Pertanika J. Soc. Sci. & Hum. 34 (S5): 1 - 28 (2026)

PERTANIKA JOURNALS

SOCIAL SCIENCES & HUMANITIES

Journal homepage: http://www.pertanika.upm.edu.my/

Social Resilience in Exploring Climate Change Impacts on Quality of Life: A Case Study Temiar Indigenous People

Ismafatin Nabilah Ismail[1], Mohd Khairul Amri Kamarudin[1,2]*, Hafis Simin[2], Asmawi Ibrahim[2], and Wan Nor Azilawanie Tun Ismail[2]

[1]East Coast Environmental Research Institute, Universiti Sultan Zainal Abidin, Gong Badak Campus, 21300 Kuala Nerus, Terengganu, Malaysia

[2]Faculty of Applied Social Sciences, Universiti Sultan Zainal Abidin, Gong Badak, 21300 Kuala Nerus, Terengganu, Malaysia

ABSTRACT

The Temiar indigenous people faced various challenges arising from climate change, a worldwide phenomenon that altering the weather patterns and expanding the frequency of extreme weather events which bring effects towards livelihood, ecosystems and individuals well-being. Deforestation, agricultural practices, urbanisations, and greenhouse gas emissions from burning fossil fuels were factors influencing climate change. The Temiar indigenous people were the first-hand directly impacted of climate change since their livelihoods depend on and close with nature and environment. This research identified the main quality of life indicators among the Temiar indigenous people using the Relative Importance Index (RII). Total of 450 respondents were selected as a representative sample from Temiar indigenous people and participated in this quantitative research design using a structured questionnaire survey. The data was analysed using RII and chemometrics techniques using Statistical Package for Social Sciences (SPSS). According to the Relative Importance Index (RII) results, the Temiar community places the highest value on feeling safe in residential with (RII = 0.866), health satisfaction (RII = 0.824) and satisfaction on air quality (RII = 0.820), demonstrating a good feeling of well-being regardless of environmental issues. Regression analysis revealed that the impact of climate change on quality of life (QoL) is statistically significant but minor (R^2=0.119), indicating that other sociocultural and resilience elements are

ARTICLE INFO

Article history:
Received: 11 September 2025
Accepted: 29 September 2026
Published: 20 November 2026

DOI: https://doi.org/10.47836/pjssh.34.S5.01

E-mail addresses:
sl4512@putra.unisza.edu.my (Ismafatin Nabilah Ismail)
mkhairulamri@unisza.edu.my (Mohd Khairul Amri Kamarudin)
mohamadhafis@unisza.edu.my (Mohamad Hafis Amat Simin)
asmawiibrahim@unisza.edu.my (Asmawi Ibrahim)
azilawanieismail@unisza.edu.my (Wan Nor Azilawanie Tun Ismail)
* Corresponding author

© Universiti Putra Malaysia Press

more relevant. These findings emphasise the importance of incorporating indigenous knowledge systems, community resilience, and adaptive methods into future climate adaptation plans in order to improve indigenous communities' sustainability and well-being.

Keywords: Climate change, environmental, indigenous people, quality of life

INTRODUCTION

Climate change is a major worldwide concern that has an impact on a variety of aspects of human life, biodiversity, and ecosystems. The Intergovernmental Panel on Climate Change (IPCC) reports that there was a greater than 50% chance that, under all observable scenarios, global temperatures will rise by 1.5 degrees Celsius or more between 2021 and 2040 (Boehm & Schumer, 2023). Malaysia dealing with a range of environmental challenges, including the effects of climate change, such as changed patterns of rainfall, high temperatures, and extreme weather conditions that are dangerous to human life (Taufek et al., 2021). Mentioned by Ford et al., (2020), indigenous populations are significant vulnerability to the challenges caused by climate change due to their reliance on natural resources for survival. The Temiar community, one of Malaysia's most prominent indigenous groups, is significantly affected by climate change, threatening their traditional knowledge systems, cultural heritage, and well-being.

The main variables contributing to climate change include urbanisation, deforestation, unsustainable agricultural practices, and greenhouse gas emissions resulting from fossil fuel consumption. Research from Clarke et al. (2022) discovered that these consequences have led to an increased frequency of extreme weather events such as heatwaves, droughts, and floods, along with significant alterations in weather patterns. Hence, the Temiar indigenous people are directly impacted, as it depends on forest and rivers for their livelihood. As supported by Arora et al., (2023), indigenous people face risks to their existence and quality of life related to alterations in traditional farming practices, biodiversity loss and water scarcity.

Besides, the indigenous Temiar people are experiencing severe consequences of climate change, including increased health risks, unstable food supplies, and a loss of their traditional ecological knowledge, amid their close ties to nature (Bogdanova et al., 2021; Redvers et al., 2023). The increased number of natural disasters has made these problems worse as they directly threaten their way of life and health. Nevertheless, limited research has been done on how climate change impacts indigenous people’s quality of life and resilience strategies. Therefore, it is essential to create policies which could safeguard and empower the indigenous populations against environmental challenge.

