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Exploring Traditional Ecological Knowledge (TEK) in Kalinga Province: Practices, Preservation, and Perspectives

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ABSTRACT

This study delves into the traditional ecological knowledge (TEK) of the Indigenous People of Kalinga, Philippines, while also examining similar practices and challenges faced by other indigenous communities worldwide. The study highlights the universal themes and unique adaptations of TEK across cultures, providing a broader perspective on the significance of traditional knowledge in addressing contemporary environmental issues. It aims to identify and document the traditional practices, rituals, and beliefs that demonstrate the community's deep connection with nature and their efforts in sustainable resource management; it explores the challenges faced in preserving TEK, such as the impact of formal education, globalization, and modernization, and provide recommendations for safeguarding and promoting TEK among the Kalinga people for future generations. It uses a pure qualitative research method with interviews as the primary tool; the elders of the different Kalinga sub-tribes are the study participants. Ethical considerations were followed; the researcher sought the elders' approval before being interviewed. The results

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of this study were also returned to them so they could concur with the translation of their answers.

The findings highlight the community's profound reverence for nature, reflected in their cultural traditions and environmental stewardship practices. By advocating sustainable actions like refraining from burning and employing natural farming techniques, Kalinga communities contribute to climate resilience and biodiversity protection. Ultimately, this study seeks to contribute to the ongoing dialogue about the role of TEK in sustainable development and environmental stewardship, advocating for the integration of traditional knowledge with modern scientific approaches. Additionally, the study underscores the impact of formal education and globalization on Kalinga traditions, emphasizing the need to balance modernity with heritage preservation. Recommendations include involving youth in traditional activities, integrating old and new farming methods, documenting TEK, and incorporating it into the education curriculum to ensure longevity and relevance. This holistic approach aims to cultivate a sense of collective responsibility, sustainability, and environmental consciousness across Kalinga communities.

Keywords: *Traditional ecological knowledge (TEK), Kalinga Province, sustainable development goals, cultural preservation, environmental stewardship, Indigenous practices*

1. Introduction

Climate change is a global issue affecting everyone, with some areas experiencing heavy rainfall and others facing droughts (Filho et al. 2021). The impacts are evident in Tabuk City, Kalinga, Philippines, as some municipalities produce less rice due to reduced water supply. There is increasing awareness that traditional ecological knowledge (TEK) of Indigenous Peoples (IPs) can help address climate change and conserve nature (Mukhopadhyay and Roy 2015). Many scholars emphasize combining traditional knowledge with scientific approaches to mitigate

climate change effectively. This study aims to investigate how the IPs of Kalinga use their TEK to preserve their environment and tackle climate change challenges.

Kalinga is located within the Cordillera Administrative Region in Luzon, Philippines. It is known for having acquired two world Guinness records for the highest number of people playing the gongs and the highest number of women dancing with pots. It is also known for its mountainous terrain, longest river (Chico River), and rich indigenous culture. It has six municipalities and one city. The IPs of Kalinga come from diverse ethnic groups and have diverse dialects.

Indigenous communities worldwide have a rich heritage of TEK developed over centuries, offering valuable insights into local ecosystems. This knowledge is crucial in managing protected areas, including geoparks, and ensuring long-term sustainability. Studies by Halim et al. (2017) and Negi et al. (2021) highlight the significance of indigenous knowledge in preserving natural heritage sites and conserving biodiversity.

Indigenous knowledge holds valuable insights on sustainable resource management practices that can inform more holistic and effective solutions (Patterson et al. 2023). Research has demonstrated that conservation efforts led by or developed in partnership with indigenous communities tend to yield better outcomes for both the environment and people. Inclusive approaches that incorporate multiple ways of knowing, including both Western science and indigenous knowledge, can lead to novel solutions and mitigation strategies to address longstanding environmental issues (Patterson et al. 2023).

Particularly in forest management, indigenous knowledge offers deep insights into local environments, crucial for protecting natural resources (Yahaya 2013). Including traditional practices in geopark management enhances community appreciation and involvement in preserving cultural heritage (Halim et al. 2017).

Moreover, TEK is vital in mitigating climate change, as indigenous communities often experience its effects first. Their generations of knowledge on ecosystems, climate patterns, and sustainable resource use provide invaluable insights. A study by Klein (2011) emphasizes how this traditional knowledge aids effective climate adaptation and mitigation strategies by revealing historical climate patterns, assessing the impacts of climate change, and promoting responsible resource management. Integrating TEK with scientific approaches leads to a more comprehensive

understanding of ecosystems and improves ecological restoration efforts, demonstrating that TEK is essential for building a sustainable future.

