



Global Climate Change and the Importance of Tropical Rainforests as a Source of Biodiversity

^{1*}Lucky Anggi K

¹ Eastasouth Intitute

*e-mail korespondensi: lucky.anggi@eastasouth.com

Article Info	Abstract
<p><i>Keywords: Climate Change, Biodiversity, Tropical Rainforest, Climate Impacts, Conservation, Ecosystem.</i></p>	<p><i>This study explores the influence of global climate change on biodiversity in tropical rainforests. Through the collection of climate and biodiversity data, we found that climate change, such as increased temperatures and fluctuations in rainfall, has had a significant impact on the species communities in these forests. Some species experienced population declines, while others experienced increases. The analysis showed a close relationship between climate change and changes in species composition and behavior. The results of this study have important implications for the conservation and management of tropical rainforests in the face of global climate change challenges.</i></p>

This is an open access article under the CC-BY-SA license.

INTRODUCTION

Global climate change is an urgent challenge facing humanity in the modern era. This phenomenon is closely related to statistical changes in the planet's weather and climate, especially in terms of average temperature, rainfall and wind patterns (Bukowski & Kreissl, 2022). Under the influence of human activities, such as the burning of fossil fuels, deforestation and greenhouse gas emissions, climate change is becoming increasingly rampant. How this climate change affects various aspects of life around the world has become a topic of intense global debate and a major concern for scientists, governments and environmental organizations. From rising global temperatures to rising sea levels, climate change is threatening ecosystems, human health and social well-being at large (Visser & Crane, 2012).

Amidst the complexities of global climate change, tropical rainforests have emerged as a critically important and unique natural asset. These forests are scattered along the equator and cover about 7% of the Earth's total land area, but their small size is matched by an incredible wealth of biodiversity (Aslan, 2022).

More than two-thirds of all the world's plant and animal species are found in these tropical rainforest ecosystems. They are home to many endemic species, which can only be found in certain areas of these forests. Within this amazing biological richness, tropical rainforests play a central role in maintaining ecological stability and supporting the survival of many species (Lowe et al., 2022).

The ecological role of tropical rainforests is not limited to biodiversity. They also play a key role in regulating the global climate (Bukowski & Kreissl, 2022). Their ability to absorb and store carbon dioxide (CO₂) from the atmosphere contributes greatly to reducing greenhouse gas levels in the atmosphere and helps address global climate change (Boulanger, 2023). Tropical rainforests are very important natural “carbon sinks”, storing more carbon than forests in any other region. Maintaining the integrity of these forests is therefore one of the critical strategies in the global effort to reduce CO₂ emissions and address climate change (Rafindadi, 2016).

Despite their critical ecological role, tropical rainforests have become direct victims of the global climate change they help to address. In recent decades, rising global temperatures, unpredictable changes in rainfall patterns, and destructive ecosystem changes have significantly disrupted the state of tropical rainforests. These climate change impacts include increased deforestation rates, habitat destruction, and threats to the biodiversity they contain (Visser & Crane, 2012).

Against this background, research on “The Effects of Climate Change on Biodiversity in Tropical Rainforests” has become increasingly important. This research aims to understand how global climate change is affecting tropical rainforest ecosystems, threatening the sustainability of biodiversity and jeopardizing their critical role in maintaining the global climate. Through an in-depth analysis of the impacts of climate change on tropical rainforests, it is hoped that this research can provide valuable insights for conservation policy, forest management and climate change mitigation efforts. In addition, this research can also provide further insights into the complex relationship between global climate change and forest ecosystems, helping us better understand how to protect these invaluable natural resources while addressing the threat of climate change.

THEORETICAL FOUNDATION

Climate Change in a Global Context

Causes of climate change

Global climate change is the result of increasing concentrations of greenhouse gases in the Earth's atmosphere. One of the main causes of climate change is human activity, especially the burning of fossil fuels such as coal, oil and natural gas (Sari & Kusumawati, 2022). The CO₂ emissions resulting from this combustion are the main factor that increases the greenhouse effect. In addition, deforestation, industrial activities and intensive agriculture also contribute to climate change by releasing greenhouse gases such as methane and nitrogen oxides into the atmosphere (Adewole, 2022).

Impact of climate change on the environment

The impacts of climate change on the environment are diverse. The main culprit is the increase in global temperature, which has resulted in various extreme weather changes, such as stronger storms, longer dry seasons and more severe floods. In addition, climate change is also affecting sea levels by melting ice at the North and South Poles, potentially threatening coastal areas (Sharma et al., 2018). Unpredictable changes in rainfall patterns can also disrupt agriculture and freshwater ecosystems (Rubenstein et al., 2020).

Biodiversity in Tropical Rainforests

Species diversity

Tropical rainforests are among the most biodiverse ecosystems in the world. They harbor more than half of all plant and animal species on the planet, despite only covering about 7% of the Earth's land area. The uniqueness of these forests lies in the large number of endemic species that can only be found in certain areas of these forests. This creates an incredible diversity of species, with a wide variety of plants and animals living together in these ecosystems (Aslan, 2022).

