

**Global Journal of Arts Humanity and Social Sciences**  
ISSN: 2583-2034  
Abbreviated key title: Glob.J.Arts.Humanit.Soc.Sci  
Frequency: Monthly  
Published By GSAR Publishers  
Journal Homepage Link: <https://gsarpublishers.com/journal-gjahss-home/>

Volume - 6 | Issue - 6 | June 2026 | Total pages 466-471 | DOI: 10.5281/zenodo.20747160

## Understanding carbon neutrality perceptions among students and residents of Samtse, Bhutan

By

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### Article History

Received: 05- 06- 2026  
Accepted: 13- 06- 2026  
Published: 17- 06- 2026

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### Abstract

*Bhutan's unique commitment to carbon neutrality, underpinned by its Gross National Happiness strategy and extensive environmental laws, serves as the backdrop for this study. The research employs a realist ethnographic approach to understand the shared beliefs and practices within this community. Findings revealed a significant awareness and understanding of carbon neutrality, highlighting the crucial role of forests and traditional agricultural practices in mitigating CO2 emissions. Cultural practices, such as reverence for trees and mountains and belief in forest deities, strongly influence environmental stewardship. However, challenges such as inadequate enforcement of regulations and maintenance of planted saplings hinder sustained carbon neutrality.*

**Keywords:** Carbon Neutral, Environmental Sustainability, cultural practices, environmental protection, regulatory challenges

## INTRODUCTION

Carbon neutrality refers to achieving a state of balance between carbon emissions and carbon absorption from the atmosphere through carbon sinks. To achieve net zero emissions, global greenhouse gas (GHG) emissions must be counterbalanced by carbon sequestration. Natural carbon sinks, such as soil, forests, and oceans, play a significant role in this process (Das et al. 2022). Carbon neutrality is essential to build a sustainable future that protects the environment and brings positive social and economic outcomes. The report on United Nations Framework for Climate Change Convention (UNFCCC) also strongly expresses the political determination to urgently address climate change (United Nations 2010). Bhutan, a small Himalayan kingdom and low-income developing nation, uniquely stands out for not only pledging carbon neutrality at COP15 but also achieving it (Yangka 2019).

Bhutan is a small landlocked country, situated between the large countries, India and China. Its total population according to National Statistics Bureau (2021) is 734,374. Bhutan has achieved carbon-negative status, with a 2014 carbon budget of 6.3 million tonnes compared to 2.4 million tonnes of CO2 emissions. Bhutan's Low Carbon Strategy aims to balance economic development,

affordable energy, environmental preservation, and climate change mitigation. The key sectors contributing to GHG emissions in Bhutan are transportation and industry (Yangka 2019).

The constitution of Bhutan article 5.1, states that "Every Bhutanese is a trustee of the Kingdom's natural resources and environment for the benefit of the present and future generations and it is the fundamental duty of every citizen to contribute to the protection of the natural environment, conservation of the rich biodiversity of Bhutan and prevention of all forms of ecological degradation including noise, visual and physical pollution through the adoption and support of environment-friendly practices and policies" (Anon. 2008, p. 11). Bhutan is committed to carbon neutrality as well as maintaining its economic development. The main reason for minimal emissions is the low industrial activity with the use of 100% hydropower for electricity. Hydropower is the source of income hence helping in improving economic development and also maintaining the net carbon sink (Munawar 2016). Bhutan generates clean hydropower energy, with its industries relying exclusively on electricity instead of carbon-based sources (Singh and Singh 2017).

Bhutan has implemented numerous laws to address and safeguard environmental issues. Key legislation includes the Environmental Assessment Act 2000, the Regulation for Environmental Clearance