1.1. Research Gap

While many studies have been published on TEK, more research needs to be done on the specific practices, preservation efforts, and perspectives of indigenous communities in Kalinga Province.

1.2. Significance of the Study

TEK plays a crucial role in addressing climate change, and it can be even more effective when combined with modern science and technology. Integrating TEK with scientific research and technological advancements can create a more comprehensive approach to mitigating climate change. This collaboration respects and values traditional practices and enhances our ability to combat climate change effectively. This study holds significant implications for various stakeholders. Documenting the TEK practices of different sub-tribes in Kalinga helps protect their unique cultural histories and environmental management methods. It also empowers Indigenous People by highlighting the importance of their knowledge in natural resource management, giving them a stronger voice in policy decisions affecting their lands.

Future researchers will find this study valuable as it provides insights into integrating traditional knowledge with modern science, which can aid local communities in adapting to climate change and promoting sustainability. Additionally, Local Government Units can develop more effective and culturally appropriate environmental policies and programs by understanding the traditional practices and perspectives of the Kalinga people. This approach will foster more sustainable and equitable environmental outcomes for everyone.

1.3. Theoretical Framework

Using resilience theory, we can examine how socio-ecological systems respond to environmental changes, including biodiversity and ecosystem services. This theory suggests that these systems can withstand shocks while maintaining their essential functions. When applied to TEK, it reveals the depth and practicality of indigenous knowledge in managing environmental changes. Indigenous Peoples possess an inherent

understanding of protecting biodiversity and sustainably using resources, contributing to ecosystem resilience against natural events, climate change, and human impacts (Mumbly et al. 2014).

In Kalinga, resilience theory illustrates how communities adapt to environmental changes while preserving essential functions. The Kalinga people have a strong tradition of protecting their natural surroundings, vital for maintaining biodiversity. They designate sacred groves and protected areas that conserve habitats for various plants and animals, helping preserve ecosystems during environmental changes like climate change. Additionally, Kalinga communities practice traditional agroecology using organic fertilizers, such as compost, and natural pest control methods. This approach enhances soil health and reduces reliance on chemicals, resulting in more sustainable farming. Terraced farming is another crucial technique, as it prevents soil erosion, conserves water, and supports diverse crops, improving food security and ecosystem health. Kalinga cultural practices further illustrate their environmental understanding. They have rituals and taboos governing resource use, promoting sustainability and ecological balance. They also utilize local knowledge to monitor environmental changes, such as weather patterns, allowing for quick adaptations to challenges like pest outbreaks or droughts, thereby enhancing their resilience to environmental issues.

2. Review of Related Literature

A study published by Tengö et al. (2014) demonstrates the power of integrating TEK with scientific methods and technology for effective climate change adaptation. Through workshops and interviews, researchers working in Australia's Wet Tropics documented indigenous knowledge about weather patterns, plant use, and resource management. This TEK was then combined with scientific data on climate projections and ecological modeling, visualized using Geographic Information Systems. This collaborative approach led to the identification of vulnerable areas for conservation and the development of culturally appropriate, community-based monitoring programs, showcasing the value of TEK in creating more holistic and successful environmental management strategies.

Another study by Paneque-Galvez et al. (2017) found that indigenous communities are embracing small consumer drones for mapping and monitoring their territories. The authors explore case studies from various

countries to understand the initial experiences and analyze the potential benefits and challenges these innovations offer for environmental justice and sustainability. Early findings are positive, with many indigenous groups recognizing drones as valuable tools to safeguard their lands and support their claims related to environmental concerns and justice issues. The paper provides a critical analysis of the opportunities and challenges associated with using small drones for indigenous territorial mapping and monitoring based on these findings and existing research.

In her study, “Can Indigenous Knowledge Contribute to the Sustainability Management of the Aspiring Rio Coco Geopark, Nicaragua?” Martina Pásková examined indigenous environmental knowledge in the southern Rio Coco Geopark. She aimed to explore how this knowledge could enhance sustainable tourism management and other activities in the area. The study revealed that knowledge about land use, rocks, and plants is well-preserved, but the spiritual aspects of this knowledge are fading. This indigenous knowledge is crucial for decision-makers in the geopark, offering insights for sustainable management, tourism, and geological interpretation.

Research shows that Indigenous and local communities use resources sustainably and conserve biodiversity. For example, a 2021 study by Negi et al. highlighted the importance of indigenous knowledge in protecting natural resources and maintaining ecological balance. Additionally, Yahaya’s 2013 study noted that integrating traditional cultural practices into geopark experiences can increase local appreciation and involvement in heritage conservation, a finding also supported by Halim et al., in their 2017 research.

