Proceedings of the 2nd International Conference on Financial Technology and Business Analysis
DOI: 10.54254/2754-1169/52/20230713

Analysis on the Impact of Human Economic Activities on Climate Change in Hainan Island

Youning Xie[1,a,*]

[1]*Hainan Middle School, Haikou, Hainan, China*
a. 1911581234@mail.sit.edu.cn
**corresponding author*

Abstract: In order to understand the relationship between economic growth and climate change, this research analyzes the effects of human economic activity on climate change in Hainan Island, a rapidly developing region in southern China. The paper examines the historical climate patterns of Hainan Island, focusing on temperature trends, precipitation levels, and extreme weather events. The paper also examines the state of Hainan Island's natural resources, including biodiversity and coastal ecosystems to assess the ecological impact of economic activities. The findings of this study contribute to the broader understanding of the relationship between human economic activities and climate change in a specific regional context. The analysis highlights the urgent need for integrated approaches that balance economic growth with environmental sustainability in Hainan Island. The research outcomes can inform policymakers, environmental organizations, and local communities in developing strategies to mitigate climate change impacts and foster a more sustainable future for Hainan Island and similar regions facing similar challenges.

Keywords: Hainan Island, climate change, global warming, temperature change

1. Introduction

Hainan Island, a tropical island in China's south, is famous for its magnificent natural beauty, diverse ecosystems, and rich cultural heritage[1]. However, Hainan Island is having serious issues with changes in the climate, much like many other places around the globe. It is crucial to recognize and research the effects of human economic activity on this delicate island ecology as the planet's climate continues to change. There is no denying that climate change is occurring, and its effects are becoming increasingly obvious around the world. Among the consequences include rising temperatures, shifting rainfall patterns, and an increase in the occurrence of severe weather events. As a tropical paradise, Hainan Island is particularly sensitive to the negative effects of climate change. Human economic activities on Hainan Island have made major contributions to the island's economic growth and development over the years. Rapid urbanization, industrialization, and tourism have all had a significant impact on the island's scenery and ecosystem[2]. These activities, however, have resulted in the production of greenhouse gases, deforestation, and pollution, aggravating the consequences of climate change and endangering the island's delicate equilibrium.

[1] Source: https://www.hainan.gov.cn/
[2] Source: https://www.hainan.gov.cn/

DOI: 10.54254/2754-1169/52/20230713

This paper will analyze and research the influence of human economic activity on Hainan Island against the backdrop of climate change and investigate the delicate relationship between human economic activity and climate change on Hainan Island by investigating numerous factors including as agriculture, tourism, energy use, and transportation. For effective plans and policies to be developed to lessen the adverse effects associated with climate change on Hainan Island, it is essential to comprehend the implications of these activities. It is crucial to obtain a sustainable growth and conservation efforts by evaluating the current state of affairs and identifying the primary causes of climate change. The investigation will include a thorough examination of existing literature, data collection, and interviews with field specialists. The purpose is to gain a complete understanding of how human economic activity impacts the environment, economy, and society of Hainan Island by combining qualitative and quantitative research approaches. The purpose of this research is to raise knowledge of sustainable practices and promote them in order to help Hainan Island cope with the issues that climate change has brought about. A more resilient and sustainable future could be realized by examining the complex link between human economic activity and climate change on the island. Finally, the goal of this essay is to offer light on how human economic activity on Hainan Island is impacted by climate change. By investigating the relationships between economic development and environmental preservation, the article hopes to provide insights and recommendations to policymakers, stakeholders, and the local community. People on Hainan Island can work together to create a healthy coexistence of economic progress and environmental sustainability[3].

2. Case Study on Climate Change in Hainan Island

2.1. Overview of Hainan Island

South China is home to Hainan Island. Through the Qiongzhou Strait, it is connected to Guangdong in the north, Guangxi and Vietnam in the west, Taiwan in the east, the Philippines, Brunei, and Malaysia in the southeast, and towards the south and southeast, the South China Sea. Hainan has a high-in-the-middle, low-around topography that reveals the vault mountain's morphology. The island also has an oceanic monsoon climate that is tropical. 35,400 square kilometers make up the entire land area, while around 2 million square kilometers of ocean space is within its purview[4]. Hainan Island, which has a 1,944.35-kilometer overall coastline, boasts five naturally occurring deep-water harbors and is just 111.12 kilometers from the primary Eurasian international shipping route. Hainan is close to many significant global markets and faces both the Pacific and the Indian Oceans. In addition to actively boosting air and maritime connections with nations and territories along the Belt and Road, it is developing an international commercial and shipping hub for the whole South China Sea[5].

