

# The Impact of Natural Disasters on Vernacular Settlements: The Impact of Hurricane Otis on the Student Communities of the Rural Schools of Mexico

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## Abstract

This research addresses one of the issues related to the impact caused by Hurricane Otis as it passed through Acapulco, Guerrero, Mexico, on October 24 and 25, 2023. The hurricane devastated the vernacular settlements in Mexico, including houses, institutions and other establishments. Nothing was spared. In this context, it analyzes the socio-environmental impact of Hurricane Otis on students from the Schools in Acapulco, Mexico, using socio-environmental perception.

It employs mixed-methods with a convenience sample, involving a survey administered to 53 students of Sociology at the Autonomous University of Guerrero (UAGro). It interviews 14 of them, employing sustainability dimensions. Data collection instruments were designed on Forms Office.com and distributed through WhatsApp.

Findings reveal that 96% of the students were affected by the hurricane but expressed willingness to continue classes, with 55% preferring online and 45.45% preferring in-person modalities. Flexible options are identified as appropriate for the students' needs.

The paper concludes that there were environmental, social, and economic impacts on the communities and especially the school communities. In this context, collaboration among the administrators, teachers, and the authorities is crucial to facilitate the reintegration of students back into the classrooms, while facilitating their healthy survival in the destroyed yet still functioning vernacular settings in which they live. The study emphasizes the multifaceted challenges faced by sociology students in Acapulco after Hurricane Otis and underscores the necessity for resilient strategies.

**Keywords:** Hurricane Otis, Socio-environmental perception, Sustainability, Education, Vernacular Settings

## Introduction

Often, meteorological phenomena such as hurricanes or cyclones generate harmful consequences that adversely impact cities and communities. They affect infrastructure and disrupt work as well as educational and other activities due to the considerable damages they cause. In fact, they have impacts on the social, environmental and economic facets of everyday life.

Guerrero, like other Mexican states is particularly vulnerable to such natural phenomena due to its geographical location. The most recent was the Hurricane Otis, which occurred between October 24 and 25, 2023. The most affected municipalities were Acapulco and Coyuca, both experiencing substantial damages. In the central area of Acapulco, the city felt the strong winds and rains more intensely during the event. The hurricane Otis, classified as a category 5, impacted the city of Acapulco, Guerrero and Mexico, during the days of October 24 and 25, 2023. This natural phenomenon left not only a marked impression on the geography of the city but also significantly influenced daily life and the activities of its inhabitants.

In the educational field, students were affected by the interruption of classes due to the damages to educational infrastructure and the disruptions to educational materials. They affected not only the educational realm but also other crucial aspects of the social, environmental and economic spheres. Overall, it was a comprehensive impact. The combination of these impacts clearly shows the socio-environmental nature of the Hurricane Otis.

It is understood that this type of impact refers to the consequences that this meteorological phenomenon causes in society, on the environment and the economic activities. Condori (2013) establishes that socio-environmental impacts resulting from economic activities have been significantly affecting various ecosystems, as well as social groups in terms of their organization and cohesion. This statement underscores the close connection between economic activities and impacts on the social and environmental context. Although the above statement clearly illustrates the association between economic activities and socio-environmental impacts, it is essential to recognize that environmental degradation is a direct consequence of these practices. This environmental degradation, in turn, is linked to extreme weather events such as intense rains and hurricanes.

When these weather phenomena impact the land, they cause devastation in communities and cities, directly affecting the people. The impact caused by such meteorological phenomena highlights the need to understand the 'socio-environmental' perception of the affected individuals to learn about their experiences, damages, attitudes, and behaviors. However, this perception arises under the assumptions of sustainable development.

Sustainable development is synonymous with sustainability and is a term coined since the 1987 Brundtland Report, drafted by the UN and authored by Dr. Gro Harlem Brundtland, originally called 'Our Common Future'. The phrase that encapsulates Sustainable Development in the report is as follows: sustainable development is 'meeting the needs of the present without compromising the ability of future generations to meet their own needs.' The three pillars related to Sustainable Development are the economy, the environment, and society. Their interrelation aims to ensure economic and social development that respects the environment (Larrouyet, 2015).

In line with the above, perception encompasses the three dimensions of sustainability. Socio-environmental perception can be defined from our sociological perspective as the accumulation of attitudes that individuals have regarding their territory, as well as the knowledge they have about it because they inhabit it, live in it, build it, and modify it (Sandoval, 2022). Socio-environmental perception involves a deeper understanding of the interaction among society, the environment, and other aspects, aiming to identify resilient strategies against hydro-meteorological phenomena and their adverse impacts on cities and, consequently, on people.

In this context, the development of an environmental impact assessment primarily aims to determine the effects of a phenomenon on people, households and institutions to obtain a

quantitative estimate of these effects (Aedo, 2005 as cited in Llave, Gelis & Fornaris, 2013a). As a result of the assessment, the resulting economic consequences of the disaster are estimated, and it is common to identify direct, indirect, and secondary effects. Direct effects include property damage. Each of these direct losses can have collateral effects, consisting of disruptions to flows, both of goods and services that cease to be produced or provided as a consequence of the effects of the event that caused the disaster (Navarro, 2007, as cited in Llave, Gelis & Fornaris, 2013b). The occurrence of natural phenomena, such as hurricanes, is often unpredictable and is linked to the disruption that people generate in the environment through anthropogenic activities. This human impact, in some way, contributes to changes in the climate on a planetary level. When referring to natural phenomena, it is not only about hurricanes but also about tsunamis, hailstorms, snowfalls, among others, all capable of causing disasters and affecting the people.

As society progresses over time, continuous changes are experienced, and advancement towards modernity takes place. However, this modernization, at times, entails significant risks that are often underestimated. Risks encompass various aspects, including environmental, social, political, and economic factors, among others. In the environmental context, there is a concern that humanity, in pursuit of economic progress, neglects environmental and socio-environmental implications. It seems that the connection with Nature has been lost, resulting in impacts and destruction. The obsession with economic growth often ignores environmental risks and associated hazards. Climate disruption, in many cases, is a direct consequence of human activities (anthropogenic) and environmental pollution. This contributes to extreme weather phenomena such as heavy rains, hurricanes, and other natural events, all of which have repercussions in environmental, social, and economic realms.

In the context of risk management, Hurricane Otis represented a significant threat to the people of Acapulco, causing diverse adverse impacts. High concentrations of people in high-risk areas and vulnerable constructions exacerbated the dangers of the hurricane. Critical infrastructure, including roads, schools, and hospitals, also suffered damage, partly due to their locations in high-risk areas. Lack of a preventive culture increases the community's vulnerability too. Social vulnerability, characterized by precarious populations and constructions, along with a lack of knowledge and preparedness, significantly contributes to the magnitude of impacts during a hurricane. It is in this context that environmental education emerges as an essential tool. By empowering communities with knowledge and preventive practices, vulnerability can be reduced, and responsiveness to adverse natural events can be strengthened. The interruption of classes during events like Hurricane Otis is a tangible manifestation of the environmental and socio-environmental risks mentioned earlier.

