

تغییرات معیشتی و راهبردهای سازگاری ناشی از تغییرات اقلیمی در میان جامعه بومی اورائون در شمال بنگلادش

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مشخصات مقاله	چکیده
مقاله پژوهشی موضوع: چندرشته‌ای، جامعه‌شناسی حوزه موضوعی: شمال بنگلادش	جوامع بومی با دگرگونی‌های چشمگیری در شیوه‌های سنتی زندگی خود مواجه شده‌اند؛ دگرگونی‌هایی که آنان را در مقایسه با جمعیت‌های غیربومی، از نظر اجتماعی، اقتصادی و محیط‌زیستی آسیب‌پذیرتر ساخته است. باوجود این، تغییرات معیشتی و راهبردهای سازگاری ناشی از تغییرات اقلیمی در میان جوامع بومی ساکن دشت‌های بنگلادش، به‌ویژه در منطقه رائگپور، تاکنون کمتر مطالعه شده است. پژوهش حاضر با هدف بررسی تغییرات معیشتی ناشی از تغییرات اقلیمی و راهبردهای سازگاری جامعه بومی اورائون، بر تأثیرات تغییرات اقلیمی و نظام‌های معیشتی و راهبردهای بقا در این جامعه تمرکز دارد. این پژوهش با بهره‌گیری از طرح پژوهشی کیفی اکتشافی انجام شده است. بدین منظور، ۱۵ مصاحبه عمیق با اعضای جامعه بومی اورائون، بالای ۳۰ سال، صورت گرفت. داده‌ها با استفاده از چارچوب شش مرحله‌ای تحلیل مضمون براون و کلارک (۲۰۰۶) به‌طور مضمون‌محور تحلیل شد. یافته‌ها نشان می‌دهد که تغییرات اقلیمی دسترسی به منابع آبی، منابع جنگلی و گیاهان دارویی را کاهش داده است؛ در نتیجه، تنوع غذایی، فرصت‌های درآمدزایی و نیز تداوم شیوه‌های سنتی درمانگری کاهش یافته است. اعضای جامعه بومی اورائون برای مقابله با این پیامدها، راهبردهای سازگاری متعددی را اتخاذ کرده‌اند؛ از جمله گذار به شیوه‌های نوین کشاورزی، افزایش مشارکت زنان در فعالیت‌های اقتصادی خرد، تغییر الگوهای دامداری، اتکای بیشتر به نظام‌های نوین مراقبت‌های بهداشتی و درمانی، و مهاجرت گزینشی معیشتی به مناطق شهری. این اقدام‌ها، از یک سو بیانگر ظرفیت سازگاری این جامعه و از سوی دیگر، نشان‌دهنده افزایش آسیب‌پذیری اجتماعی و اقتصادی آن است. یافته‌های این پژوهش بر اهمیت اتخاذ تدابیر سازگاری حساس به اقتضاهای فرهنگی و مبتنی بر ابتکارات محلی تأکید دارد؛ تدابیری که از طریق تقویت خدمات بوم‌سازگاری، ارتقای معیشت‌های پایدار، حفظ دانش و فرهنگ بومی و اجرای برنامه‌ریزی‌های پاسخگو به ملاحظات جنسیتی، بتوان تاب‌آوری جوامع بومی بنگلادش را افزایش داد.

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Climate change–induced livelihood shifts and adaptation strategies among the Oraon Indigenous community in Northern Bangladesh

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Article Info	Abstract
Original Article Main Object: Multidisciplinary; Sociology Scope: Northern Bangladesh Received: 26 June 2026 Revised: 15 July 2026 Accepted: 26 July 2026 Published online: 29 July 2026 Keywords: adaptation strategies, climate change, Oraon Indigenous community, socio-economic vulnerability.	Indigenous communities are undergoing significant transformations in their traditional ways of life, making them more socio-economically and environmentally vulnerable than non-Indigenous populations. However, climate change–induced livelihood transitions and adaptation strategies among plainland Indigenous groups in Bangladesh, particularly in Rangpur, remain underexplored. This study explores the climate change–induced livelihood shifts and adaptation strategies of the Oraon Indigenous community, focusing on the impacts of climate change on their livelihood systems and survival strategies. Adopting an exploratory qualitative research design, we conducted 15 in-depth interviews with members of the Oraon Indigenous community aged over 30 years. The data were thematically analyzed using Braun and Clarke's (2006) six-phase thematic analysis framework. The findings reveal that climate change has reduced the availability of fish, forest resources, and medicinal plants, leading to reduce food diversity, reduced income opportunities, and the erosion of traditional healing practices. To cope with the impacts, the Oraon indigenous community members have adopted several adaptive strategies, including a transition to modern agricultural practices, increased participation of women in small-scale economic activities, changes in animal husbandry patterns, growing reliance on modern healthcare systems, and selective livelihood migration to urban areas, which indicate both adaptive capacity and increasing socio-economic vulnerability. The findings highlight the importance of culturally responsive and locally-driven adaptation measures to boost the resilience of Indigenous communities in Bangladesh by enhancing their ecosystem services, sustainable livelihoods, preserving indigenous knowledge and culture, and implementing gender-responsive planning.

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1. Introduction

Climate change is widely recognized as one of the most critical and ongoing global challenges (Rahman et al., 2025). It disrupts ecological balance, threatens food security, and increases the prevalence of both infectious and non-communicable diseases (Garai et al., 2022). Variations in temperature and precipitation patterns not only elevate the risk of disease transmission, but also intensify extreme weather events such as heatwaves, cyclones, floods, and droughts. These events have direct adverse effects on agriculture, livestock, and natural resources, resulting in large-scale displacement, livelihood disruption, and increased mortality (Mukherjee & Bhattacharya, 2024). According to the World Risk Index, six of the ten most disaster-prone countries are located in the Asia-Pacific region. Despite contributing minimally to anthropogenic climate change, populations in these regions are nearly fifteen times more likely to be affected by climate-related disasters (Nakasu, 2025). Since the early 21st century, climate-related disasters in this region have impacted over 200 million people and caused more than 70,000 deaths annually, accounting for approximately 90% of global affected populations and 65% of total deaths (Liu et al., 2024). The Sixth Assessment Report (AR6) of the Intergovernmental Panel on Climate Change (IPCC) has placed Bangladesh among the most climate change and climate extremes vulnerable countries, which has implications on food security, livelihoods, public health and quality of life (Garai, 2025; Liu et al., 2024; Siwila, 2022).