Recent studies highlight that climate change has had a significant impact on

the socioeconomic conditions and health of indigenous populations worldwide (Datta et al., 2024; Lansbury Hall & Crosby, 2022). Higher exposure to climatic disasters increases the chance of health problems, including waterborne infections and other diseases. Additionally, changes in climate patterns could disrupted traditional agricultural cycles, making it difficult for indigenous farmers to continue producing food (Muluneh et al., 2021). These difficulties highlight the urgent necessity for indigenous-specific climate adaption plans. The indigenous groups in Malaysia likely Temiar people depend on traditional ecological knowledge to make a living. Sustainable farming and forest conservation are main cultural customs that are essential in preserving the natural balance of the environment (Rai & Mishra, 2022). However, their quality of life is threatening as a consequence of the catastrophic events brought on by climate change and expanding deforestation. Their ability in adapting climate challenge could weakened as no proper intervention provided to address the loss of indigenous practices and knowledge.

The purpose of this study was identifying the most important quality of life indicators among the Temiar indigenous people using the Relative Importance Index (RII). It highlights the significance of traditional ecological knowledge in adaptation techniques and evaluating the relationship between climate-induced challenges and indigenous resilience. The findings provide significant perspectives on the discussion of climate change and indigenous well-being. This study supports the Sustainable Development Goals (SDGs) of the United Nations, specifically the Good Health and Well-Being (SDG 3), Climate Action (SDG 13) and Life on Land (SDG 15), as well as highlights the need for an inclusive and sustainable future for indigenous people.

LITERATURE REVIEW

Social Resilience and Quality of Life

The concept of social resilience includes the capability in handling disruptions brought on by environmental, social, political, and others. Social resilience refers to the ability participate in, creating, and maintain healthy social interactions in addition endure and recover from the pressures that come with social engagement (Moya et al., 2022; Singapore Management University, 2024). Researchers implemented social resilience in investigating the communities respond to natural disasters, economic shocks, and conflicts, together with people's physical and mental health affected by illness, poverty, and domestic violence (Alizadeh et al., 2022). In the context of indigenous, it has strong foundation in cultural norms, common practice and social structures that offer coping strategies during difficult times (Bihari et al., 2023). Mentioned by (Saul, 2022), traditional knowledge, group customs, and strong family relationships frequently serve as buffers, strengthening the community's resistance to and ability to recover back from disasters. Hence, social resilience is essential for allowing vulnerable people to sustain themselves over a period of time.

In a sociological context, quality of life defined as a person's ability to engage in meaningful social interaction, social connections, and resource accessibility are frequently linked to their life (Nutakor et al., 2023). Psychological research highlights that quality of life consists of subjective happiness, satisfaction with life, emotional stability, and a feeling of control over circumstances in life (Das et al., 2020). Public health and medical disciplines describe quality of life in terms of physical well-being, ability to function, mental health condition, and accessibility to healthcare services (Kaplan et al., 2022).

Environmental sustainability researchers are seeking to expand the notion of quality of life by integrating environmental quality, ecosystem services, and human-nature interactions, especially in communities that rely directly on natural resources for their livelihoods (Arbuzova & Kubrina, 2024). In indigenous contexts, quality of life is multidimensional, incorporating heritage continuity, spiritual wellness, land connection, and the safeguarding of traditional knowledge systems, in addition to material and health-related indicators (Taylor et al., 2023). Researchers have progressively linked quality of life to social resilience, especially in rural and indigenous populations. From another perspectives, quality of life is a complex concept that includes how people view their place in life in respect to their culture and values, as well as their objectives, standards, expectations, and worries (Veenhoven, 2024).

The term "quality of life" seeks to measure the overall well-being of a population or individual with respect to both positive and negative aspects of their lives at certain points in time (Teoli et al., 2023; Frisch, 2024). Ismail et al. (2024a) highlights that psychological well-being, environmental safety, financial stability, and physical health are some of the components of quality of life. Regarding the indigenous communities, it includes cultural and spiritual elements as well as land stewardship, language preservation, and ceremonial practices. (Terpstra et al., 2021). The Malaysia Quality of Life Index (MQLI) was chosen for this study because its focus on fundamental living conditions is ideal for assessing quality of life in indigenous communities, and the survey instrument was designed based on its components (Department of Statistics Malaysia, 2023). The components and sub-index of Malaysia quality of life (MLQI) was displayed in Table 1. The Malaysia Quality of Life Index (MQLI) contains 45 indicators, which are divided into the 11 QOL components as shown in Table 1.

