Anthropogenic activities and tourism in the community of Puerto Cayo, Manabí, Ecuador

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ABSTRACT
The coastal dune is an ecosystem that is located between the marine and continental environments. It becomes a highly vulnerable environment due to various human activities. This research analyzed the surroundings of the local dune system with the objective of understanding the environmental consequences caused by human and tourism actions. On-site visits, literature review, as well as surveys were conducted among the local population (184) and tourists (27). The direct causes include various commercial, residential, and tourism-related activities in Puerto Cayo. The increase in sun and beach tourism without proper planning will continue to contribute to the accelerated loss of biodiversity and coastal lands. Tourism is a significant source of income for many residents. The study identified the main problems caused by human activities on the coastal environment and proposed conservation measures for the coastal dune.

Keywords: touristic activities, anthropogenic activities, coastal dunes, sun and beach tourism.

1 INTRODUCTION
Coastal dunes are ecosystems located in the transition between terrestrial and marine environments, considered a highly fragile environment due to their socially demanded properties. They are also popular locations for human settlements, which turns them into degraded geographical spaces due to human pressure and often destroyed by anthropogenic activities that take place there (Vega de Seoane, Gallego, & Vidal, 2007).

It should be noted that coastal areas are among the most visited tourist destinations worldwide, particularly for sun and beach tourism, which generates millions of annual visits to these ecosystems. These visits are closely tied to the local climatic conditions (Ayala, Martín, & Masiques, 2003). Due to competition with other tourism modalities, coastal tourism has made efforts to stand out by diversifying
and improving infrastructure, as suggested by Benseny (2006). However, tourism activities along the coastline involve significant land consumption for recreational purposes, resulting in changes to the territory, society, and economy.

Among the Latin American countries that are popular tourist destinations with anthropogenic issues in coastal dunes, notable examples include Cuba, as addressed by Ayala, Martín, & Masiques (2003); Mexico, as discussed by Jiménez et al. (2014) and Benseny (2006); and Argentina. According to MINTUR (2018), the Ecuadorian coast is home to the most popular tourist destinations. This categorizes Ecuador as a country whose residents frequently visit the coastal margin, leading to high human pressure on the sandy coastal space. The same ministry's report highlights that the province of Manabí, with it’s over 350 km of coastline, is a beach destination and the second most visited province in the country. The town of Puerto Cayo is directly linked to tourism, and most of its residents depend on it (Victores, 2011). However, the coastal dune ecosystem in this area is deteriorating due to the proliferation of various types of tourist facilities, deforestation of native vegetation that prevents sand movement by wind, solid waste, and sand extraction for construction. These anthropogenic and tourism activities have caused a loss of dynamism in the coastal area of Puerto Cayo.

2 LITERATURE REVIEW

2.1 THE IMPORTANCE OF THE COASTAL ZONE FOR TOURISM

As Bringas (1999) reveals, the coast is considered a setting for frequentation and activities that are widely influenced by the presence of the sea. This leads us to consider that coastal areas have a significant vulnerability, as they are an area with a scarce resource and enclose a high percentage of ecological wealth. Various ecosystems valued by humans for different reasons converge in these areas. This makes the coastal zone a primary point of interest due to the possibilities it offers for recreational use of leisure time, and this is how beach tourist destinations operate (Barragán, 2005).

The natural resources of the sea largely determine the demand of tourists in an area, and with the popularity of mass tourism focused on "sun and beach," the coast has changed from being an observed and admired space to being consumed and coveted. This is where the human pressure on coastal areas originates (Bringas, 1999). Tourism on the coast functions as a "solution" mechanism. It is conceived as a place of rest, away from the monotony of the city or usual place of residence, or simply as a space that brings us in contact with the environment.

Coastal areas have always been categorized as of great importance to humanity, as they serve as arrival points for boats, democratic places that serve as communication bridges and meeting points. They are even considered a source of food due to the number of species that are commercialized in these areas.
Considering what has already been mentioned, it is clear that the coast is a strategic point for economic dynamization generated through trade (Bringas, 1999).

2.2 COASTAL AREAS AS A DRIVING FORCE FOR THE TOURISM INDUSTRY

According to Dillon & Dillon (2021), among economic activities, tourism is one of the most prosperous activities, it has greater dynamism and is capable of creating productive structures and expanding in the geographical area. Therefore, coastal areas play a crucial role in tourism due to their scenic appeal, offer of activities, sun and beach tourism, gastronomy, history and economic development. They are popular destinations for tourists looking to relax, enjoy water activities, and explore the natural and cultural beauty of coastal regions.