Climate disruption, in many cases, is a direct consequence of human activities (anthropogenic) and environmental pollution. This contributes to extreme weather phenomena such as heavy rains, hurricanes, and other natural events, all of which have repercussions in the environmental, social, and economic realms. In the context of risk management, Hurricane Otis represented a significant threat to the population of Acapulco, causing diverse adverse impacts. The high concentration of people in high-risk areas and vulnerable constructions exacerbated the dangers of a hurricane. Critical infrastructure, including roads, schools, and hospitals, also suffered damage, partly due to their location in high-risk areas.

When a hurricane threatens a region, the consequences extend beyond physical and economic aspects; they directly impact the normal functioning of society, including the educational sphere. The interruption of classes during events like Hurricane Otis highlights the fragility of our communities in the face of environmental and socio-environmental risks.

It is imperative to recognize that education is a cornerstone for sustainable development and community resilience. To continue with classes after Hurricane Otis, it is necessary to implement flexible strategies that allow the reintegration of school activities. Online, in-person, or perhaps hybrid classes could be implemented. For this, it is of great importance to understand the needs of students, strengthen tutoring, etc. It is also crucial to improve and strengthen the school infrastructure, as well as all the services that students use in the institution, such as

internet access, drinking water supply, restroom maintenance, etc. Collaboration among administrative staff, teachers, and authorities is crucial to facilitate the reintegration of students.

Fothergill & Peek (2015, as cited in Vargas-Diaz & Zambrana, 2019) emphasize the importance of the school by pointing it out as one of the six fundamental spheres for the recovery of children after natural disasters. According to them, those who do not return to school after a disaster or who miss critical stages in their cognitive and social development due to the interruption caused by the disaster may suffer irreparable damage in terms of their intellectual growth, development, and future educational goals. The importance of integrating into the curriculum or promoting non-formal environmental education programs on risk culture and environmental education is emphasized to strengthen students' resilience against adverse natural events. The understanding of environmental risks, combined with robust environmental education, emerges as a fundamental pillar for building more prepared and sustainable societies.

In this context, this paper examines the harmful consequences of natural phenomena such as hurricanes that adversely impact cities and communities.

Its objective is to analyse the socio-environmental impact of Hurricane Otis on students from the School of Sociology at the Autonomous University of Guerrero (UAGro) in Acapulco, Mexico, using socio-environmental perception. Considering this, one of the goals is to identify and develop resilience strategies for students at the School of Sociology as a measure to address similar situations in the future.

## **Theoretical Framework**

### **Sustainable Development**

Sustainability is the path to achieving a balance among economic, ecological, and social aspects, resulting in prosperity and the generation of new resources. In the resource and capability theory, the concept of competitive sustainability is linked to balance (Barney, 1994; Rumelt, 1984 cited in Velázquez and Vargas, 2012). The concept of sustainability helps us understand that we are facing a world with scarce natural resources and unlimited needs, a continuously growing population, and economic development based on outdated technologies (resulting in excessive energy consumption and significant pollution). This overall scenario, already causing devastating climatic effects, has led us to realize that there is a limited capacity for the planet's sustainability, and we are rapidly approaching the ecosystem's collapse (Zarta, 2018).

Sustainable development is synonymous with sustainability and is a term coined since the 1987 Brundtland Report, drafted by the UN and authored by Brundtland, originally called 'Our Common Future.' The phrase that encapsulates Sustainable Development in the report calls upon the world to act in ways "meeting the needs of the present without compromising the ability of future generations to meet their own needs." The three pillars related to Sustainable Development are the economy, the environment, and society. Their interrelation aims to ensure economic and social development that respects the environment (Larrouyet, 2015). In line with the above, perception encompasses the three dimensions of sustainability.

Among them, socio-environmental perception which can be defined from our sociological perspective as the accumulation of attitudes that individuals have regarding their territory, as well as the knowledge they have about it because they inhabit it, live in it, build it, and modify it (Sandoval, 2022).

Perception is the activity of selecting, regimenting, and defining human sensations in a purposeful process. Robbins & Judge (2013) cited in Simaremare, et al. (2023) indicate that perception is process by which individuals organize and interpret their sensory experience so that it makes sense to them (Ningsih et al., 2022 cited Simaremare, et al, 2023). Lots of things happen in a classroom. Every student is different. Each of them has a different perception. It is necessary to understand how people perceive something because it will lead to a better understanding of their behavior. People's behavior depends on their perceptions, (Simaremare, et al. 2023).

In this context, the development of an environmental impact assessment aims primarily at determining the effects of a phenomenon on individuals, households, and institutions to

obtain a quantitative estimate of these effects (Aedo, 2005 as cited in Llave, Gelis & Fornaris, 2013a). As a result of such an assessment, the resulting economic consequences of the disaster can be estimated. It is common to identify direct, indirect, and secondary effects. Direct effects include property damage. Each of these direct losses can have collateral effects, consisting of disruptions to flows, both of goods and services that cease to be produced or provided as a consequence of the effects of the event that caused the disaster (Navarro, 2007, as cited in Llave, Gelis & Fornaris, 2013b).

Condori (2013) shows that socio-environmental impacts resulting from economic activities significantly affect various ecosystems, as well as, social groups in terms of their organization and cohesion. This statement underscores the close connection between economic activities and the social and environmental spheres. Thus, it is essential to recognize that environmental degradation is a direct consequence of these practices. Indeed, this, in turn, is linked to extreme weather events such as intense rains and hurricanes. When these weather phenomena impact the land, they cause devastation in communities and cities, directly affecting the people. The impact caused by such meteorological phenomena highlights the need to understand the 'socio-environmental' perception of the affected people to learn about their experiences, responses and behaviors. However, these must be carried out from the point of view of sustainable development, because eventually they have consequences for sustainability of the earth.

### **Socio-environmental Issues**

The escalation of the global environmental crisis is evident, but unfortunately, it seems that the people have not fully internalized the magnitude of the situation. It is well known that numerous human activities contribute directly or indirectly to the deterioration of the environment. Issues such as deforestation, indiscriminate use of pesticides, soil pollution, and energy wastage are just a few examples that exacerbate the current environmental crisis. The effects of this crisis manifest in phenomena ranging from rising temperatures and droughts to declining agricultural production, as well as the emergence of diseases, devastating hurricanes, intense storms, and snowfall. Ultimately, it is the communities themselves that bear the consequences of these environmental impacts, underscoring the urgent need to comprehensively and globally address these challenges to preserve the planet and safeguard the well-being of the future generations.

The degradation of the environment is manifested by an increase in the use and scarcity of oil, water scarcity, pollution of the oceans, and the extinction of animals and plants. This is compounded by deforestation, global warming, and climate change (Diaz, 2012). Human intervention in Nature has generated impacts that negatively affect the integrity of the ecosystems, upon which the well-being of humanity largely depends. In some cases, these impacts have even threatened the integrity of life itself on the planet, as dramatically evidenced by global warming (Rodríguez, 2007).

