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Understanding the Indigenous Knowledge, Beliefs, and Practices on Climate Change and Disaster Preparedness

Lemuel John M. Ferrer [1]
1 – Abra State Institute of Sciences and Technology
lemueljhon27@gmail.com

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Abstract

The objective of this study is to addresses the lack of documented indigenous beliefs on climate change in Poblacion, Lacub, Abra, and the gradual decline in traditional knowledge transmission. It aimed to systematically document indigenous forecasting methods, analyze environmental interpretations, and cross-check the beliefs with scientific concepts to reinforce their validity. Relatively, findings indicate that all 30 elderly respondents (10 males and 20 females) demonstrated observational awareness of climate change, primarily recognizing it as shifts in seasonal patterns. However, their understanding remained experiential rather than scientific. Male respondents contributed more beliefs across all categories, suggesting that gender influences knowledge retention and transmission. Moreover, the study identified traditional indicators related to flora, fauna, celestial bodies, weather elements, and natural phenomena, with fauna being the most frequently cited. Cross-checking these beliefs with scientific principles supported their validity and relevance, though respondents noted the diminishing reliability of some indicators over time. Also, findings emphasize the need for documentation and preservation efforts, as many beliefs are no longer actively discussed. Last, conclusions further underscore the potential of integrating traditional and scientific approaches to enhance climate resilience, particularly within indigenous communities.

Keywords: *Indigenous Knowledge System & Practices, Climate-related Disasters, Compendium, IEC Campaign, Cross-checking*

I. INTRODUCTION

Background of the Study

Climate change is reshaping the weather patterns worldwide, and the Philippines, being an archipelago surrounded by rising sea levels, is feeling its impact more than ever. Being fueled by human activities such as the burning of fossil fuels, the clearing of forests, and industrial pollution (IPCC, 2021), climate change has now brought strong typhoons, unpredictable droughts, erratic rainfall, and the consistent rise of sea levels. These changes have threatened food security, disrupted ecosystems, strained freshwater supplies, and challenged disaster efforts (DENR, 2020).

For Filipinos, climate change is not just a distant concern but a lived reality. Coastal communities are facing increased risks as the ocean comes closer to their homes; on the other hand, farmers are struggling with extreme droughts that throw off traditional planting cycles (PAGASA, 2018). The study of Tongson et al. (2017) found that the prolonged dry spells have become more unpredictable, particularly affecting provinces like Isabela, Cagayan, and Iloilo, where rice and corn production are dependent on stable rainfall. Meanwhile, typhoons have grown stronger, leaving extreme devastation in their paths. The destruction caused by Super Typhoon Haiyan (STY Yolanda) in 2013 and Super Typhoon Egay (Doksuri) in 2023 underscores the increasing severity of these disasters and the urgent need for stronger resilience measures (Israel & Briones, 2014; NDRRMC, 2023).

When STY Egay struck the Philippines in July 2023, it unleashed violent winds, torrential rain, and massive floods across northern Luzon. The province of Abra and the nearby provinces experienced the force of the storm. They experienced landslides, infrastructure damage, agricultural losses, and widespread civilian relocations (NDRRMC, 2023). Communities and municipalities were cut off as heavy rains caused heavy landslides on municipal and provincial roads, especially in the upper (elevated) municipalities. The heavy rains also submerged roads and homes in the lower municipalities, leaving residents dependent on local and national relief operations (PAGASA 2023). Prolonged power outage caused by damaged electricity lines, damaged communication lines, and shortages of potable water made recovery even harder, which highlighted the vulnerability of affected areas (CARE Philippines 2024).

In the face of these worsening climate disasters, Indigenous knowledge offers a vital but often overlooked resource for disaster preparedness and adaptation. For several generations, indigenous communities in the Philippines have relied on traditional environmental indicators, including shifts in the wind, changes in the level of rivers, as well as the behavior of animals to predict storms or typhoons and prepare for disasters (Reyes et.al., 2019). For instance, the people in Ifugao closely observe changes in water levels and the behavior of birds and insects to anticipate the arrival of rainfall. These natural indicators helped them schedule their rice planting activities in the Banaue Rice Terraces, ensuring the optimal growth of crops (Ananayo 2019). In addition, the communities of Aeta in Zambales monitor the flowering of bamboo because they believe that it signals an impending drought. When they observed this sign, they began to store water and food supplies in advance to prepare for it (Monsato et al., 2025).

This Indigenous knowledge that is passed down through generations by oral traditions and lived experiences has helped communities take early precautions to safeguard lives, livelihoods, and properties. However, with the stable rise of modernization, most local residents now depend on government-issued advisories, satellite technology, and social media updates for impending disasters (Banes et.al., 2021). As a result, indigenous knowledge of climate change and disaster preparedness is slowly fading.

Currently, there is no existing written or oral documentation on indigenous knowledge, beliefs, and practices on climate change and disaster preparedness at Lacub, Abra. Hence, with the steady decline in the transmission of this indigenous knowledge, this study sought to systematically document these indigenous knowledge, beliefs, and practices particularly in barangay Poblacion; cross-check the data with scientific concepts to validate traditional knowledge; write a compendium out of the data; and present the findings to the locals through the conduct of Information, Education, and Communication (IEC) Campaign on climate change and disaster preparedness in partnership with the office of the Local Disaster Risk Reduction Management (LDRRM).

Statement of the Problem

The study aimed to systematically document indigenous knowledge, beliefs, and practices related to climate change and disaster preparedness at Poblacion, Lacub, Abra; analyze how the indigenous community interprets environmental signs associated with these changes; and cross-check the gathered beliefs with scientific concepts to reinforce their validity.

Specifically, it sought to answer the following questions:

1. What is the demographic profile of the respondents, and how does sex relate to their climate-related beliefs?
2. What is the understanding of the respondents about climate change?
3. What indigenous beliefs associated with climate change do the respondents believe in, and what scientific concepts support them?
4. Do these beliefs affect the respondents' understanding of climate change and their preparedness for climate-related disasters?
5. Do the respondents still observe these beliefs arise, and under what circumstances are they being discussed/propagated?
6. What traditional actions or preparations do the respondents undertake based on their cultural beliefs?

Research Objectives

1. To systematically document Indigenous knowledge, beliefs, and practices on climate change and disaster preparedness
2. To analyze how the indigenous community interprets environmental signs related to climate change.
3. To cross-check the gathered beliefs and practices with scientific concepts to support the existing indigenous knowledge.
4. To write a compendium of Indigenous knowledge, beliefs, and practices on climate change and disaster preparedness

5. To enhance disaster preparedness through the conduct of an Information, Education, and Communication (IEC) Campaign on climate change and disaster preparedness (with the findings integrated) as a post-activity of the study.

II. MATERIALS and METHODS

Research Design

The study used a qualitative descriptive method which allowed for an in-depth study of native beliefs about climate change and disaster readiness. The study used phenomenological methods to document the first-hand accounts of community members about traditional environmental knowledge and its effects on resilience and adaptation. Measures of central tendency were used to examine the demographic profile of respondents especially sex which helped create an organized depiction of main population features.

Population and Locale

Barangay Poblacion in Lacub Abra served as the location where participants for purposive sampling were identified through visitation and coordination and consultation processes. The participant count was established during the first survey period. The selection process functioned with the help of "panglakayen" or elders to determine which participants had the most relevant experiences and information to share. The study prioritized participants who lived in the community from birth to present and who were 60 years old or older because they demonstrated credibility through their lifelong residency. The study included a total of 30 participants. The selection of final interview participants depended solely on their availability at the time the house-to-house interview was conducted.

Data Gathering Tool

The tools/instruments below were used to gather data.

a.) *Questionnaire*

The researcher created a semi-structured questionnaire for data collection purposes. Five experts who specialize in content assessment validated the research instrument. The content validation process utilized the framework which Getaz (2007) developed for instrument evaluation to confirm alignment between the instrument and its intended purpose. Each expert assessed the items by using a 5-point Likert scale to provide feedback which included improvement suggestions. The researcher analyzed expert feedback to determine content validity index through the average congruency percentage (ACP) method described by Waltz, Strickland and Lenz (2016). The responses from the 5-point Likert scale were transformed into percentages through the calculation of their proportions. The instrument items showed 90% or higher ACP values during analysis which demonstrated their validity together with reliability for the study application.

b.) *Communication Letter*

The researcher presented the study permission letter to the barangay captain of Poblacion in order to establish clear professional communication of information. The researcher hand-delivered the letter along with an explanation of the study objectives to the barangay captain. The researcher promptly handled any inquiries or issues that the Poblacion barangay captain had about the study during this interaction.

c.) *Certificate of Consent and Disclosure / Notice to Proceed*

The study required a certificate of consent together with disclosure from five recognized Indigenous Peoples (IP) elders before obtaining the National Commission on Indigenous Peoples' (NCIP) Notice to Proceed (NTP). After completing all necessary steps, the researcher received official NCIP approval, which granted the NTP, enabling the study to proceed under both regulatory and ethical requirements.

d.) *Consent Form*

Research ethical standards required the presentation of a consent form to participants who signed it before joining the study. The consent approval was incorporated within the translated and transcribed participant responses.

e.) *Cellphone / Audio Recorder*

The researcher employed mobile phone technology to record participant dialogues, along with maintaining questionnaire-based note-taking procedures. Through this approach, the researcher achieved precise discussion recording, which permitted them to concentrate on verbal exchanges instead of extensive note-taking. The recorded audio maintained subtle information which enhanced the data analysis quality. The researcher informed respondents through verbal communication about recorder usage before interviews started to maintain study transparency and ethical standards.

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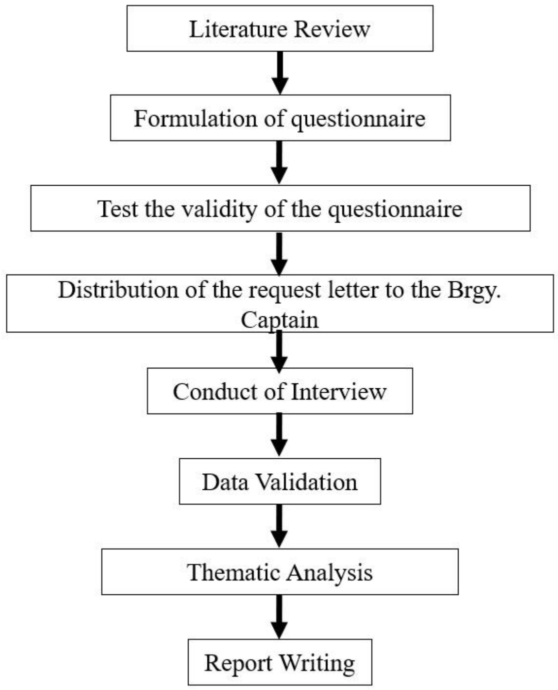
Data Gathering Procedure

Figure 1. Data Gathering Process



The procedure, as outlined in Figure 1, began with a comprehensive review of related literature on indigenous knowledge, beliefs, and practices concerning climate change and disaster preparedness. This review facilitated the identification of research gaps, the establishment of theoretical frameworks, the refinement of research questions, and the development of a strong contextual foundation for the study. Based on insights from the literature review, a questionnaire aligned with the research objectives was carefully designed.

The questionnaire received validity testing through a tool that derived its framework from Getaz's 2007 study before distribution. Revisions were made based on the results to ensure the instrument's robustness. Formal letter was presented to the barangay captain after this step to inform them about the study and to obtain their approval for conducting the research. The letter contained detailed information about the study objectives together with its importance and the roles that community members would play during the research process. In addition, certificate of consent together with disclosure from five recognized Indigenous Peoples (IP) elders were secured before obtaining the National Commission on Indigenous Peoples' (NCIP) Notice to Proceed (NTP). After completing all necessary steps, the researcher received official NCIP approval, which granted the NTP, enabling the study to proceed under both regulatory and ethical requirements.

After the final approval of the questionnaire, interviews took place with the chosen participants. The research process started with participant briefing about the study and followed by obtaining consent before distributing the questionnaire. The collected data underwent validation checks to verify accuracy and completeness by analyzing for data inconsistencies and missing values and errors. Microsoft Word encoded participants' responses and printed them for respondent validation which confirmed the translation accuracy of their original perspectives.