2.2. Climate Change in Hainan Island

Hainan Island has experienced major climate changes over the last few decades, including rising temperatures, extreme weather events are becoming more often, rainfall patterns are shifting, and sea levels are rising. As global temperatures continue to rise, average temperatures on Hainan Island have risen steadily. Furthermore, sea levels had risen and rainfall patterns on the island have shifted, with some places enjoying greater precipitation while others facing lengthy droughts. These changes have not only had an influence on the island's agriculture sector, but they have also posed problems to the

[3] Source: www.chinanews.com
[4] Source: http://xzqh.mca.gov.cn/
[5] Source: https://www.hainan.gov.cn/

DOI: 10.54254/2754-1169/52/20230713

health of the island's water resources ecology. Furthermore, Hainan Island is becoming more vulnerable to extreme weather occurrences including typhoons and rainstorms.

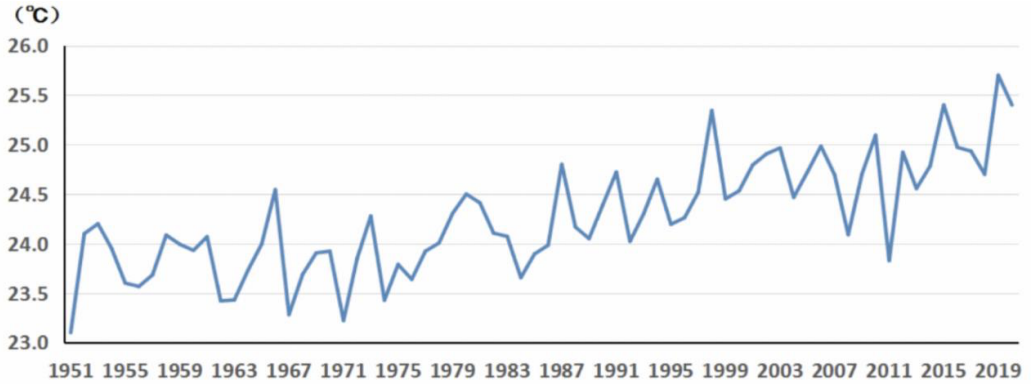

Figure 1: Average temperature trend in Hainan.

The Figure 1 above shows the average yearly temperature between 1951 and 2019[6], it is clear that the figure fluctuates and shows an overall upward trend. The intensity of the temperature rise may be unforeseen, and we must take it seriously. If the rising temperature is not regulated, mathematical models predict that the future will have a significant influence on the Earth [1]. However, according to an econometric analysis [2], rising temperatures have had a favorable impact on labor, energy, and environmental efficiencies, with an average temperature increase of 0.5 degrees Celsius over the last half century. As a result of the temperature increase, its temperatures reached an optimal level. The effectiveness of three components was harmed by extreme temperatures. Further analysis found that cities dominated by tertiary industry profited from rising temperatures, whilst cities dominated by secondary industries suffered. Because the tertiary sector dominates in Hainan, this conclusion implies that the island would profit from some temperature rise. Large center cities frequently provide tertiary businesses in China with a range of resources as part of the country's urbanization trend, pushing secondary industries out to the smaller towns nearby. Due to this, when global warming worsens, cities with various industrial architectures may see new economic disparities.