Globally, an estimated 370 million indigenous peoples reside in around 90 countries, representing about 6.2 % of the world's population (World Bank, 2025). They manage or utilize nearly 22% of the global land area. However, indigenous populations are disproportionately vulnerable to climate change impacts (Hill et al., 2024). Their habitation across diverse ecological zones, such as forests, mountains, coastal regions, and drylands-makes their experiences of climate change both complex and multidimensional. This vulnerability is not solely environmental, but is deeply rooted in historical marginalization, social inequality, and structural disadvantages. The livelihoods, cultures, and identities of indigenous peoples are closely linked to land and local ecosystems. Consequently, climate change threatens not only their economic stability, but also cultural continuity, social cohesion, and traditional knowledge systems (Mukherjee & Bhattacharya, 2024; Schlingmann et al., 2021). Environmental changes such as declining groundwater levels, biodiversity loss, reduced soil fertility, and increased seedling mortality directly undermine their subsistence systems. These challenges exacerbate economic insecurity and increase the risk of climate-induced displacement. Millions of people worldwide are likely to be displaced due to sea-level rise, floods, droughts, and other extreme events, with indigenous communities among the most vulnerable (Chumky et al., 2022).

Indigenous communities around the globe are facing climate change in a variety of ways, all of which are interdependent on each other, depending on their distinct ecological context, governance structures, and socio-economic frameworks. Research from across the Arctic, Latin America, Sub-Saharan Africa, Australia, and South Asia overwhelmingly shows that climate change is a threat to Indigenous livelihoods, including reduced agricultural productivity, loss of biodiversity, water scarcity, ecosystem degradation, and an increase in extreme weather events. These effects contribute to loss of food security, a reduced quality of life, loss of traditional knowledge and ways of living, and an increase in social and economic inequalities (Currenti et al., 2019; Ford et al., 2020; Makondo & Thomas, 2018).

Meanwhile, Indigenous communities have evolved a variety of strategies to adapt to climate change, based on their traditional ecological knowledge, such as crop diversification, community-based natural resources management, seasonal mobility, water conservation, and group risk sharing. Recent international studies, however, have started questioning whether many of these responses are actually signs of constrained adaption and not autonomous resilience, as they are influenced by marginalisation, poverty, limited institutional support and insecure land tenure (Ai et al., 2026; Bhanye, 2025; Schlingmann et al., 2021). This is not unique to the region; Indigenous communities in Bangladesh, India, and Nepal have reported similar trends, with environmental degradation, livelihood insecurity, and lack of policy recognition being shared issues, while these communities also hold valuable local knowledge in their respective regions and countries for climate adaptation (Habib et al., 2025; Tambile et al., 2024).

According to the 2022 Population and Housing Census, Bangladesh is home to roughly 1,650,159 indigenous people, accounting for about 1% of the total (Bangladesh Bureau of Statistics, 2022). A total of 54 indigenous groups reside in the country, most of whom are concentrated in the Chittagong Hill Tracts (Pal et al., 2017). However, indigenous populations also inhabit various plainland regions, where they experience both direct and indirect impacts of climate change (Toppo et al., 2016). In the northern region of Bangladesh, particularly in Rangpur, major indigenous groups include the Santal, Oraon, Munda, Malopahari, and Rajbongshi communities, along with smaller groups such as the Pahan, Turi, and Mushahar. These communities are commonly referred to as “plainland indigenous peoples” (Mondol & Paul, 2024). Similar to their hill counterparts, these groups face multidimensional climate challenges, although their experiences and adaptation strategies differ due to distinct socio-geographical contexts. The Oraon community in Rangpur is predominantly dependent on agriculture, natural resources, and local ecosystems, making their livelihoods highly sensitive to climatic variations. At the same time,

they have developed various adaptive and survival strategies in response to environmental changes, which warrant critical examination.

Climate change significantly affects economic security, social structures, and quality of life. Extreme events such as floods, droughts, and riverbank erosion reduce income from agriculture and natural resources. Limited institutional support and persistent economic inequality further intensify their vulnerability (Pandey, 2025). Additionally, climate change contributes to the erosion of local languages, folklore, traditional practices, and social cohesion, thereby weakening community resilience (Garai et al., 2022; Kelman et al., 2012; Nakashima et al., 2018).

From a health perspective, rising temperatures, disease vectors, malnutrition, and inadequate healthcare services increase both physical and mental health risks among indigenous populations (Ford, 2012; Shah et al., 2025; Vecchio et al., 2022). Climate-induced displacement and environmental stressors further contribute to anxiety, stress, and other psychological disorders. Further, sea-level rise, land degradation and extreme events pose a risk to culturally important places and spiritual activities (Dorji et al., 2024; Kelman et al., 2012; Pandey, 2025). Indigenous peoples have historically used their traditional ecological knowledge to cope with changes in the environment. Crop diversification, intercropping, water conservation, and using climate-resilient varieties are among their adaptive strategies. Social networks, communal labour and cultural practices also contribute significantly to reducing climate related stress. Resilience is also maximized through sustainable resource management practices, including terracing, controlled burning and biodiversity management (Bekuma et al., 2022; Hossain et al., 2022; International Fund for Agricultural Development, 2016; Mugambiwa, 2018; Romanello et al., 2024). In Bangladesh, plainland indigenous communities adopt alternative livelihoods, migration, and social support systems as key coping mechanisms (Garai et al., 2022; Shah et al., 2025; Uddin, 2016).

Despite extensive global research on climate change and indigenous adaptation, in-depth qualitative studies focusing on plainland indigenous communities in Bangladesh—particularly the Oraon—remain limited. Existing research primarily emphasizes hill-based indigenous groups, leaving a significant gap in understanding the lived experiences of the Oraon community in Rangpur. Therefore, this study aims to critically examine the impacts of climate change on the livelihood systems of the Oraon community and to explore their adaptation and survival strategies in the face of environmental and socio-economic challenges.