After validation the qualitative data underwent thematic analysis to discover repeating patterns about climate change perceptions and traditional forecasting approaches and local adaptation methods. The documented beliefs were organized into three separate categories which included Terrestrial Flora and Terrestrial Aerial and Aquatic Fauna and Heavenly Bodies Weather Elements and Natural Phenomena.

The research findings were compiled into a complete report which included an introduction, literature review, methodology, findings, discussion, conclusions and recommendations to form the entire research paper.

Statistical Treatment of the Data

The analysis of collected data relied on Descriptive statistics and Measures of Central Tendency (MCT) to provide summary interpretations. The study measured respondents' beliefs and practices through their answer frequency and their classification into response categories. The systematic classification of beliefs and practices into three categories included Terrestrial Flora; Terrestrial, Aerial and Aquatic Fauna; and Heavenly Bodies, Weather Elements, Natural Phenomena to achieve comprehensive analysis of indigenous environmental knowledge.

Thematic Analysis

The research paper began by dividing native forecasting traditions through their operational usage into four main classes which included typhoon indicators together with precipitation indicators drought indicators and seasonal shift indicators. After analyzing participant responses the researcher implemented a second stage of coding that organized beliefs through natural indicators which encompassed animal behavior along with plant behavior and water level changes and lunar appearance and seismic activity and wind direction and star positions and dewdrop presence. Most of the forecasting beliefs centered around animal and plant behavior which led the researcher to establish three main thematic groups: (1) Beliefs on Terrestrial Flora, (2) Beliefs on Terrestrial, Aerial, and Aquatic Fauna, and (3) Beliefs on Heavenly Bodies, Weather Elements, and Natural Phenomena.

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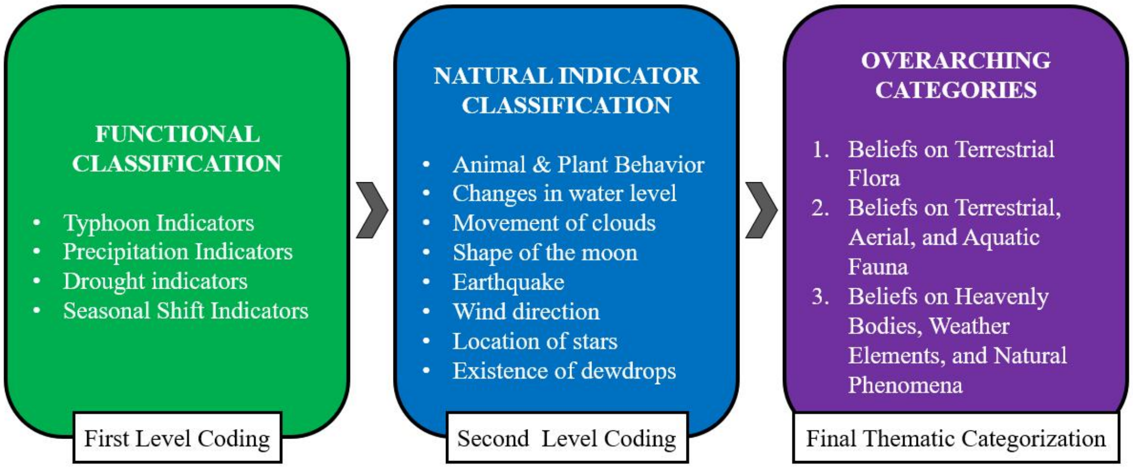
Figure 4. Thematic Coding



The researcher applied scientific concepts to develop thematic classifications which are both culturally meaningful and supported by empirical evidence. The initial category represents Beliefs on Terrestrial Flora. This category consists of all plant-related indicators which show how seasonal vegetation cycles affect climate predictions yet participants did not mention aquatic flora. Researchers support this category through the field of phenology which studies seasonal plant cycles. Scientific evidence demonstrates that flowering pattern changes and leaf shedding and plant growth patterns match environmental variables including temperature changes and soil moisture variations and humidity adjustments thus affecting climate predictions (Hassan et al., 2023).

The second category which is Beliefs on Terrestrial, Aerial, and Aquatic Fauna comprises predictions derived from animal behavioral patterns. The ethological principles which study biological responses to atmospheric variations align with these observations. Research demonstrates that insects along with birds and mammals modify their behavior when barometric pressure falls and when wind currents shift and humidity levels change thus indicating upcoming storms and climate transformations (Buckley et.al., 2023). Scientific research has demonstrated that abnormal dragonfly flight patterns together with early bird migration and aquatic species irregular movement patterns serve as markers for predicting severe weather occurrences (Veerabhadrappa et al., 2024).

The last category named Beliefs on Heavenly Bodies, Weather Elements, and Natural Phenomena groups celestial observations together with atmospheric patterns and geological events. Astronomy together with meteorology and geophysics provide the basis for this classification system. Scientists have monitored star positions together with lunar cycles to understand seasonal changes and tidal patterns while cloud motion and wind direction along with dewdrop development reflect atmospheric humidity and condensation rates and air pressure systems (Tahiluddin et al., 2023). Earth tremors represent seismic activity which scientists associate with geological stress patterns that could indirectly affect environmental changes (Chen, 2020).

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III. RESULTS and DISCUSSION

The research findings are presented in thematic order which highlights main narratives about climate-related beliefs and practices that emerged from the analysis. The research focused on discovering the beliefs together with practices that people from Poblacion Lacub Abra hold about climate change as well as how these affect their disaster preparedness strategies. Specifically, it sought to answer the following questions:

1. What is the demographic profile of the respondents, and how does sex relate to their climate-related beliefs?

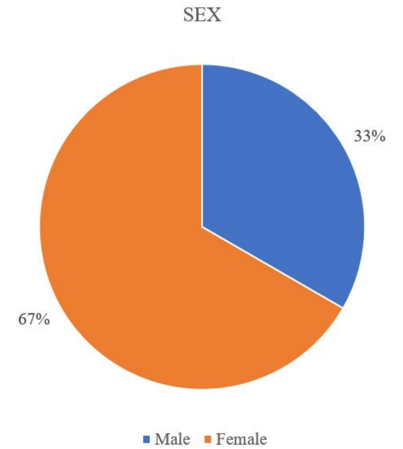

Figure 5. Respondents' Sex

The respondents were chosen based on their availability during the interview phase. According to the data from the Municipal Social Welfare and Development Office (MSWDO), Lacub, Abra, the main source of livelihood for the people of Lacub is farming. The number of elderly females is also greater than that of males, being 86 and 70, respectively. When the researcher visited houses, most male elderly people were not around since they stayed on their farms, leaving their wives to take care of the house, which led to more female respondents being interviewed.

Table 1 *(see next page)* presents the number of beliefs given by each respondent, highlighting notable differences between male and female responses across various categories. In the Flora category, male respondents provided the highest number of beliefs, with a maximum of two (2) beliefs recorded. A similar trend is observed in the Fauna category, where male respondents contributed up to four (4) beliefs, surpassing female respondents. In the Heavenly Bodies, Weather Elements, and Natural Phenomena (HB, WE, & NP) category, both sexes demonstrated equal contributions, with the highest number of beliefs per respondent recorded at one (1). However, when examining the total number of beliefs given, male respondents consistently provided more, with the highest individual count reaching six (6) beliefs, while the highest recorded from female respondents was four (4). On average, male respondents exhibited a greater tendency to share multiple beliefs across all categories compared to their female counterparts.

Table 1. Number of Beliefs Shared per Respondent

Female	Flora	Fauna	HB, WE, & NP	Total per Respondent
1	1	2	0	3
2	1	2	0	3
3	1	1	0	2
4	1	2	0	3
5	1	0	0	1
6	1	1	0	2
7	1	2	1	**4**
8	1	1	0	2
9	1	1	0	2
10	1	1	1	3
11	1	0	1	2
12	1	1	0	2
13	1	1	0	2
14	1	0	1	2
15	1	**3**	1	5
16	1	0	1	2
17	1	1	0	2
18	1	1	0	2
19	1	2	1	**4**
20	1	3	0	**4**
Total	**20**	**25**	**7**	**52**
Average	**1**	**1.25**	**0.35**	**2.6**

Male	Flora	Fauna	Others	Total per Respondent
1	1	0	1	2
2	1	3	1	5
3	1	2	1	**4**
4	1	1	1	3
5	**2**	2	0	**4**
6	1	0	0	1
7	**2**	**4**	0	**6**
8	1	2	0	3
9	1	2	0	3
10	1	0	0	1
Total	**12**	**16**	**4**	**32**
Average	**1.2**	**1.6**	**0.4**	**3.2**

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The findings match those of other global studies that show the gender differences in sharing and keeping environmental and climate-related Indigenous knowledge. For example, Singh Saud and Bhandari (2020) found that men often have more knowledge about the environment and climate because of their roles in traditional leadership and land-based activities in Indigenous communities in Nepal. Similarly, Tahiluddin et al. (2023) reported that men typically lead in environmental forecasting among fisherfolk and elders in Tawi-Tawi, Philippines, especially in reading celestial and atmospheric signs. Additionally, Lee (2025) pointed out that although both men and women contribute to traditional ecological knowledge, men usually remember more about climate patterns and land management due to their farming duties and decision-making roles in managing resources.

This pattern suggests that gender may influence the depth or frequency of traditional climate-related knowledge shared, potentially reflecting differences in exposure to environmental observations, cultural roles, or engagement with indigenous knowledge systems.

2. What is the understanding of the respondents about climate change?

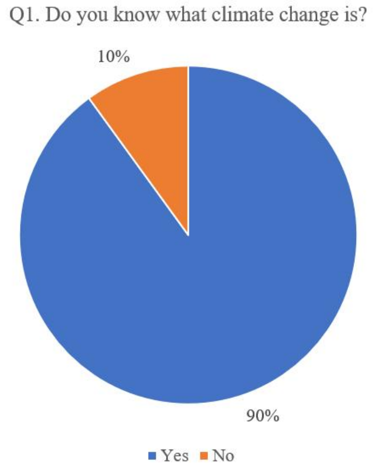

Figure 6. Awareness of Climate Change

When the respondents were asked if they knew what climate change was, 90% of them responded “Yes,” and the remaining 10% responded “No.” *(see figure 5)*

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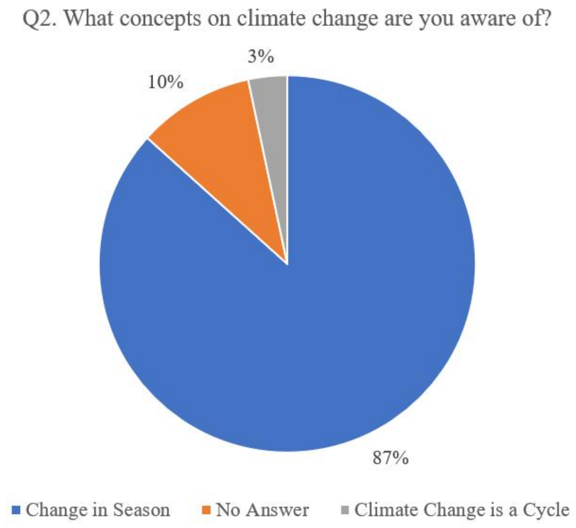

Figure 7. Respondents' Concept of Climate Change

The respondents overwhelmingly recognized climate change as a shift in seasonal patterns *(see figure 7)*, with 87% noting changes in the wet and dry seasons. Many observed that rainy seasons no longer follow their traditional timeline, with periods of rainfall occurring later than expected or extending irregularly. Likewise, prolonged extreme heat was widely reported, with respondents emphasizing that dry seasons have intensified, lasting longer than in the past.

Several respondents specifically cited their awareness on climate change based on the changes in temperature trends, mentioning that heat levels remain high for extended months, disrupting traditional expectations for seasonal cooling. One respondent emphasized, *"The change in season that we say, rainy and dry. It's also different now because the months for rainy season changed and it is extremely hot now"*. Others pointed out reduced rainfall and shrinking rivers, reinforcing concerns about water availability and local ecosystems. As another respondent noted, *"The change in the timeline of the rainy season. Now there are a few rains and the rivers have gotten smaller."* Additionally, urbanization, particularly the rise of cement-built houses, may contribute to the perceived increase in heat, suggesting a link between land-use changes and climate conditions. One respondent explained, *"Before, it was still cold during this month, but now it's so hot. But it is still the same as before, it's only hotter now because of the increasing number of houses built with cement"*.

