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Projected climate change trends and key climate response policies in Vietnam

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Abstract **Original Research Article**

The study applies a combination of methods to initially forecast climate change trends in Vietnam, while systematizing strategic policies of the Party, ministries and branches on climate change response; Reviewing the system of policies, laws, programs and action plans of the Vietnamese Government and relevant ministries and branches. The results indicate that Vietnam is experiencing significant impacts of climate change, including rising temperatures, irregular rainfall, and more intense extreme weather events, and accelerating sea-level rise. By 2100, mean temperatures are projected to increase by 1.6–2.4°C under RCP 4.5 and 3.2–4.2°C under RCP 8.5, with greater warming in the North. Rainfall is expected to increase by 15–25%, alongside more intense storms, heatwaves, and droughts, while sea level may rise 53–73 cm, heightening inundation risks in major delta regions. These changes threaten the country's economy, food security, and ecosystems. Vietnam has established a comprehensive policy framework, including Resolution 24-NQ/TW, national climate strategies, action plans, and sectoral programs, and actively aligns with international commitments such as the Paris Agreement and COP26. All provinces have also developed local adaptation plans.

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1. Introduction

Climate change is happening strongly and is one of the challenges for all countries in the world in many fields. Vietnam's economy is heavily dependent on agricultural production and is among the five countries most severely affected by climate change (CC) [1]. The impacts of CC extend across multiple sectors — including natural resources, energy, food security, livelihoods, poverty, and development policies — posing significant challenges to national sustainability [2], [3]. Among all sectors, agriculture is the most vulnerable due to its direct exposure to extreme climate events such as landslides, flash floods, droughts, storms, heavy rainfall, cold spells, and frost, along with irregular weather patterns, pest outbreaks, sea-level rise, and saltwater intrusion [4]. Mountainous provinces and coastal regions are the most affected areas, where CC not only threatens livelihoods and food security but also exerts broad impacts on local socio-economic development and environmental stability. According to the Global Climate Risk Index by Germanwatch, Vietnam ranks 6th among the world's top ten countries most vulnerable to climate risks [5]. The impacts of CC in Vietnam are evident across multiple dimensions. A 1-meter rise in sea level could result in the loss of approximately 5% of national land area—mostly agricultural land—reduce agricultural output by 7%, affect 11% of the population, and cause an estimated 10% decline in GDP [6]. CC also leads to increased average temperatures, erratic rainfall, rising sea levels, and higher frequency and intensity of natural disasters such as droughts, heatwaves, floods, and tropical storms [7]. Furthermore, secondary and synergistic impacts may occur as CC interacts with socio-economic and political factors, exacerbating overall consequences.

Over the past six decades (1958–2018), Vietnam's climate has exhibited complex changes. Both average temperature and precipitation have increased, with more frequent extreme heat days nationwide. Although cold days have decreased, severe cold spells and rare snow or frost events have been recorded in northern mountainous provinces (notably in 2008, 2015, and 2016) [8]. Heavy rainfall events have become more frequent and intense, with increasingly unpredictable patterns. These changes have altered cultivation conditions and cropping calendars, increased the incidence of pests and diseases, and created additional challenges, causing severe losses to agriculture and threatening the long-term sustainability of the production system.

Therefore, this study aims to initially forecast climate change trends in Vietnam, while systematizing strategic policies of

the Party, ministries and branches on climate change response; Reviewing the system of policies, laws, programs and action plans of the Vietnamese Government and relevant ministries and sectors. The research results will be an important premise to assess the relevance, comprehensiveness and implementation capacity of current policies. At the same time, it is an essential basis to evaluate the effectiveness and limitations in policy implementation. On that basis, solutions can be proposed to improve policy effectiveness and adapt to climate change in the coming time.

2. Research methods

2.1. Data collection and synthesis method

The study collected available data, figures and documents from reliable domestic and international sources.