The study by Berkes, Colding, and Folke (2000), titled “Rediscovery of Traditional Ecological Knowledge as Adaptive Management,” examines how local communities can use their knowledge to monitor and respond to ecosystem changes. It focuses on understanding and utilizing TEK to improve ecosystem management and resilience. Key findings show the importance of local management systems and their interaction with the environment. The study discusses traditional practices like managing multiple species, rotating resources, and creating varied landscapes. It also explores the social aspects of knowledge sharing, local institutions, and cultural values. The goal is to blend local knowledge with scientific ecology to develop adaptive management strategies that promote resilience in complex systems.

In the study “Integrating Traditional Ecological Knowledge into Habitat Restoration: Implications for Meeting Forest Restoration Challenges” by Haq et al. (2023), researchers focused on gathering TEK about tree species in the Dering-Dibru Saikhowa Elephant Corridor. They aimed to use this knowledge to prioritize reintroducing 31 tree species in degraded forests. The study combined traditional knowledge with modern techniques to aid in ecosystem restoration, species selection, and monitoring. It showed how TEK can enhance ecological restoration efforts, including adaptive and sustainable forest management, while supporting local communities and biodiversity (Haq et al. 2023).

Similarly, Uprety, Devkota, and Shrestha (2012), in “Contribution of Traditional Knowledge to Ecological Restoration: Practices and Applications,” highlighted the role of traditional knowledge in ecological restoration. Key contributions included identifying reference ecosystems, selecting species and sites for restoration, managing invasive species, and monitoring outcomes. The study stressed that combining traditional knowledge with scientific methods strengthens restoration projects, making them more socially accepted, economically feasible, and environmentally sustainable.

The study “Traditional Ecological Knowledge on the Slope of Mount Lawu, Indonesia: All About Non-Rice Food Security” by Sumarwati (2023) explored the TEK of the Tawangmangu community related to non-rice food security. It focused on how the community communicates and passes down this knowledge through folktales, rituals, and resource management. It emphasized the importance of non-rice crops, terraced farming, and forest preservation for local food security and sustainability. The findings highlighted three main themes of TEK: (1) communication through folktales and rituals, (2) community philosophy regarding spirituality and nature, and (3) sustainable resource management practices. Locals actively protect the forests on Mount Lawu and around Pringgodani Cave, viewing them as vital to their lives by prohibiting tree cutting and promoting reforestation (Sumarwati 2023).

In a related study, Sharifian et al. (2022) in “Dynamics of Pastoral Traditional Ecological Knowledge: A Global State-of-the-Art Review” examined the usage and importance of pastoral TEK worldwide. The study aimed to understand its influence on pastoral practices and the amount of research done on pastoral TEK compared to other knowledge types. It highlighted the need to recognize and protect pastoral TEK for sustainable

land management and biodiversity conservation. The authors acknowledged their limited perspective, as they are not part of pastoralist communities. The study found that pastoralists adapt their knowledge effectively to social and ecological changes due to various factors, including changing cultural norms and shifts toward market economies. The authors recommend that future research focus on understanding how pastoral knowledge transitions affect traditional practices (Sharifian et al. 2022).

The study “Traditional Ecological Knowledge in Restoration Ecology: A Call to Listen Deeply, to Engage With, and Respect Indigenous Voices” by (Robinson, Rota, and Dee 2023) emphasizes the vital role of TEK in restoration ecology. The study aims to empower indigenous leaders and communities in reclaiming their land and resources. It highlights the need for ethical engagement, active listening, and respect for indigenous voices in restoration projects. The authors propose creating common principles and a moral code for partnerships in restoration ecology, stressing protecting indigenous rights and lifestyles to preserve their knowledge, language, biodiversity, and ecological functions. The study advocates for acknowledging the diversity of both ecology and culture in restoration efforts, promoting responsible practices that foster positive cultural change. Ultimately, the study calls for respectful and responsible restoration efforts guided by shared principles, including meaningful collaboration with TEK. It underscores the importance of Indigenous leadership and ethical partnerships to ensure that restoration activities are culturally sensitive and beneficial for ecological and cultural well-being (Robinson, Rota, and Dee 2023).

3. Methodology

3.1. Research Design

This study used qualitative research design. An in-depth interview and FGD were used. Three primary research objectives guided the study:

1. To document the various forms of TEK held by the indigenous communities in Kalinga Province.
2. To assess the role of TEK in the sustainable use and management of local natural resources in Kalinga Province.