The current study makes a significant contribution to the climate change literature by offering empirical evidence of how climate change affects the livelihood, traditional knowledge and adaptation strategies of the Oraon Indigenous community in north Bangladesh. It addresses a gap in research by concentrating on an Indigenous people living in the

plainland that has not been studied extensively by academics. The study also shows that many adaptation strategies are examples of constrained survival rather than true resilience, thereby providing insights for crafting culturally appropriate and inclusive climate adaptation policies.

2. Methods and materials

2.1. Research design

This study employed an exploratory qualitative research design to examine climate change, induced livelihood shifts and adaptive strategies among the Oraon community in northern Bangladesh. An exploratory approach was selected because the topic has not been widely studied, and the research sought to identify patterns, perceptions, and responses shaped by the local context. Rather than simply describing experiences or focusing only on their deeper meaning, as descriptive or phenomenological designs do, this approach allowed for a broader understanding of how people experience and respond to climate (Creswell & Creswell, 2018; Tenny et al., 2022).

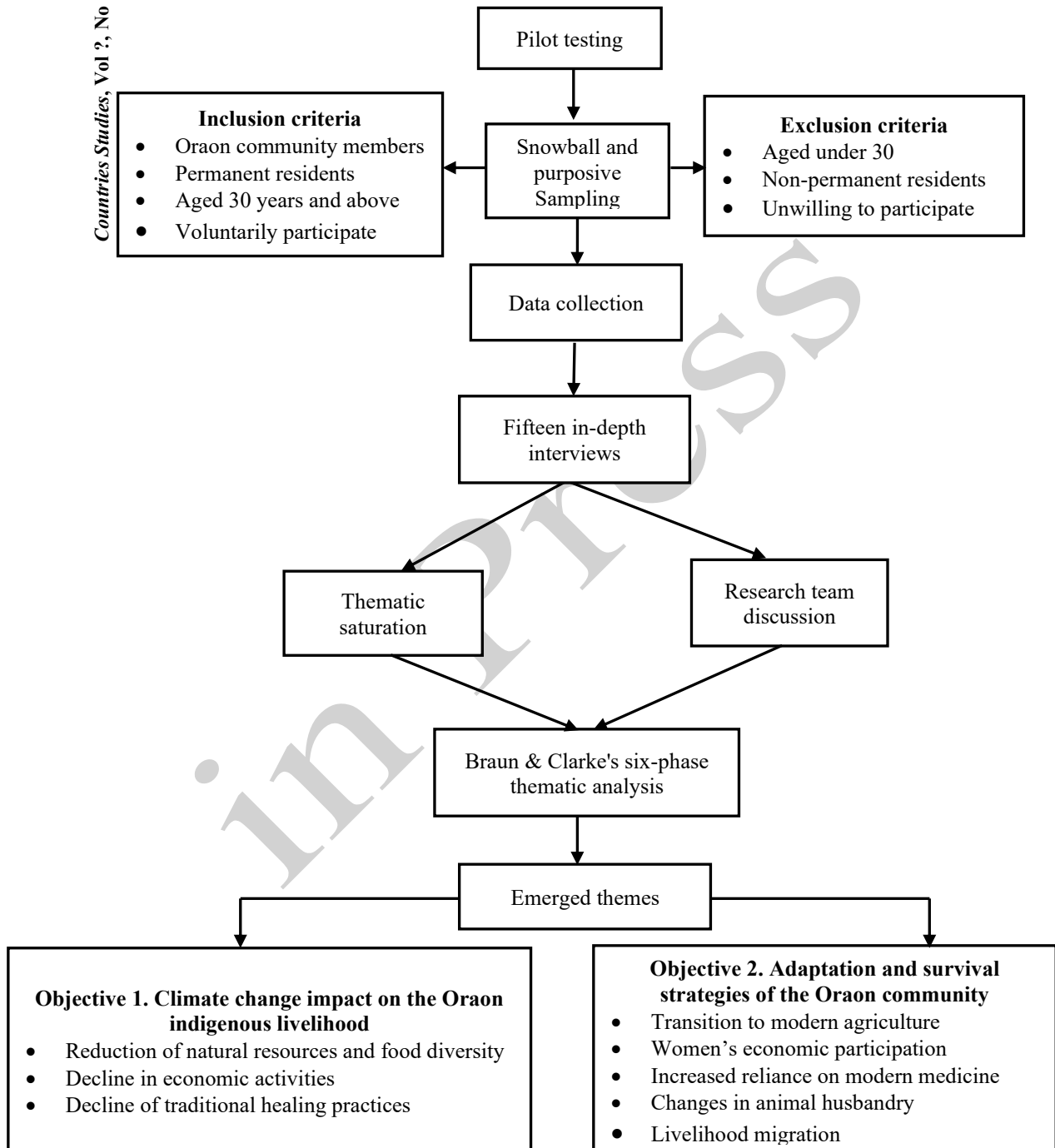
2.2. Study area

The study was conducted in Sheikhpura village, located in Rangpur Sadar Upazila under Rangpur District in northern Bangladesh (Figure 2). The village is home to the Indigenous Oraon community, whose livelihoods mainly depend on agriculture, day labor, and other activities linked to natural resources. Because of its location, the community is especially vulnerable to climate variability, such as irregular rainfall, long periods of drought, and extreme changes in temperature. These climate-related challenges affect crop production, income, food security, and the sustainability of livelihoods. The study area was purposively selected because it hosts a well-established Oraon settlement that has long experienced environmental pressures associated with climate change.

2.3. Participant recruitment and sampling

A combination of purposive and snowball sampling was employed in recruiting participants. The first sampling method that was used was purposive sampling to select those members of the Oraon community who had first-hand experience of climate change and its impact on their life. The researchers first communicated with local leaders to select those who would match the eligibility requirements. Local leaders were only involved in introducing the researchers and identifying potential participants, but they did not select participants or attend the interviews or provide informed consent. This method reduced the possible impacts on participants' choices and responses. Following the initial interviews, people who were interviewed were asked to refer additional eligible people in order to identify them by snowball sampling. The research team contacted each referred individual separately and conducted a

screening of the eligibility criteria and invited participation on a voluntary basis.