Increasing sea levels as a result of global warming presents a maritime problem. A research and assessment of the impact of rising sea levels on Hainan Island's coastal areas, and the formulation of countermeasures and recommendations, are necessary to ensure the ecological environment and the economic and social development of its coastal areas. The effects of sea level rise on Hainan Island's coastal areas primarily included submerging coastal lowlands and reducing the area of tourist beaches, exacerbating the extent of storm surge damage, coastal erosion, seawater intrusion and soil salinization, flood and water logging, and affecting coastal protection facilities. The factors of sea level rise should be thoroughly considered in the development of Hainan Island's coastal areas, including enhancing capacity building against disaster risk, urban scientific planning, sea level observation and monitoring, and the repair of damaged shorelines [3]. According to study, sea-level rise will have a severe impact on islands. The current prediction for sea-level rise ranges from 0.26 to 2.3 meters by 2100, with another 2 or 3 meters likely in the centuries after that. Furthermore, longer tide intervals, particularly centennial tides, may cause repeated floods that harm non-saline environments. Global climate change is also anticipated to increase the frequency and magnitude of seawater floods [4]. However, sea level increase is not uniform and varies regionally. A range of local conditions will dictate how sea level rise affects coastal dangers [5].

[6] Sources: http://scsweather.com

DOI: 10.54254/2754-1169/52/20230713

Daily precipitation data from 18 cities and counties on Hainan Island from 1981 to 2017 were selected to explore the variance characteristics of precipitation in flood season and its association with drought and flood in Hainan Island using linear trend and correlation analysis. Another study finds that the maximum value area of light rain days is primarily distributed in the center mountainous area, whereas the maximum value area of moderate rain and heavy rain days is typically found in the middle and southeastern sections of Hainan Island [6]. The highest-value areas with rainfall and heavy rain days are typically spread in the central and eastern regions, whereas the highest-value areas of heavy rain days are predominantly dispersed in the western Lingao and Changjiang regions. The days with light precipitation, moderate precipitation had a single peak structure, but the days with substantial precipitation had a double peak structure. Rainfall, heavy rain, extremely heavy rainstorms, heavy rain, moderate rain, and light rain are the correlations between the number of precipitation days of each grade and the overall amount of precipitation throughout the flood season, from high to low. Flood and drought years are greatly impacted by heavy rain. Flood years are more affected than drought years by heavy rain.

Extreme weather has become more common in Hainan in recent years. The Hainan Meteorological Bureau issued a four-level high temperature warning on May 7, 2023, and most towns and villages in seven cities and counties saw high temperatures of 37 degrees Celsius or higher[7]. The maximum temperature in Hainan exceeded 41.5 degrees Celsius in July 2023, setting a new record[8]. Typhoon "Compus" and other severe weather-related damage to the local living environment [7]. The occurrence of severe rains has also grown significantly in recent years. Typhoons have a considerable impact on the historical frequency of heavy rainfall, accounting for around 26.15% of the total. Under the RCP4.5 concentration route, the frequency of heavy rainfall will increase in the future, with a growth rate of around 0.16 times each decade. The average frequency of heavy rain in a 20-year event is about 11 times, while it is roughly 12 times in a 100-year event. The high-value centers are Haikou City, Qionghai City, Danzhou City, and Baoting City [8].

2.3. Environmental Impact of Human Economic Activities

Increased human activity and urbanization can contribute to water contamination in coastal areas. Runoff from metropolitan areas frequently transports contaminants such as silt, nutrients, chemicals, and solid waste into coastal seas. These pollutants can harm coral reefs and mangroves by generating sedimentation, suffocating corals, impeding photosynthesis in mangroves, and disturbing the delicate balance of marine eco-systems [9]. The increasing coastal zone economy creates more anthropogenic difficulties for marine organisms and habitats. Some researchers analyzed the strength of various anthropogenic stressors along the coast of Hainan Island, China, using a field investigation, satellite imaging, spatial geographic simulation, and machine learning techniques, and examined their impact on the distribution of juvenile HSCs. According to the findings, Danzhou Bay should be prioritized for conservation based on data on species and anthropogenic pressure [10]. This demonstrates how much human activities has influenced aquatic life. The most significant source of functional and structural harm in seagrass and mangrove habitats is human fertilizer input. Area surrounding a mangrove ecosystem has experienced the most accumulated damage from nutrients entering the system and requires cleanup in order to preserve and support the mangrove ecosystem's vigorous growth [11]. Urbanization frequently brings an inflow of people and concomitant activities to coastal areas. This increased human pressure can result in overfishing, damaging fishing practices, and unsustainable tourism activities, all of which can impact coral reefs and mangroves directly. Boating, anchoring, and dredging can cause physical damage to coral reefs, while tourism-related trampling

[7] Source: www.hnrb.voc.com.cn

[8] Source: www.shobserver.com

DOI: 10.54254/2754-1169/52/20230713

and pollution can harm both coral reefs and mangroves. Several conservation and management methods can be implemented to alleviate the effects of urbanization and land development on Hainan Island's coastal ecosystems. The government could enforce strict land-use planning and zoning rules that take coastal ecosystem conservation into account and create maritime reserves and protected areas to protect coral reefs and mangroves. Moreover, the society could promote environmentally friendly tourism activities that have a low impact on coastal ecosystems.