Various studies suggest an increased frequency of hurricanes due to global warming and rising ocean temperatures. Warmer water means more energy available for tropical cyclones as thermal energy transforms into wind. Higher temperatures result in increased evaporation, leading to more intense precipitation (Cárdenas, 2010). The effects of climate change are already manifesting, with intense and infrequent climatic events causing adverse environmental and social impacts, either regionally or locally. Examples include hurricanes, tornadoes, droughts, frosts, or hailstorms. These intense storms can lead to floods causing both material and human losses (Semarnat, 2009).

### **Socio-environmental Risks and the Risk to Society**

According to Natenzon (2004, as cited in De Armas-Pedraza & Gascón-Martín, 2017), various models have been proposed to understand socio-

environmental risks, identifying four analytically distinguishable yet interconnected elements that account for the complexity of the concept. These elements are hazard, exposure, vulnerability, and uncertainty:

**Hazard:** This refers to the potential threat involved in any natural physical phenomenon. In this sense, the more information available about the phenomenon, the higher the probability of understanding what could happen and preventing it.

**Exposure:** This relates to material constructions and the distribution of the population in the territory. It encompasses everything susceptible to responding to and facing the hazard. This component is territorially manifested as a historical construction that intertwines physical-natural processes with socio-economic relationships, shaping specific land uses, a certain distribution of infrastructure, human settlements, public services, and more. In this case, exposure is evident in the population and in precarious constructions located in settlements lacking water facilities inside the homes, without electricity and gas connections.

**Vulnerability:** This refers to socio-economic structures. It is a characteristic of society that, before the occurrence of a disastrous event, defines the situation in which the population finds itself to face an unforeseen catastrophic phenomenon.

**Uncertainty:** This belongs to the realm of (un)knowing threats and hazards, their technical control, and decision-making, situated at the level of perception of groups. For this reason, it is necessary to understand the political aspects and perceptions of the social actors involved in the process, as there are significant values and interests at stake in the consideration of the actors themselves.

The in-depth understanding of socio-environmental risks through the elements of hazard, exposure, vulnerability, and uncertainty is essential to address the complexities that arise after natural events such as Hurricane Otis. These elements provide an analytical framework that not only helps comprehend potential threats, population exposure, and socio-economic vulnerability but also underscores the importance of uncertainty in decision-making and technical control. By linking this perspective to the socio-environmental impact of the hurricane on the student community of the School of Sociology, the need for educational and risk management strategies becomes evident. These strategies should address not only the physical aspects but also the social and economic dimensions to enhance resilience and preparedness for similar events in the future.

Environmental education in socio-natural risk management is crucial because it provides knowledge to social actors vulnerable to the occurrence of a natural phenomenon about the level of risk and the type of threat they are exposed to, enabling them to act before and after the natural event occurs (Ordoñez, Montes & Garzón, 2018a). Environmental education is not just about providing information but empowering communities or, in this case, students to take proactive measures both before and after natural events.

By recognizing the importance of the connection between environmental education and the management of socio-environmental risks, the responsiveness is strengthened, fostering resilience in affected communities and providing valuable tools to face and overcome socio-environmental challenges.

Beck (n.d. cited in Ballesteros, 2014a) refers to the concept of the risk society as a key characteristic of modern society. He defines risk as the trait that "characterizes a peculiar state intermediate between security and destruction." In his terms, it is the "phase of development of modern society where social, political, economic, and industrial risks increasingly escape the control and protection institutions of industrial society. The risk society" that Beck scrutinizes is a society exposed to imminent danger. In it, all "risk calculations" are lost, and everything becomes unintelligible. It is a society where people find themselves in a completely contaminated environment that threatens the security of their existence.

Water pollution by atrazine, an agricultural herbicide that also affects fish reproduction, illustrates the danger. It is a society in which the irrationality of its technical process has led to an unwanted product; a society marked by the destruction of Nature carried out by industrial societies. Just mentioning the "ozone hole," the greenhouse effect, and its consequences is enough (Ballesteros, 2014b). This highlights the urgent need to integrate environmental education into risk management to counteract the growing vulnerability of our modern societies. Analyzing the impact of events such as hurricanes should go beyond physical implications, addressing social and economic complexities as well to strengthen community responsiveness and resilience.

### **Environmental Education for Sustainability and Socio-environmental Education**

Education to which reference is often made must be linked to the principles of sustainable development (environment, society, and economy), (Bedolla, Miranda, Bedolla & Castillo, 2016). Environmental education (EA) is considered a fundamental pillar in changing the attitude of human relationships with their environment to achieve a balance between both, as well as improving the quality of life and the environment. This involves joint support from almost all disciplines and active participation from the civil society and institutions to promote the care of the world ecosystem for future generations (Vargas, Rosario & Briones, 2017 as cited in Canaza-Choque, 2019).

As can be seen, environmental education is a strategy for understanding risks involving knowledge of the threat and vulnerability. Its risk management promotes the transmission and sharing of information regarding the threat and appropriate action processes to enable its reduction (Ordóñez, Montes & Garzón, 2018b). It should contribute to the construction of fair, socially equitable, democratic societies committed to environmental care and future generations. All of this will only be achieved if actions focus on personal fulfillment, the promotion of environmental values, and the promotion of democratic transition (Maldonado, 2009).

Socio-environmental education is a tool that, through educational change, seeks to address current issues and generate new thinking for a model change. It allows training in strategies for action and the search for new economic, political, social, and cultural approaches that can favor a harmonious coexistence where participation in the joint construction of a healthier environment is promoted (Solis, 2011). Especially, institutions of higher education are the places that offer the greatest resistance to incorporating the environmental dimension into their curricula, despite being the places where students should carry with them the mindset and constant reflection on how their actions impact the environmental issue, which is an absolutely necessary condition for the environment (Carrillo & Moretto, 2011).

The importance of incorporating into the curriculum, or alternatively, promoting non-formal environmental education programs on risk culture and environmental education to strengthen students' resilience in the face of adverse natural events is emphasized. The combination of understanding environmental risks with a robust environmental education is revealed as a fundamental pillar for building more prepared and sustainable societies.