Collected meteorological and statistical reports from the Ministry of Natural Resources and Environment (MONRE), the General Department of Meteorology and Hydrology, IPCC, UNDP, World Bank (WB), and FAO, among others.

Compiled data on temperature, rainfall, storms, sea level rise, and socio-economic damages.

Reviewed relevant research studies, scientific articles, and national reports on climate change.

2.2. Comparative method

Compared climate change indicators among regions (North–Central–South) or between different time periods (e.g., before 1980 vs. after 2000).

Compared Vietnam's data with that of Southeast Asia or global averages to determine the relative severity of climate change impacts.

2.3. Data analysis and processing method

Utilized meteorological datasets on temperature, precipitation, storms, and sea level rise from the past 30–60 years.

Employed statistical software such as Excel, SPSS, R, or Python to calculate trends, averages, standard deviations, and correlations.

3. Results and discussion

3.1. Projected climate change trends in Vietnam

Vietnam is experiencing significant impacts of climate change, characterized by rising temperatures, irregular rainfall, stronger storms, and rapidly increasing sea levels. Over the past 60 years, the average temperature has increased by nearly 0.9°C, winters have become warmer, and heatwaves have become more intense. Extreme rainfall, drought, saltwater intrusion, and flooding are becoming increasingly severe, particularly in the Mekong Delta. According to the Vietnam Climate Change Scenarios Report (MONRE, 2022), major projected trends toward the end of the 21st century include:

a) Temperature Projections

Average annual temperature across the country will continue to rise:

Medium scenario (RCP 4.5): +1.2–1.7°C by mid-century and +1.6–2.4°C by the end of the century.

High scenario (RCP 8.5): +1.7–2.3°C by mid-century and +3.2–4.2°C by the end of the century.

The northern regions are expected to warm faster than the south.

Extreme temperatures will also increase notably:

Under RCP 4.5: maximum temperature +1.7–2.6°C, minimum temperature +1.7–2.1°C.

Under RCP 8.5: maximum temperature +3.2–4.7°C, minimum temperature +3.3–4.1°C.

b) Precipitation projections

Rainfall is projected to increase in most regions:

RCP 4.5: +10–15% by mid-century and +15–20% by the end of the century.

RCP 8.5: +10–15% by mid-century and +15–25% by the end of the century.

Extreme precipitation will increase significantly:

Under RCP 4.5, the maximum 1-day rainfall may increase by 20–30% by century's end (30–40% in the North).

Under RCP 8.5, the increase could reach 25–40%, and 40–50% in the North.

c) Scenarios on extreme climate events

Storms and tropical depressions: little change in number, but stronger intensity and a southward shift in storm tracks.

Summer monsoon: onset time remains stable, but duration and intensity increase.

Cold spells: decline in the Northern mountainous, Red River Delta, and North Central regions.

Heatwaves: increase nationwide, especially in North Central, Red River Delta, and Southern regions.

Droughts: intensify in North Central, Central Highlands, and parts of Northern and Southern deltas, but decrease in Northern and Central coastal areas.

d) Sea level rise projections

Medium scenario: sea levels along Vietnam's coast will rise by 23 cm by 2050 and 53 cm by 2100.

High scenario: 27 cm by 2050 and 73 cm by 2100.

If sea levels rise by 100 cm, projected inundation risks are:

Mekong Delta: 47.3% of the area (Ca Mau: 79.6%; Kien Giang: 75.7%).

Red River Delta: 13.2%; Quảng Ninh: 1.9%.

Central coastal provinces: average 1.5% (highest in Thua Thien Hue: 5.5%).

Ho Chi Minh City: 17.2%; Ba Ria – Vung Tau: 4.8%.

Thus, climate change in Vietnam is becoming increasingly complex and unpredictable, characterized by rising temperatures, increasing rainfall, rising sea levels, and more frequent extreme weather events. These changes profoundly affect every aspect of Vietnamese life, production, and mental well-being. Therefore, Vietnam must develop and implement flexible adaptation strategies to minimize risks and enhance resilience across economic sectors in the face of escalating climate impacts.