Social capital known as the networks of reciprocity shared standards, and trust is acknowledged as a main factor in social resilience (Carmen et al., 2022). Higher level of social capital linked to various advantages like improved health, increased sense of community, and enhance community engagement, hence improving one's well-being (Imbulana Arachchi et al., 2023). Philip et al., (2022) stated that social capital frequently preserved in indigenous communities through cooperative labor systems, familial relationships, and

Table 1
The components and sub-index for Malaysia Quality of Life (MQLI)

Components	Sub-Index
Income and Distribution	113.3
Workplace Environment	104.6
Transportation and Communication	120.3
Health	110.5
Education	120.4
Housing	115.7
Environment	106.6
Family Life	104.6
Social Participation	110.1
Public Safety	110.8
Culture and Leisure	113.5
Malaysia Quality of Life Index	111.9

Note. Base Year 2000 = 100
Source: MENTERI, 2012 and DOSM,2023

oral traditions. Furthermore, additional challenges like land invasion, environmental degradation, and displacement could weaken these vital relational networks, which are important in responding towards climate-related catastrophes such as floods or food shortages (Nguyen et al., 2023).

Harangody et al., (2022) argues which is the local tradition and knowledge have a strong relationship with resilience in indigenous community. Traditional ecological knowledge (TEK) offers localised wisdom for the management of natural resources and anticipating environmental changes (Mardero et al., 2023). On the other hand, TEK provides a foundation for collaborative learning and innovation, enhancing the capacity to manage evolving risks (Berkes et al., 2021). Given that this knowledge systems are dynamic and flexible, communities can modify their practices in response to altering climatic conditions while maintaining their cultural identity (Ghorbani et al., 2021). Consequently, the preservation and recognition of TEK are important for both adapting to change and enhancing the indigenous people's well-being (Das et al., 2021).

Considering its importance, policy and development frameworks frequently neglect the social dimension of resilience. Yang et al., (2021) points out that most adaptation strategies prioritise technological and infrastructure solutions over local experiences and practices. When indigenous people are not included in the decision-making processes that are crucial to their future, their capacity to design their own future is hindered (Gustafsson et al., 2022). Thus, inclusive strategies that enhance indigenous viewpoints and integrate their knowledge into resilience planning are

essential to address this issue. Enhancing social resilience is likewise essential for improving the quality of life in indigenous communities and ensuring sustainable development outcomes.

In this context of study, quality of life is considered as the dependent variable. Individuals and societies' quality of life are determined by their environmental, social, and economic circumstances. Previous research has consistently shown that changes in environmental circumstances, particularly those caused by climate change, affect both objective and subjective aspects of quality of life, such as health status, environmental satisfaction, safety, and general well-being. Thus, quality of life was an appropriate dependent variable for analysing how external stressors, such as climate change, influence indigenous well-being.

Climate Change and Indigenous People

Globally, climate change issues are worsening, impacting both human livelihoods and ecological systems. Climate scientists predict over 25% of Malaysia's population will be displaced due to the country's increasingly effects of changes in the climate and environmental degradation by 2030 (Sahani et al., 2022). Ismail et al. (2024b) defines "climate change" terms as gradual alterations of weather trends, temperatures, and other climatic variables. Indigenous community which traditional practices and livelihoods that strongly related to environment are suffering the most severe consequences (Aich et al., 2023; Jerez, 2021). The traditional livelihood that strengthens indigenous well-being are disrupted the ecosystems by rising temperatures, changed precipitation patterns, and frequent floods (Dhimal et al., 2021).

Research reveals that indigenous communities are affected from the climate-related changes which risks their health issues like vector-borne illnesse, respiratory failures, and water-borne illnesses (Akanwa et al., 2022; Anik et al., 2023). Moreover, the indigenous community that reliance with rain-fed crops, prolonged droughts caused by climate change resulting in widespread agricultural failures (Atanga et al., 2021), therefore resulting to food insecurity (Saleem et al., 2024). Particularly, floods have been linked to outbreaks of diarrheal and vector-borne diseases, highlighting the relationship between environmental and health hazards. (Coalson et al., 2021). The risks are further compounded in many rural communities by a lacking emergency response services and infrastructure (Doke et al., 2021). As environmental changes become increasingly frequent, the capacity of these societies to adapt is subject to these factors.

Regardless the vulnerability, indigenous peoples maintain comprehensive ecological knowledge systems developed over centuries via interaction with and observation of their environment. Traditional ecological knowledge (TEK) encompasses insights regarding climatic trends, soil fertility, biodiversity, (Harefa, 2024) and others which are essential for adapting to environmental change (Dalyan et al., 2024). For instance, farmers in indigenous

communities may adjust their planting and harvesting strategies in responses to climatic disasters to secure their food supply (Mallick et al., 2024). Indigenous farmers may advance their planting schedules to align with the excess rainfall, aiming to harvest prior to the onset of severe drought, in order to cope with increasingly early and extreme dry seasons (Ricart et al., 2022). Nonetheless, traditional climate adaption tactics often overlook the potential of TEK, resulting in several top-down solutions that misalign with the genuine needs and practices of indigenous communities. (Rarai et al., 2022).

