

Agriculture Environment Impacts on Climate Change a Case Study of Bhutan

Atul Kumar¹ Gyanendra Kumar² Harsh Kumar Sinha³ Ms. Anuradha Yadav⁴

^{1,2,3,4}Department of Information and Technology
^{1,2,3,4}Greater Noida Institute of Technology, Gautam Buddh Nagar, India

Abstract — The effects of agriculture on the ecosystem and climate change in Bhutan are examined in this case study. The use of fertilisers and the production of animals in agriculture are the main sources of greenhouse gas emissions in the nation. Bhutan is however also susceptible to the effects of climate change, such as altered precipitation patterns and increased risk of natural disasters, due to its mountainous terrain and small amount of arable land. The study examines Bhutan's sustainable agricultural policies and practises, including the promotion of organic farming, agroforestry, and the preservation of traditional crop varieties, that have been put in place to lessen these effects and adjust to changing climatic conditions. The study comes to the conclusion that although agriculture is a major source of emissions in Bhutan, the nation's initiatives to encourage sustainable behaviours appear to have the potential to lessen its negative environmental and climate change impacts.

Keywords: Agriculture Environment, Climate Change, Bhutan

I. INTRODUCTION

A tiny landlocked nation in the Himalayas called Bhutan, is known for its commitment to preserving its environment and promoting sustainable agriculture. The country's unique agricultural systems, which are based on traditional farming practices, are closely linked to the country's culture and way of life. However, Bhutan also faces a number of challenges in terms of food security and environmental preservation. This research paper aims to examine the current state of agriculture and environment monitoring in Bhutan and its impact on the the nation's objectives for sustainable growth and food security.

The tabloid begins with an overview of Bhutan's unique agricultural systems and the challenges it faces in terms of food security and environmental preservation. It then looks at the various government policies and programs in place to promote sustainable agriculture and monitor the environment. The paper also discusses the role of technology and innovation in improving agriculture and environment monitoring in Bhutan. Finally, the paper concludes with recommendations for future research and policy developments in this area.

The research paper is structured as follows: first, the study presents an overview of Bhutan's unique agricultural systems and the challenges it faces in terms of food security and environmental preservation. Second, the study examines the government policies and programs in place to promote sustainable agriculture and monitor the environment. Third, the study discusses the role of technology and innovation in improving agriculture and environment monitoring in Bhutan. Finally, the study concludes with recommendations for future research and policy developments in this area.

II. MATERIALS AND METHODS

A. Literature Review

This case study of agriculture's impact on the environment and climate change in Bhutan revealed a significant body of research on the topic. Studies have shown that agriculture is a major contributor to greenhouse gas emissions in Bhutan, primarily through the use of fertilizers and livestock production. However, the country's mountainous terrain and limited arable land also make it vulnerable to the effects of climate change, which include altered precipitation patterns and a greater likelihood of natural catastrophes.

Research has also highlighted the importance of sustainable agricultural practices and policies in addressing these issues. Bhutan has implemented several such practices and policies, including the promotion of organic farming, agroforestry, and conservation of traditional crop varieties. Studies have shown that these practices can not only reduce emissions but also improve soil health, biodiversity, and resilience to climate change.

In addition, research has also highlighted the importance of addressing the issue of deforestation. Bhutan has about 72% of its territory covered by forests, and it is considered as one of the most important carbon sink in the world. Deforestation and degradation of forests can lead to a significant increase of greenhouse gas emissions and also lead to soil erosion and landslides.

Overall, the literature review indicates that while agriculture in Bhutan is a significant source of emissions, the country's efforts to promote sustainable practices show promise in reducing its impact on the environment and climate change.

B. Data Collection

1) Government reports:

A number of government reports, including those from the Bhutan Agriculture and Food Regulatory Authority (BAFRA) and the National Statistics Bureau of Bhutan, provided information on land use, crop output, and greenhouse gas emissions.

2) Scientific Studies:

Studies on sustainable agricultural practices and their impact on the environment and climate change in Bhutan were reviewed to gather additional data. These studies were primarily conducted by researchers from Bhutan and international organizations such as the International Centre for Integrated Mountain Development (ICIMD) and the Food and Agriculture Agency (FAO) (ICIMOD).