of Projects, and the Regulation on Strategic Environmental Assessment 2002. Additionally, the Environment Protection Act 2007, the Waste Prevention and Management Act 2009, the Water Act 2011, and the Waste Prevention and Management Regulation 2012 play significant roles. The country also developed the National Strategy and Action Plan for Low-Carbon Development in 2012 (Kaewkhunok 2019). The Forest Policy of 2011, Bhutan's Forest Policy focuses on sustainable forest management and conservation. Forests in Bhutan act as carbon sinks, absorbing more carbon dioxide than the country emits. The policy aims to maintain and enhance forest cover, mitigate climate change, and preserve biodiversity (Wangdi et al. 2013). To support its carbon neutrality and sustainable development goals, Bhutan has enacted, the 2013 Renewable Energy Policy. This policy promotes hydropower expansion and the exploration of solar, wind, and biomass energy, aiming to reduce fossil fuel dependence and transition to clean, sustainable energy sources (Ministry of Economic Affairs 2013). Bhutan aims to minimise greenhouse gas emissions from waste and contribute to carbon neutrality (Shrestha 2018). The 2020 Climate Change Policy commits Bhutan to maintain its carbon-neutral status, aiming for ecologically balanced, sustainable development alongside justifiable economic and social progress through low GHG emissions pathways (National Environment Commission 2020). These laws and policies, along with others related to environmental conservation and sustainability, provide the framework for Bhutan's efforts to achieve carbon neutrality.

However, the Climate Action Tracker has cautioned Bhutan about the potential limitations of relying solely on its forest carbon sink to offset the increasing emissions from energy-consuming sectors in the long run. Therefore, it becomes essential to address the question of how Bhutan plans to sustain its carbon-neutral goal over the long term (Yangka et al. 2020). That is why this research focused on the socio-cultural factors and the practices among the students and people of Samtse which has contributed to the reduction of carbon emissions.

One of the cultural factors is religion, besides many sustainable practices of the people of Bhutan to maintain the environment of the country. The majority follows Mahayana Buddhism, which views humans and the environment as interconnected, significantly influencing Bhutanese life, and shaping their perception, worldview and relationship with nature. This belief has fostered a deep respect for the environment (Kaewkhunok 2019). Some of the environmentally friendly practices observed in Bhutan are; in Bhutan, for every tree cut down, seven new ones are planted to sustain forest life. The country regularly organizes forest-related events and workshops to raise awareness about global warming and environmental conservation. (Singh and Singh 2017).

The Samtse district shares borders with the Haa and Chukha districts of Bhutan and the Indian states of West Bengal and Sikkim. The district's population is 62,977 (National Statistics Bureau 2021). Samtse covers an area of 1309 square kilometers with altitudes from 300 to 3800 meters (S and Gyeltshen 2014). Culture

encompasses all of the society's unique ideas, beliefs, values, and knowledge (Serrat 2008).

Although Bhutan's commitment to environmental preservation and conservation has gained international recognition, Bhutan is still facing some challenges. Samtse, being one of the districts of Bhutan, has the same challenges. So, the study focused on students and residents of Samtse. The review also showed that much research has been conducted on carbon neutrality, sustainable development, and economic development in Bhutan. However, the studies regarding perception, belief and cultural practices, particularly among the people and students of Samtse district towards maintaining carbon neutrality are still not done. Therefore, this research focuses on the perceptions of people and students of Samtse on carbon neutral.

### Research questions

1. How do the students and people of Samtse, Bhutan perceive Carbon Neutrality?
2. How do the cultural values, traditions, and environmental beliefs of the people in Samtse influence their perception and willingness to contribute towards carbon neutrality?
3. What are the challenges for sustaining Carbon Neutrality in Samtse, Bhutan?

### Objectives of the study

1. To explore the perceptions of students and people in Samtse, Bhutan regarding carbon neutrality.
2. To explore the influence of cultural values, traditions, and environmental beliefs prevalent in Samtse, Bhutan on the perceptions and willingness of its people and students to actively contribute towards carbon neutrality.
3. To find out the challenges in sustaining Carbon Neutrality in Samtse, Bhutan.

### Research Design

Qualitative research serves various purposes, including description, explanation, reporting, and development of key concepts, theory generation and testing (Cohen et al. 2018). The research method that the study is based on is the ethnography. Ethnographic design is a qualitative procedure for describing, analyzing and interpreting a cultural group's shared patterns of behaviour, beliefs, and language that develop over time (Creswell 2015).

Under the Ethnographic method, the Realist type of Ethnography was chosen to carry out the study of the perception and contribution of Carbon Neutrality by the students and people of Samtse: Bhutan. Realist ethnography allowed to deeply understand the subjective perceptions and experiences of the people of Samtse regarding carbon neutrality.