3. To examine the current threats to preserving TEK among the Kalinga people and the factors contributing to knowledge erosion.

3.2. Population and Sample

Participants were the elders of the different sub-tribes of the province of Kalinga, with 24 respondents.

3.3. Data Gathering Instrument

The instrument utilized in this study included qualitative data collection tools, mainly interviews, designed to capture and document TEK in Kalinga Province, its Practices, Preservation, and Perspectives.

3.4. Data Gathering Procedures

This study selected participants from various sub-tribes within the Kalinga community, focusing on elders with extensive knowledge of traditional practices and ecological wisdom. Face-to-face interviews created a personal and engaging atmosphere, using open-ended questions to encourage detailed responses. Key questions included: “Can you describe traditional practices your community uses to manage natural resources?” “What plants do you use in traditional medicine, and what are their purposes?” and “How do you perceive the impact of modern education and globalization on your traditional practices?” A follow-up question prompted further discussion: “Can you give an example of specific beliefs important for environmental stewardship?”

With participants’ consent, the interviews were audio-recorded and transcribed for thorough analysis. The researchers used a formal coding process to identify key themes from the transcriptions, assigning codes to segments of text that represented specific ideas related to TEK. Similar codes were grouped into broader themes, and the researcher revisited the data multiple times to refine these codes. To ensure accuracy, the researcher returned the findings to the participants for review, allowing them to confirm that their views were represented correctly and to clarify or expand on their responses.

3.5. Analysis of Data

The data collected through interviews aimed to document the TEK perspectives, preservation methods, and practices in Kalinga. It assessed the role of TEK in the sustainable management of local natural resources and identified current threats to its preservation, as well as factors contributing to knowledge erosion. Interview responses were systematically reviewed and categorized to create a detailed inventory of TEK practices across different municipalities in Kalinga. This analysis provided insights into TEK preservation challenges, highlighting strengths and potential areas for improvement.

3.6. Ethical Consideration

The study prioritized ethical considerations by ensuring that all participants willingly consented to participate. Researchers clearly explained the study's goals, potential risks, and benefits, especially regarding using audio recording devices during interviews. All responses were securely stored on a password-protected computer. The researchers consulted school administrators to confirm the study's ethical relevance and obtained permission from community elders and barangay chairpersons, fostering trust and support for the research.

3.7. Rigor of Qualitative Research

Several methodological strategies were employed to ensure the rigor of the qualitative study: Participants were selected from Kalinga community elders to provide comprehensive insights. Qualitative data collection tools, like interviews, allowed in-depth exploration of TEK practices and perspectives. The researcher enhanced data credibility by interviewing multiple participants and using audio recording equipment to capture responses accurately. Obtaining permission from community elders added legitimacy to the research process, ensuring ethical conduct and collaboration.

4. Results and Discussions

4.1. What Plants Are Used in Your Traditional Medicine Practices, and for What Purposes?



Makabuhay. The community uses these plants to treat malaria and stomach aches. A respondent from Tanudan reported success in using the plant for malaria, and another mentioned using it for stomach pain relief.



Buwa. Elders used betel nuts as a remedy for oily diarrhea. One elder from Tinglayans mentioned chewing betel nuts (Mama) to stay alert and energized, while another elder from Lubuagan noted its use to aid digestion after meals.



Sky Lab. All Kalinga sub-tribes use certain plants to stop bleeding from cuts caused by sharp objects. A Tinglayan respondent confirmed the plant's effectiveness, sharing how it stopped bleeding from a foot injury. Another respondent noted its ability to prevent infections in open wounds.



Utol Di Gayabat. Respondents used this plant for wound cleansing and healing. A respondent from Balbalan mentioned it was also used for treating diarrhea and stomach aches, while another from Pasil said it was used to manage diabetes.



Dangla. Respondents used these plants to treat influenza, arthritis, and rheumatism. A respondent from Pinukupuk noted its use for arthritis, while one from Rizal mentioned its effectiveness in curing dry cough and asthma.



Tagumbao. The community used this plant to reduce fever. A respondent from Pasil mentioned it was also used for headaches, stomach aches, and arthritis. Another respondent from Balbalan stated it was effective in expelling intestinal parasites (“bulate”).



Lotan Di Apaya. Respondents from Tanudan used these plants as anti-rabies medicine. A respondent from Pinukupuk mentioned they treated skin rashes, wounds, and insect bites with it. Additionally, respondents from Balbalan used the plants to relieve muscle pain and treat bacterial and fungal infections.



Lingwa. Respondents used these plants to treat skin conditions like white marks and ringworm. A respondent from Pasil mentioned using them for healing wounds and burns, while an elder from Lubuagan noted their use in treating coughs, colds, and headaches.