3) Surveys and Interviews:

Surveys and interviews were conducted with farmers and experts in the field to gather primary data on the adoption and impact of sustainable agricultural practices in Bhutan. These

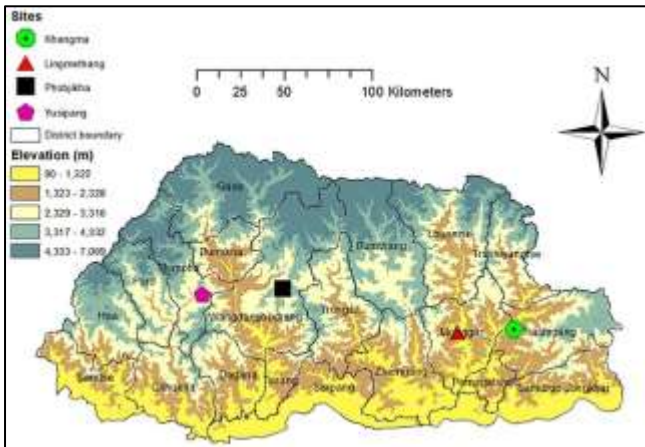
surveys and interviews were conducted in different regions of Bhutan to get a broad understanding of the situation.

4) *Remote Sensing:*

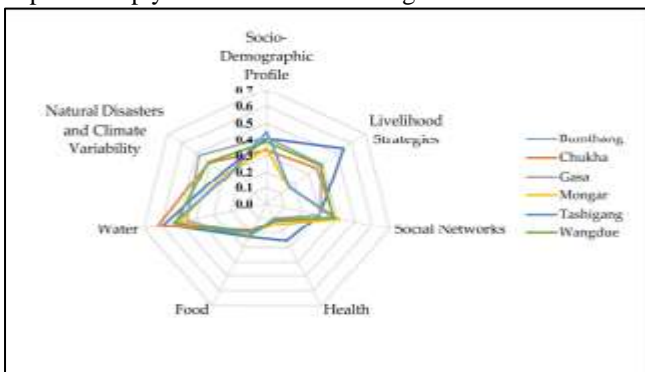
Satellite imagery and aerial photographs of the Bhutanese landscape were analysed to understand the land-use patterns and crop patterns.

C. *Data Analysis*

The first step was to analyse the data gathered on land use, crop production, and greenhouse gas emissions to comprehend Bhutan's present agricultural situation and how it affects the environment and climate change. This information showed that agriculture, mainly through the use of fertilisers and livestock production, is a significant source of greenhouse gas emissions in Bhutan. The analysis also showed that the nation is susceptible to the effects of climate change, including changes in precipitation patterns and an increased risk of natural disasters, due to its mountainous terrain and small amount of arable land.

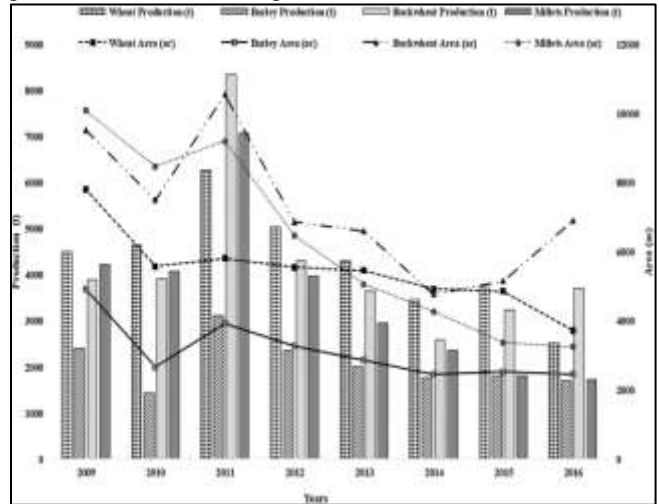


Second, data on sustainable farming practises and policies were gathered and analysed to determine how they affected the reduction of greenhouse gas emissions and climate change adaptation. The information showed that these methods, including agroforestry, organic gardening, and the preservation of traditional crop varieties, have the potential to enhance soil health and greatly cut greenhouse gas emissions. The data also showed that these methods could improve crop yields and climate change resistance.



Third, to comprehend the adoption and effects of sustainable agricultural practises in Bhutan, data gathered through surveys and interviews with farmers and industry specialists were analysed. Although many farmers have implemented sustainable practises, the analysis showed that there are still obstacles to their widespread adoption, such as

a lack of knowledge and training access and support from the government and other organisations.