According to Benseny (2006), the main consumers of tourism come from economically industrialized countries, where tourism is considered a basic need for the residents. Coastal areas are always within the sight of large beach resorts, as these accommodation, entertainment, and recreational establishments are constantly seeking and expanding into new tourist markets. The establishment of new companies such as resorts can lead to improvements in public infrastructure, increased accessibility through communication channels, and road enhancements (Barrantes, 2013).

This aligns with Benseny's (2006) suggestion that the tourism development of a coastal space requires the installation of various facilities, which will be capable of generating and sustaining tourist demand. Facilities and infrastructure are necessary to attract and retain tourist consumers. The process of preparing a locality to offer tourism services or products, taking advantage of the coastline, entails an urban transformation by the sea. Since renowned hotels are built along the coast, the road system is designed near the coastal strip, and commercial activities take place there as well. Another point emphasized by Barrantes (2013) is the openness to foreign investment, based on the notion that a locality with external investment becomes a more open and competitive dynamic source, and it must be integrated into the global market to achieve economic growth and improvement in the quality of life of its residents.

2.3 IMPACT OF TOURISM IN COASTAL AREAS.

Tourism has become an important driver of local development, and it should be noted that the paradigm shift is the revitalization of tourism activities, the promotion of natural resources, regional culture, economic development and increased ecological awareness. (Alonso & Revelo, 2021).

As pointed out by Victores (2011), coastal ecosystems are experiencing a much faster disappearance than any other region, such as jungles and tropical forests. It emphasizes that the coastal profile is the most threatened on the planet, and the main agent of this phenomenon is human intervention due to the activities carried out by humans. The coastal space is one of the most important because the
conditions it offers are attractive to outsiders and lead to an increase in tourist demand, as long as these geographical spaces are directed towards tourism. However, this influx of people often causes environmental damage, which is sometimes irreversible, wreaking havoc on the resources that the coastal zone possesses. This affects the quality of life of residents and people who use this area for leisure, recreation, or leisure activities, as well as directly impacting the habitat of marine and coastal species that rely on these places as ecological niches.

The coast is a scenario with different points of interest and power relations, as it is a flexible field for internationalization and economic improvement, as both currency growth and human interaction flourish (Bringas, 1999). Tourism in coastal areas is reflected in the growth and improvement of the quality of life of its inhabitants, as well as in commercial relationships in favor of tourism since it is located in a favorable space for the development of differentiation activities. However, due to this prominence, natural resources can be affected because they are fragile and in demand for their commercial tourism potential.

3 METHODOLOGY

To develop the research, a search for documents was carried out in addition to fieldwork. The study is an analytical descriptive cross-sectional study, as it involves collecting and analyzing data at a specific moment. The theoretical methods used include analysis and synthesis, induction-deduction, transition from abstract to concrete, and historical-logical approaches. The empirical methods include surveys, observation, document analysis, and the use of GIS.

To gather information through on-site data collection, surveys were conducted for both tourists and residents of the parish of Puerto Cayo. The surveys were conducted with 27 people who visited Puerto Cayo beach in 2018. The target population consisted of the residents of the parish of Puerto Cayo in 2019. Based on the formula proposed by Ramos (2009) for calculating the optimal sample size applied to the research, the following was considered for sample selection:

- Inclusion Criteria: Population aged 18 and above willing to cooperate with the study and who are residents of the parish, in order to understand their previous evolution.
- The sample for this study was represented by 184 residents.

To gain a deeper understanding of the anthropic and tourist impact in Puerto Cayo, the surveyed population was stratified by age, which allows for handling information from different age groups, considering Cordón's study (2012).

To address the object of study, a study on the impact of tourism by Picornell (1993) was used as a guide. By using his criteria, it was possible to fully respond to the objective and gain a better understanding
of the phenomenon in question. This approach allows for a comprehensive coverage of the object of study in its entirety and contributes to proposing the transformation of the studied reality.

Similarly, the analytical and synthetic methods were used for the development of the theoretical framework and the selection of relevant information for the purposes of this study during the literature review process. These methods allowed for a deeper exploration of the essential aspects of all the collected materials, breaking down and integrating the information, in order to achieve the results and conclusions presented in this research.

The induction-deduction method was also employed, as it provides universal conclusions or laws that explain and relate to the studied phenomenon, in line with specific cases from other locations. Starting from general truths, which are supported by empirical sources such as direct observation within the context of the studied site, this method enables the creation of possible solutions to the problem at hand.

