PERCEIVED VULNERABILITY OF BEACH TOURISM TO CLIMATE CHANGE IN OLONGAPO, SUBIC, AND SAN ANTONIO, ZAMBALES

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ABSTRACT

Climate change is a global issue, impacting not only developing or tropical countries but also nations worldwide. Tourism, particularly coastal tourism, is a significant industry in many countries, including the Philippines, an archipelagic nation in Southeast Asia known for its numerous islands and beaches. Despite its reliance on the blue economy, the Philippines is identified as the third most vulnerable country globally to climate change. This study utilizes the vulnerability theory framework to evaluate the effects of climate change on beach tourism in Zambales, Philippines, focusing on factors such as increased temperatures, severe typhoons, floods, and rising sea levels. By examining existing research, this study highlights the climatic conditions, environmental situations, and adaptation strategies implemented in various countries and regions. By employing descriptive research methods, including both quantitative and qualitative approaches, this study surveyed stakeholders in Zambales to gauge the vulnerability and condition of beach tourism in the region. The findings indicate a perceived vulnerability of beach tourism to climate change, prompting the proposal of adaptation measures to mitigate these challenges and ensure the sustainability of beach tourism in Zambales.

Keywords: climate change, beach tourism, Vulnerability Theory, Philippines, mixed method research

INTRODUCTION

Climate change impacts are evident more than ever. Effects are being experienced across the globe. This matter is not heavily considered in planning and decision-making in the Philippines compared to countries like those in Europe where most things are made towards alleviating climate change.

Talks on climate change have been around for quite some time now. Global warming came after what was called a period of global cooling between the 1940s and 1970s. Temperatures across the globe shot up, creating extreme events such as drought and wildfires due to the increased heat being experienced. The year 1988 they have marked the point of posing global warming as a crucial world phenomenon (History, 2020).

Most types of tourism are highly dependent on weather and climate and also natural resources (Friedrich et al., 2020; Gómez-Martin et al., 2020; Pandy and Rogerson, 2021). This paper's focal subject matter significantly influences the beach tourism sector. A hundred percent of this type of tourism relies on the climate and weather conditions of a destination. With the issue of climate change lingering, the tourism industry, mainly nature-based tourism, will be greatly affected.

Beach tourism is one of the top tourism offerings of the Philippines; the country is an archipelago boasting numerous islands and beaches. Beaches in the Philippines have always secured a place in the world's best beaches list.

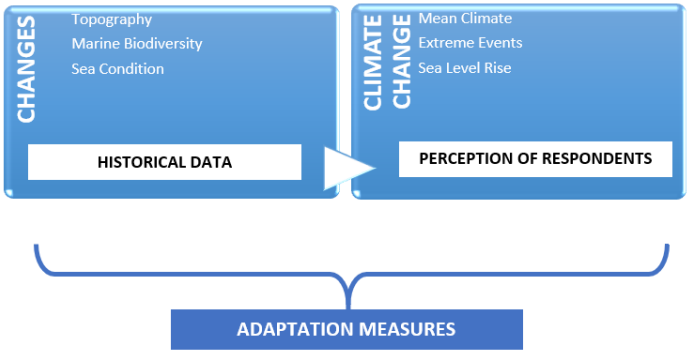
The Philippines will be hard hit by the dreadful effects of intense climate situations as it is located in the Pacific Ring of Fire and, therefore, one of the most vulnerable and hazard-prone countries in the world (Paz-Alberto et al., 2021). The Philippines even ranked third as the most vulnerable country in the world to climate change. This is based on the 2017 World Risk Report (NICCDIES, n.d.).

There was one incident in Zambales, the Philippines happened in June 2013, wherein a part of a beach in the municipality of Candelaria, around 80 to 100 meters in length and 10 meters in width, eroded (see Figure 1). This caused worry for the coastal community in that area (Valencia, 2013).

Figure 1.Eroded Beach in Candelaria, Zambales

The researcher saw the urgency of that pressing global issue. In that crucial time, humanity had to decide how to act towards climate problems and human-induced issues as it approached the brink and fell into critical levels of global warming. It was very important to tackle that topic of high concern before it was too late.