According to PAGASA (2025), the timeline of seasons in the Philippines has shifted, with noticeable changes in the onset and duration of the wet and dry seasons. Traditionally, the rainy season spanned June to November, while the dry season covered December to May, further divided into the cool dry season (December to February) and hot dry season (March to May). However, recent climate observations indicate delays in the start of the rainy season, with prolonged dry periods extending beyond May, leading to higher temperatures and intensified drought conditions in some regions. A respondent reflected on this shift, stating, *"Before, during the month of June, rainy season starts. Now, it's late and it's so hot."*

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One respondent also described climate change as a natural cycle, comparing it to seasonal shifts and ecological transformations. They emphasized that change is inevitable, much like how organic matter decomposes and gives rise to new life. Using the analogy of carabao manure breaking down and producing mushrooms, the respondent explained, *"Climate change naturally happens, it's the same as the change in seasons. Climate change is a cycle, like the manure of a carabao, it is fresh right, then it decomposes, then something new will come out of it, like the mushrooms".*

The respondents demonstrated a general awareness of climate change, primarily identifying it as a shift in the timing of wet and dry seasons. Their understanding was based on direct observations of seasonal irregularities, such as delayed rainfall and prolonged dry periods. However, no respondent provided a scientific explanation for these changes, indicating that their knowledge is rooted in experiential observations rather than established climatological principles. This suggests that while they recognize the manifestations of climate change, their awareness remains at a phenomenological level, lacking engagement with meteorological or environmental science frameworks that explain its underlying mechanisms.

3. What indigenous beliefs associated with climate change do the participants in the study believe in?

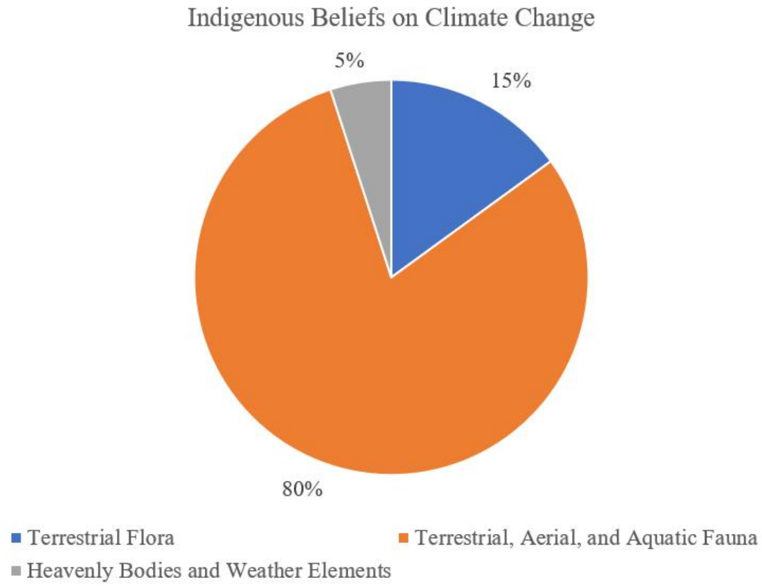

Figure 8. Categorized Beliefs on Climate Change

The beliefs gathered were categorized into three: Terrestrial Flora; Terrestrial, Aerial, and Aquatic Fauna; and Heavenly Bodies, Weather Elements, and Natural Phenomena. Most of the beliefs were related to fauna, as shown in Figure 8.

Beliefs Related to Terrestrial Flora

Indigenous communities hold deep-rooted beliefs about terrestrial flora, viewing plants not only as ecological components but as sacred entities intertwined with their cultural and

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spiritual traditions (see table 2). These beliefs influence conservation practices, medicinal applications, and rituals, reflecting a profound understanding of the environment that has been passed down through generations. In relation to this, all the respondents believe that when bamboo produces flowers or fruit, it signals an impending drought, which could lead to a food and water crisis. A respondent noted, *"Our ancestors before told that, if puser bamboos and bamboos bear fruit, it means crisis of food and there will be drought."* Another explained, *"Every three years, the puser bamboos flowers then die. That's what they say a time of drought."* According to the journal published by Biswas et al. (2021), the phenomenon of bamboo flowering is often linked to environmental stress and is considered a rare event for many species. Scientifically, mass flowering in bamboo is associated with end-of-life reproduction cycles, where certain species, particularly those that exhibit gregarious flowering, bloom simultaneously after decades of vegetative growth, followed by widespread die-off. This event can lead to ecological shifts, including reduced soil moisture retention and changes in microclimate conditions, which may exacerbate drought-like effects.

In addition, stress-induced flowering in bamboo is triggered by environmental factors such as drought, fire, and pruning, with hormonal responses—particularly increased levels of abscisic acid (ABA)—playing a role in regulating flowering time. Comparative genomic studies indicate that bamboo flowering is influenced by photoperiod, vernalization, and hormonal regulation, with drought acting as a potential cue for reproductive cycles (Pal, et al., 2016). While indigenous beliefs associate bamboo flowering with impending drought, scientific studies suggest that this phenomenon could either signal environmental stress or serve as an indicator of cyclical climate variations (Biswas, S. et al., 2021). The correlation between bamboo flowering and drought conditions warrants further investigation to understand its predictive potential in climate science.

Table 2. Beliefs Related to Flora

Category	Indigenous Belief	Scientific Explanation	Validation	Citation
Terrestrial Flora	When bamboo (*puser bamboo*) produces flowers or fruit, a drought is coming, leading to food and water shortages.	Bamboo flowering signals environmental stress and can reduce soil moisture, worsening drought effects.	Matches known climate responses of bamboo species.	Biswas et al., 2021
	Bamboo flowers every three years before dying, signaling drought.	Stress-induced flowering occurs due to drought, fire, or pruning, regulated by plant hormones.	Supported by studies on bamboo reproductive cycles.	Pal et al., 2016
Terrestrial Flora	Bumps on the youngest leaf of sugarcane indicate the number of typhoons in a given	Leaf bumps may result from environmental stress, nutrient deficiencies, or genetic	Requires further validation for predictive accuracy.	

Category	Indigenous Belief	Scientific Explanation	Validation	Citation
	year, with larger bumps signifying stronger typhoons.	factors, not direct meteorological signals.		
Terrestrial Flora	When Carabao mangoes bloom, summer is approaching.	Mango flowering is triggered by dry conditions and temperature changes, marking seasonal transitions.	Matches known phenological cycles of tropical fruit trees.	Cavalcante, 2022; Garcia-Barreda et al., 2021

On the other hand, a respondent believes that the youngest leaf of sugarcane can indicate the number of typhoons expected within the year, explaining, *"When the youngest leaf of a sugar cane has bumps in it, you count it from the bottom to the tip. The number of bumps will tell how many typhoons will come in that specific year, and if there is a large bump, it means that there will be a strong typhoon."* The presence of bumps on the youngest leaf of sugarcane could be associated with environmental stressors, including fluctuations in temperature, soil conditions, or water availability, rather than serving as a direct meteorological indicator. Scientifically, irregularities in leaf texture may result from factors such as nutrient deficiencies (particularly calcium or silica), pest activity, or genetic variation in sugarcane growth patterns (Singh et al., 2019). While indigenous observations link these bumps to typhoon frequency and intensity, current meteorological science relies on large-scale atmospheric patterns like El Niño-Southern Oscillation (ENSO), sea surface temperatures, and barometric pressure systems to predict typhoons (Wang et al., 2021). However, local agricultural knowledge often emerges from long-term environmental observation, and some studies suggest that plant responses—such as leaf deformities—may signal seasonal climatic variations, though further empirical research is needed to validate such claims (Garcia et al., 2021).

Meanwhile, another respondent believes that the flowering of Carabao mangoes foretells the arrival of summer, explaining, *"When the native mangoes here produce flowers—the Carabao mangoes—you will know that it will be summer soon."* The flowering patterns of mango trees, including native and Carabao mangoes (*Mangifera indica* L.), are closely linked to seasonal climatic conditions. Mangoes generally require dry periods and specific temperature fluctuations to initiate flowering, which aligns with the transition toward summer. Scientifically, mango flowering is influenced by photoperiod (day length), temperature, and drought stress (Cavalcante, 2022). Many tropical mango varieties bloom when there is a drop in temperature followed by prolonged dry conditions, signaling the onset of summer. The Carabao mango, which thrives in warm, humid climates, follows a flowering cycle that typically aligns with dry-season transitions, making it a reliable seasonal indicator. The indigenous observation that native mango trees begin flowering before Carabao mangoes suggests a phenological pattern, where early-blooming varieties act as biological markers for upcoming seasonal shifts. Similar studies have shown that fruit-bearing trees are sensitive to climate variability, making traditional

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ecological knowledge valuable for understanding localized weather cycles (Garcia-Barreda et al., 2021).

Beliefs Related to Terrestrial, Aerial, and Aquatic Fauna

Indigenous communities have long observed and interpreted the behaviors of terrestrial, aerial, and aquatic fauna as indicators of environmental change, seasonal cycles, and even spiritual significance. These beliefs, rooted in deep ecological knowledge, guide traditional practices in agriculture, hunting, and conservation. Many of these interpretations align with modern ecological studies, reflecting a sophisticated understanding of wildlife patterns and their interactions with climate and habitat conditions. By documenting these beliefs alongside scientific concepts, the relationship between traditional wisdom and environmental science becomes clearer, offering valuable insights into biodiversity conservation and climate adaptation strategies.

Table 3. Beliefs Related to Fauna

Category	Indigenous Belief	Scientific Explanation	Validation	Citation
Aerial Fauna	Observing white birds (*Kuwapo/Puwapo*) flying in a V-formation or appearing in large numbers signals an incoming typhoon.	Birds sense barometric pressure drops before storms and adjust flight patterns to avoid harsh conditions.	Aligns with bird migration responses to atmospheric changes.	Sprague et al, 2018; Burnside et al, 2021
	The appearance of *Kuwapo/Puwapo* signals a transition in weather patterns, particularly toward the wet or dry season.	Seasonal temperature shifts influence bird migration, aligning with monsoonal wind patterns.	Matches known migration adaptations.	Kolecek et al., 2020; Tanedo, 2022
Aerial Fauna	When *pippingaw* birds make noises, a typhoon is coming.	Birds vocalize more in response to barometric pressure drops and environmental stress before storms.	Supports avian sensitivity to weather changes.	Bermudez-Cuamatzin et al., 2020
Aerial Fauna	When *wik-wik* or *siggakok* birds vocalize more at dawn, rain is coming.	Increased humidity and atmospheric shifts before the rainy season trigger vocalization in certain bird species.	Matches observations on birds responding to climate variations.	Bermudez-Cuamatzin et al., 2020
Aerial Fauna	If the other type of eagle makes a sound, drought is coming.	Raptors adjust vocal activity due to environmental stressors. Dry	Consistent with studies on bird responses to prey availability and	Martinez-Ruiz et al, 2023; Navares-

Category	Indigenous Belief	Scientific Explanation	Validation	Citation
		conditions may cause food scarcity, increasing vocalization for territorial defense and signaling distress.	atmospheric shifts.	Alegre et al., 2025
Aquatic Fauna	Freshwater snails moving away from riverbanks indicate an approaching typhoon.	Snails migrate to higher ground before heavy rainfall and flooding.	Consistent with aquatic invertebrate survival strategies.	Zhang et al, 2024; Frifer, 2016; Qiu et al, 2022
Aquatic Fauna	When crabs move away from the river, a typhoon is coming.	Crabs relocate to avoid flooding and strong currents caused by excessive rainfall.	Matches known flood-avoidance behavior in aquatic species.	Grzesiuk, 2016; Thabet et al, 2017
Terrestrial Fauna	When cows from the mountains move into town, and *Kuwapo* birds become noisy, a typhoon is coming.	Cattle seek lower elevations for shelter due to barometric shifts before extreme weather.	Reflects livestock adaptation to pre-storm conditions.	Muzzo et al., 2025; Wilcox, 2025; Ha et al., 2022
Terrestrial Fauna	When cows moo at riverbanks, the dry season is coming.	Cattle vocalize more due to thirst stress, responding to declining water availability and rising temperatures.	Matches observed livestock behavior linked to seasonal water scarcity.	Muzzo et al., 2025
Terrestrial Fauna	If the number of leeches in the mountains increases, a typhoon will come.	Leeches become more active in humid conditions and respond to pressure drops before storms.	Matches studies on humidity-driven invertebrate behavior.	Saglam, 2018; Phillips et al., 2020
Terrestrial Fauna	When rice fields are suddenly infested by mice, prolonged rain is coming.	Mice relocate to food-rich areas before extended rainfall to stock up for survival.	Consistent with observations on rodent foraging behavior linked to seasonal shifts.	Rochais et al, 2022
Terrestrial Fauna	When earthworms come to the surface of the land, rain or a typhoon is approaching.	Earthworms emerge in response to water-saturated soil and reduced oxygen levels, anticipating flooding.	Matches studies on earthworm sensitivity to moisture and pressure changes before storms.	Toor et al., 2024
Terrestrial	When earthworms come	Earthworms migrate	Matches studies	Ghosh, 2021