Enhancing the accessibility and justice of climate governance involves reconsideration in collaboration with indigenous perspectives. Several studies reported such adaptation strategies that developed in collaboration with indigenous community are more successful, long-lasting, and accepted in society. As example, the restoration of traditional Sasi Laut system by indigenous coastal communities in Maluku, Indonesia, was supported by researchers and non-governmental organisations, driven by concerns of overfishing and marine degradation caused by climate change (Daeli et al., 2019; Muin et al., 2023). The collaborative efforts leading in improving food security, restored fish populations, and enhanced community governance by incorporating scientific marine conservation techniques with traditional laws (Ufie et al., 2023). This case study proves that the potential of traditional ecological knowledge-based co-management in strengthening ecosystem resilience while preserving cultural integrity is important. As such, indigenous knowledge is important to create resilient, community-driven climate responses rather than being regarded as supplementary.

Climate change is regarded as the independent variable in this study, serving as an external environmental driver that impacts human and social systems. Climate-related issues, such as modified temperature patterns, shifting precipitation, extreme weather phenomena, and environmental degradation, function independently of individual behaviour and directly or indirectly impact livelihoods, health, and environmental quality. Multiple studies highlighted climate change as a primary factor influencing disparities in quality of life, especially among indigenous groups whose livelihoods are intricately linked to natural ecosystems.

Underpinning Theory

Two main theoretical frameworks act as the foundation for this research: the Social Resilience Theory and the Social-Ecological Systems (SES) Theory. These frameworks provide in-depth understanding regarding the climate change impact on Temiar indigenous people's quality of life and the capability in adapting and their cultural resilience which is significance in maintaining their wellbeing. The Resilience Theory was introduced by Holling 1973, a Canadian ecologist that focuses on how systems respond to shocks and disturbances while maintaining their fundamental

functions (Holling, 1973; Mayar et al., 2022). Social Resilience theory describes the ability of individuals or communities to persevere, adjust, and prosper in the amid major transformations and challenges (Rachmad, 2022). Mentioned by Zhai et al. (2024), resilience identifies as the ability of people and groups to resist shocks, continue to perform vital tasks, and adapt to change. The Temiar people demonstrate resilience with the application of traditional ecological knowledge (TEK), social support structures, and cultural practices that encourage adaptation and restoration.

Elinor Ostrom introduced Social-Ecological Systems (SES) Theory in 2009, highlighting the dynamic relationship between ecological processes and social structures, comprehending human and environmental systems as interrelated and interacting. **(**Biggs et al., 2021; Ostrom, 2009**)**. The SES framework provides fundamental for assessing the behaviours which ecological deterioration impacts community survival and continuity, highlighting the necessity of sustainable and integrated methods to environmental change management (De Garine-Wichatitsky et al., 2021). This theory applicable to indigenous communities as it's significant to understand indigenous community like the Temiar as they heavily depend on nature for their way of life and culture, therefore through deforestation, extreme weather, and biodiversity loss can negatively affects both their well-being and the ecosystem.

In conjunction with these frameworks, the theory of Maslow's Hierarchy of Needs offers a human-centered framework for evaluating quality of life. Maslow (1943) proposed that human well-being develops through a structured hierarchy of needs, starting with physiological necessities (such as food, water, and shelter), followed by safety (including security and stability), then feelings of love and belonging (which includes friendship, family, and intimacy), followed by esteem (respect and recognition), and self-actualisation, which refers to discovering one's full potential. In indigenous societies, fulfilling fundamental necessities like food security, shelter, health, and personal safety serves as the foundation for achieving higher levels of social, cultural, and psychological well-being (Sutherland & Adams, 2019).

Maslow's theory is relevant to this study because it can theoretically link quality of life variables (such as income satisfaction, living conditions, well-being, environmental safety, and public security) to basic human needs. The threat to basic needs posed by climate change impacts, such as environmental degradation and disruption of livelihoods, may adversely affect the overall quality of life and resilience of indigenous communities. Thus, connecting human wellness theory with resilience and social-ecological perspectives and incorporating Maslow's Hierarchy of Needs enhances the theoretical foundation of this research.

Case Study on Quality of Life and Climate Change among Indigenous Communities

Quality of life has been the subject of several empirical studies from a variety of academic

fields, including public health, sociology, environmental studies, and indigenous research. Prior studies indicate that quality of life is a multidimensional construct that may be evaluated by both quantitative measures (including income, housing, health, and environmental circumstances) and subjective assessments (such as satisfaction, well-being, and perceived safety). In the context of climate change, research has increasingly emphasised the interaction of environmental stresses with social, cultural, and economic factors in shaping community well-being. This perspective was significant for indigenous people, whose quality of life was deeply connected to land, natural resources, cultural continuity, and traditional livelihoods, making them particularly at risk for climate-induced environmental changes. Table 2 present the summary of case study on quality of life and climate change among indigenous communities.