In the Philippines, scant research has been conducted on the intersection of climate change and beach tourism. Consequently, it is imperative to formulate measures aimed at safeguarding and



adapting beach destinations against the adverse effects wrought by climatic factors.

Figure 2. Framework for Development of Adaptation Measures for Beach Tourism

Presented in Figure 2, the researcher probed on the changes in the sea in terms of topography, marine biodiversity, and sea condition that happened in Olongapo City, Subic and San Antonio, Zambales in the past years, and the perception of locals on climate change that may add to the vulnerability of the tourist beach areas, so that adaptation measures can be proposed accordingly.

To gauge whether the destination is susceptible to climatic events or not, the researcher looked into the vulnerability of beach tourism in the chosen destinations toward the following climatic factors: mean climate, extreme events, and sea level rise.

Considering the current state of the beach area and the climate change factors, a more holistic adaptation measures can be created.

OBJECTIVES OF THE STUDY

Given the escalating concerns surrounding climate change, the researcher's objective was to facilitate the adaptation of beach tourism to mitigate the

adverse impacts of climatic factors. More so, it sought to fulfill the following specific objectives.

1. Probe the changes in topography, biodiversity, and sea conditions in the coastal barangays of Olongapo City, Subic, and San Antonio, Zambales.
2. Investigate the vulnerability of climate change factors like mean climate, extreme events, and sea level rise on beach tourism in Olongapo City, Subic, and San Antonio, Zambales.
3. Formulate adaptation measures to address the vulnerability of beach tourism in Olongapo City, Subic, and San Antonio, Zambales resulting from the perceived impacts of climate change.

METHODOLOGY

The respondents for this study's quantitative survey are residents within the coastal barangays of the chosen cities. All the adult residents, aged 18 years old and above, were considered regardless of gender, profession, nationality, and place of origin. Their perceptions are vital to this study as they experience variations in climate in their daily lives.

Quantitative and qualitative methods were utilized for to answer the problems in this study. Through the quantitative method, a structured survey questionnaire containing close-ended questions was designed and prepared to serve as a tool for obtaining answers from the chosen respondents.

Before the actual questionnaire, there is an attached survey consent form to ensure that the respondent understood the purpose of the survey, agreed to partake in the research, and answered the questionnaire. A generic survey consent form was provided to all respondents. In times when an invited participant declines to answer the survey, they simply do not sign the consent form and complete the questionnaire. In events when a respondent wished to withdraw from the study, they were allowed to do so without any penalty. There was no monetary or in-kind compensation provided to the respondents.

In the qualitative method, informal interviews and observation methods of data gathering were used. Several trips for data gathering happened between May and August 2022. The researcher stayed in the place of study for more than one month and had first-hand observation of the situation in the destinations. Apart from the observations made by the researcher, there were informal interviews with two groups of five boatmen in San Antonio, a beach resort employee in San Antonio, a group of expats residing in San Antonio, and a resident/local government employee in Subic.

However, some participants were willing to further share their views and the researcher had several informal discussions with individuals or groups of residents, beach resort employees, and government employees. Important and valuable insights were obtained during the time the researcher lived and immersed in the selected destinations.

The insights and perspectives of the residents, resort owners/employees, and government officials/employees were sought to gain a broader view of climate change effects in their locality. Their perceptions were given equal importance in devising the adaptation measures. Their insights were highly valuable because their businesses and their area are foremost affected by the impacts caused by climate variations and impacts from the development within their area. This research will benefit them the most.

The secondary data are the information on changes in the sea landscape, marine biodiversity, and sea conditions obtained from the National Mapping and Resource Information Authority (NAMRIA) which is under the Department of Environment and Natural Resources (DENR). NAMRIA is the agency that can provide the data needed. This government organization is tasked with serving as a repository for the aforementioned data as well as mapping services on artificial and natural topography, hydrography, oceanography, geospatial mapping, and resources.

To properly interpret the data acquired from the survey and the interview, appropriate statistical treatments were applied. Data on changes in the landscape, biodiversity, and sea conditions were scrutinized using content analysis and thematic analysis for changes in people's livelihood.