### **Review of Literature**

Natural phenomena such as hurricanes or cyclones have led to impacts that negatively affect cities or communities, causing disasters of significant magnitude. Mexico has experienced hurricanes that have caused adverse impacts. Due to its geographical location, Mexico is a stage for the manifestation of various types of natural phenomena. Hurricanes and earthquakes are perhaps the main threats faced by the national territory, and their intensity can lead to disasters. The impact that natural disasters can cause must be considered in the planning of population centers (Rodríguez, 2004). Rodríguez (2017) who has studied the recurrent disasters in Mexico, specifically Hurricane Pauline and Storm Manuel in Acapulco, Guerrero, analyzes the impacts caused by disasters associated with the influence of hurricanes from a comparative perspective between two particular phenomena: Hurricane Pauline in 1997 and

Storm Manuel in 2013. These hydro-meteorological events have affected the Mexican state of Guerrero, especially the port of Acapulco. He concludes that not only the intensity of the natural phenomenon matters to generate damage in society, but the total damage also relates to the vulnerability contexts that a society develops over the years. He also establishes a certain relationship between the intensity of the natural phenomenon, the damages, and the vulnerability of the people. Villegas et al. (2009), looking at the trajectory and rainfall-runoff relationship caused by Hurricane Pauline in the La Sabana River basin, Guerrero, Mexico, have established that Hurricane Pauline, which occurred between October 5 and 10, 1997, was a meteor with a high ecological impact due to floods, water erosion, mass movements, and the amount of sediments it generated in the hydrographic basins of the states of Guerrero and Oaxaca. This has caused losses of human and material lives, with partial reconstruction costs amounting to \$447.8 million USD. In reference to this, in some cases, disasters are more environmental, nevertheless, they transcend to become social and economic. Sánchez (2011) analyzing the danger and exposure to tropical cyclones in the metropolitan area of Tampico, Mexico, which has historically suffered from floods, says that in the 21st century, high-intensity cyclones (categories IV and V) are expected to impact the region. The consequences can be catastrophic for the metropolitan area and its population in a context of lack of planning and prevention. The aforementioned aligns with the previous assertion by stating that high-intensity cyclones, such as category IV and V, as was the case with Hurricane Otis that impacted Acapulco, Guerrero, Mexico in October 2023, leave behind environmental, social, and economic disasters. Patiño et al. (2009), referring to a more affected area in the port of Manzanillo, Colima, Mexico, due to intense hydro-meteorological events and their periodicity, have established that in 1999, various areas of the port of Manzanillo, Colima, Mexico, have been flooded due to Hurricane Greg. The most affected was the largest colony in the port (Valle de las Garzas). The event caused significant economic losses. This assertion also has a strong correlation with the impacts caused by Hurricane Otis in Acapulco, as it also brought about floods and substantial economic losses. Hurricane Otis highlights the continuity of challenges and lessons learned from natural disasters in Mexico, emphasizing the importance of preventive measures, planning, and community resilience.

### **Hurricane Otis in Acapulco**

According to the National Water Commission (CONAGUA, 2023) in meteorological bulletin No. 091-23, Mexico City, dated October 25, 2023, at 00:25 hours, Central Mexico time, the center of Hurricane Otis made landfall near the municipality of Acapulco de Juarez, Guerrero, as a category 5 on the Saffir-Simpson scale. It had a maximum sustained winds of 270 kilometers per hour (km/h), gusts of 330 km/h, and a movement to the North-Northwest at 17 km/h.

According to Dominguez & Juarez (2023), the intensity that Otis acquired upon making landfall on the Guerrero coast took climate scientists by surprise. Surveillance system data did not anticipate the risk of a destructive force that would trigger the disaster in Acapulco and nearby populations, resulting in human and material losses. Models and satellite images did not indicate that the phenomenon would strengthen significantly. On Monday, October 23, the warning was for heavy rains due to Tropical Storm Otis. The next day, Tuesday, October 24, CONAGUA reported that Otis had intensified to a Category 4 hurricane and estimated that it would reach Category 5 before impacting the Guerrero coast.

However, a few hours later, at 12:25 a.m. Central Mexico time on Wednesday, October 25, the hurricane made landfall near the port of Acapulco. Its power devastated the coast of Guerrero, with maximum sustained winds of around 270 kilometers per hour. According to De Dios (2023), in a note published in *El Universal* on November 11 of this year, Hurricane Otis not only destroyed houses, hotels, restaurants, and businesses in Acapulco but also devastated the city's fauna and flora. winds of the Otis left almost all the hills bald. They now look as if they were swept by a forest fire: dry trees with no branches or leaves, only trunks and the concrete of the remaining standing houses. Flora and fauna are also major victims. The problem is that now there are hardly any trees, and finding shade for refuge is very difficult. Acapulco

is exposed to the sun's inclemency, having lost much of its vegetation, and this is already having consequences. De Dios also mentioned that garbage is another issue. An ongoing environmental problem in Acapulco caused by Hurricane Otis is the accumulation of waste in the streets. The piles of garbage are getting larger, and the foul smells, more intense.

### **Acapulco, Guerrero, Mexico**

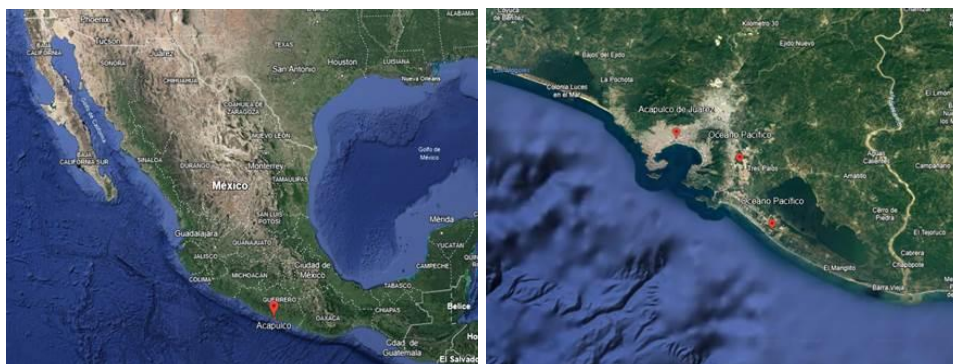
The city and port of Acapulco is located on the Pacific coast of Mexico, in the southern state of Guerrero. It is situated in the central-southern part of the country in Acapulco Bay, largely surrounded by the Sierra Madre del Sur, within the municipality of the same name, which is the most important urban area and holds significant relevance within the state (Fig. 1).

Tourism industry serves as the driving force for its economy and the primary source of income. Notable attractions include the beaches of Acapulco Diamante, Puerto Marques, Pichilingue, Revolcadero, Icacos, Condesa, Caleta, and Pie de la Cuesta, among others (Padilla and Sotelo, De Sicilia & Ángeles, 2021), (Fig. 2).

According to the 2020 Population and Housing Census, the total population in Guerrero is 3,540,685 inhabitants. Of these, 1,840,073 are women (52.0%), and 1,700,612 are men (48.0%). Guerrero ranks 13th nationally in terms of population and has dropped one position compared to 2010. Acapulco de Juárez is the most populous with 779,566 inhabitants, while Atlamajalcingo del Monte is the least populated, with 5,811 inhabitants (INEGI, 2020), 47.7% men and 52.3% women (DATA MÉXICO, 2023).

In Acapulco, tourism sustains the active population, generating both positive and negative impacts that are often categorized as economic, social, and environmental. Negative impacts originated from the expropriation of ejidos for tourist development. Currently, issues such as wastewater discharge, precarious employment, extreme poverty, and marginalization are identified (Cruz & Montesillo, 2022).