2.4. Economic Consequences of Climate Change

Climate warming along with other environmental changes pose numerous challenges to food safety. Food manufacturing, transportation, and consumption all occur within dynamic ecological systems, yet this context is typically overlooked or dismissed as static and unchanging. Novel pests and diseases, frequently caused by problem species broadening their geographic distributions in response to alterations in the environment, poison generation in plants, immediate impacts on agriculture and livestock farming, commerce network ramifications caused by altering the financial stability of production methods in evolving climates, and, finally, wholesale ecosystem transformation in response to novel environmental regimes are among the challenges posed by environmental change [12]. According to the UN Food and Agriculture Organization, adapting requires both "modern" and "indigenous" farming practices and skills [13]. Consequently, merging agricultural databases and allowing adaptive information to be shared among Hainanese is a difficulty.

Agriculture and fishing in coastal seas and estuaries help millions of people on economic, social, and cultural levels. While coastal fisheries are approaching their harvest limits, the marine aquaculture industry is predicted to grow in the future decades. Both industries are critical to supplying the growing demand for aquatic foods. They represent significant challenges and hazards that vary depending on location, magnitude, and other factors unique to each case. Climate change and its consequences are both a serious threat and a rare opportunity. Coastal aquaculture and fishing provide around 110,000,000 tons of invertebrates and fish for human consumption and other uses each year. They supply hundreds of millions of people with jobs, economic gains, and high-quality nutritional advantages. To prevent negative environmental consequences and maintain sustainability, both sectors must be handled effectively and in accordance with an ecosystem approach. A range of concerns, such as frequent poor management, spillover effects from other coastal and marine companies, or poverty and marginalization among many fishers and fish workers, particularly in small-scale sectors, are endangering them. Climate change concerns marine species range, abundance, and output, as well as maritime security and safety [14].

Climate change, ocean acidification, sea-level rise, zone deoxygenation, and a rise in both the intensity and frequency of extreme events have all had an influence on coastal aquaculture and fishing businesses, with the consequences expected to worsen in the future years. Despite the fact that environmental degradation, tourism, and transportation are all intricately related, scientific research has focused on their pairwise links, such as visitors and climate change, transportation and environmental change, or tourists and transportation. A study is presented before being examined on the Italian town of Misano Adriatico that explores the three notions together, emphasizing the two impacts of the changing climate on the demand for tourism and the importance of tourism-related transportation to carbon dioxide pollutants using a heuristic approach to assess climate change implications on future years carbon dioxide (CO2) emission. The study's findings suggested that summer tourism demand varies depending on climatic and socioeconomic factors. As a result, if tourists adopt more sustainable transportation options, total carbon dioxide produced by tourism transport might reduce from 550.57 total CO2 (status quo) to 216.91 total CO2 by 2035. This outcome helps to accomplish the environmental goals listed in the local city's sustainable transport approach, enabling transportation for tourism an active driver in achieving those goals. With minor

DOI: 10.54254/2754-1169/52/20230713

modifications, the approach might be used to many different types of tourist towns, assisting local politicians and other interested parties in better understanding the carbon effects of visitor mode decisions and enacting sustainable policies [15].

3. Conclusion

This paper has analyzed the impact of human economic activities on Hainan Island under the context of global warming. The analysis has shown that various economic sectors, including agriculture, tourism, industry, and urbanization, contribute to environmental degradation and climate change, posing significant challenges to the island's sustainable development. To address these issues, it is crucial to adopt comprehensive strategies promoting sustainable practices, such as sustainable agriculture, ecotourism, clean industries, and efficient resource management. In conclusion, mitigating the impact of human economic activities on climate change in Hainan Island is a complex task that demands immediate attention. By implementing sustainable measures, embracing renewable energy sources, and fostering a culture of environmental responsibility, Hainan Island can contribute to global efforts in combating climate change while ensuring a prosperous and sustainable future for its residents and the environment.