RESULTS AND DISCUSSION

1. Changes in Zambales

1.1. Changes in Topography

Over the past decades, the municipalities of Subic and San Antonio and the city of Olongapo have seen and undergone many changes.

Table 1
2003 – 2020 Land Use Classification in Olongapo City, Subic, and San Antonio (in hectares)

Land Classification	2003	2010	2015	2020
Built-up area	1,796	3,472	4,440	7,874
Closed forest	61	4	5	517
Open forest	17,765	16,165	17,256	17,490
Fishpond	284	293	233	195
Inland water	42	476	195	250
Open/barren	17,894	822	738	549
Annual crop	2,149	12,985	11,203	7,025
Perennial crop	7,601	3,063	2,880	2,525
Shrubs	12,866	5,616	39,337	45,566
Grassland	11,653	20,546	18,962	15,431
Wooded Grassland	12,932	9,719	N/A	N/A
Mangrove Forest	N/A	57	57	65
Marshland	46	N/A	N/A	N/A

Source: NAMRIA

According to data from NAMRIA, notable alterations were observed in the topographical characteristics of the specified municipalities, as depicted in Table 1. Over the years, built-up areas have exhibited a consistent average growth rate of 66% every five years, expanding from 1,796 hectares in 2003 to 7,874 hectares in 2020. These findings signify a pronounced trend towards urbanization within the mentioned municipalities.

The other land classifications are all pertaining to the natural environment. In the closed forest classification, a big jump of 10,240 percent was recorded especially between the 5 hectares count in 2015 and 517 hectares in 2020.

Numbers are seen to be fluctuating in some of the land classifications listed like the open forest, fishpond, annual crop, shrubs, and grassland.

An increase of 1,033 percent in inland water was noted between 2003 and 2010 with areas of 42 hectares and 476 hectares, respectively. For open or barren land, a sharp decline in the area was recorded, with 17,894 hectares in the year 2003, then 822 hectares in 2010, following a steady decline as the years passed. The perennial crop has been on the decline as well, ending with 2,525 hectares in 2020.

Wooded grassland has only been recorded until the year 2010 with 9,719 hectares, and marshland with 46 hectares in the year 2003. For mangrove forests, records of it were only documented from 2010 and are gradually increasing in numbers with 65 hectares in 2020.

1.2. Changes in Marine Biodiversity

Table 2
Coastal Resources in Olongapo City, Subic, and San Antonio (2015 and 2020)(in hectares)

Coastal Resource	2015	2020
Corals	902.85 ha	1,029.81 ha
Mangrove Forests	57.16 ha	64.79 ha
Seagrass / Seaweeds	296.03 ha	358.93 ha

Source: NAMRIA

Realizing the importance of tourism, and the vulnerability of its long coastline to climate change, the local authorities of Zambales started a drive to protect and preserve its marine resources.

To address coral degradation in the Philippines, several efforts were made. Orejas (2013) reported that coral reef protection in Zambales is being implemented by the Bureau of Fisheries and Aquatic Resources, the University of the Philippines, the Department of Science and Technology (DOST), and some non-government organizations (NGOs). In 2012, the *Filipinnovation Coral Reef Restoration Program* started and was funded by DOST Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD). The provinces of Zambales, Pangasinan, Bataan, Sarangani, Bohol, Palawan, Camiguin, Zamboanga del Norte, and Ilocos Norte were acknowledged as sites to be restored (Bataan Peninsula State University, n.d.; DOST-PCAARRD, 2016).

Moreover, there is an ongoing 2-year coral conservation project in Iba, Zambales, funded by the Australian Embassy and carried out by The Mead Foundation (TMF), Marine Environment and Resources Foundation (MERF), and Southern

Cross University of Australia (Mayuga, 2022; BusinessWorld, 2022; Reforestemos Patagonia, 2022).

In 2018, through the initiative of BFAR Central Luzon, Redondo Peninsula Energy, Inc., and the locals of Subic started a seaweed farming project in their areas of Barangay Cawag and Barangay Matain in Subic (Casayuran and Terrazola, 2018).