Source: The authors

Figure 1. Methodological flow of the study

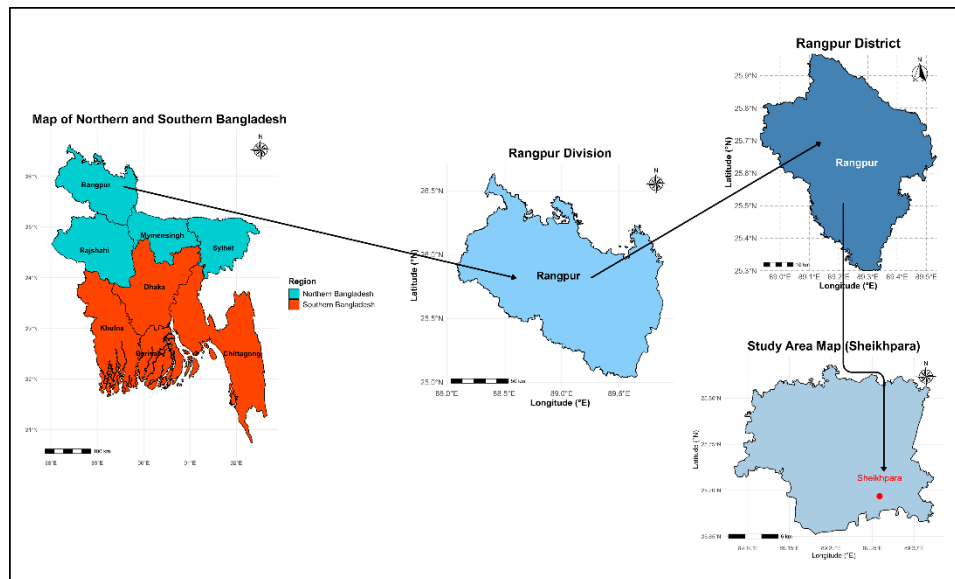


Figure 2. Geographic location and boundaries of the study area in Sheikhpara, Rangpur, Bangladesh

2.4. Inclusion criteria

- Members of the Indigenous Oraon community
- Permanent residents of Sheikhpara village
- Adults aged 30 years and above
- Willingness to voluntarily participate

2.5. Exclusion criteria

- Individuals below 30 years of age
- Non-permanent residents
- Individuals unwilling to participate

Prior to recruitment, screening of the potential participant was completed with inclusion and exclusion criteria. The study involved only those who met all the eligibility criteria and who volunteered for the study.

2.6. Pilot testing

Before the main data collection began, the semi-structured interview guide was pilot tested with two individuals from a nearby Indigenous community that shared similar social, cultural, and livelihood characteristics. The pilot test was carried out to check whether the interview questions were clear, culturally appropriate, and relevant to the study. The feedback was used to make some minor adjustments to enhance the wording, sequence, and probing of the questions. Those who participated in the pilot test were not part of the final study sample.

2.7. Data collection

Data were collected through 15 in-depth semi-structured interviews conducted between November and December 2024. Before each interview, the researcher confirmed participants' eligibility based on the predefined inclusion and exclusion criteria and obtained informed consent. The interviews were carried out in Bangla so that participants could express their experiences and perceptions more comfortably, and each interview lasted around 30 to 45 min. However, participation was entirely voluntary, and no pressure was exerted by any intermediary to obtain information from the participants. During the interviews, the locations were selected according to the participants' preferences. Data were mainly collected at their homes and in other quiet and neutral places within the community where they could express their opinions freely.

Table 1. Participant characteristics

Characteristic	Category	Frequency (n=15)	Percentage (%)
Sex	Male	09	66.67
	Female	06	33.33
Marital status	Married	15	100.0
Age range	30–72 years	15	100.0
Education level	Illiterate	08	53.33
	Primary	05	33.33
	Secondary	02	13.33
Occupation	Farmer	04	26.67
	Basket weaver	02	13.33
	Housewife	03	20.00
	Shopkeeper	03	20.00
	Daily laborer	01	6.67
	Rickshaw puller	01	6.67
	Sweeper	01	6.67

The sample size was determined through thematic saturation. Data collection and preliminary analysis were conducted concurrently, allowing the researchers to monitor the emergence of new codes and themes throughout the study. Following each interview, transcripts and field notes were reviewed, and initial coding was undertaken to identify emerging patterns. After the thirteenth interview, no substantially new codes or themes emerged. Two additional interviews were conducted to confirm that subsequent interviews reinforced existing themes rather than generating new conceptual insights. Saturation was confirmed through discussions among all authors, who agreed that sufficient depth and diversity of perspectives had been achieved.

Participants were selected from different age groups and livelihood backgrounds to ensure a wider range of experiences. With informed

consent, all interviews were audio-recorded, and detailed field notes were taken to capture contextual observations, non-verbal expressions, and early analytical insights, which added depth to the data.

2.8. Researcher reflexivity

The interviews were conducted by the primary researcher, who had no previous personal relationship with the participants. Throughout the research process, reflexive notes were maintained to critically examine the researcher's position, assumptions, and possible biases. This helped increase transparency and reduce the influence of personal perspectives on the interpretation of the data.

2.9. Data analysis

The collected data were analyzed using Braun and Clarke's (2006) six-phase thematic analysis framework, a widely used qualitative method for identifying, examining, and interpreting patterns within textual data. The audio recordings were transcribed verbatim in Bangla and then translated into English by the third author who is fluent in both languages.

During analysis, translated transcripts were constantly checked against the Bangla transcripts and audio recordings to ensure that the original meaning was retained. Special efforts were made to capture culturally specific terms, idioms and expressions that were not directly translatable into English. In these instances, the original meaning of the participants was translated conceptually, rather than literally, to preserve their meaning and to ensure it was comprehensible to an international audience. When necessary, the research team discussed any issues about translation until consensus was reached. The analysis followed the six phases proposed by Braun and Clarke (2006): (1) familiarization, (2) initial coding, (3) theme development, (4) theme review, (5) theme definition, and (6) report production.