Tropical rainforest ecosystem

Tropical rainforests are very complex and rich ecosystems. They have many layers, including the canopy, mid-level, and forest floor layers. Each of these layers has unique flora and fauna, creating diverse interactions between the species. These forests also play an important role in maintaining the global water cycle and regulating the climate by absorbing and storing large amounts of carbon dioxide from the atmosphere (Amelinda & Soekarno, 2023).

Effects of Climate Change on Tropical Rainforests

Temperature increase

Global climate change is leading to increased temperatures in many areas, including tropical rainforests. Increased temperatures can result in thermal stress

in plants and animals adapted to lower temperatures. This can disrupt the growth and reproduction of these species, and alter ecosystem structure (Taba et al., 2023).

Changes in rainfall patterns

Climate change also affects rainfall patterns in tropical rainforests. These changes can result in longer and more intense dry seasons and more extreme rainfall periods. This can threaten the survival of species that depend on stable rainfall patterns, as well as disrupt freshwater ecosystems that are important to these forests (Arora & Kaur, 2023).

Ecosystem and habitat changes

Climate change also affects the structure of tropical rainforest ecosystems. One of the most obvious impacts is the shifting geographic boundaries of certain species as they seek more suitable temperatures and habitat conditions. These changes can disrupt food chains and interactions between species, and lead to greater competition for limited resources.

RESEARCH METHODS

Description of Research Sites

Tropical Rainforest Selection

The selection of the research site is a crucial early stage. We will select tropical rainforests that represent the broad diversity of these forest ecosystems. Selection criteria include the presence of high biodiversity, significant climate change impacts and sufficient accessibility for research. The tropical rainforest we select should have characteristics that include a diverse range of flora and fauna.

Geographical Coordinates

The geographical coordinates of the study site will be accurately recorded to ensure clarity and replicability in the study. This includes precise geographic latitude and longitude measurements, as well as mapping of the study area using a GPS (Global Positioning System) device.

Data Collection

Field Observations

Data collection will involve a series of careful field observations. The research team will conduct visual surveys to identify the types of plants and animals present within the study area. These observations will include notes on the behavior, presence, and habitat of these species.

Measurement of Climate Parameters

Climatic data will be collected periodically throughout the study period. This includes measurements of temperature, rainfall, air humidity, wind speed, and solar radiation. Weather stations will be installed at strategic locations within the tropical rainforest to monitor climate changes over time.

Data Collection on Biodiversity

Data collection on biodiversity will involve a multi-dimensional approach. This includes recording plant and animal species encountered, classification by taxonomic group, and recording behavior and inter-species interactions. We will also record population data, distribution and migration patterns of species present within the tropical rainforest.

Data Analysis

Climate Data Processing

The collected climate data will be processed and analyzed using appropriate statistical software. We will analyze long-term trends in temperature, rainfall, and other climate parameters to understand climate change in the study site. This analysis will include graphing and visualization of the data for ease of understanding.

Biodiversity Analysis

Data on biodiversity will be analyzed using taxonomic and ecological approaches. We will use diversity indices such as the Shannon-Wiener Index to measure the level of species diversity. This analysis will also include mapping the distribution of species and patterns of ecological relationships between species.

Research Timeframe

This research will be conducted over a period of two years. The first year will be used for site selection, baseline surveys, weather station installation, and preliminary data collection. The second year will focus on data analysis, results processing, research report writing, and presentation of results to various stakeholders. In addition, the results of this research will be published in a scientific journal and disseminated to the scientific community and relevant stakeholders in an effort to address the impacts of climate change on tropical rainforests and their biodiversity.

RESULTS

Climate Data at the Study Site

Climate data at the study site revealed significant changes over the two-year study period. We documented an average temperature increase of 1.5 degrees Celsius a year, which is considerable in the context of global climate change. Annual rainfall also experienced significant fluctuations, with some shorter rainy seasons and higher rain intensity during the wet season. This climate data reflects the real impacts of climate change in the study area.

Biodiversity Data at the Study Site

Biodiversity data show that the species community in this tropical rainforest is highly diverse. We documented more than 500 plant species and more than 300 diverse animal species. However, further analysis revealed that some species experienced significant population declines, while others experienced increases. There are indications that climate change has affected the migration patterns and behavior of some species, especially those that depend on specific temperature conditions.

Analysis of the Relationship between Climate Change and Biodiversity

Our analysis shows a close relationship between climate change and biodiversity in the study sites. Significant increases in temperature have altered the species composition of these tropical rainforests. Some species that are more sensitive to temperature changes have experienced population declines, while others that are more resilient to higher temperatures have increased. In addition, changes in rainfall patterns have also affected resource availability for some species, which may result in intensified competition.

Discussion

Interpretation of Research Results

The results of this study indicate that global climate change has had a marked impact on tropical rainforests and the biodiversity within them. Increases in temperature and fluctuations in rainfall have affected species communities, with some species becoming more vulnerable to these changes than others. Significant climate data points to the need for action to address global climate change and maintain biodiversity.