In a study made by Mallari and Alcazar (2015), the lack of awareness of people on the importance of mangroves in the ecosystem led to the degradation of the mangrove forests. Under SBMA, the Ecology Center was formed to manage the natural environment in Subic Bay. Stakeholders inside Subic Bay Freeport are urged to partake in the mangrove conservation projects like clean-up drives and mangrove seed planting and reforestation.

NAMRIA also provided data on the status of marine biodiversity in Olongapo City, Subic, and San Antonio collectively. In the coastal resources itemized in Table 2, there was an increase in the number of corals, mangrove forests, and seagrass/seaweeds. The corals have increased 14 percent from 902.85 hectares in 2015 to 1,029.81 hectares in 2020. Mangrove forests increased 13 percent from 57.16 hectares in 2015 to 64.79 percent in 2020. Lastly, seagrass/seaweeds increased 21 percent between 2015 with 296.03 hectares and 2020 with 358.93 hectares.

1.3. Changes in Sea Condition

Table 3

Inundation Scenarios in Olongapo City, Subic, and San Antonio (in hectares)

Inundation Level	0.5 meter	1 meter	2 meters	3 meters	4.5 meters
No Flooding	39,429	37,677	31,266	25,646	18,054
Ankle Deep	465	540	652	890	371
Knee Deep	1,283	1,497	1,111	2,805	589
Waist Deep	N/A	1,464	2,826	3,346	1,940
Neck Deep	N/A	N/A	2,232	2,589	2,534
Top of Head	N/A	N/A	3,091	1,967	4,598
1 Storey Deep	N/A	N/A	N/A	3,935	6,686
1.5 Storey Deep	N/A	N/A	N/A	N/A	6,406

Source: NAMRIA

According to PAG-ASA (n.d.), the Philippines has recorded a sea level rise of between 5.7 to 7.0 mm per year, which is higher than the global average of sea level rise. Inundation scenarios were provided by NAMRIA. The extent of inundation is presented in Table 3. Should the area reach a 0.5-meter sea level rise, the studied areas in Zambales will flood until knee-deep, covering 1,283 hectares, 465 hectares ankle-deep, and 39,429 hectares will not experience flooding.

In the 1-meter sea level rise scenario, the highest flood will be waist-deep in 1,464 hectares, 1,497 hectares knee-deep, 540 hectares ankle-deep, and 37,677 hectares with no flooding.

For the 2-meter sea level rise situation, Olongapo City, Subic, and San Antonio will experience flooding up to the top of the head, covering 3,091 hectares, 2,232 hectares neck deep, 2,826 hectares waist deep, 1,111 hectares knee deep, 652 hectares ankle-deep, and 31,266 hectares will not flood.

In the event that the sea level already rose to 3 meters, a flood will reach a depth of 1 story for 3935 hectares of land. This is followed by top-of-head deep for 1,967 hectares, neck-deep for 2,589 hectares, waist-deep for 3,346 hectares, knee-deep for 2,805 hectares, ankle-deep in 890 hectares of land, and no flooding in 25,646 hectares.

The worst-case scenario is 4.5 meters of sea level rise. Leaving 18,054 hectares potentially not being flooded, ankle-deep flood for 371 hectares, knee-deep for 589 hectares, waist-deep for 1,940 hectares, neck-deep for 2,534 hectares, top of head flood in 4,598 hectares, 1-storey deep flood for 6,686 hectares of land, and highest possible is 1.5-storey deep in 6,406 hectares.

2. Perception of the Respondents on the Vulnerability of Beach Tourism from Climate Change Factors

The data below were derived from the respondents' discernment towards the presence of certain indicators about climate change and its effects on beach tourism and their locality.

2.1. In terms of Mean Climate

Table 4 shows that the respondents from the three areas surveyed perceive that beach tourism is moderately vulnerable to most of the mean

climate indicators (loss of land biodiversity, rise in water temperature, loss of marine biodiversity, loss of coral reef, loss of seagrass, and increased number of jellyfish).