From the Table 2, it was demonstrated that quality of life is multidimensional within the indigenous and climate-affected communities. Quality of life has been studied in both global and local settings using subjective aspects like well-being, cultural continuity, perceived safety, and adaptive ability, as well as objective ones like health, income, environmental conditions, and job security. Global-scale reviews highlight that traditional ecological knowledge (TEK) gives communities the ability to deal with environmental challenges in ways that are traditionally important, and that is why indigenous resilience remains strong (Ford et al., 2020). Nevertheless, regional studies, like those conducted on the Sámi in Finland, show that when traditional land-based practices and cultural systems are progressively restricted, climate change can negatively impact quality of life, underscoring the fact that resilience varies

Table 2
Summarise on quality of life and climate change among indigenous communities

Study Area	Indigenous Population	Research Method	QoL Indicators	Findings	References
Global	Global Indigenous population	Systematic literature review	Multidimensional	Indigenous communities more resilient to environmental change since they use traditional knowledge to adapt to environmental change.	Ford et al., 2020
Finland	Saami Indigenous	Systematic literature review	Mental health, cultural well-being, lifestyle and diet, adaptive capacity	The Saami have limited adaptability to climate change impacts due to difficulties in preserving traditional practices and land-based lives.	Jaakkola et al., 2018

Table 2 (*continued)*

Study Area	Indigenous Population	Research Method	QoL Indicators	Findings	References
Australia	Remote Indigenous Settlement	Review	Physical health, phycological well-being, environmental resource security, socio-economic conditions	Climate change increase health vulnerability via direct and indirect pathways	Lansbury Hall & Crosby, 2022
Guyana, South America	Amerindian peoples	Qualitative	Food security & nutrition, livelihood stability, social & cultural practices	Climate change negatively effects food productions, threatening food security and income	Bynoe, 2015
Hopedale, Canada	Inuit Community	Mixed qualitative	Livelihood security, health & safety, adaptive capacity	Climate change increased the risk of traditional hunting and harvesting by altering sea ice thickness	Malik et al., 2025
Selangor, Malaysia	Temuan Indigenous People	Qualitative	Environmental stability, TEK, governance & rights, livelihood security	Environmental damage & unpredictable weather threaten safety and quality of life	Rahman et al., 2025
Kelantan Malaysia	Temiar Indigenous People	Quantitative	Malaysia Quality of Life	QoL influenced by socio-economic and environmental factors	Ismail et al., 2024a
Johor, Malaysia	Indigenous People	Cross sectional quantitative	Lifestyle vulnerability, awareness & risk perception, health impacts	Indigenous respondents considered climate change as an immediate threat to their health and well-being.	Kwa et al., 2024
Sarawak, Malaysia	Indigenous People	Mixed method	Livelihood security, socio-ecological resilience, cultural practices, and social networks	TEK is not only a cultural asset but a practical tool for climate adaptation	Hosen et al., 2020
Sabah, Malaysia	Indigenous People	Mixed Method	Awareness & perception of climate change, TEK, and climate impacts on livelihood	The awareness and attitudes of indigenous peoples concerning climate change significantly influenced their willingness to support participate in adaptation measures.	Pimid et al., 2022

among indigenous communities (Jaakkola et al., 2018). Bynoe (2015) conducted a study on Amerindian communities in Guyana, revealing that climate change adversely impacts food production systems, thereby threatening food security, livelihood stability, and nutritional health, demonstrating how environmental change can directly compromise essential aspects of quality of life when adaptive capacity is limited. Similarly, Malik et al. (2025) observed that climate-induced sea ice shifts in Hopedale, Canada, have raised hunting and harvesting safety concerns, reducing livelihood security and physical well-being.

Research in Australia and Malaysia demonstrates the impact of climate change on the quality of life for indigenous populations via interconnected health, environmental, and socio-economic pathways. Empirical research conducted in Malaysia among indigenous tribes in Kelantan and Sabah shows that socioeconomic circumstances, cultural practices, and perspectives contribute to quality of life in addition to the environment (Ismail et al., 2024a; Pimid et al., 2020). Furthermore, mixed-method studies by Hosen et al. (2020) mentioned that TEK serves as a practical adaptation mechanism as well as a cultural legacy, enhancing socio-ecological resilience and assisting community-based responses to climate change. Rahman et al. (2025) indicated that degradation of the environment and unpredictable weather conditions within the Temuan community in Selangor have intensified concerns regarding safety, livelihood stability, and overall quality of life. Conversely, Kwa et al. (2024) discovered that indigenous respondents in Johor regarded climate change as an imminent threat to health and well-being, signifying increased risk awareness and lifestyle susceptibility.

Overall, the reviewed case studies emphasised the necessity of assessing quality of life through integrated objective and subjective frameworks, especially when investigating the effects of climate change on indigenous populations. These case studies indicate that environmental pressures pose threats to health, livelihoods, and safety; however, strong social ties, cultural traditions, and traditional knowledge may assist communities in addressing these challenges.