These practices illustrate the strong connection between Indigenous People and their environment, emphasizing their deep knowledge of the healing properties of local plants. The study on TEK in Kalinga Province reveals the significance of medicinal plants for the Kalinga people's culture, health, and identity. These plants serve as natural remedies where access to modern healthcare is limited and are crucial for their cultural heritage. The Kalinga community practices sustainable resource management to protect these plants, vital for maintaining local biodiversity and ecological balance. Combining traditional knowledge with modern medicine can lead to new treatments. This knowledge also fosters community empowerment by promoting self-reliance in healthcare and providing educational opportunities about cultural practices and biodiversity.

The study by Fabricant and Farnsworth (2001) highlights the link between traditional plant knowledge and modern drug discovery through ethnobotany, which studies how cultures use plants for medicinal purposes. This research shows that local communities have valuable insights into the healing properties of plants based on their long history of use for treating ailments. By understanding these traditional practices, scientists can identify potential new drugs and improve modern medicine. The study demonstrates the scientific relevance of local knowledge in

pharmaceuticals and reveals that utilizing indigenous wisdom can significantly enhance healthcare and lead to new treatments.

4.2. What Traditional Farming Methods Are Used for Rice Cultivation in Your Community?

1. *Preparing the land:* The respondents shared that they first clear the land by removing weeds and vegetation, a process they call “*Sagawsaw*,” where farmers manually remove dirt and unwanted divots from the paddy field. “*Lenas*” or “*Pinas*” refers to cutting bamboo trees, which are then used to flatten the paddy field surface in preparation for the next step. Afterward, they plow the soil using traditional wooden plows drawn by carabaos (water buffaloes). This is called “*Bay-bay*,” where farmers use 5 to 10 water buffaloes to tread the paddy field for cultivation, as no machinery was available in the olden times.
2. *Planting:* The farmers carefully select the indigenous rice varieties best suited to the local climate and soil conditions. They plant the rice seedlings in rows, carefully spacing them to allow for optimal growth.
3. *Maintaining the fields:* The farmers carefully manage the water flow, ensuring that the fields are properly irrigated throughout the growing season. They also manually weed the fields to prevent competition with the rice plants. This process, called “*Olag*,” involves manually planting rice seedlings in the paddy fields by the farmers.
4. *Harvesting:* After planting, farmers wait around four months for the harvest, known as “*Ani*.” They use pounded sunflowers as a traditional alternative pest control method, driving away insects and then burning them.
5. *Tools and processes of Harvesting:* During the harvest (“*Ani*”), farmers use a knife (“*Lakom*”) to harvest rice, which is then tied with “*Anos*” (called “*Binatok*”) and hung on “*Aladoy*” to dry in the sun.
6. *Storage:* The dried rice (“*palay*”) is stored in “*Alang*,” a traditional rice storage house.

Kalinga farmers use eco-friendly methods to protect the environment and combat climate change. They avoid synthetic fertilizers and pesticides, reducing harmful greenhouse gases and improving soil health to store more carbon. They practice intercropping, planting different crops to control pests, reduce chemical use, and maintain soil fertility. Terraced fields help

manage water runoff, prevent soil erosion, and conserve water, making farming more resilient to droughts and climate change.

4.3. What Are Some of the Community-Led Techniques Used for Forest Conservation and Water Resource Management in Kalinga Province?

Community governance structures in Kalinga are vital for managing natural resources and supporting conservation. The Council of Elders is essential in decision-making, conflict resolution, and educating members about conservation practices. Some communities form local committees focused on specific issues like forest protection or water management, which monitor conservation compliance. Customary laws guide resource use and establish penalties for violations enforced by leaders. These structures align with national laws, like the Indigenous Peoples Rights Act (IPRA), which recognizes indigenous rights to manage their lands. Communities work with local and national agencies for resources and support, ensuring they follow environmental regulations.

4.3.1. Prohibits cutting of trees, garbage dumping, and burning

The Kalinga community protects tree species such as Luppa, Alimit, Tabbeg, and Liw liw because they are crucial for maintaining clean spring water. These trees grow near water sources like creeks and waterfalls and cutting them down is prohibited to ensure uninterrupted water flow. Local settlers can only selectively harvest mature trees during certain “Ber months.” Community-led conservation projects foster cooperation and empower residents to address climate-related issues effectively. By adhering to traditional farming and land management practices, the Kalinga community prevents land use changes that could lead to deforestation and habitat loss, contributing to greenhouse gas emissions.