During the familiarization phase, the first author repeatedly read the Bangla transcripts while listening to the audio recordings to gain a comprehensive understanding of participants' experiences. Initial codes were generated inductively by identifying meaningful segments of text that reflected participants' perceptions of climate change, livelihood changes, and adaptation strategies. The coding process remained flexible, allowing new codes to emerge as additional transcripts were reviewed. Similar codes were then grouped into broader categories based on conceptual similarity. These categories were subsequently reviewed, compared across all interviews, and refined into candidate themes that captured shared patterns while preserving important variations in participants' experiences. Themes were repeatedly reviewed against the coded extracts and the complete dataset to ensure internal coherence and clear distinctions between themes before they were defined and named.

Both inductive and deductive coding strategies were applied to capture patterns emerging from the data as well as those informed by the research objectives. Initial codes were generated manually and later reviewed independently by a second researcher to improve the reliability of the analysis. The codes were organized in Microsoft Excel to allow for systematic comparison across different transcripts. An audit trail was also maintained to document coding decisions, theme development, and analytical reflections, which helped ensure transparency and strengthen the rigor of the analysis. Themes were developed based not only on their frequency across the 15 interviews but also on their conceptual depth and relevance to the research objectives. Special attention was given to variations in responses according to age, occupation, and educational background of the participants.

Repeatedly, candidate themes were revised by comparing them with individual coded extracts, and the entire dataset, to understand that they captured the experiences of the participants. Themes that significantly overlapped were combined, and themes with little support were either merged into broader themes or deleted. Themes were finalized by considering their conceptual richness as well as relevance to the research objectives, not just by how many times they were mentioned.

2.10. Trustworthiness

Credibility, transferability, dependability and confirmability were used to ensure rigour. The credibility was enhanced by the adoption of triangulation of methods, using both interviews and field notes and peer discussions for the purpose of improving the coding process. Transferability was supported with detailed contextual information on the setting and participants for this study. The systematic audit trail that captured the research process ensured the dependability of the research, and the reflexive journaling ensured that the initial understandings and interpretations were critically examined and that the final themes were well grounded in the perspectives of the participants.

2.11. Ethical consideration

The study protocol was reviewed and approved by the Ethical Review Committee of the Research and Extension Office, Begum Rokeya University, Rangpur, Bangladesh (Ref. No.: ERC/REO/BRUR/26). Participants were told the objectives of the research, how the research was conducted, and their rights as participants. Verbal informed consent was obtained before each interview. Confidentiality and anonymity of the participants were ensured by the use of pseudonyms and the removal of identifying information. All participation was voluntary, and it was made known that people could drop out of this study at any time without penalty.

3. Results and findings

This section presents the findings derived from 15 in-depth interviews conducted with members of the Oraon indigenous community living in Sheikhpura village of Rangpur district. Thematic analysis was used to explore the impacts of climate change on livelihood systems and the adaptation strategies adopted by community members.

Table 2. Emerged themes reported by 15 participants

Objective	Themes	Participants reporting (n=15)
Impacts of climate change on livelihood systems	Reduction of natural resources and food diversity	11
	Decline in economic activities	08
	Decline of traditional healing practices	12
	Transition to modern agriculture	12
Adaptation and coping strategies	Women's economic participation	5
	Increased reliance on modern medicine	14
	Changes in animal husbandry	14
	Livelihood migration	09

3.1. Impacts of climate change on the livelihood systems of the Oraon Indigenous community

3.1.1. Reduction of natural resources and food diversity

Eleven participants (n=11) out of the 15 respondents reported that the depletion of fish, birds, and forest resources has created a growing food security crisis in Sheikhpura village. According to the participants, the drying up of rivers and inadequate drainage systems have damaged fish habitats, thereby negatively affecting traditional livelihood practices.

One respondent stated:

“In the past, I used to catch fish from the river, but now the river has almost dried up. I used to hunt birds in the forest. There are no fish in the river and no birds in the forest” (P2, male, farmer, age 65).

This account illustrates how declining water availability has disrupted traditional fishing practices that previously contributed to household food security and income generation.

Another respondent explained:

“We used to cook our own food, but now we have to buy food from the market, and there is not always enough money” (P11, female, basket weaver, age 57).

This statement suggests that environmental degradation has increased dependence on purchased food, exposing households to greater economic insecurity.

An elderly participant further added:

“The situation is not the same anymore. There is no

water, so the fish have disappeared. Also, the city's drainage water has destroyed the river's biodiversity" (P5, male, basket weaver, age 67).

The participant directly links biodiversity loss to environmental degradation, indicating that ecological changes are undermining the natural resource base on which the community traditionally depended.

3.1.2. Decline in economic activities

Over the past two decades, livelihood opportunities have declined considerably. More than half of the respondents (n= 8) reported engagement in low-income informal occupations such as fishing, bird hunting (e.g., doves and storks), animal hunting (e.g., wild boar and rabbits), and small-scale animal husbandry.

One respondent explained:

"About 10–15 years ago, I worked in different occupations at different times. Now I work as a sweeper in the city corporation" (P7, male, sweeper, age 68).

This quotation shows how environmental change has reduced traditional livelihood opportunities, forcing people into insecure wage-based employment.

Another participant stated:

"Now I only make baskets and sell them in the market. It is not enough for the family, but there is no other option" (P5, male, basket weaver, age 67).

This reflects the declining economic viability of traditional occupations and the limited availability of alternative livelihood options.

3.1.3. Decline of traditional healing practices

Twelve out of fifteen participants (n= 12) reported a significant decline in shrubs and medicinal plants due to shrinking forest cover and environmental changes, including reduced rainfall and rising temperatures. As a result, access to medicinal plants has become increasingly limited, contributing to the gradual disappearance of traditional healing systems.