Category	Indigenous Belief	Scientific Explanation	Validation	Citation
Fauna	out, drought is near.	upward when soil moisture decreases to avoid dehydration.	on earthworm sensitivity to moisture	
Terrestrial Fauna	When ants form a line carrying rice seeds or gather food, the rainy season is near.	Ants adjust foraging patterns and increase food collection before prolonged rainfall, avoiding flood-prone areas.	Matches known colony adaptations to seasonal humidity changes.	Baccaro et al., 2016; Khazan et al, 2022; Almeida et al., 2023
Terrestrial Fauna	Empty honeycombs indicate the continuation of the wet season.	Wet conditions limit nectar collection and honey production, reducing stored honey in beehives.	Matches pollination cycles affected by rainfall.	Park et al., 2016; Descamps et al., 2021
Terrestrial Fauna	When *yayas* or *rerer* insects make noises, it signals prolonged dry conditions.	Many insects vocalize more during dry periods due to humidity shifts and seasonal mating behaviors.	Matches insect bioindicator patterns linked to environmental stress.	Low et al., 2021; Massen, 2024
Terrestrial Fauna	When livestock such as carabaos, cows, and pigs suddenly die, extreme heat is the cause.	Prolonged exposure to high temperatures leads to heat stress, organ failure, and dehydration in animals.	Matches studies on heat-related livestock mortality.	Santos et al., 2021; Slayi & Jaja, 2025

Respondents believe that observing the behavior of certain animals provides clues about upcoming weather patterns, indicating either an approaching typhoon or the transition between wet and dry seasons. A particular white bird, known as *Kuwapo/Puwapo*, is widely regarded as a predictor of incoming storms. One respondent shared, *"If white birds fly in the sky showing a V-formation, a typhoon is coming."* Another remarked, *"When kuwapos come out, there will be a typhoon again, and the count of kuwapos is the count of typhoons that will come."* The V-formation is commonly observed in migratory birds such as herons, egrets, and other large wading species. While the formation itself is not a direct predictor of typhoons, birds are highly sensitive to atmospheric pressure changes. Scientific studies suggest that birds can detect drops in barometric pressure, which often precede storm systems like typhoons (Sprague, 2018). When a typhoon approaches, birds may instinctively alter their flight patterns or initiate early migration to avoid strong winds and heavy rainfall (Burnside et al., 2021). This sensitivity may explain why indigenous communities associate the sight of white birds in formation with impending storms. Additionally, local bird movements may shift due to wind currents, making them appear more frequently in structured flight formations. Seasonal shifts, especially cooler temperatures, trigger changes in bird migration patterns (Koleček et al., 2020). Many birds move toward

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warmer coastal or inland regions before the full onset of colder months. In the Philippines, the monsoon system influences bird movement, with the Northeast Monsoon (Amihan) bringing cooler air. Birds flying west may be responding to shifting monsoonal winds and adjusting their migration accordingly (Tanedo, 2022).

Another notable animal behavior that many respondents believe can predict the arrival of a typhoon is the movement of freshwater snails toward riverbanks, away from the water. One respondent shared an observation, *"When many freshwater snails move to the side of the river away from the water, a typhoon is also coming."* Snails, like many invertebrates, can detect changes in atmospheric pressure, which drops significantly before storms and typhoons. This pressure change may trigger avoidance behavior, leading snails to migrate toward higher ground to escape rising water levels caused by heavy rainfall and potential flooding (Zhang et al., 2024). Typhoons cause river current alterations due to increased wind speed and pre-storm pressure fluctuations, which in turn modify dissolved oxygen concentrations in water. The survival chances of snails depend on steady oxygen levels, prompting them to relocate to tranquil shallow waters or riverbanks when oxygen levels drop or turbulence occurs (Frifer, 2016). Some aquatic creatures, including snails, exhibit predictive movement patterns that enable them to escape high-risk flood areas before severe weather hits — a behavior that may represent an adaptive mechanism to avoid displacement by strong currents (Qiu et al., 2022). During extended dry seasons, river water levels decline due to diminished rainfall and elevated evaporation rates. In response, snails that require moist environments burrow into deep water pockets or underground spaces to maintain hydration and enhance survival. Stagnant water that heats up during droughts often accumulates higher levels of organic pollutants, presenting additional threats to snail populations. This decline, or absence, of snails along riverbanks may signal water quality degradation, pushing them into dormancy or more suitable habitats (Altaf et al., 2017).

The respondents identified several animal behaviors that they believe can predict the arrival of a typhoon. One respondent noted that "When pippingaw birds make noises, there will be a typhoon." Scientifically, birds (particularly small passerine and migratory species) adjust their behavior in response to upcoming storms (Bókony et al., 2019). A drop in barometric pressure before a typhoon can trigger increased vocalization, possibly as a warning signal or a response to environmental stress (Mainwaring et al., 2021). As the typhoon nears, wind disturbances affect food sources, such as insects being displaced from vegetation. Birds may become more active and vocal while foraging before the storm disrupts their habitat (Wilcox & Tarwater, 2025). The increased calls of pippingaw birds could indicate heightened activity as they prepare for the storm's impact (Ha et al., 2022).

Another respondent observed that "When cows from the mountains come into town, and *kuwapo* birds are noisy, there is a typhoon." Cattle, like many animals, are highly responsive to barometric pressure shifts. A significant drop in pressure often precedes storms or typhoons (Muzzo et al., 2025). Before extreme weather events, cows may instinctively move to lower elevations, seeking safer terrain with more shelter and protection from strong winds and heavy rainfall. The passage of typhoon systems leads to both reduced temperatures and elevated humidity levels, which could enhance comfort levels for cattle in low-altitude areas (ACASA-BISA, 2025). The storm's approach causes cooler air temperatures with decreased atmospheric stability, which might drive movement toward the town.

A survey participant indicated that "The number of mountain leeches tends to rise before typhoons." The leech population flourishes under wet conditions and shows increased activity when environmental moisture rises (Saglam, 2018). Leeches become more visible when air humidity rises substantially because of low-pressure systems which precede typhoons. The drop in atmospheric pressure, which signals approaching storms, causes leeches to become more active on the surface, thus increasing their visibility in mountain regions (Phillips et al., 2020).

One noted that "When crabs move away from the river, there will be a typhoon." Crabs, particularly freshwater species, instinctively migrate away from rivers before heavy rainfall or storms. This behavior is linked to anticipatory flood avoidance, as excessive rainfall can lead to strong currents that disrupt their habitat (Grzesiuk & Mikulski, 2006). Some crab species also react to changes in water salinity and turbulence before storms. Typhoons often cause fluctuations in river water composition, prompting crabs to move toward stable inland habitats where salinity changes are minimal (Thabet et al., 2017). This suggests an environmental adaptation mechanism, allowing crabs to avoid habitat disturbances caused by extreme weather.

The survey participants also recognized animal behaviors which show signs of moderate rain or the approaching rainy season. A respondent explained that "When the *wik-wik* (a bird similar to a crow but smaller) starts making sounds at dawn it indicates the rainy season is about to begin." Another person claimed "The *siggakok* sounds indicate incoming rain. They believe their noise functions as a water request." Birds modify their vocal patterns based on changes in daylight duration and atmospheric pressure and humidity levels (Bermúdez-Cuamatzin et al., 2020). Some species show increased vocalization during pre-rainy season humidity spikes, especially those which communicate through sound for territorial defense and mating protocols. The frequency of birds' calls changes in response to atmospheric shifts that occur during pre-monsoon periods (Mushtaq Puswal et al., 2022). The increased dawn vocalizations of *wik-wik* and *siggakok* birds before rainfall point to their biological ability to detect climate changes, including falling barometric pressure that predicts wet weather.

A respondent explained that rice fields become vulnerable to mouse infestations during periods of heavy rainfall. The sensitivity of mice to seasonal changes makes them move toward different locations when environmental conditions transform. Mice shift their population toward rice fields, which contain abundant food, as they prepare for extended rainfall conditions. Rodents increase their search for food before prolonged rainfall because moisture changes impact seed supply, driving their behavior to guarantee survival through challenging periods. Seasonal shifts in precipitation and vegetation cover influence rodent movement and foraging strategies, particularly in semi-arid and agricultural landscapes where rainfall alters food availability and habitat structure (Rochais et al., 2022).

Another respondent noted, "When earthworms come to the surface of the land, there is incoming rain or a typhoon." Earthworms emerge on land surfaces before rainstorms and typhoons due to changes in soil moisture and oxygen levels. As rainfall saturates the soil, underground oxygen availability drops, prompting earthworms to surface to avoid suffocation (Toor et al., 2024). Their activity intensifies with rising humidity, making them reliable indicators of impending wet conditions (Opute & Maboeta, 2022). Additionally, earthworms respond to sudden drops in atmospheric pressure (an early signal of approaching storms) by

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migrating upward in anticipation of flooding (Ghosh, 2021). These behavioral patterns reflect their ecological sensitivity to environmental transformations and their role as natural climate forecasters.

Ant behavior serves as a practical way to identify the beginning of the rainy season according to the survey respondents. One respondent said that "ants form lines when carrying rice seeds to indicate the upcoming rainy season." A different respondent stated that "ants appear when the rainy season is approaching." Ants modify their foraging behavior according to signals they detect from their surroundings. They enhance food collection activities to build up resource supplies because wet conditions interrupt movement and nesting sites during the approaching rainy season (Baccaro et al., 2016). Ant societies use organized lines for food transport as a strategy to prepare for environmental stressors such as flooding and reduced mobility (Song et al., 2018). Nest relocations are also observed in response to increased soil moisture and flood risk, with colonies shifting to elevated or drier areas to maintain survival during extended rainfall periods (Khazan et al., 2020). Ant workers carrying rice seeds in organized patterns reflect a colony-level behavioral shift to secure vital resources before their territory becomes unstable. Soil humidity and air moisture fluctuations have been shown to increase ant activity in tropical regions, especially during pre-monsoon periods when environmental cues signal incoming rainfall (Almeida et al., 2023).

A respondent stated that the absence of honeycomb honey during mountain honey collection indicates the beginning of the wet season. Bees need warm, dry weather to successfully collect nectar as their primary food source. Continuous rainfall and elevated humidity levels throughout the wet season restrict bees from flying normally, which decreases their ability to gather nectar. Extended wet periods suppress foraging activity, leading to diminished honey production in combs. Environmental conditions such as rainfall and humidity strongly influence nectar availability in flowering plants, which directly affects honeybee productivity. During wet seasons, colonies tend to reduce brood numbers and reallocate energy toward hive maintenance rather than nectar collection, reflecting a survival-oriented shift in behavior (Park et al., 2016; Descamps et al., 2021).

People who participated in the survey identified specific animal actions which they link to both dry season beginnings and drought situations. A participant reported that rice fields with insect infestations signal the approach of drought. Multiple insect species including leafhoppers, weevils, and aphids show better survival rates in warm, dry environments. Drought conditions lower soil and plant moisture, making crops more vulnerable to insect attacks due to weakened plant defenses (Luo et al., 2024). Low humidity and reduced rainfall create ideal conditions for rapid insect reproduction, often triggering pest outbreaks before prolonged dry periods (Singh et al., 2020). Additionally, natural predator populations such as frogs, beneficial arthropods, and birds tend to decline during drought, allowing pest populations to grow unchecked (Kim et al., 2019). These indigenous observations align with ecological findings, as insect infestations often emerge as early indicators of extended dry weather when predator-prey balances shift.