Another method used is the transition from abstract to concrete in the development of the theory that supports this study, understanding the essential relationships between human behavior in the dune space, the impact of tourism, and the current situation of Puerto Cayo. Lastly, but no less important, the historical-logical method was employed to analyze the trajectory of the dunes with human intervention in Puerto Cayo, as well as the use of its natural resources and consequently the rationale behind utilizing this heritage for the locality.

The primary method used is surveys, which were conducted with tourists and residents. Surveys are an effective means of obtaining accurate information and were referenced by doctoral studies conducted by Ugarte (2007) titled "Image and positioning of Galicia as a national and international tourist destination" at the University of Santiago de Compostela, Gutiérrez (2010) with the topic "Residents' attitude towards tourism" at the University of La Laguna, Cardona (2012) with the research titled "Attitudes of residents towards tourism in consolidated tourist destinations: The case of Ibiza" at the University of the Balearic Islands, and finally, the thesis by Galán (2002) titled "Urban tourism as a strategy for sustainable development: Analysis of four Andalusian cities" at the University of Malaga. All of these studies served as references for conducting the surveys.

Direct observation is another method that allowed for a careful, rational, planned, and systematic perception of the phenomena related to the research objectives. Alonso (2003) defines it as a data collection procedure that provides a representation of reality and the phenomena under study. It was used to objectively verify the reality in which the population of Puerto Cayo lives, regarding anthropic activities in the coastal dunes.

The data on the number of residents to be surveyed were extracted from the Puerto Cayo PODT (2015). The surveys were developed with key questions obtained from studies conducted in Europe, and adjusted to the territorial situation of the area. Surveys were randomly applied to tourists to understand
their perspective on the identified issues, with no limit on the number of visitors willing to participate, as indicated by Penco & Gordón (2003). By surveying both groups involved in Puerto Cayo, the necessary information for the research was obtained. The data were tabulated and synthesized to understand the current situation regarding the research objectives and provide answers to them. The survey model was structured based on observations made previously to ensure the highest possible reliability of the results. Furthermore, those results were summarized in tables and graphs to provide a clear understanding of the research. APA style guidelines were used for the citation and referencing of both printed and electronic sources.

4 FINDINGS/RESULTS DISCUSSION

4.1 IDENTIFYING THE TYPES OF IMPACTS CAUSED BY TOURISM IN THE SELECTED AREA.

The main anthropogenic activities affecting the sandy coast in Puerto Cayo have been identified as population growth, cultural activities (fishing), uncontrolled consumption of organisms, and the increase in commercial and service activities. Tourism directly impacts the sandy dune, especially during holiday seasons with the movement of approximately 10,000 people daily. However, the main consequences of anthropogenic activities are evident through the loss of beach areas observed in the last 15 years (Image 1 and 2), introduction of invasive exotic species, and displacement of species. The implemented tourism system has primarily focused on the intensive exploitation of natural resources (fishing, coastal dune flora and fauna) to meet tourist demands. The exploitation of the coastal dune to satisfy the tourist demand for sun and beach, through the construction of cabins, hotels, and cafes, is evidence of deforestation of green spaces, as well as the presence of small garbage and debris dumps.

Image 1 Satellite image of the coastal dune of Puerto Cayo taken on September 4, 2003, showcasing the utilization of the sandy area at that time.

Source: Images demonstrating the loss of the coastal dune over the past 15 years. UTM coordinates: 17 M 529024.57 m E 9850022.85 m S alt. Eye 921 m from Google Earth Pro.
Prepared by: Erick Fabian Sabando Cedeno
A geographic information system (GIS), called Google Earth Pro, was used. This allowed us to observe the evolution that the coastal dune of Puerto Cayo has undergone in approximately 15 years, as suggested by Añó, Pascual, & Sánchez (2005), Rangel (2009), and Espinosa et al. (2011). These studies state that GIS, such as satellite records and aerial photographs, are used to assess the impact within a dune area. In this regard, we can appreciate that the occupation of the coastal dune in 2003 was minimal compared to the current situation. The dune area is now occupied by tourist infrastructure such as restoration and leisure cabins, hotels, beach tent offerings, and boat parking lots. By 2018, it is evident that these same activities have multiplied, along with a new service, which is parking land vehicles on the beach. This has caused a significant occupation of the site, leading to visual pollution. As a result, the area for tourist enjoyment, which used to be the main reason for visiting, has been reduced due to the implementation or improvement of tourism services on the coastal dune. The vegetation coverage observed in Image #2 is less abundant compared to Image #1. This vegetation helps to stabilize the sand in its proper place and prevents wind from transporting the sand grains.