In terms of education, 30.2% of the population aged over 3 years attends school in the municipality of Acapulco; of this percentage, 50.1% are men and 49.9% are women, while 6% of the population over 15 years old is illiterate (PMD, 2018). In 2010, the average grade of schooling for the population aged 15 and over was 8.9 grades, compared to the state average of 7.3 grades. In the same year, the municipality of Acapulco had 393 preschools (9.6% of the total state), 503 primary schools (10.4%), 185 secondary schools (10.7%), 59 high schools (19.8%), four technical professional schools (22.2%), 57 vocational training schools (32.8%), and six indigenous primary schools (0.7%). During the year 2018, the educational infrastructure in the municipality remained with 1,376 institutions, of which 1,026 are public institutions and 350 are private educational institutions at the preschool, primary, secondary, high school, undergraduate, and postgraduate levels. In the 2017-2018 school year, there was an approximate teaching staff of 12,877 professors and a student enrollment of 235,127, of which 51% are women and 49% are men (Municipal Plan for the Urban Development of Acapulco de Juárez, Guerrero, 2020).



**Fig. 1:** Acapulco, Guerrero, Mexico, in the national and local context

Source: Google Earth (2023)



**Fig. 2:** The image of Acapulco at risk. Source: <https://www.revistapresencia.net/la-imagen-de-acapulco-en-riesgo-editorial/>

### The School of Sociology

In this study, reference is made to students from the School of Sociology. The research was conducted with students from the School of Sociology at the UAGro. According to the statistical yearbook 2022-2023 of the Autonomous University of Guerrero, Mexico. The School of Sociology (Fig. 3) offers the Educational Program in Sociology of Communication and Education. In its curriculum structure, there are 8 semesters equivalent to four years. It offers a Bachelor's degree through a classroom mode. It is located in Acapulco, Guerrero, Mexico.

In the school year 2023, it had a student enrollment of 193 students, including 84 men and 109 women. The first intake for this period recorded 53 students, including 21 men and 32 women, and the re-entry was a total of 140, including 63 men and 77 women. There are 18 teachers of whom, 17 are men and one woman, although there are two women. There is a single four-story building where administrative and teaching functions are carried out.



**Fig. 3:** The School of Sociology  
Source: Author, 2023.

### Research Methodology

This research employed mixed research methods. Surveys and interviews were conducted during November 27th to 30th, 2023. The variables for both instruments were the dimensions of sustainable development (social, environmental, and economic). The survey consisted of 8 questions, seven of which were multiple-choice, and one was open-ended. For the interview, there was only one open-ended question where participants had to express their socio-environmental perception within the framework of sustainable development. A total of

53 students from different shifts (morning and afternoon), grades, and academic groups at the institution were surveyed. Additionally, 14 students were interviewed to delve deeper into the collected information and enrich the analysis of the socio-environmental impact of Hurricane Otis on the student community.

**Table 1:** Research Schedule

Source: Author, 2023

No.	Location	Research Schedule
1.	Survey was designed using Forms.Office.com, and the link was sent online to students through WhatsApp. Note: Some students did not have internet access at their homes and could not respond to the survey and the interview.	Surveys and interviews were applied during November 27th to 30th, 2023. Note: During that period of time, information was being gathered from these instruments.

### Data collection

Instruments were designed using Forms.Office.com, and the link was sent online to students through WhatsApp due to the classes being interrupted by the hurricane. The survey was processed in the Microsoft Forms program, and the results were also processed in this program, revealing percentage data. As for the interview, the method for processing information involved the analysis and interpretation by the researcher.

**Interviews:** An open-ended interview was conducted in an effort to ascertain details to delve deeper into the gathered information and enhance the analysis of Hurricane Otis's socio-environmental impact on the student community in question, 14 students were interviewed.

**The survey:** An online survey was conducted with students from the school in question, covering all groups (101, 102, 301, 302, 501, 502, 701, and 702) corresponding to morning and evening groups. The platform used for this purpose was Forms.Office.Com. The survey aimed to identify the socio-environmental perception of students regarding sustainable development, considering the socio-environmental impact evidenced during Hurricane Otis. A total of 53 students were surveyed.

### Findings and Discussion

Hurricane Otis, classified as a category 5, struck the City and Port of Acapulco, Guerrero, Mexico, on October 24 and 25, 2023. Despite some government institutions stating that it made landfall in the city in the early minutes of October 25, its intense winds and rains were felt beforehand. Official information on the intensity of the meteorological phenomenon was limited (Figs. 4 & 5).



**Fig. 4:** Acapulco, devastation after the hurricane.

Source: Author, 2023.



**Fig. 5:** Acapulco, devastation after the hurricane.

Source: Author,2023.

The school related with this study investigation, along with other educational institutions in the area, operated normally during the first shift on October 24. However, by noon of that day, government authorities began to disseminate notices through social media about the hurricane, without specifying its intensity. In line with these announcements, several schools of all educational levels chose to suspend classes for the afternoon shift (Figs. 6 & 7).

The authorities of the School of Sociology officially received information from the authorities of the Autonomous University of Guerrero at noon on October 24, regarding the order to suspend classes due to the approaching hurricane. Based on this information, the authorities of the School of Sociology announced on the Facebook page that classes were suspended for the afternoon classes.



**Fig. 6:** Impacts of the Hurricane on the University, Faculty of Medicine, UAGro, Acapulco.

Source: Author,2023.



**Fig. 7:** Impacts of the Hurricane on the University, Faculty of Law, UAGro, Acapulco.

Source: Hernandez (School Principal and Professor of the Sociology School), 2023.

Although the impact of the hurricane was more pronounced in Acapulco, other neighboring municipalities were also affected, although to a lesser extent. The repercussions covered various aspects, including the environmental, social, and economic spheres. Environmentally, devastation reached vegetation, trees, ornamental plants, parks, and the drinking water system. Socially, there were impacts on hospitals and educational institutions. Economically, businesses, hotels, and offices suffered significant damage, leading in some cases to the closure of these spaces that represented sources of employment for many people. Regarding the educational issue, from that day to the present, classes at some schools in Acapulco, specifically at the School of Sociology, have remained interrupted due to the damage caused by Hurricane Otis, (Figs. 8, 9, and 10). The educational infrastructure has suffered serious damage, preventing the resumption of academic activities. This situation has posed significant challenges for the student and teaching community, who face the need to rebuild and adapt to the adverse circumstances caused by the meteorological phenomenon.



**Fig. 8:** The Mark of the Hurricane on the University, School of Sociology, UAGro, Acapulco.  
Source: Hernandez (School Principal and Professor of the Sociology School), 2023.



**Fig. 9:** The Impact of the Hurricane on the University, School of Sociology, UAGro, Acapulco.  
Source: Hernandez (School Principal and Professor of the Sociology School), 2023.