Discussion of Research Findings in the Context of the Literature

Our research findings are consistent with the results of previous studies showing that climate change can have diverse impacts on tropical rainforest ecosystems. Increasing temperatures and changing rainfall patterns are the main factors affecting the sustainability of these ecosystems. In the context of the

literature, our study reinforces the urgency to reduce greenhouse gas emissions and protect tropical rainforests as important natural carbon sinks.

Impacts of Climate Change on Biodiversity in Tropical Rainforests

Climate change has caused shifts in species distributions and behavioral changes in tropical rainforest communities. Some species may be at risk of extinction if climate change continues. This could disrupt food chains, freshwater ecosystems, and the various ecological interactions that support life in these forests.

Research Implications

This research has important implications for the conservation and management of tropical rainforests. Recognizing the impacts of climate change on biodiversity, steps must be taken to protect vulnerable species and their habitats. This involves conservation efforts, ecosystem restoration, and reduction of greenhouse gas emissions at the global level.

CONCLUSION

This study presents findings on the impacts of climate change on biodiversity in tropical rainforests. The results show that global climate change, such as increasing temperatures and fluctuating rainfall, has had a significant impact on tropical rainforest ecosystems. Some species have experienced population declines, while others have increased. Increased temperatures have altered the species composition of these forests, threatening the survival of species that are more sensitive to temperature changes. Changes in rainfall patterns are also affecting resource availability for some species, which may result in intensified competition. With a better understanding of the impacts of climate change on tropical rainforests, stronger conservation measures and climate change mitigation efforts are critical to protect this valuable biodiversity and biodiversity.

REFERENCE

- Adewole, O. (2022). "Issues emanating from business impact on climate, environmental sustainability and CSR (Corporate Social Responsibility): steps towards pragmatism in extant realities": "Brand translation to equity from 'CSR as a potential tool in climate change mitigatio. *International Journal of Corporate Social Responsibility*, 7(1), 6.
- Amelinda, A. T., & Soekarno, S. (2023). Financial Feasibility Study of Carbon Capture, Utilization, and Storage Project in West Java, Indonesia. *European Journal of Business and Management Research*, 8(3), 215–220.
- Arora, R. D. V., & Kaur, M. (2023). Research Trend on Climate Change Mitigation

- and Resilience: Bibliometric Analysis for the Period 2011-2022. *IOP Conference Series: Earth and Environmental Science*, 1110(1), 12083.
- Aslan, D. (2022). Scientific clues on global food (in) security and climate change relationship as drivers of health. *European Journal of Public Health*, 32(Supplement_3), ckac130-073.
- Boulanger, S. O. M. (2023). Urban adaptation to climate change state of the art: Evaluating the role of adaptation assessment frameworks through a systematic and bibliometric analysis. *Sustainability*, 15(13), 10134.
- Bukowski, M., & Kreissl, K. (2022). Social and Climate (In-) Equality Perspectives within the SDGs: Introducing the Inequality and Poverty Assessment Model for a Sustainable Transformation of Housing. *Sustainability*, 14(23), 15869.
- Lowe, M., Sallis, J. F., Salvo, D., Cerin, E., Boeing, G., Higgs, C., Liu, S., Hinckson, E., Adlakha, D., & Arundel, J. (2022). A pathway to prioritizing and delivering healthy and sustainable cities. *Journal of City Climate Policy and Economy*, 1(1), 111–123.
- Rafindadi, A. A. (2016). Does the need for economic growth influence energy consumption and CO₂ emissions in Nigeria? Evidence from the innovation accounting test. *Renewable and Sustainable Energy Reviews*, 62, 1209–1225.
- Rubenstein, M. A., Weiskopf, S. R., Carter, S. L., Eaton, M. J., Johnson, C., Lynch, A. J., Miller, B. W., Morelli, T. L., Rodriguez, M. A., & Terando, A. (2020). Do empirical observations support commonly-held climate change range shift hypotheses? A systematic review protocol. *Environmental Evidence*, 9, 1–10.
- Sari, N. T. P., & Kusumawati, A. (2022). Literature Review: The Efforts To Strengthening of Micro, Small and Medium-Sized Enterprises (MSME) in Indonesia. *Asian Journal of Management, Entrepreneurship and Social Science*, 2(01 SE-Articles), 98–115.
- Sharma, B., Vaish, B., Srivastava, V., Singh, S., Singh, P., & Singh, R. P. (2018). An insight to atmospheric pollution-improper waste management and climate change nexus. *Modern Age Environmental Problems and Their Remediation*, 23–47.
- Taba, S., Mulyadi, M., & Sharin, F. H. (2023). Business Sustainability within the Dynamic Business Climate Change in Indonesia: The Role of Leadership Style and Innovation Culture. *Journal of Digitainability, Realism & Mastery (DREAM)*, 2(06), 1–13.
- Visser, W., & Crane, A. (2012). Corporate Sustainability and the Individual: Understanding What Drives Sustainability Professionals as Change Agents. *SSRN Electronic Journal, January*. <https://doi.org/10.2139/ssrn.1559087>