The floristic list for the reforestation of the coastal dune of Puerto Cayo, extracted from the research by Vega de Seoane, Gallego, & Vidal (2007), emphasizes that the flora is a dynamic agent of the coastal dune. Another study conducted by Casasola & Paradowska (2009) provides some native flora species of the coastal dune in America, and finally, a study carried out by the Machalilla National Park (2008-2010) indicates that many of its recorded plant species can be found in areas near the protected area, such as Puerto Cayo. Therefore, the geographical approximation and existing bibliography were considered to establish this list. The dune system of Puerto Cayo is possibly in a regressive state, as indicated by Vega de Seoane, Gallego, & Vidal (2007), stating that the system is regressive when it is in...
a state of retreat, combined with a progressive erosion of the coastal dune. Meanwhile, the morphology of Puerto Cayo beach is straight to slightly convex, sharing similarities with other beaches in the province of Manabí (Méndez, 2018).

Another consequence is the displacement of native species, as if a species is consumed uncontrollably, it could move to other nearby areas, evading the anthropic activity that motivates it to find another nearby habitat. In this context, despite having a land use plan, specific actions lead to the loss of natural and scenic resources in the area. Sometimes, the current landscape consists of a linear and compact development of constructions along the coastal strip. The natural environment of the coastal strip suffers from anthropogenic damage due to complete occupation by urban uses, especially residential and tourist accommodation offering sun and beach experiences.

In surveys conducted among elderly residents, it was found that in recent years, there has been an increase in the development of tourist accommodations, allowing for residential tourism. This trend has been supported by the improvement of the road leading from Jipijapa and other areas, enhancing accessibility for tourists. Compact residential tourist homes with mixed functionality, serving as permanent residences, tourist accommodations, and service providers, are being constructed more frequently. This area used to offer a harmonious relationship between human activity and the natural environment, with its sandy beaches and mangrove forests, where fishermen used to reside. However, due to the aforementioned conditions, the landscape has undergone significant changes, and if this growth continues, it could lead to the loss of all the tourism-related assets currently being offered.

Some of the anthropogenic causes of natural resource degradation in the community of Puerto Cayo are:

- Population growth: The highest concentration of visitors to the area occurs during national holidays. During this time, there is a beneficial increase from an economic standpoint for the community, but it affects the environment with an overload of visitors to the coastal dunes. Inorganic pollutants are also deposited on the beaches and surrounding areas.
- Uncontrolled consumption of organisms: During holidays, there is a demand for food products, mainly seafood. Therefore, there is a tendency to commercialize species without proper control, as a way of life for those involved in fishing activities.
- Commercial activities: Anthropogenic motives lead individuals to engage in non-routine commercial activities, outside the boundaries of the law, to meet financial needs. During tourism booms, informal craft and food activities involve unsustainable consumption of organisms for commercial purposes, leading to species displacement and neglect of environmental sustainability and conservation.
As part of environmental sustainability, measures can be taken to control anthropogenic problems caused by tourism in the Community of Puerto Cayo. These measures include implementing standards or indicators to create collection rates for high-demand organisms, among others.

The public and private establishments involved in safeguarding the natural assets in the community are as follows:

- **Decentralized Autonomous Government of the Jipijapa canton**: The parish government of Puerto Cayo contributes to this effort, with individuals dedicated to preserving the environment. They are also within their jurisdiction.
- **Southern State University of Manabí**: They train professionals who will be immersed in environmental and tourism projects, emphasizing their relevant areas in response to existing needs and problems.
- **Foundations**: They establish and manage projects aimed at undertaking initiatives that are necessary for environmental sustainability.

Based on the results obtained, the trend towards biodiversity change was addressed, in line with authors such as Challenger et al. (2009), who point out the existence of anthropogenic motives that affect environmental behavior and conservation.

Sustainability is a prioritized factor that has been developing in response to deficits in various competent areas. For this reason, it is promoted and forms part of the Ecuadorian constitution. It has broad objectives related to the environment, such as "guaranteeing the rights of nature for present and future generations" (SENPLADES, 2017-2021). With these objectives guiding the Ecuadorian population, there is a shift towards environmental change and goals such as increasing the continental territory and Ecuador's marine-coastal area under environmental management or conservation (MAE, 2013). The results obtained in this study have demonstrated what other authors have announced. For example, Graber (2011) suggests that changes in tourism trends are mainly driven by anthropogenic factors such as fishing, marine wildlife sightings, beach pollution, marine transit and traffic, and a lack of awareness among local residents.