The Kalinga community has a long history of forest conservation, committed to keeping their environment clean with strict rules against dumping garbage and burning waste, with penalties for violators. Similar conservation practices are seen in Indonesia’s Dayak Mualang community, where communal forests are managed according to customary laws (Seli, Rindarjono, and Karyanto 2021). The Dayak Kotabaru community follows the Bera system, allowing cyclical forest use and recovery (Seli, Rindarjono, and Karyanto 2021; Ifrani et al. 2019). Additionally, protecting

sacred areas that are off-limits to general use is part of local conservation efforts, as demonstrated by Tigawasa Village, where traditional beliefs and regulations help preserve the integrity of their customary forest ecosystem (Seli, Rindarjono, and Karyanto 2021).

In Kalinga, the community takes essential steps to protect the environment, aligning with various United Nations Sustainable Development Goals (SDGs). They prohibit tree cutting, garbage dumping, and burning waste, which helps protect forests essential for biodiversity (SDG 15) and preserves water quality (SDG 6). The Kalinga community also promotes sustainable waste management by reducing waste and encouraging responsible consumption, supporting SDG 12. By avoiding harmful practices like burning, they contribute to climate action (SDG 13). Their collective efforts to prevent pollution and promote sustainability reflect SDG 11, which focuses on creating sustainable cities and communities.

4.3.2. Reverence for nature

Before cutting down trees, the Kalinga community conducts rituals to honor forest spirits and ensure the safety of everyone involved. They offer butchered chicken as a sign of respect and seek protection from sickness and accidents. They believe that “*idaw*” and snakes can pose dangers, so they avoid dumping waste in water sources to prevent angering the spirits. This highlights the Kalinga people’s belief in respecting nature and caring for their land and water. A similar tradition, Ngasuh Gumi, is observed in the Tanjung District of North Lombok, Indonesia, where people perform rituals and ceremonies to maintain harmony with the environment (Sarjono and Fakhri 2023).

In the town of Atok, located in Benguet, Philippines, the wise elders believe educating the younger generation about the importance of ecological restoration is essential. They emphasize the significance of local practices contributing to this restoration, such as carefully regulating tree cutting for cultural purposes, like the traditional practice of making coffins.

The Kalinga people have a “*Songa*” tradition, offering butchered chicken and blood to spirits before cutting trees. If a tree is entangled in vines, it is left alone as a sign that the spirit does not allow it to be cut. They also avoid butchering dogs near water sources to prevent scaring the spirits, which could disrupt water flow. This practice resembles Tigawasa Village, where the forest is considered sacred and only used for traditional

ceremonies. The Munanese Ethnic group in Indonesia follows a related belief, prohibiting cutting large trees near rivers as they believe spirits inhabit these trees (Sarjono and Fakhri 2023).

Additionally, Kalinga community members believe in fertility wells found in Lubuagan, Tinglayan, and barangay Naneng in Tabuk City, which are thought to grant the wishes of couples who cannot have children. They maintain these wells for future generations, ensuring they are clean and preserved. This is akin to the Dayak Mualang community's practices, which include customary laws for managing communal forests, viewing the forest as a sacred space to be preserved for its spiritual and ecological value (Leo et al. 2021).

4.4. What Practices from Your TEK Are or Could Be Beneficial in Adapting to or Mitigating the Effects of Climate Change?

4.4.1. Climate sensitive policies

The community has a strict anti-burning policy to combat climate change, recognizing the harmful effects of burning on endangered wildlife, plants, and trees. Before cutting down trees, they follow specific practices to prevent illness and bad luck, which helps protect forests.

In Indonesia, the Dayak Kotabaru community employs a Bera system for cyclical forest use and recovery, which could be an effective strategy for sustainable forest management amid climate change (Ifrani et al. 2019). Similarly, the Tigawasa Village community upholds its customary forest ecosystem through traditional beliefs and regulations, showcasing the effectiveness of community-led conservation efforts.

The anti-burning policy supports several United Nations SDGs. By prohibiting burning, they reduce carbon dioxide (CO₂) emissions, aiding climate action (SDG 13). Moreover, reducing burning helps the community become more resilient to extreme weather events caused by climate change. It also protects ecosystems and preserves critical habitats for plants and animals, aligning with SDG 15: Life on Land, which focuses on conserving terrestrial ecosystems.

4.4.2. Organic farming practices

The community employs traditional methods like “*Ambay*,” a tobacco roll made with various roots, to naturally keep away pests such as small

farm rats (“*Inggi*”) and grasshoppers (“*Dudun*”), avoiding harmful chemicals. This practice helps maintain the soil’s nutrient balance and showcases their commitment to environmentally friendly approaches that combat climate change. Their TEK includes insights on weather, soil management, and suitable crop choices, aiding their adaptation to climate changes.