### Population

The population of the study is the people of Samtse, including individuals from different age groups, professions, and backgrounds and students of higher secondary. This inclusive approach allowed a holistic study of the perceptions, attitudes, and

behaviours regarding carbon neutrality among the people of Samtse. By engaging with both students and the people of Samtse, the research captured the perspectives related to carbon neutrality.

The sample of the study included 25 students from various educational institutions in Samtse. The students were from secondary and higher secondary schools and 10 individuals from different professions and occupations within the district of different villages. This included professionals working in government offices, local businesses, agriculture, and forestry sectors, respectively.

The instruments to gather valuable insights and understand the local perspectives are participant observation, in-depth interviews and field notes.

Ethical considerations are of paramount importance to ensure the well-being, privacy, and respect of the participants involved Creswell (2015). The research acquired the informed consent from the participants. The confidentiality and anonymity of the participants were ensured by assigning pseudonyms or codes to each individual during data collection and analysis.

## Result

### Knowledge of the consequences if carbon neutrality is not maintained

**R5**, “Certainly, carbon neutrality holds significance in my view because the absence of a CO<sub>2</sub> balance can have adverse effects on our country, such as pollution. Maintaining equilibrium in carbon emissions is crucial as it helps prevent the escalation of pollution levels. By striving for carbon neutrality, we can effectively mitigate the harmful impact of excessive CO<sub>2</sub> emissions and contribute to a cleaner and healthier environment for our nation.”

**R8**, “Industries and vehicles generate carbon dioxide (CO<sub>2</sub>) emissions, which are effectively absorbed by the vegetation in our forests, resulting in carbon neutrality. This process allows the forests to serve as a natural sink for CO<sub>2</sub>. Indeed, there are several benefits associated with this carbon-neutral phenomenon.”

The data revealed the importance of maintaining carbon neutrality to mitigate environmental and health impacts. Participant R5 highlights the direct correlation between CO<sub>2</sub> balance and pollution control, emphasizing that carbon neutrality is essential to prevent escalating pollution levels and promote a healthier environment. R8 states the role of forests as natural CO<sub>2</sub> sinks, illustrating the benefits of carbon-neutral processes in absorbing emissions from industries and vehicles. R3 stresses the broader implications of CO<sub>2</sub> accumulation, linking it to the greenhouse effect, global warming, and climate change. The consensus among participants indicates that achieving carbon neutrality is pivotal in combating these adverse effects and ensuring climate stability.

This knowledge showed a strong commitment among the student community towards sustainable environmental practices and the importance of protecting their natural surroundings.

### Understanding the value of being carbon-neutral in Bhutan

**R1**, “It helps offset and balance the environmental impact caused by these sources by ensuring that an industry's overall carbon emissions are effectively counteracted or reduced.”

**R8**, “Firstly, it helps protect against the occurrence of landslides, as the presence of dense vegetation contributes to soil stability. Additionally, the absorption of CO<sub>2</sub> by forests promotes the generation of fresh air, creating a healthier and more breathable environment.”

**R10**, “It entails striking a balance between the amount of carbon released into the environment and the amount of carbon removed or absorbed from the atmosphere. The key concept of carbon neutrality revolves around achieving this equilibrium between carbon emissions and carbon absorption.”

The students of Samtse, Bhutan, demonstrate a profound understanding of the value of carbon neutrality in Bhutan. They recognized its essential role in mitigating environmental impacts and combating climate change. Their responses indicated a deep appreciation for the value of balancing carbon emissions with carbon absorption to ensure environmental sustainability.

The value of being carbon-neutral in Bhutan is appreciated by students and people of Samtse. They understand that carbon neutrality is essential for offsetting and balancing environmental impacts, particularly from vehicular emissions. It plays a crucial role in mitigating global warming by controlling atmospheric CO<sub>2</sub> levels. Maintaining carbon neutrality is valued to protect against landslides by ensuring soil stability through dense vegetation, and it improves air quality by enabling forests to absorb CO<sub>2</sub>. They value its critical role in balancing environmental impacts, preventing climate change, and maintaining ecological equilibrium. Their insights reflect a strong awareness of the importance of sustainable practices and the need for pro-environmental behaviours to protect their environment and contribute to global efforts against climate change.