Mass tourism is one of the main sources of pollution of all kinds, from landscape pollution to inorganic pollution of the beaches. This type of tourism is mainly observed in Manabí and is prominent during national holidays. In 2018, during the Carnival holiday, Manabí received 140,688 tourists, while in 2017 there were approximately 168,174, surpassing the 110,626 visitors in 2016. During the Holy Week holiday, the numbers have been increasing, with a difference of more than 25,000 visitors between 2016 and 2018 (MINTUR, 2016, 2017, 2018). This aligns with what Vega de Seoane, Gallego, and Vidal (2007) state, that there is a high human pressure in coastal areas due to the influx of people. This significant
increase in visitor numbers during certain times of the year clearly indicates the environmental impact on the tourist destination during these periods. As Manabí is a popular tourist destination, with its

4.2 DETERMINING THE RELATIONSHIPS THAT EXIST BETWEEN TOURIST ACTIVITIES AND THEIR INFLUENCE ON COASTAL DUNES

The surveys indicated that 9.78% of tourists care about the preservation of nature and landscape, followed by 9.07% who indicated the importance of an attractive beach in the area. Additionally, 9.04% mentioned the need for a calm and relaxed environment, ideal for rest, while 8.93% emphasized personal safety. Furthermore, 8.89% expressed the desire for quality accommodation, and 8.85% preferred destinations with fewer crowds. The presence of local gastronomy and the destination's fame and reputation each represented 8% of the respondents' preferences. 7.85% valued friendly local residents, 7.47% sought entertainment and nightlife options, and 7.29% looked for abundant historical and artistic heritage. The remaining 6.84% mentioned the presence of interesting shops to visit.

The reason the total frequency adds up to 324, despite the sample size being 27, is because each item within question 11 was answered by all 27 respondents. Therefore, when adding up the totals for each item, the final figure is reached. In other words, the total is divided by the number of items, resulting in a frequency of 27.

4.3 PROPOSAL OF ENVIRONMENTAL MEASURES TO ENABLE THE CONSERVATION OF THE COASTAL DUNE AND TOURISM ACTIVITY IN THE REGION

Conservation measures for the coastal ecosystem of Puerto Cayo, adapted from Vega de Seoane, Gallego, & Vidal (2007):

- Implement visually pleasing enclosures in areas where there is still vegetation coverage within the coastal dune of Puerto Cayo to prevent human access and its impacts on these ecosystems.
- Construct a walkway that connects the main cross streets of the locality as a measure to safeguard the dune system and make the beach inclusive.
- Establish a system of communication and environmental education through informative signs placed along Guayas Avenue up to the beachfront and at points with higher concentrations of people on the Malecon. These signs will address the issues related to the coastal dune and human activities in Puerto Cayo.

Environmental policies and development regulations in the coastal area of Puerto Cayo, adapted from Román (2007):
• Strengthen territorial control instruments, such as municipal ordinances, to safeguard land use and sand extraction from the coastal dune, ensuring appropriate coastal growth and avoiding drastic changes in land use and their associated effects.
• Proper management of solid waste by implementing classified waste containers in areas with the highest accumulation within the coastal dune.
• Protect the mangrove areas that are located near tourist services, as they are threatened by human activities.
• Develop environmental prevention plans for anthropogenic activities in Puerto Cayo to be prepared for any reported negative environmental impact."

5 CONCLUSIONS

The types of impacts caused by tourism in the community of Puerto Cayo were identified, with the most important ones being: population growth, cultural activities (fishing), uncontrolled consumption of organisms (fauna and sand), and an increase in commercial and service activities. This has led to a decrease in beach areas, resulting in the accumulation of solid waste, illegal extraction of sand for construction purposes, deforestation of coastal dune vegetation and mangroves, introduction of flora, and parking of cars on sandy areas. All of this has generated pollution in the sea, coast, and river.

The relationships between tourist activities and their influence on the coastal dune of Puerto Cayo were evidenced, with the most impactful factors being: climatic conditions, beach extent, scenic beauty, tranquil environment, and limited overcrowding due to seasonal tourism. These factors have led to a drastic change in land use, resulting in the replacement of the coastal ecosystems for tourist development, offering various services to visitors on the sandy area. Additionally, the coastal dune is influenced by the lack of coordination among competent entities in this locality to counteract any negative human actions. The obtained results have been of vital importance for safeguarding and protecting the natural heritage and the associated benefits for the local community and visitors.

A proposal for environmental measures was developed to conserve the coastal dune and the tourism activities carried out in it. The proposal aims to address and minimize anthropogenic impacts caused by solid waste in the sandy area through the implementation of classified garbage containers in locations with the highest accumulations. This proposal is necessary since there are no existing elements of this nature in place to address the problem. It is considered an environmentally viable and economically low-cost investment proposal.
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