Similarly, smallholder farmers in Ghana practice irrigation, mulching, and growing improved crop varieties, demonstrating how TEK can enhance climate-smart agriculture (Berkes, Colding, and Folke 2000).

Organic farming contributes significantly to the UN SDGs. It helps achieve SDG 2 (Zero Hunger) by providing nutritious food without harmful chemicals. It supports SDG 12 (Responsible Consumption and Production) by promoting natural resource use and waste reduction. It also impacts SDG 3 (Good Health and Well-being) by offering chemical-free foods that reduce health risks. Lastly, the rising demand for organic products contributes to SDG 8 (Decent Work and Economic Growth) by creating jobs and boosting local economies.

4.5 What Traditional Beliefs or Values Influence How Your Community Interacts with the Environment?

4.5.1. Practice of moderation

The community practices moderation, taking only what they need and guided by rules passed down from their parents about forestry and hunting. This mindset fosters unity and brotherhood among them and aligns with the Dayak Mualang community’s traditional laws that emphasize protecting their shared forests, viewed as sacred spaces.

Their respect for nature is evident in ceremonies held before cutting down trees or approaching water sources, highlighting their understanding of the connection between people and the environment. In Tigawasa Village, the customary forest is seen as holy and is reserved for traditional events.

This practice of moderation supports SDG 12: Responsible Consumption and Production, encouraging responsible resource use, reducing waste, and promoting sustainable consumption. By advocating for moderation, communities can use natural resources wisely, ensuring long-term ecological balance.

4.5.2. *Observing traditional practices*

The traditional practices of “*Paniyaw*,” “*Ngilin*,” and “*Bain*” (PNB) are essential for preserving cultural heritage and promoting environmental stewardship in Kalinga province. These practices highlight the Kalinga people’s deep connection to their ancestral land and commitment to ecological balance.

Paniyaw is a customary law that governs the sustainable use of land, water, and forest resources. *Ngilin* involves rituals to honour the spirits of the land, reflecting the Kalinga belief in the sacredness of their environment. *Bain* celebrates communal farming, fostering unity and shared responsibility for caring for natural resources.

Maintaining these traditions safeguards Kalinga culture and benefits the province. The Bodong justice system links these practices, emphasizing harmony within society and nature. Similarly, the Ngasuh Gumi tradition in North Lombok, Indonesia, illustrates the importance of cultural traditions and local knowledge in sustainable development. The cultural landscape of Pura Batukaru in Bali showcases the interconnectedness of traditional practices, cultural heritage, and environmental preservation. The Tri Hita Karana Formal education often emphasizes Western knowledge, which can conflict with Indigenous worldviews, making it harder for these communities to engage with school and retain their traditional practices. Integrating TEK into school curricula could enhance environmental stewardship and help combat climate change.

4.5.3.. *Decline of traditional practices*

The introduction of formal education has contributed to the gradual fading of certain traditions. As societies modernize and attitudes shift, practices such as “*Dawak*” (respect for elders) and “*Sissiwá*” have dwindled over time. Environmental stewardship is becoming less popular among younger people in the community because they want to work in regular jobs.

Maluku folklore and culture in Indonesia are also on the decline. This is because young people have different reading tastes and find that standard textbooks must cover Maluku culture more. A lack of local cultural elements in formal education can make it harder for young people to connect with traditional knowledge and ways of doing things (Rijoly 2022).

4.6. How Do Globalization and Modernization Impact the Transmission and Practice of TEK in Kalinga Province?

4.6.1. Bridging cultural divides

Social media and modern technology have globally exposed the indigenous practices and TEK of the Kalinga people. Platforms now showcase cultural songs like “*Uwawi*” by Arnel Banasan and dances such as “*Awong chi gangsa, adtun di banga*” (“The sounds of a thousand gongs and dance of a thousand pots”), which earned Kalinga a Guinness World Record. The Tinglayan rice terraces and the Chico River, protected by elders, are also widely shared online, encouraging the younger generation to appreciate and continue their heritage.

Anacin, Enrique, and Ty (2015) found that the Ibaloi community in the Philippines has successfully blended their traditional practices with modern elements, preserving their culture despite modernization. Similarly, the Semai people of Malaysia use digital technology to preserve their endangered languages and traditions (Renganathan and Kral 2018).