### Significance of conserving trees and forests

**R7**, “First and foremost, conserving forest leads to an increase in the oxygen level, resulting in fresher air for us to breathe. Additionally, the risk of landslides is mitigated through the preservation of trees, as their roots help stabilize the soil. Lastly, by safeguarding the marked trees, the natural springs are protected, ensuring that the supply of spring water remains sustainable and does not dry up prematurely.”

**R15**, “Forests act as a vital mechanism for absorbing CO<sub>2</sub> from the atmosphere, thereby assisting in reducing the heat generated by greenhouse gases (GHGs). This process of absorption and reduction of GHGs helps achieve a state of equilibrium and supports efforts to combat climate change.”

Respondent 7 (R7) highlighted key benefits of tree and forest conservation, including increased oxygen levels for fresher air and improved respiratory health, soil stabilization to prevent landslides, and protection of natural springs for a sustainable water supply. Respondent 15 (R15) emphasized the role of forests in absorbing CO<sub>2</sub> from the atmosphere, which reduces greenhouse gas heat and

supports climate change mitigation. Together, these perspectives underscore the vital interconnectedness of forest conservation with environmental health, public health, and climate stability.

These responses indicate a comprehensive understanding among the students and people of Samtse of the significance of conserving trees and forests. This awareness reflects a community deeply aware of sustainable practices and the preservation of their natural heritage, recognizing the broader ecological and societal benefits of their conservation efforts.

### **Influence of cultural values, traditions, and beliefs of the people in Samtse, Bhutan on their perception towards carbon neutrality.**

#### **Revering trees and mountains contributing to carbon neutrality**

**R1**, “Tree and mountain worship hold significant importance within the Lepcha community. The Lepcha people, an indigenous group inhabiting certain regions, have a deep reverence for trees and mountains. These natural elements are regarded as sacred entities, believed to possess spiritual and divine qualities. Trees are seen as providers of life and play a vital role in maintaining ecological balance. The Lepcha community often conducts rituals and ceremonies to express gratitude and seek blessings from these revered entities. Mountains, symbolizing strength and resilience, are considered sacred abodes of deities and ancestors. The Lepcha people's connection with tree and mountain worship reflects their profound respect for nature and their understanding of the interconnectedness between humans and the natural world.”

**R6**, “Those who engage in tree worship do not engage in tree-cutting activities; instead, they focus on worshipping and honoring the trees.”

**R7**, “In our region, both we and the local community hold reverence for trees and stones, engaging in worship and showing deep respect towards them.”

Respondent 1 (R1) explained the cultural practices of the Lepcha community, highlighting the significance of tree and mountain worship. Trees and mountains are revered as sacred entities with spiritual and divine qualities. This reverence reflects the Lepcha people's profound respect for nature and their understanding of the interconnectedness between humans and the natural world. Respondents (R6), (R7) and (R9) echo similar sentiments, noting that those who engage in tree worship refrain from cutting trees. This cultural practice of revering trees translates directly into actions that support environmental preservation and reduce deforestation, thereby contributing to carbon neutrality.

These responses showed the way cultural values, traditions, and environmental beliefs deeply influence the perception of carbon neutrality among the people of Samtse. The reverence for trees and mountains, seen across various communities, fosters a natural inclination towards environmental conservation. These cultural practices preserve biodiversity and ecological balance and also contribute significantly to carbon sequestration efforts.

#### **The belief in a deity in the forest- fostering respect for the forest**

**R2**, “In our village, the cultural beliefs of many residents revolve around the presence of a deity in a specific area encompassing dense forests. As a result of this belief, the community takes great care to keep this area clean and ensures that no harm comes to the vegetation within it. Consequently, this practice indirectly contributes to supporting carbon neutrality. The reverence for the deity and the associated respect for nature lead to a preservation of the environment, preventing unnecessary carbon emissions and promoting a more balanced and sustainable ecosystem.”

**R5**, “As practitioners of the Hindu religion, we hold reverence for sacred trees, such as the people's tree and bar tree, and we refrain from cutting them.”