Another respondent noted, "When earthworms come out, it's like there is drought because they are looking for water." The presence of earthworms on the surface during droughts indicates that these creatures seek water as a survival mechanism. Earthworms require moist

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conditions to survive, and dry soil compels them to rise to the surface in search of hydration. Their movements intensify during drought periods as they relocate toward areas with higher moisture, demonstrating their role as biological indicators of soil dryness (Ghosh, 2021). Earthworms are also sensitive to soil oxygen levels, which decline during drought due to compaction and reduced porosity. This forces them to surface to avoid hypoxic stress and maintain respiration (Klaar et al., 2024). These traditional observations reflect a sound ecological understanding of how earthworm behavior responds to climate-driven changes in soil conditions.

A respondent also observed, "If the other type of eagle makes a sound, there will also be a drought." Eagles and other raptors modify their vocal patterns in response to environmental stressors. During prolonged dry conditions, food availability declines, prompting increased vocalizations for territory defense and distress signaling. These shifts in calling behavior often coincide with prey scarcity and elevated temperatures. Research shows that raptors exhibit heightened vocal and flight activity during hot, dry periods, reflecting thermoregulatory needs and altered foraging strategies (Martínez-Ruiz et al., 2023). Additionally, extreme weather events such as droughts and heatwaves can disrupt raptor behavior, leading to louder and more frequent calls as birds respond to physiological stress and changing prey dynamics (Naves-Alegre et al., 2025). These indigenous observations align with scientific findings, as eagle calls often coincide with environmental changes that signal the onset of drought.

Several animal behaviors linked to extended dry periods and severe heat have been observed through respondent feedback. Respondent observations show that the sound production from *yayas* or *rerer* insects signals the onset of an extended dry period before the rainy season. The mating and communication patterns of cicadas and crickets depend on temperature and humidity indicators for behavioral regulation. During dry periods, insects produce louder vocalizations to attract mates before seasonal transitions. Some species modify their sound patterns based on ambient moisture levels, with vocalization frequency increasing before prolonged dry seasons. These acoustic signals may reflect population surges or stress responses triggered by rising temperatures and reduced predator activity. Indigenous observations align with scientific findings, as elevated insect noise patterns serve as natural indicators of extended dry conditions (Low et al., 2021; Massen, 2024).

A respondent stated, "Cows making noise at riverbanks signal that the dry season is about to start." Cattle require consistent water intake and respond strongly to seasonal changes in water availability. As river levels begin to decline at the onset of the dry season, cows instinctively move toward water sources to secure hydration. Livestock vocalizations increase when animals experience water deprivation, reflecting distress and heightened resource-seeking behavior (Slayi & Jaja, 2025). Heat and dehydration also trigger restlessness and vocalizations among cattle. Rising temperatures disrupt thermoregulation, prompting cattle to seek shaded areas and water bodies to cool down and maintain homeostasis (Santos et al., 2021). The louder vocalizations of cows at riverbanks reflect their physiological sensitivity to environmental stress, making them effective natural indicators of impending dry conditions.

A respondent also observed, "When animals such as carabaos, cows, and pigs suddenly die, it means that the season is extremely hot—that's the cause of their deaths." Prolonged exposure to high temperatures can lead to heat stress and heatstroke in livestock, especially when

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shade and water are insufficient. As ambient temperatures rise, animals struggle to regulate their core body temperature, resulting in dehydration, organ failure, and sudden death (Slayi & Jaja, 2025). Extreme heat also reduces forage quality and water availability, intensifying nutritional stress and increasing mortality risks (Tamboli et al., 2023). Livestock exposed to excessive heat without cooling mechanisms experience reduced feed intake, metabolic imbalances, and circulatory collapse, which can trigger fatal outcomes (Santos et al., 2021). These physiological breakdowns highlight the vulnerability of farm animals to extreme seasonal heat and reinforce their role as indicators of climate stress.

Heavenly Bodies, Weather Elements, and Natural Phenomena

Table 4. Beliefs Related to Heavenly Bodies, Weather Elements, and Natural Phenomena

Category	Indigenous Belief	Scientific Explanation	Validation	Citation
Heavenly Bodies	If the middle portion of the half-moon appears flat, rainfall will be delayed.	The moon's shape can be affected by atmospheric refraction and high-pressure systems, which are linked to dry conditions.	Aligns with known atmospheric and tidal influences on moisture retention.	Kohyama, & Wallace, 2016; Hickey, 2016
Weather Elements	If it rains early in April, rainfall will be continuous; if it arrives late, it will be sporadic.	Early April rainfall supports stable moisture buildup, while late rainfall may signal weak monsoon activity.	Matches seasonal precipitation cycles in tropical regions.	Ge et al, 2021; Villafuerte et al., 2021; Liu et al., 2025
Natural Phenomena	If an earthquake occurs and rain does not follow within a week, the rainy season will be late.	Seismic activity can release atmospheric gases but does not directly influence rainfall patterns. Dry weather following earthquakes may indicate pre-existing climate trends.	Requires further study on seismic impacts on atmospheric moisture.	Strasser et al. 2018
Natural Phenomena	When springs dry up, drought is coming.	Springs depend on groundwater levels, which decline before drought periods due to reduced rainfall and soil absorption.	Matches known hydrological patterns indicating drought onset.	Dai et al., 2018; Valete, 2023
Weather Elements	If the wind blows from north to south, the cold season is coming.	The northeast monsoon (*Amihan*) brings cooler air and lower temperatures, signaling seasonal transitions.	Matches meteorological data on monsoonal wind shifts.	Servando, 2024; Cruz, 2024

Category	Indigenous Belief	Scientific Explanation	Validation	Citation
Heavenly Bodies	A bright star appearing in the east signals the cold season from November to February.	Some bright stars, such as Betelgeuse in Orion, are more visible in the eastern sky during colder months due to Earth's axial tilt.	Aligns with astronomical cycles and seasonal monsoon shifts.	Hamacker et al, 2019; Cruz, 2024
Heavenly Bodies	A bright star appearing in the west signals a water crisis and poor harvest.	Certain celestial objects become more prominent during seasonal transitions toward prolonged dry periods, correlating with climate variability.	Aligns with astronomical cycles and seasonal monsoon shifts.	Hamacker et al, 2019; Becker, 2024
Weather Elements	If there is heavy dew on roofs and grasses, the cold season has returned.	Dew forms when moisture condenses on cooler surfaces during cold nights, indicating seasonal temperature drops.	Matches known humidity and temperature fluctuations in cold months.	Yu et al, 2022; National Weather Service, 2024
Weather Elements	Fast-moving clouds toward the east signal a strong typhoon, while slow-moving clouds indicate only rain.	Typhoons drive strong eastward winds, pushing clouds rapidly. Slow-moving clouds reflect weaker storm systems.	Matches known cloud movement patterns before storms.	Wang & Wu, 2020; NOAA 2024
Weather Elements	Clouds moving westward mark the start of cold winds (*Amihan*).	The northeast monsoon pushes cool air southward, shifting cloud formations.	Matches meteorological data on seasonal wind shifts.	PAGASA, 2024; Cruz, 2024
Weather Elements	Red clouds in the east signal incoming rain, while red clouds in the west indicate dry conditions.	Rayleigh scattering affects red cloud visibility; moisture levels influence precipitation probability.	Supports atmospheric observations on cloud coloration and humidity.	Kher, 2024; Augustine & Smith, 2024; Chow, 2025

The respondents shared beliefs on heavenly bodies, weather elements, and natural phenomena that predict moderate precipitation, cold season, rainy season, dry season, and typhoon. One respondent shared, "Based also from their observation before, if the middle portion of the halfmoon is flat, it will take a long time before it will rain." The moon's apparent shape can be influenced by atmospheric refraction, where variations in humidity, temperature, and pressure affect how light bends through the atmosphere (Kohyama & Wallace, 2016). A "flat-looking" half-moon may coincide with stable high-pressure systems, which suppress cloud formation and delay rainfall (Zhang et al., 2021). Additionally, lunar phases are linked to tidal forces and subtle shifts in atmospheric moisture, with studies showing that rainfall tends to slightly decrease when the moon is overhead due to increased air pressure and reduced relative humidity (Hickey, 2016). While lunar cycles don't directly control precipitation, they may align with seasonal atmospheric patterns, making traditional lunar observations a form of empirical weather forecasting rooted in lived experience.

On the other hand, a respondent noted, "If it rains early in April, the rain will be continuous that's why the farmers will plant, but if the rain comes on the later part of April, the raining will be seldom." In tropical regions, April rainfall often marks the transition between dry and wet seasons. Early April rain may signal the onset of a strong and sustained monsoon, while delayed rainfall can indicate weaker monsoon activity or prolonged dry spells (Ge et al., 2021). Farmers have historically aligned planting cycles with these rainfall patterns, relying on seasonal consistency to optimize crop growth. Early April precipitation enhances soil moisture stability, which supports continuous rainfall and healthy crop establishment (Liu et al., 2025). In contrast, late April rain tends to produce irregular precipitation due to slower atmospheric moisture buildup and weaker convective activity (Villafuerte et al., 2021). The indigenous observation that early rain leads to continuous rainfall aligns with these findings, making it a valuable agricultural decision indicator rooted in empirical climate knowledge.

The respondents mentioned that earthquakes seem to affect the change of seasons. According to one participant, the rainy season would start late if earthquakes occurred without rain within seven days. While scientific research shows that major seismic events may influence atmospheric moisture and cloud formation, they do not directly alter seasonal weather transitions. Earthquakes cause ground displacement, which can release carbon dioxide and methane gases into the atmosphere, subtly modifying local air composition without significantly affecting rainfall patterns (Strasser et al., 2018). A week without rain following an earthquake is more likely a reflection of existing dry weather or delayed monsoon onset, rather than a causal link between seismic activity and precipitation (Villafuerte et al., 2021). Nonetheless, indigenous observations may align with broader climate patterns, as dry spells after earthquakes reinforce community beliefs about seasonal delays, offering a culturally grounded lens into environmental forecasting.

Springs also served as marks of impending drought, as one respondent noted, "When springs dry, it also means drought. Of course, the size of the spring diminishes so you will be able to observe." Springs rely on underground water sources, which fluctuate based on rainfall, soil absorption, and groundwater retention. A drying spring is a clear indicator of reduced water availability, commonly associated with prolonged drought conditions (Lu et al., 2025). Studies confirm that declining groundwater levels often precede drought periods, reinforcing indigenous observations of spring depletion as a sign of incoming dry spells (Valete, 2023). Seasonal droughts result from low precipitation, high evaporation, and rising temperatures, all of which contribute to diminishing spring water levels (Dai et al., 2018).

The direction of the winds also contributed to the forecasting of seasonal transitions. A respondent shared, "If the wind blew from north to south, it's the time of the north wind." In

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tropical climates, wind direction is a key indicator of seasonal shifts. The northeast monsoon, locally known as Amihan, brings cooler, drier air from Siberia and China, typically signaling the onset of the cold season in the Philippines and Southeast Asia (Villafuerte et al., 2021). The observation that north-to-south winds indicate seasonal change aligns with meteorological data, as *Amihan* dominates regional climate patterns from October to March, driven by high-pressure systems over the Asian continent (Servando, 2024). These seasonal wind patterns result from atmospheric pressure gradients between landmasses and oceanic regions, causing cooler northern air masses to push southward and alter humidity and temperature levels (Cruz, 2024).

It was also believed that the stars played an important role in determining shifts in seasons. The location of the big star determines the arrival of the cold and dry season, making it an essential seasonal marker. A respondent noted, "If the big star is located at the east, it's the cold season, during November to February." Additionally, another respondent explained, "When the big star is located at the west, there will be no harvest since there is a water crisis." Many cultures associate bright stars with seasonal transitions. The appearance of prominent celestial objects in the east during certain months may correlate with Earth's axial tilt and regional weather shifts, especially in tropical climates. In the Philippines, November to February marks the Northeast Monsoon *(Amihan)*, which brings cooler temperatures and dry air—aligning with this traditional belief (Cruz, 2024). Bright stars such as Betelgeuse in the Orion constellation rise in the eastern horizon during late-year transitions, reinforcing their role as seasonal indicators (Hamacher et al., 2019). Indigenous knowledge systems often interpret the westward movement of stars as signs of water scarcity and agricultural stress, reflecting lived experiences of drought and crop failure during dry spells (Villafuerte et al., 2021).

The indigenous people likely track stars over extended periods to identify specific seasons through their natural seasonal markers. When bright stars dominate the western sky, this pattern may correspond to approaching dry seasons, as observed in traditional ecological knowledge systems (Becker, 2024). The observation of celestial events in agricultural communities helps link astronomy with environmental forecasting, as water shortages typically follow seasonal transitions. Indigenous star tracking may function as a premonitory indicator to guide agricultural planning and water supply management. Research shows that traditional astronomical systems enabled societies to predict climatic changes by observing star movements that followed regular cycles (Hamacher et al., 2019).