Table 4
Perception of Vulnerability of Beach Tourism in terms of Mean Climate

Mean Climate Indicator	Mean	S.D.	Verbal Interpretation
Heat waves	3.50	1.28	Very Vulnerable
Loss of land biodiversity	3.19	1.40	Moderately Vulnerable
The rise in water temperature	3.41	1.19	Moderately Vulnerable
Loss of marine biodiversity	3.28	1.39	Moderately Vulnerable
Loss of coral reef	3.34	1.40	Moderately Vulnerable
Loss of seagrass	3.24	1.36	Moderately Vulnerable
Increased number of jellyfish	3.41	1.31	Moderately Vulnerable
Overall	**3.34**	**1.07**	**Moderately Vulnerable**

However, beach tourism is very vulnerable to heat waves. In general, beach tourism is moderately vulnerable to mean climate indicators for the selected destinations in Zambales.

However, a Subic resident who participated in a casual conversation said that tourists and locals alike even prefer visiting beaches when the weather is hot especially during summer so they can swim. Residents, on the other hand, opt to visit malls to beat the heat.

As gathered from an informal interview in Subic, loss of land biodiversity, rise in water temperature, loss of marine biodiversity, and loss of coral reef is not an issue within Subic. In fact, there is still a coral sanctuary on an island in Calapandayan, Subic. However, the number of jellyfish increases in number during summertime, and it affects beach tourism, especially because the sting from the jellyfish is poisonous. Ocean warming was a result of the atmosphere's warming. The oceans warm by about 0°11°C every 10 years, according to IPCC (2014). This leads to a cascade of effects, including ocean acidification, salinization, the extinction of marine life, and the appearance of jellyfish. Beach visitation is lessened as people are afraid to swim in areas infested with jellyfish. At present, some resort owners in Subic said they install nets to mark borders and separate people from these jellyfish. If someone gets stung by a jellyfish, the rescue team of Subic is easy to call and responds quickly to the emergency as per an interviewee from the said municipality.

2.2. In terms of Extreme Climate Events

As displayed in Table 5, the respondents from the three selected areas perceive beach tourism to be moderately vulnerable to droughts and wildfire: but very vulnerable to the other three extreme event indicators (strong typhoon, flood, and storm surge). Overall, beach tourism in the selected localities is very vulnerable to these extreme climatic events. The occurrence of extreme climate events is a hazard to beach tourists.

Table 5
Perception of Vulnerability of Beach Tourism in terms of Extreme Climate Events

Extreme Event Indicator	Mean	S.D.	Verbal Interpretation
Strong typhoon	4.07	1.05	Very Vulnerable
Flood	3.74	1.36	Very Vulnerable
Droughts	3.44	1.36	Moderately Vulnerable
Wildfire	3.39	1.51	Moderately Vulnerable
Storm surge	3.67	1.36	Very Vulnerable
Overall	**3.66**	**1.13**	**Very Vulnerable**

Insights from an informal interview with a Subic government employee revealed that beach visits decline during strong typhoons due to the erosion of beach sand caused by typhoon-induced waves. Subsequently, the local government conducts coastal clean-ups to remove debris left by the typhoon. Floods occur during heavy rains accompanied by high tides but recede once the rain stops, flowing back to the sea. Subic faces water scarcity during the dry season, presenting a significant challenge for the area. Grassfires are prevalent during hot weather, emitting smoke from the mountains due to the burning of dry leaves, with Subic Rescue responding to such incidents. Although selected beach destinations in Subic have not experienced storm surges, the Subic MDRRMO is prepared for such events, as indicated by the interviewee.

Albeit informal, the researcher also got valuable insights from two groups of boatmen in the municipality of San Antonio. San Antonio Boatmen # 1 mentioned that at times there is wildfire in the mountains of San Antonio caused by dried leaves. However, according to another group the researcher encountered, San Antonio Boatmen # 2

said it was caused by people living in the mountains.

2.3. In terms of Sea Level Rise

In reference to Table 6, the respondents from the three selected areas believe beach tourism is moderately vulnerable to beach erosion and beach retreat/loss but is very vulnerable to the rise in sea level. Therefore, beach tourism in the selected destinations is moderately vulnerable to these sea level rise indicators.