**Fig. 10:** The Impact of the Hurricane on the University, School of Sociology, UAGro, Acapulco.  
Source: Hernandez, (School Principal and Professor of the Sociology School), 2023.

## Survey Results

Between November 27 and 30 of this year, an online survey and interview were conducted with students from the school in question, covering all groups (101, 102, 301, 302, 501, 502, 701, and 702) corresponding to morning and evening shifts. The platform used for this purpose was Forms.Office.Com. In relation to the survey, the primary objective of this initiative was to assess the willingness of students to continue their academic activities and complete the semester for the August 2023 - January 2024 period.

Initially, there was a question asking if Hurricane Otis had caused them any harm. The response options were yes or no. 51 students, representing 96%, chose the yes option, and 2 students, representing 4%, answered no. Continuing with the survey results and regarding the willingness to continue with academic activities, it was evident that only some students responded to the survey: 101 (19 students), 102 (6 students), 301 (10 students), 302 (2 students), 501 (4 students), 502 none, 701 (5 students), and 702 (2 students).

When asked how they could better take their classes, with the options being in-person (going to school to take classes) or online (using WhatsApp, a platform, or some other social network), 24 students, representing 45% of the surveyed students, chose the in-person option, while 29 students, representing 55%, chose online. This finding highlights the importance of providing flexible options to adapt to the individual needs and preferences of students. Regarding the possibility of having internet access, and therefore, access to a social network like WhatsApp, a platform, Facebook, email, or another means, 46 students, representing 53%, chose WhatsApp, 12 students, representing 14%, chose the platform, 13 students, representing 15%, chose Facebook, similarly, 13 students, representing 15%, chose the email option, and 3 students, representing 3%, chose the other option. The diversity in the options chosen by students regarding the possibility of internet and social media access highlights the complexity of the technological landscape in which they operate. The fact that 53% of students opted for WhatsApp reflects the prevalence of this application as a fundamental communication tool in their daily lives. There was also a question about the possibility of receiving assignments online, either using WhatsApp, a platform, or another social network, and thus, if they had the possibility of being sent through these means. The response options were yes or no, to which 33 students, representing 62%, said yes, while 20 students, representing 38%, said no. The results of the question about the possibility of receiving assignments online reveal a clear trend in the students' disposition toward this method. Sixty-two percent of respondents indicated that they do have the possibility of receiving assignments through digital means, such as WhatsApp, online platforms, or social networks. This percentage suggests widespread acceptance and accessibility to digital tools for task completion and submission. There was also a question that referred to the possibility of going to school (in-person) to bring work or activities that their teachers would give them to be done at home and returning them in the same way within a specified time. The response options were yes or no. Twenty students, representing 38%, said they could do it, and 33 students, representing 62%, said they could not.

These results reveal a division in the preferences and capabilities of students. Thirty-eight percent of students expressed willingness to perform this task in person, suggesting a disposition by a significant segment to maintain a physical connection with the educational institution and their academic responsibilities. The post-natural disaster situation may have affected students' mobility and availability, influencing their ability to perform tasks in person. In this context, flexibility and consideration of individual circumstances are crucial to ensuring equity in access to education and the fulfillment of academic responsibilities. A question was asked about basic services at their homes related to the internet, with options including electricity, water, internet, WhatsApp, Facebook, and other. Fifty students said they already had electricity, 25 students said they already had water, 12 said they already had internet, 42 said they had WhatsApp service, 16 had access to Facebook, and 2 indicated they had another service.

The results indicate that the majority of surveyed students have essential services such as electricity and water. Although a significant number have internet access, the preference for messaging services like WhatsApp and Facebook highlights the importance of considering

different levels of connectivity. The diversity in responses underscores the need for flexible educational strategies that adapt to students' individual conditions and address possible digital divides.

According to Fothergill & Peek, 2015, as cited in Vargas-Diaz & Zambrana, (2019), they emphasize the importance of school by identifying it as one of the six fundamental spheres for the recovery of children after natural disasters. According to these authors, those who do not return to school after a disaster or who miss critical stages in their cognitive and social development due to the disruption caused by the disaster may suffer irreparable damage.

At the end of this survey, there was an open-ended question where students were asked to express how Hurricane Otis affected them in terms of socio-environmental impact. Therefore, it was necessary to understand their socio-environmental perception, considering the environmental and economic dimensions.

The responses collected from the 53 students were organized according to the environmental, social, and economic dimensions.

### **Environmental Dimension**

Regarding the environmental dimension, all participants experienced intense rains and extremely strong winds, phenomena they had not previously encountered in the region. Additionally, the majority lacked knowledge about hurricanes of this magnitude in Acapulco, Mexico, or in other parts of the world. Although some students were aware that there had been strong hurricanes with impacts and devastations before, none had reference to one of the magnitude of Otis.

It was highlighted that fallen trees were a common sight in their homes, neighborhoods, and practically throughout the city of Acapulco. Several mentioned the loss of roofs in their homes and the consequent damage to their possessions, leading to considerable volumes of urban solid waste and garbage scattered by the strong winds of the hurricane. The students pointed out that the streets and neighborhoods affected by the hurricane presented enormous amounts of garbage, but they expressed concern about the authorities' lack of promptness in cleaning up such waste and debris.

Some students also shared their experiences of flooding in their homes due to the rise of rivers, resulting in the loss of belongings and material damage that eventually turned into waste and debris. In this regard, the need for prompt attention from the authorities to address the cleaning and management of waste generated by the hurricane is emphasized. The supply of drinking water has not yet been normalized, which is a situation that affects several neighborhoods in Acapulco, including the homes of some students, where the vital liquid is still not available regularly.

The environmental dimension reveals that the students experienced extreme weather conditions during Hurricane Otis in Acapulco, with intense rains and strong winds. The lack of prior knowledge about hurricanes of such magnitude highlights the unusual nature of the phenomenon in the region. The fall of trees and the loss of roofs generated considerable volumes of urban solid waste, exacerbated by the authorities' slow response in cleaning. The students' concerns about the poor management of waste and debris underscore the need for an effective response. Additionally, the lack of normalization in the supply of drinking water affects several neighborhoods, emphasizing the importance of addressing the basic needs of the population to facilitate recovery after Hurricane Otis.

### **Social Dimension**

Regarding the social dimension, some students mentioned displacements and changes of residence, as several students were forced to leave Acapulco due to safety and economic issues. Some students moved to other places such as Chilpancingo and Zihuatanejo, affecting their access to education and social stability. Losses due to the conditions of their homes were also reported since many students suffered total losses in their homes, affecting not only their quality of life but also their ability to focus on their studies. The insecurity of houses, with blown-off roofs and damaged structures, was also highlighted.