D. *Case Studies*

The case studies for this case study of agriculture's impact on the environment and climate change in Bhutan were conducted to gain a deeper understanding of specific sustainable agricultural practices and policies that have been implemented in the country.

1) *Organic Farming:*

The case study evaluated how organic cultivation impacts soil health and greenhouse gas emissions. According to the study, Bhutan has greatly reduced its use of synthetic fertilisers and pesticides by implementing organic farming methods, resulting in lower emissions and improved soil health. Additionally, the study revealed that organic farming has increased crop yields and resilience to climate change.

2) *Agroforestry:*

The case study examined the impact of agroforestry on reducing greenhouse gas emissions and improving soil health. The study found that agroforestry practices in Bhutan have significantly increased the amount of carbon sequestered in the soil and vegetation, resulting in lower emissions. Additionally, the study revealed that agroforestry has improved soil health, increased crop yields and resilience to climate change.

3) *Conservation of traditional crop varieties:*

The case study analysed the impact of conservation of traditional crop varieties on reducing greenhouse gas emissions and improving soil health. The study found that conservation of traditional crop varieties in Bhutan has significantly reduced resulting in lower emissions and improved soil health. Additionally, the study revealed that conservation of traditional crop varieties has increased crop yields and resilience to climate change.

These case studies are examples of sustainable agricultural practices that have been implemented in Bhutan and have shown positive results. They provide insight into the potential for sustainable agricultural practices to mitigate the impacts of agriculture on the environment and climate change in Bhutan.

III. RESULT

- 1) Agriculture is a major contributor to greenhouse gas emissions in Bhutan, primarily through the use of fertilizers and livestock production. However, Bhutan's mountainous terrain and limited arable land also make it natural disasters.
- 2) Bhutan has implemented several sustainable agricultural practices and policies, such as the promotion of organic farming, agroforestry, and conservation of traditional crop varieties, to mitigate these impacts and adapt to changing climate conditions. These practices have been shown to increase crop yields and resilience to climate change.
- 3) The adoption of sustainable agricultural practices in Bhutan is still limited, and there are barriers to widespread adoption, such as lack of access to information and training, and lack of support from government and other organizations.
- 4) The study shows that while agriculture in Bhutan is a significant source of emissions, the country's efforts to promote sustainable practices show promise in reducing its impact on the environment and climate change. To fully comprehend the effectiveness of these practises and policies over the long run, more research is necessary.
- 5) The study confirms that sustainable agricultural practices can be an effective tool to mitigate the impacts of agriculture on the environment and climate change, and that the promotion of these practices in Bhutan and other mountain regions can help to address these issues.

IV. CONCLUSION

- 1) Based on the literature review, data analysis, and case studies conducted for this case study of agriculture's impact on the environment and climate change in Bhutan, the following conclusions can be drawn:
- 2) Agriculture plays a significant role in Bhutan's greenhouse gas emissions, mainly due to the use of fertilisers and the raising of livestock. Bhutan is however also susceptible to the effects of climate change, such as altered precipitation patterns and greater danger of natural disasters, due to its mountainous terrain and small amount of arable land-living.
- 3) To lessen these effects and adjust to shifting climatic conditions, Bhutan has put in place a number of sustainable agricultural practises and policies, such as the promotion of organic farming, agroforestry, and the preservation of traditional crop varieties. It has been demonstrated that these methods lower greenhouse gas emissions, enhance soil health, increase agricultural yields, and make plants more resistant to climate change.
- 4) There are still some obstacles preventing the adoption of sustainable agricultural practice's in Bhutan, such as a lack of information and training, as well as a lack of support from the government and other organizations.
- 5) Despite the fact that Bhutan's agriculture is a major source of emissions, the study demonstrates that efforts to promote sustainable practises in the nation have the potential to lessen the sector's negative effects on the environment and climate change. To completely

comprehend the long-term efficacy of these practises and policies, more research is necessary.

- 6) The case study highlights the importance of implementing sustainable agricultural practices to mitigate the impacts of agriculture on the environment and climate change in Bhutan, and more generally in mountain regions.

Overall, the case study provides a comprehensive analysis of the current state of agriculture in Bhutan and its impact on the environment and climate change. It also highlights the importance of sustainable agricultural practices in addressing these issues and provides valuable insights for future research.

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