Many people associate dew drops with the arrival of cold weather periods. A participant expressed, "The roof and grass will have many dews when the cold season returns." Dew forms when atmospheric moisture condenses onto cooler surfaces such as roofs and vegetation during nighttime, as these surfaces lose heat through radiative cooling. This process intensifies during colder months (particularly from November to February) when nighttime temperatures drop significantly and relative humidity increases, making dew a reliable natural marker for seasonal transitions (Jia et al., 2019; Khalil et al., 2016). Cold air holds less moisture than warm air, which elevates relative humidity and enhances condensation potential (Yu et al., 2020). Clear skies and minimal cloud cover further accelerate surface cooling, while low nighttime wind speeds reduce evaporation, allowing water droplets to accumulate. The prevalence of stable air masses during the cold season reinforces these conditions, resulting in more frequent and pronounced dew formation (National Weather Service, 2024).

Clouds also play an important role in determining the arrival of typhoons and minimal precipitation. One respondent shared their observation, "If the clouds move fast to the east, there is a strong typhoon, but if they move slower, it's just rain. If the clouds move to the west, it's the start of cold winds." Fast-moving clouds toward the east often indicate strong winds associated with typhoons, as tropical cyclones in the Western Pacific generally move westward, dragging cloud formations along (Wang & Wu, 2020). Meanwhile, slower-moving clouds signal weaker storm activity or localized rainfall, as light precipitation events tend to result from gradual moisture buildup rather than intense wind systems (NOAA, 2024; Dastrup, 2014). When clouds move westward, it may signify the onset of the Northeast Monsoon *(Amihan)*, which brings cooler air and dry conditions from November to February in tropical regions like the Philippines (PAGASA, 2024; Cruz, 2024). Typhoons emerge through low-pressure systems that generate powerful eastward winds before the storm reaches its point of impact. The speed and direction of cloud movement reflect changes in pressure zones, reinforcing the connection between typhoon intensity and fast-moving cloud formations (Wang et al., 2025). Wind patterns associated with monsoonal shifts, such as the Northeast Monsoon *(Amihan)*, transport air masses from north to south, influencing cloud distribution and seasonal temperature variations across tropical regions (Cruz, 2024; PAGASA, 2024).

One respondent observed, "The red clouds appearing in the east mean rain is coming. When the clouds show up in the west it means rain is not coming." Red clouds in eastern skies often signal elevated moisture levels and impending rainfall, as high humidity enhances light scattering through suspended water droplets and aerosols. This reddish hue results from Rayleigh scattering, which intensifies during sunrise and sunset when sunlight travels through a longer atmospheric path, filtering out shorter wavelengths and allowing longer red wavelengths to dominate (Kher, 2023; Chow, 2025). When red clouds appear in the west, it often signals drier air conditions, as low humidity levels reduce cloud condensation and lower the probability of rainfall. This observation aligns with traditional ecological knowledge, where red-tinged sunsets are interpreted as signs of fair weather. Scientific studies confirm that clear sunsets with reddish hues are commonly associated with high-pressure systems, which suppress vertical air movement and cloud formation, reinforcing indigenous insights about delayed or absent rainfall (Augustine & Smith, 2024; NOAA, 2024). The reddish coloration results from Rayleigh scattering, where sunlight travels through a longer atmospheric path during sunset, filtering out shorter wavelengths and allowing longer red wavelengths to dominate, especially in atmospheres with fewer water droplets and more aerosols (Kher, n.d.).

4. Do these beliefs affect the respondents' understanding of climate change and their preparedness for climate-related disasters?

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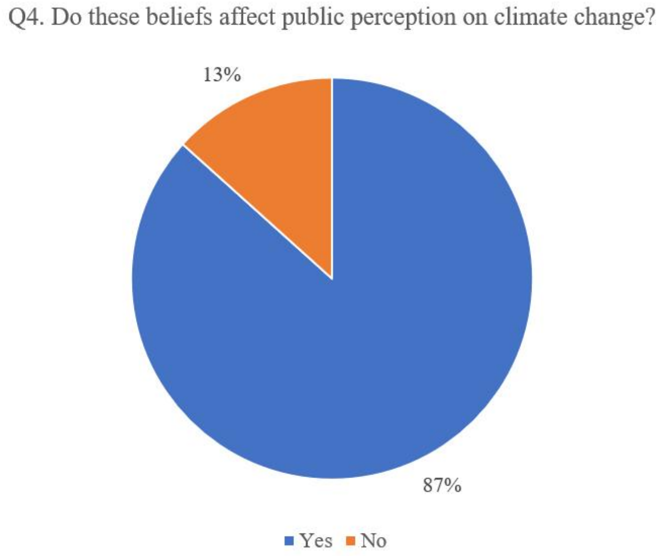

Figure 9. Effect of Indigenous Beliefs on Climate Change Perception

Most respondents, as shown in Figure 8, affirmed that these beliefs still influence how people perceive climate change. One respondent noted, “Yes, because when you observe things like these, it still indicates that there will be typhoons or rains, it means that time is really changing.” This perspective suggests that many individuals still see traditional beliefs as relevant, believing that they help forecast upcoming weather events like typhoons or rain. Another respondent reflected on the enduring presence of these beliefs, noting, “You know, climate change existed for a long time, there are still believers of these beliefs because sometimes, it’s really on point. These beliefs also are their basis for dry and wet season and what months they occur.”

While many respondents still found value in these beliefs, others acknowledged that their reliability had diminished over time. One participant noted, “Yes, it’s still true since these beliefs are on point sometimes, it’s just that they are not on point most of the time nowadays because the times have changed.” Elders, in particular, emphasized that these beliefs were once essential for tracking seasonal changes and understanding weather patterns. However, one respondent lamented the decline in interest among younger generations, stating, “These beliefs have great influence because they explain these phenomena and tell if a disaster is coming before. But now, only a few know these beliefs since no one from the young ones want to listen to these conversations, they prefer holding their cellphones instead.”

Several respondents highlighted how the internet and modern technology have lessened the reliance on traditional beliefs. One respondent stated, “Yes, before since they are what existed before, but now there is the internet that the people can know from.” Another added, “They will still understand climate change during this time even without these beliefs since there is already the internet and Facebook.” This shift towards modern sources of information, such as the internet and social media, reflects how scientific data is now more accessible, allowing younger generations to learn about climate change through formal education and digital platforms rather than relying on indigenous observations.

The research indicates traditional beliefs used to be central to community weather and climate understanding but their impact has diminished substantially among younger demographic groups. The rise of modern technology such as smartphones and internet access has decreased the level of interest and involvement of younger generations with traditional knowledge systems. Elders within the community maintain strong respect for these beliefs because they function as vital tools to forecast seasonal alterations and upcoming catastrophes. The community continues to embrace these indigenous beliefs as fundamental elements of its cultural heritage despite its increasing use of scientific data.

The results show the essential requirement to combine historical understanding with recent scientific knowledge about climate. Traditional beliefs maintain influence on certain community members especially elders but scientific data availability needs to be incorporated into climate change education to prepare future generations for climate challenges. Disaster preparedness and climate adaptation programs need to combine indigenous knowledge with modern scientific approaches to achieve their objectives.

These findings are supported by research conducted both domestically and internationally. According to local research by Dela Cruz and Reyes (2020), Garcia and Alvero (2022), and Santos et al. (2021), traditional knowledge is still important in rural areas, but in order to promote a more comprehensive understanding of climate change, contemporary climate education is becoming more and more important. Comparably, international research by Jones and Lee (2021), Williams and Roberts (2020), and Alvarez and Thompson (2019) demonstrates that combining traditional knowledge with modern scientific methods can result in more successful climate action plans. In order to improve climate change knowledge and resilience, these studies highlight the necessity of educational initiatives that honor regional beliefs while incorporating scientific methodologies.

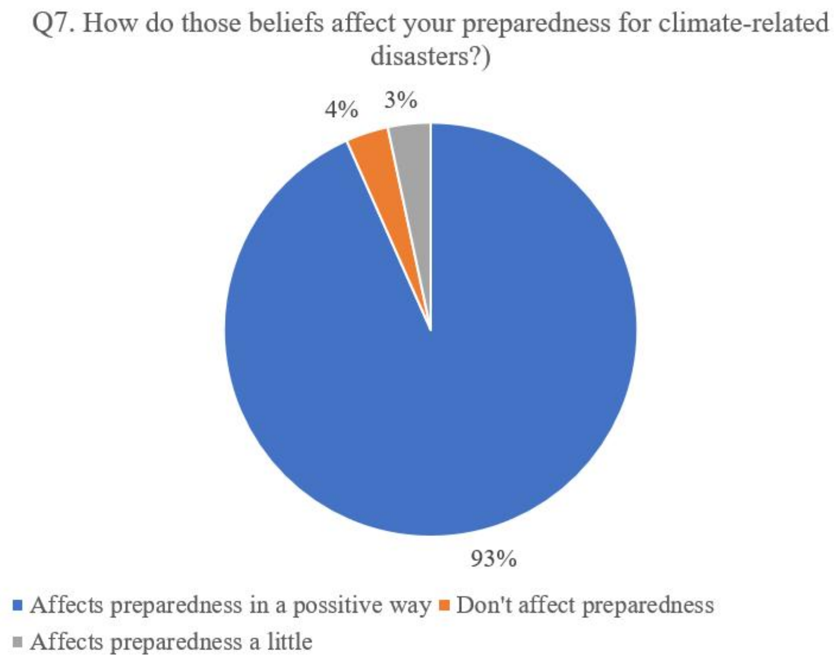

Figure 10. Effect of Beliefs on Preparedness

93% of the respondents concurred that these beliefs improved their level of readiness, as seen in Figure 9. Before the widespread use of contemporary forecasting tools, several respondents emphasized how their community was able to predict typhoons and other disasters by studying natural indicators including cloud movements, animal behavior, and seasonal changes. One respondent shared, “Our observations help us prepare for typhoons because without these beliefs, we wouldn’t know what kind of disaster is coming since announcements on typhoons were not available before.” This reflects the importance of traditional beliefs as an early warning system that guided individuals and families in preparing for extreme weather events, even when formal weather warnings did not exist.

Respondents also pointed out that these beliefs were especially valuable in earlier times, when there were no radios, television alerts, or weather announcements. One participant noted, “We can fully prepare because we already know what will happen. If it comes or not, at least we are prepared, especially since there were no radios yet before, unlike now that if there is a typhoon, the LGU will announce it, like that.” This statement underscores the reliance on generational knowledge for predicting weather conditions and preparing accordingly. Before modern technology, communities relied heavily on the observations of nature to understand the weather patterns, demonstrating the practical benefits of indigenous ecological knowledge in disaster preparedness.

In addition to individual preparedness, these beliefs also contributed to collective disaster readiness. Respondents described how community-wide meetings were once organized to discuss and prepare for impending disasters. One respondent recalled, “Since these are beliefs that were followed during earlier days, they helped a lot since people tend to prepare. People in the town also conduct meetings before, and help one another.” In order to ensure that everyone in the community was ready and had the resources necessary to withstand extreme weather events, traditional knowledge promoted a sense of collective responsibility and action. These community events emphasized the value of collaboration and knowledge sharing in building resilience.

Some respondents acknowledged that early communities were able to prepare for disasters even in the absence of contemporary weather warnings, and they expressed gratitude for these beliefs despite the changes brought about by modernization. “We are thankful that those beliefs existed before because we are all able to prepare even without news from televisions and cellphones,” said one participant, demonstrating how traditional beliefs provided a crucial safety net when other information sources were unavailable, giving families and communities a sense of security and readiness.

However, other responders also pointed out that these ideas are no longer as applicable in the present era, especially since instantaneous climate updates are now possible thanks to technological improvements. According to one respondent, “In these times, not anymore since the beliefs can only be observed sometimes, and there is already the announcement coming from the government if there are typhoons, like that.” This is indicative of the move away from traditional knowledge, particularly among younger generations, and toward modern, scientific forecasting and official alerts. Many people now rely more on digital resources, such social media and government-led weather alerts, to learn about climate-related threats as they have become more publicly available.