Some students had repercussions on their health, either directly related to the hurricane or as a result of the conditions generated by it, such as the lack of access to drinking water and the deterioration of living conditions. One of the main impacts was the disruption of their education due to the effects caused by the hurricane in Acapulco, affecting the infrastructure and services of schools, especially the school they attend. In the social dimension, significant impacts are evident after Hurricane Otis, with students experiencing displacements and changes in residence due to safety and economic issues. The relocation to places like Chilpancingo and Zihuatanejo not only affects their access to education but also their social stability.

Total losses in their homes generated not only consequences for their quality of life but also difficulties in focusing on studies, highlighting the insecurity of homes with blown-off roofs and damaged structures. Repercussions on health, stemming from both direct hurricane effects and generated living conditions, are evident, with the lack of access to drinking water being a crucial factor. Education of the students was particularly affected, not only by the damages that the hurricane caused to the school's infrastructure but also in their personal and emotional development, and above all in their learning. These circumstances underscore the complexity of social challenges arising from Hurricane Otis and emphasize the need for specific interventions to mitigate its effects on the well-being and education of affected students.

### **Economic Dimension**

Related to the economic dimension, issues such as job loss were presented. Many participants experienced a significant loss of employment, affecting their economic income and their ability to cover basic needs and continue their studies. Concerning financial difficulties, the lack of a stable source of income is emphasized, making it challenging to participate in educational activities that require financial resources, such as attending school or having access to the Internet. In relation to the need for home reconstruction and replacement of belongings, it directly impacts the economic situation of the participants, who face unexpected expenses to restore basic conditions.

On the economic dimension, significant challenges are identified, highlighting job loss as one of the most prominent issues. Most participants experienced a substantial decrease in their income, affecting both their ability to cover basic needs and their continuity in studies. Financial difficulties are exacerbated by the lack of a stable source of income, hindering participation in educational activities that demand financial resources, such as attending school or accessing the Internet. The need to rebuild houses and replace belongings directly impacts the economic situation of the participants, who face unforeseen expenses to restore basic conditions.

These circumstances underscore the interconnection between economic and educational factors, emphasizing the urgency of interventions that comprehensively address economic challenges to ensure educational continuity and economic recovery for those affected by Hurricane Otis. In summary, the results reflect a profound and multifaceted impact of Hurricane Otis on the lives of students, ranging from material losses to socio-economic and environmental challenges. These factors directly influence their ability to continue with their studies and academic commitments. In general, the results of this study coincide with the one carried out by Islebe et al., (2009), they conducted a study where the damage to vegetation was analyzed one month after the impact of Hurricane Dean, a category 5 hurricane on the Saffir-Simpson scale, which hit the coasts of southeastern Mexico (specifically the coasts of Quintana Roo, Mexico) on August 21, 2007, causing severe damage to infrastructure and biodiversity.

The damage caused by Hurricane Dean in the subperennial medium semi-deciduous forest and mangrove was analyzed, and characteristic damage from strong hurricanes, such as uprooted trees, defoliation, or loss of canopy, was observed. Mangroves were severely damaged with 100% defoliation. They also agreed with the Inter-American Development Bank (IDB) and the Economic Commission for Latin America and the Caribbean (ECLAC), (2021) in the evaluation of the effects and impacts of Tropical Storm Eta and Hurricane Iota in Honduras in November 2020. This event, during its formation, was classified as a category 4 and 5 hurricanes, and it was established that the population was affected, with individuals losing their

lives. In relation to health, the estimated effects of both meteorological events in this sector were valued at L. 1,430 million. It is noteworthy that 57% of the damages corresponded to equipment.

It is fair to claim that Tropical Storm Eta and Hurricane Iota affected the country's educational infrastructure, causing damage to 534 educational institutions, representing 3% of the total. Additionally, 620 educational institutions had to be used as temporary shelters. It is estimated that the losses due to the cessation of activity do not have a significant impact on the country, as the suspension of classes occurred a month before the end of the school period. This is reinforced by the fact that the pandemic forced the suspension of in-person classes months before these events.

Regarding housing, according to available data up to the present date, Tropical Storm Eta and Hurricane Iota affected at least five percent of the 1.8 million occupied homes in the country. The effects of these meteorological events affected the agricultural sector, tourism, trade and industry, electricity, water and sanitation, transportation, telecommunications, and the environment. The majority of the damages corresponded to environmental assets (vegetation) and the ecosystem services they provide. Similarly, there were similarities with the study by Bedolla et al. (2021), who conducted research on the impacts of Hurricane Max in September 2017 in a community in the Costa Chica region of Guerrero, Mexico, causing negative effects on the environment, economy, and society. The objective was to analyze the social impact of the impacts, and an unstructured interview was conducted with affected citizens, covering variables related to the environment, economy, society, risk perception, and Sustainable Environmental Education (SEE). The results of this analysis revealed environmental damage, including tree falls, overflow, and flooding; economic losses such as material possessions, animals, and damage to homes; social impacts, including physical and emotional harm to individuals; disruptions to water and electricity services, leading to a lack of food.

The disconnection between society and the government authority in the emergency situations was also exposed. Experiences like these underscore the need to foster a risk culture among the population in the face of natural events and to promote SEE for the care and preservation of the environment. It is important to recognize that education plays a crucial role in risk reduction. Some studies concluded on the importance of education for the prevention and mitigation of risks and disasters.

Nevertheless, they emphasize the integration of education into study plans and programs with the aim of equipping students with competencies to prevent risks from phenomena that may pose dangers or threats in environmental, social, and economic domains. In this context, the following studies are mentioned. Valladares (2022) conducted a study with the aim of characterizing education for disaster risk reduction and exploring its curricular inclusion in the Basic Education Plan and Programs in Mexico, in effect since 2017. The study emphasized that, from the perspective of public pedagogy, it is proposed to rethink education in disasters as a "pedagogy of public interest," capable of recovering, revitalizing, and transforming public life from schools. Another study is that of Arauz (2008) with research on reflections on disaster risk education in Costa Rica.

It presented a reflection on the importance of education for disaster risk prevention in the national education system, summarizing that current educational proposals tend towards an incomplete interpretation of risks and disasters, which in turn distorts the meaning and scope of prevention. There is a bias towards one practical dimension of the problem – the response to emergency situations – and the imperative to develop comprehensive social actions in this regard is lost. Therefore, it is urgent to develop a new educational approach that allows for a holistic analysis of disaster risks.

## The Interview Results

To delve deeper into the gathered information and enhance the analysis of Hurricane Otis's socio-environmental impact on the student community in question, 14 students were also interviewed using the same survey method. The 14 interview responses from the students were

analyzed, and a general analysis was conducted on knowledge and perception of Hurricane Otis. Several expressed that they had limited knowledge about Hurricane Otis before its impact. Despite being announced as a depression four days before and government meetings discussing its evolution, most of the population was not fully informed about the cyclone's development. Preventive measures, such as class suspension and shelter openings, were taken, but the general population seemed to underestimate the hurricane's severity.