One elderly respondent shared:

"I used to go to the forest and collect medicinal plants. I treated various illnesses of my family and neighbours using those plants. But sadly, there are no trees anymore" (P12, male, farmer, age 72).

This quotation illustrates the close relationship between biodiversity

and Indigenous healthcare practices.

Another participant noted:

“We had our own treatment system, but now those medicinal plants no longer exist. So, we have lost our own methods of treatment” (P15, male, shopkeeper, age 45).

The participant highlights that the disappearance of medicinal plants has resulted in the erosion of traditional medical knowledge rather than merely a change in treatment methods.

3.2. Adaptation and survival strategies of the Oraon Indigenous community

3.2.1. Transition to modern agriculture

Twelve out of fifteen participants (n= 12) reported that rapid depletion of forests and natural resources due to climate change has constricted the traditional forest-based agricultural system of the indigenous community. Consequently, they have shifted to modern agricultural systems to maintain the stability of their livelihoods. In the past, they relied on forestry and traditional crop production, but environmental changes, deforestation, and declining land availability have made this approach unsustainable.

One respondent said:

“In the past, we had a forest-based agriculture system. But now with the reduction of forests, we have shifted to modern agricultural systems like maize, rice, wheat, and vegetables” (P13, male, day laborer, age 49).

This statement suggests that modern agriculture has become a necessary adaptation to declining forest resources rather than a voluntary technological transition.

Another noted:

“Our forefathers were farmers. But now they can't grow crops in the plains. So, we have moved to the modern agricultural system” (P4, female, housewife, age 59).

The quotation reflects how environmental pressures have constrained traditional farming systems and encouraged reliance on commercially oriented agriculture.

3.2.2. Women's economic participation

Five out of fifteen respondents (n=5) reported running small shops or tea stalls at home, reducing household workload while contributing to family income. These small businesses allow women to earn modest but regular income, supporting household economic stability.

One female respondent said:

“I have a small shop in front of my house. It earns a little money” (P1, female, shopkeeper, age 37).

This illustrates how women are diversifying household income through small-scale enterprises in response to climate-related livelihood uncertainty.

Another added:

“A few days ago, I opened a grocery store. Sales are down, but it is still running” (P8, female, shopkeeper, age 35).

The quotation suggests that these businesses provide an important coping strategy despite generating only modest income.

3.2.3. Increased reliance on modern medicine

Fourteen out of fifteen participants (n= 14) stated that they use modern medical treatment from hospitals and clinics instead of traditional methods. Previously available medicinal plants are nearing extinction due to climate change, and drought has disrupted their natural growth, making traditional medical practices increasingly difficult.

One respondent shared:

“In the past, I used to treat ailments with herbs. Now the disease is more, so I go to the hospital or get medicine from the pharmacy” (P3, male, farmer, age 72).

This quotation illustrates how declining access to medicinal plants has altered healthcare-seeking behaviour.

Another expressed:

“Due to drought and deforestation, traditional medicine is no longer available, so I am forced to take modern treatment” (P9, housewife, age 53).

The participant explicitly links environmental degradation with the abandonment of traditional healing practices.

3.2.4. Changes in animal husbandry

Fourteen out of fifteen respondents (n= 14) reported that instead of rearing pigs, there is now a preference for cows, goats, and poultry. Pig rearing has declined due to reduced open land and feed shortages caused by climate change. Moreover, cows and goats are more socially acceptable, particularly among those who have migrated to cities.

One respondent explained:

“I used to do a lot of pig farming earlier. But now there is no land, no food. So many people have stopped” (P3, male, farmer, age 72).

This quotation demonstrates how environmental constraints have reduced the feasibility of traditional pig farming.

Another said:

“Many of our villagers have moved to the city. They don't eat pork anymore. Pig farming was part of our traditional livelihood, but now cows and goats are reared more because they are socially acceptable” (P14, male, farmer, age 52).

The participant also highlights the influence of changing social norms alongside environmental pressures.

3.2.5. Livelihood migration

As local livelihood opportunities have declined due to environmental degradation and the loss of agriculture and natural resource-based income sources, some community members have been compelled to migrate from rural areas to urban centers in search of alternative employment. A smaller proportion of respondents (n= 9) reported that sustaining livelihoods in the village has become increasingly difficult, leading households to consider migration as a necessary survival strategy.

One respondent explained:

“We used to live together, but there are no jobs in the area, so she moved to the city with her family” (P10, female, housewife, age 45).

This quotation illustrates how declining local employment opportunities are reshaping household livelihood decisions.

Another participant stated:

“My eldest son used to farm here, but work as a labourer is not available throughout the year, so he has moved to the city” (P6, male, rickshaw puller, age 58).

The statement suggests that migration has become a necessary response to persistent livelihood insecurity rather than a preferred economic choice.

4. Discussions

4.1. Climate change and food insecurity

An important finding of this study is that climate change has significantly reduced the availability of freshwater fish, different species of birds, and forest resources that traditionally contributed to the food systems of the Oraon community. As biodiversity-based food sources decline, households are becoming increasingly dependent on market-based food systems. These findings are consistent with previous

studies showing that climate-induced environmental degradation weakens Indigenous food systems and reduces access to locally available biological resources (Asuamah Yeboah, 2024; Saxena et al., 2016). However, this study extends previous research by demonstrating that climate-related food insecurity among the Oraon people is not only a problem of reduced food availability, but also represents a deeper transformation of their livelihood autonomy. The transition from a semi-self-sustaining food system toward market dependency reflects a form of constrained adaptation, where communities adjust their livelihood practices within increasingly limited choices shaped by environmental degradation and socio-economic vulnerability (Mirzabaev et al., 2023). Rather than representing successful adaptation, this transition exposes households to a dual vulnerability: ecological dependency due to declining natural resources and economic insecurity due to limited purchasing capacity.