Table 6
Perception of Vulnerability of Beach Tourism in terms of Sea Level Rise

Sea Level Rise Indicator	Mean	S.D.	Verbal Interpretation
Rise in sea level	3.58	1.25	Very Vulnerable
Beach erosion	3.22	1.52	Moderately Vulnerable
Beach retreat/beach loss	3.34	1.45	Moderately Vulnerable
Overall	**3.38**	**1.30**	**Moderately Vulnerable**

According to predictions made by the IPCC (2014), the sea level will rise by about 1 point 1 meter by the year 2100 and by 5 meters by the year 2300.

As per another informal interview in Subic, the rise in sea level is not that evident; low tide and high tide are still of normal height. Beach erosion is not much observed in Subic, only in northern parts of Zambales, noting that there was already an incident of beach erosion in 2013 in the municipality of Candelaria, located in the northern part of Zambales (Valencia, 2013). Also, during rainy days, resorts in Cawag, Subic get muddy beaches which could have been a result of beach erosion. Beach retreat in Subic happens as an effect of high tides and waves caused by typhoons or southwest monsoons. The presence of such indicators narrows the beach area, the main resource of beach tourism, and also makes it hazardous, especially beach erosion.

3. Proposed Adaptation Measures

As an output of all the discoveries of this study, Adaptation Measures are presented to address the realizations and issues that were uncovered in Olongapo City, Subic, and San Antonio. Measures that cannot be controlled and program actions already being implemented were not included in the list below. Some of the adaptation measures recommended below are adapted from the study of Paz-Alberto et al. (2021).

Table 7
Adaptation Measures for Selected Sites in Zambales

Factors	Findings and Implications	Adaptation Measures Proposed
Topography	Rapid Urbanization	Observe strict implementation of Comprehensive Land Use Plan (CLUP), to control inappropriate constructions.
	Deforestation	Mandate reforestation projects; and tree planting activities (Paz-Alberto et al., 2021).
Mean Climate	Heat waves	Promote the use of solar power to lessen greenhouse gas emissions; local governments can subsidize or give incentives to establishments that use solar power.
	Heat waves	Re-educate and encourage the locals to use energy-efficient devices to lessen greenhouse gas emissions.
Extreme Events	Extreme climate events	Have a dedicated rescue team per city or municipality (Paz-Alberto et al., 2021) like the one in Subic. If possible, each barangay should have its rescue team.
Sea Level Rise	Beach loss	Develop a beach buffer area by clearing the beach area of any obstructions.

CONCLUSIONS

From the findings, the researcher deduces the following conclusions:

1. In conjecture with the results from the coastal resources data provided by NAMRIA, restoration and rehabilitation projects such as those being implemented in the selected destinations help to improve the state of the natural environment which is a good sign and gives much hope to humanity.
2. It can be inferred that the effects of climate change have rendered many beach destinations vulnerable, and poses a great threat to the tourism industry in Olongapo City, Subic, and San Antonio.
3. The conditions in the locality and the experiences of the people affect the understanding of the residents of Olongapo City, Subic, and San Antonio on the issue of climate change, thus the role of policy makers in these localities is vital when planning education, training and community improvements.

RECOMMENDATIONS

This study presents adaptation measures for climate change in response to its effects on

beach tourism in Olongapo City, Subic, and San Antonio, providing recommendations as follows:

1. Incorporate scientific studies, like NAMRIA's, into restoration and rehabilitation projects planned and implemented in these destinations, advocating for their ongoing support.
2. Encourage beach resorts and local residents to endorse policies and adaptation measures aimed at mitigating vulnerability in their areas and industries.
3. Consider and adapt the proposed adaptation measures outlined in Table 7, not only in the selected destinations but also in other coastal cities and municipalities, with involvement from tourism destination managers and local and national government.
4. Encourage future researchers to explore similar studies on the impact of climatic factors, not only on beach destinations but also on other types of destinations.
5. Suggest that academics reference this study in discussions on the impacts of climate change factors.
6. Urge the researcher to continue investigating climate change in different locations or provinces, potentially on a larger scale.

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