Respondent 2 shared that the belief in a deity residing within dense forests instills a strong sense of reverence and responsibility towards these areas among the community members. This cultural belief motivates the community to maintain cleanliness and prevent harm to the vegetation, indirectly supporting carbon neutrality. Respondent 5 emphasized the Hindu religious practice of revering sacred trees, such as the Peepal and Banyan trees, which are not cut down due to their sacred status. This religious reverence ensures the preservation of these trees, contributing to environmental conservation. By protecting these trees, the community actively participates in maintaining ecological balance and supporting carbon neutrality.

The reverence for deities and sacred trees encourages behaviors that protect and sustain natural resources, aligning with the principles of carbon neutrality. This deep-rooted cultural respect for nature fosters a Country-wide commitment to environmental sustainability.

#### **Community Forest**

**R4**, “In our village, our culture promotes the protection of forests through specific practices. One way we achieve this is by establishing community forests, ensuring that the collective land is dedicated to preserving the natural environment.”

Respondent 4 (R4) emphasized that cultural practices in their village actively promote forest protection through the creation of community forests. The establishment of community forests not only safeguards the local biodiversity but also enhances carbon sequestration, directly contributing to carbon neutrality efforts.

The practice of establishing community forests showed an approach to environmental stewardship that is rooted in cultural values. This highlighted their proactive role in combating climate change and promoting ecological balance in Bhutan.

#### **Challenges for Sustaining Carbon Neutrality in Samtse, Bhutan**

**R5**, “Regarding tree cutting, it is necessary to seek permission from the government. Additionally, if we are granted permission, we are obliged to replant saplings. Unfortunately, not everyone adheres to this practice. Another is it can be argued that the government made an error in legalizing smoking.”

R20, "To prevent indiscriminate tree felling, there are regulations in place. It is not completely prohibited to cut down trees; however, a royalty fee is required for such actions, even for trees within one's property. Not everyone may be aware of these regulations, as only educated individuals tend to know about them."

Respondent 5 highlighted that many rules are in place against tree cutting and replanting. In contrast, the respondent criticizes the government's decision to legalize smoking, suggesting it undermines environmental goals and complicates carbon emission reduction efforts. The statement from Participant R7 highlights a critical gap in the maintenance of planted saplings in Bhutan. The lack of adequate care, including proper fencing, is identified as a significant issue, particularly to protect the saplings from animals. This suggests that while planting efforts are being made, the long-term success of these initiatives is compromised by insufficient follow-up measures. Respondent 20 discusses the regulations in place to prevent indiscriminate tree felling, which include a royalty fee for cutting down trees, even on one's property. In such cases, it is observed that the regulations on cutting trees are not strictly followed.

## Conclusion

The study on the understanding of the perception of carbon neutrality among the students and people of Samtse, Bhutan, revealed a strong understanding and knowledge of carbon neutral. The students and people of Samtse demonstrate significant awareness of the importance of balancing carbon emissions, and absorption, recognizing the vital role of natural resources and cultural values in achieving carbon neutrality. The study revealed commitment among the local population and students to practice sustainable practices. The education system has played a key role in providing knowledge on Carbon neutrality and instilling the values and practices among students towards the protection of the environment. The findings highlight the significant role of cultural values and traditions in fostering environmental stewardship among the people of Samtse. However, challenges such as insufficient infrastructure, non-compliance with regulations, and inadequate education on carbon neutrality persist. To sustain progress, the study recommends enhanced education, improved waste management, and community engagement to align cultural values with contemporary environmental challenges and maintain carbon neutrality.

## Acknowledgements

The authors are grateful to all the participants from Samtse who generously contributed their time and insights to this research. We are also immensely thankful to the academic and support staff of Sikkim University where the research was conducted.

## Funding Details

Any funding agency does not support the research

## Disclosure statement

The authors declare no conflicts of interest for the research, authorship, and/or publication of this article.

## Data availability statement

The datasets generated and/or analysed during the current study are not publicly available due to privacy and ethical concerns related to participant data. However, data are available from the corresponding author upon request and subject to appropriate ethical approvals. The requestors must ensure compliance with all applicable data protection regulations. Further information about the data and conditions for access can be provided by contacting the corresponding author at ybhtia@cus.ac.in

## Data deposition

The data supporting the findings of this study are available with the authors. This dataset includes all relevant raw and processed data necessary to understand and assess the research conclusions reported in the manuscript.

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