METHODS

Research Design

This study employed quantitative research design to identify the impacts of climate change on the quality of life of the indigenous community. The study used a survey-based research approach, which enabled the systematic collecting of standardised quantitative data from a large population through a structured questionnaire. The demographic characteristics such as age, gender, religion, education level, marital status, occupation, and income were included in the questionnaire. Furthermore, the questionnaire consists of 11 main components of quality of life according to Malaysia Quality of Life (MQLI); (A) income and distribution, (B) workplace environment, (C) transportation and

communication, (D) health, (E) education, (F) housing, (G) environment, (H) family life, (I) social participation, (J) public safety, and (K) culture and leisure. The questionnaire was adapted from the Malaysia Quality of Life Index (MQLI), a nationally acknowledged framework extensively utilised in quality-of-life evaluations in Malaysia. The MQLI components were transformed into survey items to represent the socio-economic, environmental, health, and social conditions pertinent to indigenous cultures. Minor contextual modifications were implemented to promote cultural relevance and understanding among the Temiar participants, while preserving the conceptual framework of the original MQLI model. Likert scale ranging from 1 to 5, with 1 denoting "strongly disagree," 2 "disagree," 3 "somewhat disagree," 4 "agree" and 5 denoting "strongly agree" was implemented to assess the response. The five point of Likert scale allows respondents to indicate different levels of perception and satisfaction, making it particularly effective for evaluating multidimensional issues like quality of life. The application of a Likert scale facilitates compatibility with analytical methods such as the Relative Importance Index (RII) and regression analysis, thereby enabling reliable and significant statistical interpretation.

Study Area and Population

This research was carried out at the Nenggiri River Basin, Gua Musang, Kelantan, Malaysia as shown in Figure 1. Located between latitudes 4°40′ and 6°12′ North and

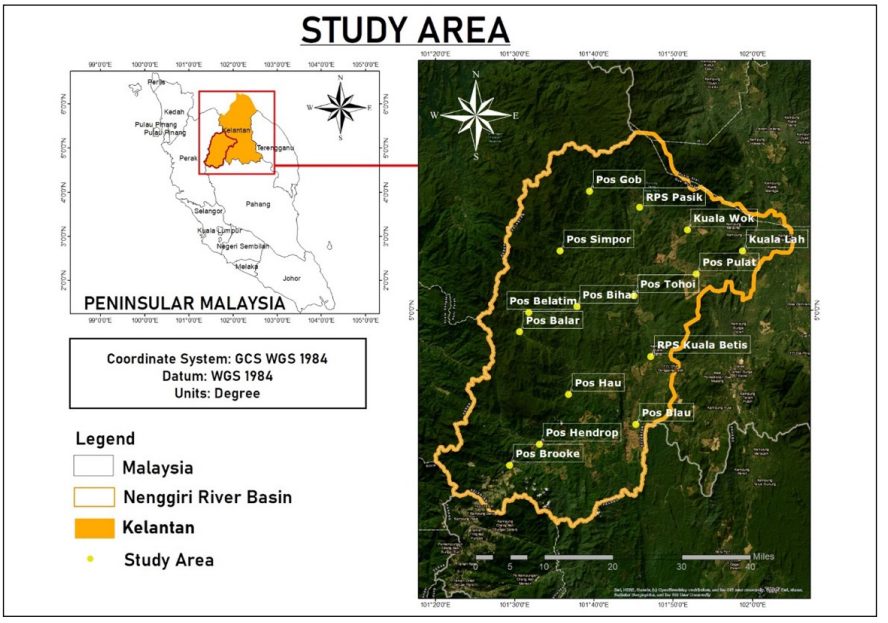


Figure 1. Location of the study area, Nenggiri river basin
Source: Author's work

longitudes 101°20′ and 102°20′ East, the Nenggiri River Basin had a total catchment area of approximately 3,993 km^2. The target population consisted of Temiar indigenous individuals living in the Nenggiri River Basin, with their livelihoods and well-being strongly linked to the nearby natural environment.

Data Collection

Primary data were collected using a structured questionnaire through face-to-face interviews and completed surveys. Total of 450 respondents (indigenous people) that resident along the Nenggiri river basin were collected through quantitative study using random sampling with distribution of survey questionnaire and direct interviews. Random sampling was performed at both the household and individual levels among Temiar communities along the Nenggiri River Basin. Temiar households were identified with the aid of local community leaders (Tok Batin), and one eligible respondent aged 18 years or older, who had resided there for a minimum of one year, was randomly selected from each household. This method guaranteed extensive representation across age, gender, and socio-economic categories while preserving randomness within field-based limitations. The data collection and fieldwork were conducted over a one-year period from January 2024 to January 2025. Total of 450 respondents (indigenous people) that resident along the Nenggiri river basin were distribute the survey questionnaire and direct interviews. The involvement of trained field assistants, who assisted in questionnaire distribution, survey item clarification, and communication with respondents.