Nevertheless, the majority of respondents concurred that their preparation was improved by their traditional beliefs. According to one participant, "It has a big influence, especially on people's preparedness." Consider a time when there was no news, but people were still able to get ready because of these beliefs. This illustrates the ongoing importance of traditional beliefs in supplying early warnings and directing preparatory activities. These ideas nevertheless retain cultural significance and provide important insights into how communities have historically dealt with environmental difficulties, even though their applicability has diminished in modern times.

These changes are explained by theoretical frameworks as the Ecological Modernization Theory (Mol, 2016) and the Theory of Resilience (Norris et al., 2008). The Ecological Modernization Theory emphasizes how technology developments impact environmental practices, while the Theory of Resilience contends that societies adjust by combining modern tactics with old knowledge. Studies conducted locally by Dela Cruz and Reyes (2020), Garcia and Alvero (2022), and Santos et al. (2021) highlight the value of traditional knowledge in rural communities and show how it continues to support community resilience despite the adoption of contemporary tools. These studies demonstrate how combining science and traditional knowledge can result in better preparedness plans for disasters.

Based on international research, traditional knowledge is essential for boosting resilience, especially in areas with little access to contemporary forecasting techniques (Alvarez and Thompson, 2019; Williams and Roberts, 2020; Jones and Lee, 2021). According to these studies, disaster preparedness plans can be strengthened and made more sustainable by combining indigenous knowledge with contemporary scientific methods. This is especially crucial in rural and underserved areas. The study's overall conclusions highlight the need of conserving and recording indigenous knowledge since it keeps bolstering efforts to increase resilience to climate-related calamities.

5. Do the respondents still observe these beliefs arise, and under what circumstances are they being discussed/propagated?

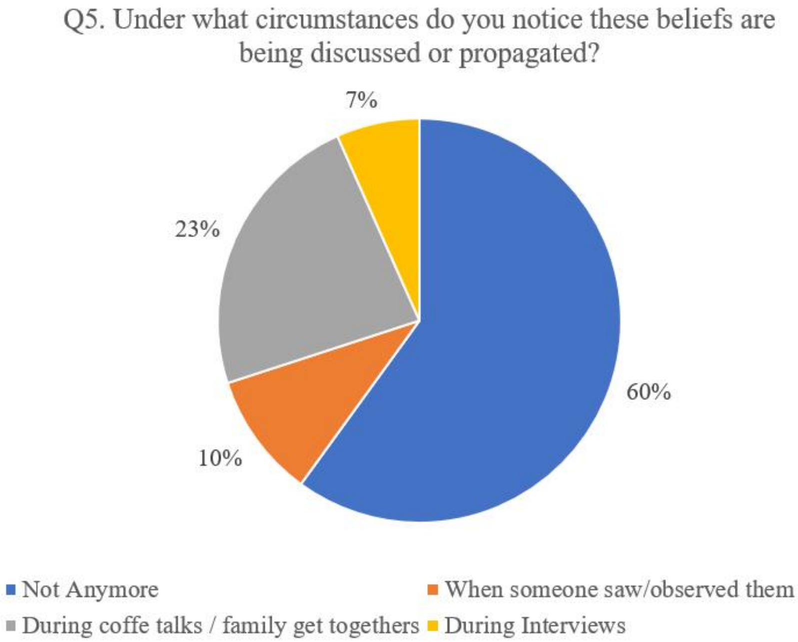

Figure 11. Circumstances Leading to Discussions

Many respondents admitted that they had mostly forgotten these ideas over time, and the majority pointed out that they are no longer frequently discussed in the community. According to one respondent, many beliefs have already been forgotten because these aren't really being discussed. Another respondent stated, “Not anymore, these days, I can't remember much myself.” These remarks demonstrate a distinct trend in which traditional environmental beliefs are gradually vanishing as they are no longer discussed on a regular basis. Many respondents acknowledged that modern influences have contributed to the decline of these beliefs, which have become harder for younger generations to remember due to the shift away from oral traditions and the decreasing transmission of these beliefs.

However, some respondents pointed out that when certain environmental phenomena take place, like freshwater snails moving away from riverbanks, indicating changes in the environment, these traditional beliefs are sometimes resurrected. According to one respondent, “Yes, like when someone observed that freshwater snails are moving away from river sides, they will tell other people about it, and that’s it, they will talk about what it means.” This implies that these beliefs are only discussed when they are connected to observable events in nature, and that their transmission is largely dependent on direct observations rather than ongoing cultural practices or everyday conversations.

In contrast, other respondents pointed out that these conventional ideas come up again at informal social events, especially when elderly people get together for coffee. "If there are moments like these that we share tales, the themes expand out when we get together," said one respondent. Although traditional knowledge may still surface in casual social interactions, it is no longer a regular component of cultural practice. They are not really the normal topic we talk about, and we only recall them when someone reminds us of them. "Only when matured people enjoy coffee together and relate stories," said another responder. Elderly people can recollect traditional views during these chats, but they have grown less common over time.

Respondents who said that these ideas are rarely expressed in casual conversations and are only recalled when specifically asked about, like during an interview, further emphasize the decline in the transmission of these beliefs. "Those are not being discussed anymore," noted one response. “Only when someone asks about them.” “Only this time that you are conducting an interview,” said another respondent. Since they are no longer discussed, I have already forgotten the majority of it myself.”) This indicates a substantial decline in the natural transmission of these beliefs, since many respondents find it difficult to remember specifics because of their waning significance in contemporary society.

Given that these cultural insights are no longer automatically transmitted through everyday encounters, the implications of these findings imply that proactive measures are required to maintain them. As modernization and shifting social priorities continue to influence the younger generation's perception of climate change and environmental issues, the decrease in the transmission of these beliefs highlights the necessity of documentation and deliberate efforts to preserve indigenous knowledge. Reintroducing these ideas to younger generations and incorporating them into the current conversation about climate change may be made possible in large part through education and cultural revival initiatives.

Similar trends of dwindling indigenous knowledge in the Philippines and around the world have been examined in recent studies. Studies conducted in the Philippines by Dela Cruz and Reyes (2020), Garcia and Alvero (2022), and Dizon (2023) show that traditional knowledge is being transmitted less frequently, especially in rural communities, as a result of a greater reliance on modern technologies and scientific knowledge. The function of oral traditions in community climate adaption techniques has also been studied by Santos et al. (2021), Bautista and Gomez (2021), and Villanueva (2022), who have observed that traditional practices are being neglected more and more as modernization picks up speed. According to these research, older generations continue to appreciate certain ancient knowledge systems, but unless efforts are taken to archive and convey them to newer generations, they run the risk of disappearing.

The difficulties of maintaining indigenous knowledge in the face of globalization are also highlighted in international studies. According to Alvarez and Thompson (2019), Williams and Roberts (2020), and Jones and Lee (2021), formal education systems and the pervasive use of digital media are replacing traditional environmental knowledge. The significance of incorporating indigenous knowledge into contemporary climate adaptation techniques is further emphasized by research by Brown and Green (2022), Owen and Smith (2023), and Wilson and Johnson (2024), which contend that it offers insightful information for boosting community resilience to climate change. These investigations lend credence to the idea that, despite the fact

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that indigenous knowledge is in danger of extinction, it is still useful in tackling today's environmental issues, particularly when combined with scientific theories of climate change.

6. What traditional actions or preparations do the respondents undertake based on their cultural beliefs?

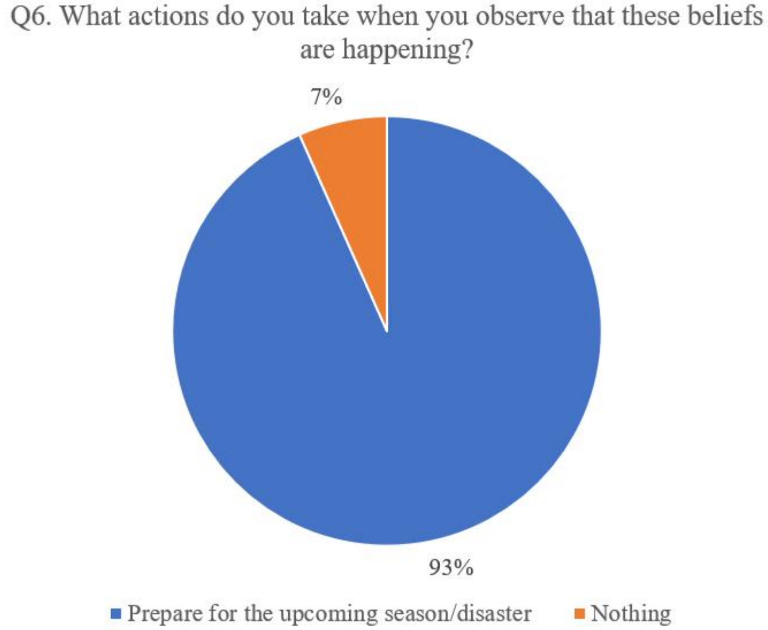

Figure 12. Actions Taken by the Respondents Upon Observing the Beliefs

As shown in Figure 12, a majority of the respondents (93%) stated that they begin preparing for environmental changes once they observe certain signs linked to traditional beliefs, particularly those predicting droughts and typhoons. One respondent shared, “If we observe that the bamboos bear flowers, which means that there will be a drought, we store water in available water storage, and if there is a coming typhoon, we chop a lot of firewood for cooking and preserve food to eat.” This illustrates the direct link between environmental observations and immediate preparations, a practice rooted in indigenous knowledge passed down through generations.

Other respondents elaborated on their specific preparations for typhoons. One noted, “When we know that there will be a typhoon, we will stock up foods to eat and gather firewood to use when the typhoon comes.” Another respondent emphasized the importance of seeking refuge in sturdier homes, saying, “We buy rice if we know that there will be a typhoon, gather and chop firewood, and we stay at the house of other people with a more durable house when the typhoon arrives.” These actions show a clear strategy of preparing for typhoons, with a focus on securing essential resources and finding safety in more resilient shelters.

Respondents also described how modern sources of information, such as news broadcasts, have improved awareness of incoming storms. One participant noted, “Before, we prepare food, actually until now, and it’s better today because you can hear from the news immediately compared before if there is an incoming typhoon.” This statement highlights the way modern

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technologies have enhanced preparedness by providing timely weather information, contrasting with the past when information was solely based on traditional indicators.

In the past, it was more typical for communities to work together to prepare for major weather disasters. Respondents related how, in the days of their ancestors, people would blow horns or ring bells to call community meetings to discuss disaster preparation. As one person recalled, "Our forebears used to blast the horn or ring the bell if they saw something like these." This is how they let people know about a gathering to discuss what the community ought to do. This indicates a change from group activity to individual readiness, which is probably affected by modernity and shifting community dynamics. Previously, everyone helped prepare; now, it's done individually.

Respondents also discussed methods for protecting their homes, such as strengthening windows and roofs to resist high winds. One person remarked, "We get ready, our father ties the windows and walls of our house so that the wind won't be able to blow it away." This measure highlights how crucial it is to keep homes secure in case of a typhoon.

Additional traditional preparation techniques, such repairing streams to keep the rice paddies hydrated during droughts, were revealed by other respondents. In several instances, respondents engaged in "pinar," a technique used by farmers without irrigation systems to prepare their crops while awaiting rainfall. One participant clarified, "When we know that there will be a drought, we fix the streams so that we can still irrigate our rice paddies." According to one reply, "We do pinar if we know it will be a long time before it rains." Adjustments in rice planting methods were also discussed, such as choosing particular rice types dependent on water availability, while those without irrigation systems will wait for the rain before planting. One respondent said, “If it the land is dry, you need to look for the kind of rice that you will plant. Urritay if there is an abundance of water, *ginapas* during dry times.” This shows the adaptability of traditional agricultural practices to varying environmental conditions.

In preparation for extreme droughts, some respondents shared spiritual practices, such as the burning of bushes and praying for rain, and spiritually dreaming about what actions to take. One respondent recalled, “Our ancestors, if the drought was extreme and there was really no rain at all, they gather and burn bushes then pray for rain. The smoke will deliver their prayers.” Another respondent added, “When there is drought, other farmers cease planting specially when they do not have irrigation. They wait for the right timing when there will be rain. They also say that when there is really no rain for a very long time, someone will dream of a certain leaf. That person will look for that leaf, wrap it in bamboo, then put it in the deepest part of the river, then it will rain. When the rain is too much, the person will retrieve the leaf from the river to stop the rain.” These highlight the strong connection between spirituality and climate resilience in the community.