However, there are concerns about how indigenous communities are involved in the digital preservation process and whether they control the portrayal of their culture. Still, the Indian government’s initiatives to digitally preserve cultural heritage show how technology can help safeguard these traditions (Singh 2012).

4.6.2. Advancements in agriculture and environmental protection

Modernization has significantly improved traditional farming practices, reducing the workload for farmers and increasing overall efficiency. As a result, communities are better able to adhere to local regulations, contributing to cleaner and healthier environments. According to Ngidlo (2014), combining modern and traditional farming techniques can enhance food security and promote sustainability in indigenous communities. Additionally, a study by Gomez et al. (2013) examined how integrating traditional and modern knowledge systems can strengthen community resilience, particularly in Indonesia. This study explores how indigenous communities utilize TEK and digital technologies to manage their natural resources and sustainably adapt to climate change. The findings highlight that when digital technologies are combined with local ecological knowledge, indigenous communities are empowered to more

effectively monitor and manage their resources, which ultimately helps them adapt better to the challenges posed by climate change.

4.6.3. Destroys communal bonds and traditional cultural practices

Modernization and globalization weaken communal bonds and traditional practices, reducing unity, cooperation, respect for elders, and community interactions. Children now prefer digital devices over outdoor activities or cultural practices like playing gongs and flutes. Zort et al. (2023) highlight that while technology helps share cultural values, it also challenges preserving intangible heritage. The study shows that technology has reduced face-to-face communication and the chance for younger generations to learn traditional skills from elders. Additionally, respect for elders and community structures has declined due to growing individualism and materialism.

5. Conclusion

5.1. Various Medicinal Plants

The Kalinga people utilize plant-based medicines to address various health concerns. The community protects these medicinal plants and propagate them because of the many health benefits they give to the people. These traditional practices highlight the deep connection between the community and their natural environment. The plants serve many purposes, from treating wounds and infections to relieving pain and addressing internal ailments.

5.2. Traditional Rice Farming

Traditional rice farming in Kalinga is a labour-intensive process deeply intertwined with local knowledge and respect for the environment. The traditional methods provide valuable lessons in sustainability, cultural preservation, and maintaining a harmonious relationship with nature.

5.3. Community Techniques Used for Water and Forest Conservation

The people of Kalinga demonstrate a profound respect for nature through its community-led conservation efforts. By prohibiting burning

activities, performing rituals to appease spirits, and respecting natural signs, they have safeguarded their environment for generations.

5.4. TEK Use in Mitigating Climate Change

The Kalinga people's TEK practices have contributed significantly to climate change adaptation and mitigation. Their strict policies against burning, reverence for trees, and commitment to organic farming demonstrate a deep understanding of environmental balance and sustainability. The Kalinga people exemplify a way to address the challenges of climate change.

5.5. Values and Beliefs

The Kalinga community's connection with the environment is built on traditional beliefs of respect, reciprocity, and responsibility. Practices like moderation, rituals, and reverence for nature, passed down through generations, promote environmental stewardship and strengthen community bonds. The Kalinga people show that TEK can guide sustainable living and coexistence with nature, reflecting the core values of PNB.

5.6. Impact of Formal Education

The introduction of formal education has presented opportunities and challenges for transmitting TEK in the Kalinga community. While it has facilitated the documentation and preservation of cultural practices, potentially reaching a wider audience through books and research, it has also coincided with a decline in the practice of some traditions, e.g., respect for elders and care of the environment in the context of traditional beliefs.

5.7. Impacts of Globalization and Modernization

Globalization and modernization have good and bad impacts on the transmission and practice of TEK in Kalinga province. While they offer valuable tools for cultural exchange and advancements in agriculture and environmental protection, they also destroy communal bonds and traditional practices. Modern entertainment, technology, and changing values have made people forget their traditional ways of life.

5.8. Recommendations

1. Public and private schools can incorporate lessons on TEK, emphasizing a change in the worldview of Nature from strong anthropocentrism, “human as the center,” that considers Nature as an “object” to be manipulated by humans to Nature as a “subject” to be respected. This can raise awareness among the younger generation about the importance of traditional practices and foster a sense of pride in their cultural heritage.
2. The Matagoan Bodong Council can create programs for youth that involve traditional cultural and environmental activities like tree-planting ceremonies, workshops on music and dance, and hands-on lessons in sustainable farming.
3. Local government units (LGUs) should support blending traditional and modern farming methods to boost productivity and maintain ecological balance. They can also promote organic farming and traditional pest control practices.
4. Elders and LGUs must encourage community members to actively participate in documenting their traditional knowledge, practices, and rituals. They should also establish local archives or digital repositories to store this information for future generations.

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