Data Analysis

The Statistical Package for the Social Sciences (SPSS) version 27 software was used to import and analyse the acquired data for statistical analysis. The respondents' demographic information was examined and presented using descriptive analysis. Furthermore, regression analysis was performed to investigate the relationship between climate change indicators and quality of life. In this study, regression analysis allowed to quantify the extent to which reported climate change impacts explain variances in quality of life among the Temiar indigenous population. Furthermore, the Relative Importance Index (RII) is used to assess the relative relevance of quality variables. The formula for calculating RII were as Equation 1.

$$Relative\ Importance\ Index\ (RII) = \frac{\sum W}{A * N} \quad [1]$$

W is the respondent weighting of each statement (ranging from 1-5); A is for a higher number of respondents, and N is the overall number of respondents. The points on the Likert scale are equivalent to the value of W, which represents the respondent's weighting of each component. This method determines the factor using a

ranking mechanism based on the weight received from the given data value.

Pilot Study

Prior to the main survey, a pilot study was conducted involving 30 Temiar respondents to assess the reliability, clarity, and suitability of items in the questionnaire. The pilot research feedback revealed that slight modifications in language were necessary to enhance respondents' understanding. The reliability analysis from the pilot study indicated satisfactory internal consistency, as evidenced by Cronbach's alpha values surpassing 0.90 for the quality-of-life dimensions. Hence, the questionnaire was refined before full scale data collection based on these results.

Ethical Considerations

This study followed ethical guidelines for research involving human subjects, particularly indigenous populations. Prior to data collection, authorisation to perform the study was secured by engaging with local community leaders, including the Tok Batin, to verify compliance with community norms and cultural practices. Participation in the study was fully voluntary, and all respondents provided informed consent before receiving the questionnaire. Respondents were told about the study's goal, the confidentiality of their responses, and their opportunity to withdraw at any time without penalty. No personal identifiers were collected, and all information was used purely for academic research.

RESULTS AND DISCUSSION

The Socio-Demographic Profile

Table 3 shows the socio-demographic profile of 450 respondents that live along the Nenggiri river basin. Socio-demographic profiles consist of age, gender, religion, education level, marital status, occupation, and incomes gathered. The frequency and percentage distribution of each socio-demographic trait was detailed in the Table 3.

As shown in Table 3, the majority of respondents were between the ages of 26 and 40, with (42%) indicating a generally young and active adult population. The following were aged 41 to 59 (28.2%), youngsters aged 19 to 25 (14%), and only (6.7%) were under 18 years old, while (9.1%) were 60 and above. The gender distribution among responders was nearly balanced with man (51.6%) slightly outnumbering woman (48.4%). Religion-wise, Islam was the major religion (72.7%), followed by those who practiced animism or indigenous spiritual beliefs (23.6%), Christians (2.9%) and Buddhists (0.9%). The existence of animist practices demonstrates the Temiar community's persistent reliance on traditional beliefs, which may influence perceptions of environmental change and reactions to climatic issues. In terms of education, (39.1%) of respondents stated having no formal education, (25.6%) had completed primary school, and (33.3%) had completed secondary school. Only a small percentage went on to further their education, with only (1.6%) completing STPM/ HSC and a combined (0.4%) completing

Table 3
The socio-demographic profile of respondents

Socio-Demographic		Frequency, n	Percentage (%)
Age	Below 18	30	6.7
	19 - 25	63	14
	26 - 40	189	42
	41 - 59	127	28.2
	60 and above	41	9.1
Gender	Man	232	51.6
	Woman	218	48.4
Religion	Islam	327	72.7
	Christian	13	2.9
	Buddha	4	0.9
	Others (Animisms)	106	23.6
Education Level	No formal education	176	39.1
	Primary school	115	25.6
	Secondary school	150	33.3
	STPM/HSC	7	1.6
	Diploma	1	0.2
	Others	1	0.2
Marital Status	Married	339	75.3
	Single	90	20
	Widow	3	0.7
	Widower	18	4.0
Occupations	Self-Employed	258	57.3
	Government	10	2.2
	Private Sector	16	3.6
	Housewife	66	14.7
	Unemployed	93	20.7
	Others	7	1.6
Income	RM1,000 and ````below	412	91.6
	RM1,001- RM2,000	35	7.8
	RM2,001 - RM3,000	3	0.7

diploma-level or other courses. This lack of formal education demonstrates significant obstacles to accessing information, services, and job opportunities, which can have a severe impact on resilience and quality of life in the face of climate change. It also highlights the necessity of customized educational and awareness campaigns that take literacy and local knowledge systems into account. Marital status data reveals that the majority of respondents (75.3%) were married, (20%) single, while widows and

widowers represented a tiny proportion of the group (0.7% and 4%, respectively). The occupation numbers reflect the community's socioeconomic status, with more than half (57.3%) self-employed with most likely in forest-based work or agriculture and (20.7%) jobless, while (2.2%) of the respondents worked in government and 3(.6%) in the private sector, demonstrating limited access of formal employment opportunities. The income levels shown severe economic vulnerability with (91.6%) of respondents reported monthly earnings of RM1,000 and below, as well as (0.7%) earning more than RM2,000. These data highlight the community's economic instability since limited income hinders access to education, healthcare, clean water, and other resources.

