integrity of critical infrastructure, including roads, piers, and public facilities, which are essential for transportation, commerce, and daily activities. The disruption of these facilities has implications for both economic and social stability, as the community depends on them for mobility, trade, and access to services. The study highlights that protecting and maintaining infrastructure is a key component in safeguarding the overall well-being of coastal communities.

The investigation into sediment dynamics revealed that both natural processes and human activities influence coastal stability. Volcanic lahars, shifting sediment patterns, and dredging activities have disrupted the natural replenishment of sediments along the shore, impacting shoreline stability. These findings indicate that environmental management strategies must consider not only erosion control but also the preservation and restoration of natural sediment flow to maintain the ecological balance of the coastline.

Coastal erosion has also had significant socioeconomic effects, affecting livelihoods, employment, and income-generating activities. Fishing, tourism, and other coastal-dependent industries have been disrupted, leading to reduced income and increased economic vulnerability. The study suggests that adaptive strategies, including livelihood diversification and community-based programs, are crucial to enhance economic resilience and ensure sustainable income opportunities for affected residents.

The social well-being of the community has been compromised as a result of erosion. Anxiety, uncertainty about the future, and the relocation of some families reflect the broader impact on residents' quality of life. The study emphasizes the importance of addressing social and psychological concerns alongside environmental and economic interventions, ensuring that communities are supported holistically in coping with the challenges posed by coastal erosion.

Overall, the study highlights the complex and interconnected nature of coastal erosion, affecting the environment, infrastructure, economy, and social well-being of the residents. Effective management requires a comprehensive approach that combines structural measures, environmental conservation, socioeconomic support, and community engagement. By addressing these challenges collectively, the community can enhance its resilience, safeguard its resources, and promote sustainable development despite the ongoing threats posed by coastal erosion.

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