These findings' ramifications highlight how crucial it is to maintain customs and expertise in order to adapt to climate change. Even while some aspects of preparedness have been enhanced by modern technologies, traditional methods—particularly those involving community service and spiritual beliefs—remain essential for lessening the effects of environmental change. According to these results, combining traditional and modern methods of

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disaster preparedness could improve resilience, especially in rural areas where local knowledge is important.

These findings are supported by recent studies. Local studies by Garcia and Alvero (2022), Santos et al. (2021), and Dela Cruz and Reyes (2020) also examine how rural communities in the Philippines use both traditional and contemporary techniques to prepare for natural disasters. These studies highlight the continued value of traditional methods, especially in agricultural contexts where understanding seasonal variations and water management is still essential. Similar techniques in rural communities around the world are highlighted by international studies by Alvarez and Thompson (2019), Williams and Roberts (2020), and Jones and Lee (2021), demonstrating how traditional knowledge and contemporary tools can work in tandem to improve disaster preparedness. According to these studies, promoting cooperation between scientific research and indigenous knowledge systems can result in more successful climate change mitigation tactics, especially for communities that are already at risk.

Study Limitations

Although this study offers insightful information about indigenous knowledge about climate change and disaster preparedness, some limitations limited the breadth and depth of the results. The results were interpreted taking into account these constraints, which were mostly associated with logistical difficulties, participant demographics, and geographic coverage.

Scope

Documenting indigenous knowledge, beliefs, and practices regarding climate change and disaster preparedness was the main goal of the study. It did not extend beyond its main purpose to compare beliefs across different ethnic groups or study the mechanisms contributing to the reduction in the transmission of indigenous knowledge.

Locale and Participants

The study was initially intended to be conducted across all six barangays in the municipality of Lacub, Abra. However, due to time constraints and the considerable distance between barangays, requiring extensive travel on foot for hours or even days, the locale was limited to Barangay Poblacion. The gathered data serve as a preliminary documentation of beliefs in Lacub and do not fully represent those of the entire municipality.

Additionally, the study originally included participants from various age groups: adolescence (10–19 years), adulthood (20–59 years), and older adulthood (60–79 years). However, during the trial interview to assess the questionnaire, little to no beliefs were gathered from the adolescent and adult groups, preventing future meaningful comparative analysis. As a result, the researcher focused on the older adulthood group, commonly referred to as the elderly, to align with the study's primary objective of documenting indigenous beliefs. This adjustment was communicated to and approved by the thesis adviser.

Identifying Species

Due to limited descriptions and the absence of visual representations, the researcher was unable to determine the exact species of the mentioned birds, including *kuwapo/puwapo*, *pippingaw*, and *wik-wik*. As a result, their local names and general identities were used instead. Accurately identifying their species would require additional time and effort.

Schedule of IEC

An Information, Education, and Communication (IEC) Campaign on climate change and disaster preparedness, along with the presentation of study results, was initially planned for Barangay Poblacion in May 2025. However, due to the Mayoral Elections in 2025, the campaign has not yet been conducted. It will be rescheduled for June or July 2025, or later, to align with the Barangay assembly schedule.

Similarly, the IEC was initially scheduled to be conducted at Alfredo D. Bersamina National High School and Our Lady of Guadalupe School, Inc., both secondary institutions in the municipality. However, since their academic year 2024–2025 ended in April 2025, the IEC will be rescheduled for June to August 2025, aligning with their first-quarter schedule for academic year 2025-2026.

IV. CONCLUSION

The lack of recorded indigenous beliefs regarding climate change in Poblacion, Lacub, Abra, as well as the slow decline in traditional knowledge transmission, prompted the conduct of this study. It sought to analyze how the indigenous population understands environmental indicators linked to climate change and disaster preparedness while methodically documenting indigenous knowledge, beliefs, and practices in these areas. It aimed to confirm the validity of the collected beliefs by comparing them with scientific ideas. The study also made an effort to organize and preserve Indigenous insights for future reference by compiling the data into a complete compendium.

Based on the results, all 30 respondents (10 men and 20 women) who were 60 years of age or older showed awareness of climate change, and almost all of them recognized it as a change in seasonal schedules characterized by longer dry seasons and later wet seasons. However, since none of the respondents offered a scientific justification for these changes, their comprehension remained observational. This implies that rather than being based on formal climatological frameworks, their awareness is largely phenomenological and grounded in lived experiences. Notably, male respondents provided more beliefs in every category, even though there were more female participants. This implies that gender may have an impact on how climate-related knowledge is retained and passed down, possibly influenced by social roles and knowledge-sharing customs. These revelations emphasize the necessity of focused educational programs that connect empirical findings with scientific theories in order to promote a more thorough comprehension of climate change and its effects.

Beliefs related to plants, animals, celestial bodies, weather, and natural phenomena that act as predictors of typhoons, precipitation, droughts, and seasonal shifts were identified in the study. Fewer of these beliefs were found in other categories, but most were associated with fauna. These beliefs' continued use in the community is supported by logical explanations that were produced by cross-referencing them with scientific principles. Furthermore, given that these indicators still predict typhoons, droughts, and seasonal changes, the majority of respondents

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agreed that their sense of climate change was influenced by traditional beliefs. Some, however, voiced worries about these observations' deteriorating dependability over time. While the majority of respondents agreed that these beliefs were important for disaster preparedness, particularly when there were no radios, televisions, or official weather announcements in the past, others pointed out that these beliefs are becoming less relevant in the present day because of technological advancements that provide more timely and accurate climate updates. Additionally, the results show that the majority of the identified beliefs are no longer actively addressed in the community, with many respondents admitting that public memory has mostly forgotten them. Only under certain circumstances, such as when specific environmental phenomena take place, during infrequent storytelling sessions, or when prompted in interviews, do these beliefs tend to reappear. Since these cultural insights are no longer organically transmitted through daily contacts, this decline in transmission emphasizes the urgent necessity for deliberate documentation and preservation activities.

Finally, it was discovered that most respondents start getting ready when they saw indicators linked to these conventional beliefs. They prepare by cutting firewood, storing food and water, or spending typhoons in the houses of those with more resilient buildings. This illustrates the clear connection between safety measures, prompt readiness, and environmental observations. The respondents also mentioned that they are now more aware of climate-related scenarios thanks to contemporary technological information sources. A long-standing community-wide initiative was also noted, in which meetings for disaster preparedness were announced by blowing horns or ringing bells. Since then, this group strategy has changed to include more customized catastrophe planning. Traditional techniques that demonstrate how traditional agricultural practices can adapt to changing environmental conditions were also highlighted, including the maintenance of rivers to guarantee that rice terraces remain irrigated and the selection of particular rice types appropriate for each season. Some respondents talked about spiritual practices like praying for rain, burning bushes, and having spiritual dreams about what to do in the event of severe droughts. These customs highlight the close relationship between communal climate resilience and spirituality.

The research's ramifications generally highlight how crucial it is to maintain traditional knowledge and customs in order to adapt to climate change. Even while some aspects of preparedness have been improved by contemporary technologies, traditional methods (particularly those based on community service and spiritual beliefs) remain essential for lessening the effects of environmental change. According to these results, combining traditional and modern methods of disaster planning could improve resilience, especially in indigenous communities where traditional knowledge is important.

Recommendations

Based on the findings from this study, several recommendations can be proposed to preserve, integrate, and enhance indigenous knowledge in modern disaster preparedness efforts. These recommendations focus on documentation, education, interdisciplinary collaboration, policy implementation, and future studies, ensuring that indigenous knowledge remains relevant and beneficial.

1. Documentation and Cultural Preservation

Many respondents noted that traditional beliefs are fading, with younger generations less familiar with indigenous forecasting methods. To prevent the loss of this knowledge, efforts should be made by:

a. Local Government Units (LGUs), particularly the Local Cultural Council (LCC), should record and archive traditional environmental indicators through written and digital resources.
b. Municipalities and Barangays should develop community-based repositories of indigenous knowledge that can be accessed by researchers, educators, and policymakers.
c. Indigenous People (IP) leaders should encourage oral histories through interviews with elders and knowledge keepers to preserve firsthand accounts of environmental forecasting. Alternatively, this can be done by facilitating storytelling sessions with the youths at the barangay level.

2. Integration of Indigenous Knowledge with Scientific Forecasting

While modern meteorology provides precise weather predictions, indigenous observations offer localized, experience-based insights. Combining these methods can enhance community resilience. To achieve this:

a. Local Disaster Risk Reduction Offices (LDRRMOs) of indigenous communities should develop hybrid forecasting models that incorporate both traditional and scientific indicators in disaster preparedness programs to create more adaptive and localized early warning systems.
b. Promote collaboration among climate-focused Government and Non-government organizations, and indigenous communities. The partnership should foster knowledge-sharing sessions, workshops, and field studies to design sustainable environmental monitoring solutions.

3. Education and Awareness Initiatives

Since younger generations are less engaged with traditional forecasting, educational efforts should bridge the gap between indigenous knowledge and climate science. Recommended actions include the following:

a. The Commission on Higher Education (CHED) and the Department of Education (DepED) should consider integrating indigenous climate knowledge into school curricula, particularly in environmental science subjects.
b. Universities and State Colleges should encourage their students to conduct interdisciplinary research that compares indigenous observations with meteorological data. Collaborative studies should be conducted to assess the accuracy and relevance of traditional forecasting methods alongside scientific climate data.
c. LGUs in partnership with schools in their respective Area of Responsibility (AoR) may organize workshops and seminars where elders teach traditional weather indicators alongside meteorological experts.

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d. Social Media Influencers and Digital Content Creators can be encouraged to create content on indigenous climate knowledge to make it more accessible to younger individuals.

4. Community-Based Disaster Preparedness Programs

Respondents highlighted that disaster preparedness was once a communal effort, but modern approaches are increasingly individualistic. To restore collective resilience:

a. LDRRM offices can revitalize participatory disaster planning, ensuring that local officials and other community representatives are included during disaster planning.
b. Barangay officials can strengthen community engagement by facilitating dialogues, workshops, and interactive sessions that can help preserve and transfer indigenous forecasting practices.
c. LDRRM offices and IP leaders can collaborate to incorporate indigenous indicators into local disaster response protocols, complementing government-issued forecasts.

5. Policy and Institutional Support for Indigenous Knowledge

The National Commission for Culture and the Arts (NCCA), National Commission on Indigenous Peoples (NCIP), legislative bodies, policymakers, and lawmakers should recognize the role of indigenous forecasting in environmental adaptation and support its preservation by:

a. Collaborating to create regulations that incorporate indigenous forecasting methods into formal disaster preparedness planning.
b. Allocating resources for projects focused on preserving and validating traditional forecasting practices.
c. Working together to institutionalize programs that safeguard indigenous climate knowledge and integrate it into broader climate adaptation strategies.

6. Future Studies

Future studies can further explore the integration of indigenous environmental observations with scientific methodologies to enhance climate resilience. While this study has documented traditional forecasting methods, additional investigation is needed to validate their accuracy and applicability in contemporary disaster preparedness strategies. Additionally, certain limitations from this study should be addressed to ensure a more comprehensive approach. To achieve this, future researchers are recommended to:

a. Expand the timeline of their studies to incorporate all barangays in their chosen municipalities, as time and geographic constraints hindered broader coverage for this study.

b. Explore methods to engage younger generations with indigenous knowledge, as initial attempts in this study found minimal knowledge retention among adolescent and adult participants, which prevented comparative analysis.
c. Incorporate strategies for accurate species identification of animals mentioned in traditional environmental indicators, as the absence of detailed descriptions may pose a problem for precise classification.
d. Develop flexible research timelines that align with local political and administrative schedules to avoid disruptions, such as those caused by elections, to avoid postponement of post-study activities (e.g., postponed planned IEC campaigns)
e. Compare indigenous knowledge on climate change and disaster preparedness practices across different regions and ethnic groups.
f. Conduct comparative analyses between indigenous environmental indicators and modern meteorological data to assess correlations and predictive reliability
g. Examine the sociocultural factors influencing the transmission and retention of indigenous forecasting knowledge across generations, ensuring that younger populations are engaged in the knowledge transfer process.
h. Develop practical guidelines for policymakers and disaster risk reduction agencies on how indigenous climate knowledge can complement existing scientific forecasting models.

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