3.2. Vietnam's policies and strategies for climate change response

In the face of escalating climate change challenges, the Party and the State have introduced multiple directives aimed at proactively responding to climate change, protecting the environment, and strengthening natural resource management. Across successive Party Congresses—from the Sixth Congress in 1986 to the most recent ones—objectives and orientations related to climate change response have been consistently emphasized and updated (Vo Tuan Nhan, 2017).

According to Resolution No. 24-NQ/TW dated June 3, 2013, issued by the 7th Plenum of the 11th Party Central Committee, proactively responding to climate change, enhancing natural resource management, and protecting the environment are identified as critical and decisive issues that profoundly influence national development. The Resolution establishes a fundamental objective for 2050, stating that Vietnam will "proactively respond to climate change; exploit and use natural resources rationally, efficiently, and sustainably; ensure environmental quality and ecological balance; and strive to achieve environmental indicators comparable to those of developed industrialized nations in the region.". After five years of implementing Resolution No. 24-NQ/TW, the Politburo issued Conclusion No. 56-KL/TW on August 23, 2019, reiterating major tasks and solutions: (1) raising awareness and responsibility in disaster prevention, climate change adaptation, and natural resource and environmental management; (2) improving the legal framework, mechanisms, and policies on climate change response and environmental protection; and (3) strengthening inspection, supervision, law enforcement capacity, and addressing urgent issues.

In addition to policies directly focused on climate change, related content is mainstreamed across various strategic documents, such as:

The National Master Planning Orientation for 2021–2030, vision to 2050;

Resolution No. 13-NQ/TW (January 16, 2012) on infrastructure development;

Resolution No. 36-NQ/TW (October 22, 2018) on sustainable marine economic development;

Resolution No. 55-NQ/TW (February 11, 2020) on the orientation of national energy development strategy.

Based on these Party guidelines, the National Assembly, Government, and ministerial bodies have enacted numerous legal documents to facilitate climate change response, environmental protection, and natural resource management. On December 5, 2011, the Prime Minister approved the National Climate Change Strategy under Decision No. 2139/QĐ-TTg. Subsequently, the National Action Plan on Climate Change for 2012–2020 was issued under Decision No. 1474/QĐ-TTg, outlining 65 specific programs, schemes, and projects assigned to ministries. The plan also identifies 10 priority programs for 2012–2020, such as the National Target Program on Climate Change and the National Science and Technology Program on Climate Change. In 2022, the Prime Minister approved the updated National Climate Change Strategy toward 2050 under Decision No. 896/QĐ-TTg.

Vietnam is also an active party to international climate change agreements. At COP26 in December 2021, Vietnam joined nearly 150 countries in committing to achieving net-zero emissions by 2050.

The National Assembly has enacted multiple laws that incorporate climate change and environmental protection provisions. Environmental protection measures were first included in the 1992 Constitution. The 2013 Constitution further strengthened the responsibilities of the State, organizations, and individuals in environmental protection. Vietnam's legal framework on climate change and environmental protection has become increasingly comprehensive and rigorous, ensuring sustainable development and safeguarding environmental quality. Key laws include: the Law on Environmental Protection (2020), Law on Disaster Prevention and Control (2013), Land Law (2013), Law on Water Resources (2014), Law on Hydrometeorology (2015), Law on Irrigation (2017), Law on Forestry (2017), Fisheries Law (2017), Law on Crop Production (2018), Law on Livestock Production (2018), Law on Biodiversity (2018), and the Law on Marine Resources and Environment (2018).

In addition to the legal framework, Vietnam has implemented numerous programs and national plans related to climate change adaptation and international commitments, such as: the National Target Program on Climate Change (2011–2015; 2016–2020), the Support Program to Respond to Climate Change, the National Science and Technology Program for Climate Change (Decision No. 2630/QĐ-BKHCN), the Science and Technology Program for Climate Change Adaptation, Natural Resource and Environmental Management (2016–2020), the National REDD+ Program to 2030, and the approval of the Paris Agreement (Resolution No. 93/NQ-CP, 2016).