4.2. Collapse of traditional economic activities and the reconstruction of livelihoods

The findings of the present study indicate that environmental degradation is significantly undermining traditional livelihoods such as fishing, hunting, basket making, and forestry labour. This observation is consistent with previous research showing that climate change reduces access to natural resource-based livelihoods among Indigenous and marginalized communities (Roy et al., 2023). Nevertheless, our findings contribute to the existing literature by showing that livelihood change among the Oraon community is not merely occupational diversification but represents a structural transformation from relatively autonomous resource-based livelihoods toward insecure market-dependent employment. As environmental resources decline, participants increasingly engage in low-income informal labour and unstable wage-based activities (Dodman et al., 2023). This suggests that adaptation is occurring under conditions of restricted agency, where people are not choosing new livelihood pathways because they provide greater opportunities, but because traditional options are becoming increasingly unavailable. Therefore, these changes represent constrained adaptation rather than transformative resilience.

4.3. Decline of traditional medicine and the loss of indigenous knowledge

The findings of the study revealed that the decline of medicinal plants and forest biodiversity has seriously affected the traditional healthcare systems of the Oraon people. These findings support previous research highlighting the vulnerability of Indigenous knowledge systems under environmental change (Ford et al., 2020; United Nations Development Programme, 2024). Traditional medicine is not only a healthcare practice but also an important mechanism for intergenerational knowledge transmission, cultural identity formation, and ecological

understanding. The present study extends this understanding by demonstrating that biodiversity loss affects not only material resources, but also the social and cultural foundations through which Indigenous communities interpret and respond to environmental change (Billiot et al., 2019; Datta et al., 2024). The disappearance of medicinal plants represents a form of cultural erosion, where climate change gradually weakens Indigenous epistemological systems and reduces opportunities for knowledge continuity. Thus, adaptation to environmental change may simultaneously involve survival and cultural loss

4.4. Transition to modern agriculture: resilience or compulsive adaptation?

The transition from traditional forest-based agriculture to modern agricultural practices has emerged as one of the major adaptation responses among participants. Similar agricultural transitions have been reported among other climate-vulnerable communities (Mugambiwa, 2018). However, this study challenges the assumption that agricultural modernization among Indigenous communities always reflects successful adaptation (Chaudhuri, 2018). The findings indicate that the shift toward maize, rice, wheat, and vegetable cultivation is largely a response to the declining viability of traditional agricultural systems rather than a voluntary process of innovation. In this context, modernization functions as a forced survival strategy, where communities adopt externally dominant agricultural practices because existing livelihood systems can no longer sustain them. While these changes may provide short-term livelihood stability, they may also introduce long-term vulnerabilities through increased dependence on commercial seeds, fertilizers, irrigation systems, and market fluctuations. Therefore, the agricultural transition observed among the Oraon people should be understood as constrained adaptation, where immediate survival needs are prioritized at the expense of long-term livelihood independence and ecological sustainability.

4.5. Gender-based understanding of women's economic participation and adaptation

Increased participation of Oraon women in small-scale businesses and home-based income-generating activities indicates that climate-related livelihood pressures are transforming household labour distribution and gender roles. These findings align with previous studies demonstrating that women often assume greater economic responsibilities during climate crises (Chowdhury et al., 2026). However, the findings caution against interpreting this increased participation as straightforward empowerment. Instead, women's expanding economic roles represent a complex adaptation process in which livelihood responsibility is transferred onto women without necessarily reducing existing domestic burdens (Bryan et al., 2023). This reflects the feminization of adaptive responsibilities, where women become central actors in household

survival strategies while simultaneously experiencing increased labour pressure and vulnerability.

4.6. Increasing dependence on modern medicine and institutional dependence

The decline of traditional medicinal resources has increased the Oraon community's dependence on modern healthcare systems. Although this transition may represent practical adaptation, it also indicates the weakening of Indigenous health autonomy (Ford, 2012). The findings suggest that this shift should not be interpreted simply as voluntary modernization. Instead, it represents an adaptation pathway shaped by environmental loss, where communities are compelled to replace culturally embedded healthcare practices with externally dependent systems (Shah et al., 2025). This form of forced adaptation may improve access to biomedical services while simultaneously contributing to the erosion of Indigenous knowledge and self-reliance.

4.7. Changes in animal husbandry practices and cultural adaptations

The recent transition from traditional pig farming toward cattle, goat, and poultry rearing among the Oraon people reflects changing animal husbandry practices. Participants associated these changes with land scarcity and reduced resource availability, while social acceptance and broader cultural influences also contributed to this transformation. Previous studies have similarly demonstrated that climate change and socioeconomic transformation influence livestock systems and Indigenous livelihood practices (Demi & Ahmed, 2025; Dey, 2023; Khan et al., 2026). Our findings further indicate that such livelihood adjustments involve cultural trade-offs. Although alternative livestock practices may provide economic benefits, the decline of culturally significant pig farming reflects broader transformations in identity, tradition, and social practices (Nahar et al., 2015). Thus, adaptation is not only an ecological or economic process but also a cultural transition involving both survival opportunities and cultural losses.

4.8. Livelihood migration: compulsory survival strategies

Although migration was reported by relatively few participants, it represents an emerging adaptation pathway among the Oraon community. Increasing environmental pressure and declining livelihood opportunities are encouraging some households to seek employment in urban areas. Previous studies indicate that migration often emerges when local adaptive capacities become insufficient, functioning as a distress-based response to climate stress (Gilmore et al., 2024; Hoque et al., 2026). This study extends existing migration literature by emphasizing that migration among the Oraon people is not primarily a voluntary livelihood improvement strategy but a compulsory survival mechanism (Chandra & Paswan, 2020). In this context, migration represents the outcome of shrinking local

opportunities rather than successful adaptation. It reflects the limits of local resilience and highlights how climate vulnerability can push marginalized communities toward uncertain livelihood pathways.

4.9. Holistic analysis: erosive adaptation rather than transformative resilience

The findings of this study demonstrate that adaptation strategies among the Oraon community are largely reactive, restricted, and associated with significant social, cultural, and economic trade-offs. Although these communities demonstrate adaptive capacity through livelihood diversification, agricultural transitions, healthcare adjustments, and migration, these responses are accompanied by declining traditional occupations, weakening Indigenous knowledge systems, reduced cultural continuity, and diminished livelihood autonomy. These findings support and extend the theoretical concept of “erosive coping” proposed by Davies (1993), which suggests that marginalized communities often respond to climate change through short-term survival strategies that gradually undermine long-term social, cultural, and economic sustainability. Notably, this study demonstrates that Indigenous adaptation should not be assessed only by the presence of adaptive actions; rather, attention must also be given to the consequences and trade-offs associated with these responses. In the case of the Oraon community, adaptation represents a complex process in which survival is achieved through strategies that simultaneously reduce vulnerability in the short term while creating new forms of dependency and cultural erosion in the long-term.