However, it is critical to recognize the study's shortcomings. The analysis primarily focused on the impact of human activities on climate change and did not extensively explore the natural factors influencing climate in Hainan Island. Future studies could consider incorporating a more comprehensive analysis that accounts for both human and natural factors. Moreover, this study mainly relied on existing data and literature, which may have limitations in terms of accuracy and comprehensiveness. Conducting field surveys and collecting primary data would provide more robust and reliable results for future studies.

References

[1] *Pipatsawet, J.; Podisuk, M. (2013). Temperature Rise of the Earth. Procedia - Social and Behavioral Sciences, 88, 220–224.*

[2] *Song, M., Wang, J. and Zhao, J. (2023). Effects of rising and extreme temperatures on production factor efficiency: Evidence from China's cities. International Journal of Production Economics, 260, 108847.*

[3] *Shi H., Lyu Y., Feng Z. (2018).Influence of Sea Level Rise on Coastal Areas of Hainan Island. Ocean Monitoring and Forecasting Center of Hainan Province(10),68-71.*

[4] *Courchamp, F. Hoffmann, B. D. Russell, J. C., Leclerc, C., Bellard, C. (2014). Climate change, sea-level rise, and conservation: keeping island biodiversity afloat. Trends in Ecology and Evolution, 29(3), 127–130.*

[5] *Cazenave, A. and Cozannet, G. L. (2014). Sea level rise and its coastal impacts. Earth's Future, 2(2), 15–34.*

[6] *Zhang, T., Cai, Y. and Fu, X. (2022). Characteristics of precipitation change in flood season and its relationship with drought and flood in Hainan Island. Shaanxi Meteorology (01),47-52.*

[7] *Yuan, Y. and Fu, X. (202). Hainan Typhoon hit a good defensive initiative. China Meteorological News, 001.*

[8] *Wen X., Li Z., Feng L., Guo H. and Fang W. (2022). Social and economic exposure of rainstorm disasters in Hainan under the scenario of future land use change. Science of Catastrophism (04),225-234.*

[9] *Adyasari, D., Pratama, M. A., Teguh, N. A., Sabdaningsih, A., Kusumaningtyas, M. A., &and Dimova, N. (2021). Anthropogenic impact on Indonesian coastal water and ecosystems: Current status and future opportunities. Marine Pollution Bulletin, 171, 112689.*

[10] *Chen, X., Gu, Y. G., Ying, Z., Luo, Z., Zhang, W., and Xie, X. (2023). Impact assessment of human activities on resources of juvenile horseshoe crabs in Hainan coastal areas, China. Marine Pollution Bulletin, 188, 114726.*

[11] *Fang, X., Li, X., Xiang, Y., Hao, C., Zhao, Y., and Zhang, Y. (2020). Cumulative impact of anthropogenic nutrient inputs on lagoon ecosystems—A case study of Xincun Lagoon, Hainan, China. Regional Studies in Marine Science, 35, 101213.*

[12] *Lennon, J. J. (2015). Potential impacts of climate change on agriculture and food safety within the island of Ireland. Trends in Food Science and Technology, 44(1), 1-10.*

[13] *Dun, O., Klocker, N., Farbotko, C., and McMichael, C. (2023). Climate change adaptation in agriculture: Learning from an international labour mobility programme in Australia and the Pacific Islands region. Environmental Science and Policy, 139, 250-273.*

DOI: 10.54254/2754-1169/52/20230713

[14] *Cochrane, K. L., Bahri, T., Dabbadie, L., Fernandez-Reguera, D., Kalioski, D. C., Ma, X., and Vannuccini, S. (2023). The impact of climate change on coastal fisheries and aquaculture. Reference Module in Earth Sytems and Environmental Sciences*

[15] *Cavallaro, F., Irranca Galati, O., and Nocera, S. (2021). Climate change impacts and tourism mobility: A destination-based approach for coastal areas. International Journal of Sustainable Transportation, 15(6), 456-473.*