Various regional and sectoral development projects, particularly in vulnerable areas, have also been approved, such as:

Scheme on Developing Climate-Resilient Urban Areas (2623/QĐ-TTg, 2013);
Master Plan for Irrigation in the Mekong Delta to 2050, considering climate change and sea level rise (1397/QĐ-TTg, 2012);

Master Plan for Irrigation in the Central Region to 2050 (1588/QĐ-TTg, 2012);
Resolution 120/NQ-CP on Sustainable Development of the Mekong Delta in Response to Climate Change (2017);

The Comprehensive Action Program for implementing Resolution 120;
Mekong Delta Regional Master Plan for 2021–2030, vision to 2050 (287/QĐ-TTg);

Comprehensive Program for Sustainable Agriculture Adaptation in the Mekong Delta to 2030, vision to 2045.

A series of national action plans on climate change have also been issued:

National Action Plan on Climate Change (2012–2020, Decision 1474/QĐ-TTg);

National Adaptation Plan 2021–2030, vision to 2050 (2020);

Plan for Implementing the Paris Agreement (2016);

National Action Plan for Agenda 2030 on Sustainable Development (2017);

Vietnam Green Urban Development Plan to 2030 (2018).

At the ministerial level, ministries have developed sectoral climate action plans. Notable examples include:

Ministry of Natural Resources and Environment's Climate Action Plans for 2011–2015 (Decision 2418/QĐ-BTNMT) and 2016–2020 (Decision 672/QĐ-BTNMT);

Plan for Implementing the Climate Change Response and Green Growth Program (2016–2020, Decision 2967/QĐ-BTNMT);

Ministry of Agriculture and Rural Development's Action Plans for 2011–2015 and 2016–2020 (Decision 543/QĐ-BNN-KHCN; Decision 819/QĐ-BNN-KHCN). Other ministries, including Construction, Transport, Industry and Trade, Health, and Education—have also developed climate response plans for their sectors.

At the local level, all provinces and centrally governed cities have formulated and issued action plans to respond to climate change and environmental protection.

4. Conclusion

Vietnam is experiencing increasingly severe impacts of climate change, reflected in rising temperatures, erratic rainfall, more extreme weather, and rapid sea-level rise. According to the Vietnam Climate Change Scenarios, by the end of the 21st century, national mean temperatures are projected to rise by 1.6–2.4°C under RCP 4.5 and 3.2–4.2°C under RCP 8.5, with faster warming in the North. Temperature extremes will also increase notably. Annual rainfall is expected to rise by 15–20% (RCP 4.5) and 15–25% (RCP 8.5), accompanied by stronger extreme precipitation, especially in northern regions. Extreme climate events will shift toward more intense storms, more frequent heatwaves, and more severe droughts in the North Central region, the Central Highlands, and parts of the deltas. Sea level is projected to rise by 53 cm (RCP 4.5) to 73 cm (RCP 8.5) by 2100, posing high inundation risks for the Mekong Delta, the Red River Delta, and Ho Chi Minh City.

Climate change is profoundly affecting Vietnam's economy, food security, water resources, and ecosystems. Vietnam has developed a comprehensive framework to address climate change through strategic directives of the Party and State. Resolution 24-NQ/TW (2013) identifies climate change response, natural resource management, and environmental protection as critical priorities, with a vision toward 2050. Subsequent policies strengthen legal systems, institutional capacity, and disaster prevention. The government has issued national climate strategies, action plans, and sectoral programs, while actively engaging in global commitments such as the Paris Agreement and COP26. Numerous laws, regional plans, and ministerial actions further integrate climate adaptation across sectors. All provinces have also implemented local climate response plans.

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