4.10. Implications

The results of this study emphasize the importance of developing climate adaptation policies that are culturally responsive and ecosystem-based for Indigenous communities in Bangladesh. The first priority for adaptation programmes should be on restoration of wetlands, rivers and community forests for the conservation of biodiversity, restoration of fish habitat, and maintenance of ecosystem services including for the support of Indigenous livelihoods.

Second, medicinal plants need to be safeguarded via community-managed conservation and sustainable harvesting, thereby maintaining traditional healthcare practices and biodiversity conservation projects.

Third, there is a need to bolster targeted livelihood assistance (such as climate resilient agriculture, sustainable livestock production, and locally appropriate livelihoods) with financial and technical support to mitigate the livelihood insecurity and distress migration.

Fourth, Indigenous knowledge needs to be documented, passed on and integrated into local climate adaptation planning processes, including through meaningful engagement with communities.

Fifth, gender-responsive adaptation policies should enhance women's access to adaptation training, finance, markets and social

protection to mitigate the differential burden of climate adaptation. Finally, locally-led adaptation programming should be the mechanism for Indigenous communities to prioritise and pursue solutions that align with their cultural values and environmental knowledge.

These interventions, we believe, would enhance the long-term resilience of the community and preserve the cultural heritage and livelihood security of the Oraon community and other plainland indigenous peoples in Bangladesh.

While this study is targeted on the Oraon Indigenous community of northern Bangladesh, its conclusions are pertinent to the lives of other Indigenous and climate vulnerable communities in the Global South. Indigenous people face some of the same problems in other parts of Asia, Africa, Latin America and the Pacific, such as the degradation of their environment, insecurity of their livelihoods, limited institutional support and the loss of traditional knowledge. Thus, policy makers, development agencies and non-governmental organizations can translate these recommendations and incorporate Indigenous knowledge into climate planning, ensure that adaptation is community-led, build climate-resilient livelihoods and make adaptation policy culturally appropriate and socially inclusive. These strategies can help improve and ensure fair and sustainable climate adaptation in nations with similar environmental and socio-economic circumstances.

5. Conclusion

This study analyzed climate change-induced livelihood changes and adaptation strategies among the Oraon Indigenous people of northern Bangladesh. The findings reveal that climate change is profoundly affecting the natural resource-dependent lifestyle of the Oraon community, bringing about multidimensional changes in their traditional livelihoods, food systems, healthcare practices, and sociocultural structures. The depletion of fish, forest resources, medicinal plants, and other natural resources has reduced food diversity, constrained livelihood opportunities, and increased dependence on market-based resources. At the same time, significant changes have occurred in traditional medicine, animal husbandry practices, agricultural systems, and social roles. The study also shows that the Oraon community is adopting various adaptation strategies, including a transition to modern agricultural practices, increased women's economic participation, greater reliance on modern healthcare services, changes in animal husbandry practices, and selective livelihood migration.

However, most of these adaptation strategies are not voluntary developmental changes; rather, they are forced survival strategies adopted in response to environmental degradation, economic hardship, and structural marginalization. As a result, while these adaptations create opportunities for short-term survival, they may undermine

Indigenous knowledge, cultural identity, livelihood autonomy, and social resilience in the long term. Therefore, this study concludes that climate change is not merely an environmental crisis for the Oraon community but also a driver of profound social, economic, and cultural transformation. The community's current adaptation process reflects constrained adaptation and erosive coping rather than genuine resilience. To ensure the sustainable adaptation of the Indigenous peoples of the plains, including the Oraons, policymakers should adopt environmentally sustainable conservation measures, strengthen livelihood protection, preserve Indigenous knowledge systems, and implement culturally sensitive adaptation policies. Without such interventions, climate adaptation processes may gradually erode the cultural heritage, traditional knowledge, and livelihood sustainability of Indigenous communities.

6. Limitations of the study

There are some methodological limitations that need to be taken into account when interpreting the results of this study. First, the study took place in one Oraon settlement, Sheikhpura village in Rangpur, which means the results may not be extended to other settlements or other Indigenous groups, including the Oraon, in Bangladesh, which may face different socio-cultural, economic or environmental conditions. Thus, results must be viewed as local in nature and not as representative of all Indigenous communities.

Secondly, the sample was relatively small, with 15 participants, and the study was exploratory with an in-depth qualitative design, emphasizing in-depth exploration of participants' lived experiences rather than statistical representativeness or generalization of the findings to a larger population. Next, the results rely on self-reported information and might be subject to recall bias or individuals' perceptions of adaptation measures and climatic changes.

Lastly, the study lacked environmental measurements and longitudinal data, which precludes it from confirming the reported changes in the environment and to assess the changes and adaptations of livelihoods over time.

While these limitations exist, the study has a wealth of contextual details of the Oraon's lived experiences and their responses to adaptation, which could prove fruitful for analytical studies in other Indigenous contexts. Future studies should use larger and more varied samples, multiple study locations, mixed-methods and longitudinal designs to increase the transferability and strength of evidence concerning the impacts and adaptation of climate change among Indigenous communities.

Conflict of interest

The author declared no conflicts of interest.

Ethical considerations

The author has completely considered ethical issues, including informed consent, plagiarism, data fabrication, misconduct, and/or falsification, double publication and/or redundancy, submission, etc.

The authors used ChatGPT-4 solely to improve grammatical accuracy and sentence structure. No AI tools were used to generate data, analyze the results, or influence the findings of this study.

Ethical approval of publication: ERC/REO/BRUR/26)

Data availability

The dataset generated and analyzed during the current study is available from the corresponding author on reasonable request.

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