Some students mentioned that, even as Otis rapidly evolved into a category 5 hurricane, many did not give it the necessary importance. The lack of awareness about the hurricane's magnitude led to the population facing devastating consequences once it made landfall, including loss of lives, significant material damage, and chaotic situations, such as looting in shopping centers. The authorities' response and subsequent aid are described as vital, but the experience left a profound impact on the social, environmental, and economic perception of the Acapulco community. The impact of Hurricane Otis in Acapulco has had significant consequences in the environmental, social, and economic dimensions. The responses from these interviews were also analyzed within these dimensions.

In the environmental sphere, most students understood and perceived a deterioration of the ecosystem in Acapulco as a result of the intense winds and torrential rains caused by Hurricane Otis. They also observed a substantial loss of trees, plant diversity, and an adverse impact on animal species, with the devastation of this natural environment potentially leading to long-term consequences for ecological balance. Additionally, a local climate change has been identified as another relevant aspect. It is emphasized that the loss of vegetation will not only contribute to an increase in temperature in the area but also that the absence of shade, resulting from the loss of trees, leads to a decrease in oxygen levels. This, in turn, could increase the incidence of gastrointestinal diseases and other conditions, as well as the proliferation of mosquitoes, among other factors that could negatively impact the residents' quality of life. Furthermore, it is emphasized that the impact on fauna could result in a decrease in animal species in the region. Additionally, a significant problem is evident in the streets and every corner of the city related to the generation of garbage, debris, sheets, unusable household items, water tanks (tanks where water is stored in homes), etc. This phenomenon worsens the environmental situation, contributing to pollution and presenting additional challenges for recovery and preservation of the environment.

In the social dimension, this hurricane impacted the population in various areas of their lives, including the social, work, educational, family, and economic aspects. The loss of homes, interruption of educational and work activities, as well as the lack of basic services, has generated a crisis in the community. The population's reaction to these events was mentioned, noting a lack of solidarity from some residents who took advantage of the situation to loot commercial establishments. This behavior has hindered recovery and generated social tensions. Regarding resilience and hope, it was mentioned that, despite the difficulties, the resilience and hope of the population stand out. The intention to rebuild Acapulco and overcome adversity demonstrates the community's strength.

In terms of the economic dimension, significant economic damages are largely perceived. Hurricane Otis has caused significant economic losses in Acapulco. The destruction of properties, impact on businesses such as hotels or the tourism sector, disruption of commercial activities, and job losses have affected the economic stability of the region. Reference was made to the government's response to these events, and it was mentioned that the arrival of assistance from the government, the National Guard, the Navy, and the Military to collaborate in cleaning the affected areas and distributing provisions is of great support. Additionally, the Federal Electricity Commission (FEC) is working to restore electrical service.

In summary, Hurricane Otis has left a profound impact on Acapulco, affecting not only infrastructure and the environment but also generating social and economic challenges that the community is addressing with resilience and hope.

## Conclusions

Although Hurricane Otis significantly affected the students in Acapulco, particularly those at the School of Sociology, majority of them expressed their willingness to continue the academic activities and complete the semester corresponding to the August 2023 - January 2024 period.

The survey revealed a diversity of preferences between in-person and online classes, emphasizing the need for flexible options. Despite the challenges, students demonstrate resilience and adaptability, underscoring the importance of the school and its academics supporting them with digital tools and flexible strategies to ensure access and re-integration into education. In the environmental dimension, this hydro-meteorological phenomenon has left a significant mark on sociology students in Acapulco.

They faced extreme weather conditions, experiencing intense rains and strong winds, a phenomenon completely unprecedented for the region. The widespread falling of trees and the loss of roofs have resulted in considerable volumes of urban solid waste, aggravated by the delay in the responses of the authorities to cleaning. The interconnection between the loss of vegetation and the increase in temperature, coupled with the decrease in oxygen due to the lack of shade, raises concerns about the quality of life, the incidence of diseases, and the proliferation of mosquitoes. The impact on fauna and the clear challenge associated with waste generation present additional obstacles for recovery and preservation of the environment in Acapulco. The lack of prior knowledge about hurricanes of this magnitude highlights the uniqueness of the event, emphasizing the need for educational institutions to provide information on how to face similar situations and promote environmental care.

In the social dimension, Hurricane Otis has left deep marks on the sociology students in Acapulco. Displacement and changes of residence, motivated by security and economic issues have negatively impacted their access to education or the ability to continue their studies and their social stability. Total losses in their houses not only affected their quality of life but also their ability to focus on studies, highlighting the insecurity of homes with blown roofs and damaged structures. Repercussions on health, either directly related to the hurricane or as a result of the generated conditions, are evident, with the lack of access to drinking water being a crucial factor.

Education of the students was particularly affected, not only due to the conditions of schools and infrastructure in Acapulco but especially in the school they attend. These circumstances underline the complexity of the social challenges derived from Hurricane Otis and emphasize the need for specific interventions to mitigate its effects on the well-being and education of the affected students. The lack of solidarity and looting have further complicated the situation, but despite the difficulties, the community shows resilience and hope, standing out in the determination to rebuild Acapulco and overcome adversity, demonstrating its strength.

The economic dimension after the passage of Hurricane Otis has presented substantial challenges, manifested mainly in significant job losses and income losses among the participants. This situation directly affects the ability to cover basic needs and poses an obstacle to the continuity of studies. In fact, the lack of a stable source of income hinders participation in educational activities that require financial resources, and the need to rebuild houses adds an additional economic burden. Thus, the close interconnection between economic and educational factors is evident. It is imperative to implement comprehensive interventions that address these challenges together, ensuring educational continuity and contributing to the economic recovery of students affected by the Hurricane Otis.

This study concludes the following:

a) Academic insights:

- The survey reveals a diverse range of preferences for in-person and online classes, emphasizing the need for flexible educational options.

- Students exhibit resilience and adaptability, underlining the importance of providing digital tools and flexible strategies for continued access to education.
- b) Environmental Implications:
- Hurricane Otis has left a lasting mark on the environment, raising concerns about quality of life, disease incidence, and environmental preservation.
  - The lack of prior knowledge about hurricanes of this magnitude emphasizes the unique challenges and underscores the need for educational institutions to provide information on facing similar situations.
- c) Social Impact:
- The hurricane has deeply affected sociology students socially, leading to displacement, changes in residence, and challenges to their education and well-being.
  - Social challenges, including lack of solidarity and looting, underscore the need for specific interventions to mitigate the effects on the affected students and their community.
- d) Economic Challenges:
- Substantial job and income losses post-Hurricane Otis present significant obstacles to covering basic needs and continuing studies.
  - The interconnectedness of economic and educational factors highlights the importance of comprehensive interventions for educational continuity and economic recovery.

In conclusion, the study emphasizes the multifaceted challenges faced by sociology students in Acapulco after Hurricane Otis and underscores the necessity for resilient strategies across academic, environmental, social, and economic domains. Implementing targeted interventions and support mechanisms is essential for fostering resilience and facilitating recovery in the aftermath of such natural disasters.

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