The Relative Importance Index (RII)

The Relative Importance Index (RII) was utilised to assess Quality of Life (QoL) using primary data from a field survey. Based on literature by Magdalena et al. (2025), this method of analysis can be used to identify the most significant elements on a study object by displaying the relative value of each aspect based on respondents' perspectives. The highest RII scores represent the highest rating scale that respondents choose to assess their quality of life. This RII was generated using the survey respondents' preference scale. Table 4 shows the relative importance index calculated from the QOL components.

From the Table 4, the highest relative importance index was that respondents feel safe in their residential area with (RII=0.866), showing that the Temiar people appear to have a strong sense of public safety and communal security. This is followed by satisfaction with current health and air quality with RII=0.824 and RII=0.820 respectively. It reflects a clean environment, a probable dependence on traditional health practices, and a low level of industrial contamination in their locations. Conversely, the lowest RII was juvenile in the community with RII=0.472, showing a positive sign in Temiar community which implying a healthier environment for young people, with strong social supports, economic stability, and competent institutions in place to prevent and handle youth crime.

The highest-ranked item in the income and distribution component was "income is distributed and adequate" (RII = 0.649), which could indicate perceived equity in income sharing or shared economic arrangements. Interestingly, "satisfied with present income" ranked somewhat lower (RII = 0.560), reflecting that even though income considered to be evenly distributed, the real amount was insufficient. This is supported by the statement "the income enables me to support myself and my family" (RII = 0.640), which highlights the financial limitations. The findings correspond with previous demographic data, which showed that 91.6% of respondents earned RM1,000 or less per month, indicating financial hardship that can have an impact on overall quality of life.

For the component workplace environment, satisfaction with current

Table 4
The Relative Importance Index (RII) calculated from QoL elements

Components	RII	Rank
INCOME AND DISTRIBUTION		
Level of satisfaction with present income	0.560	2
Income is distributed and adequate.	0.649	1
The income enables me to support myself and my family.	0.640	3
WORKPLACE ENVIRONMENT		
Content with present employment	0.698	1
Community experiences a low rate of unemployment	0.636	2
Present job were highly risks	0.619	3
TRANSPORTATION AND COMMUNICATION		
Have a vehicle	0.673	2
Communicate using a mobile phone	0.766	1
The quality of roads in my living area is satisfactory	0.631	3
HEALTH		
Current health is satisfactory	0.824	1
People in this community tend to live a long time	0.729	3
Pleased with the provided healthcare services	0.740	2
EDUCATION		
Community able to write and read	0.742	2
The community has members pursuing tertiary education	0.687	3
The educational facilities are satisfactory	0.752	1
HOUSING		
Pleased with my current residence	0.776	2
The community has a sufficient power supply	0.654	3
Water supply is adequate	0.792	1
ENVIRONMENT		
The air quality is satisfactory	0.820	1
Pleased with the water conditions	0.792	2
The area around my residence has experienced logging	0.647	3
FAMILY LIFE		
Pleased with the affordability of food and kitchen necessities	0.677	2
Many family members live in the same household	0.776	1
The community is dealing with juvenile delinquency.	0.472	3
SOCIAL PARTICIPATION		
Community takes part in NGO activities	0.732	3
Community takes part in event organized by JAKOA/JKKK/TOK BATIN	0.800	2
Become a registered voter	0.811	1
PUBLIC SAFETY		
Feel secured in my residential area	0.866	1
Residential area experiences frequent accidents	0.552	2
Neighborhood has a high level of crime.	0.506	3

Table 4 (*continued*)

Components	RII	Rank
CULTURE AND LEISURE		
Watch entertainment shows on TV.	0.616	1
Various accommodations available in the neighborhood, like hotels, homestays, and chalets.	0.512	3
Many visitors/tourists in my residential area.	0.562	2

employment received the highest RII score (0.698), demonstrating a modest level of contentment with existing work, which are mainly self-employment and informal sectors. The unemployment rate was seen as moderately low (RII = 0.636), probably due to the dependence on agriculture for survival, forest activities, or informal labor. Nevertheless, the opinion on present professions as unsafe (RII = 0.619) indicates that many people work in hazardous or physically demanding occupations. These jobs may expose individuals or respondents to environmental risks, particularly during extreme weather conditions such as heatwaves, drought, intense rainfalls, storms, and others that are caused by climate change. In all, while employment was readily available, job safety and reliability remain concerns.

The transportation and communication component revealed the highest (RII = 0.766) on communication using mobile phones, showing strong connectivity and access to communication tools. The ownership of vehicles was also prevalent with (RII = 0.673), enhancing accessibility and mobility to key services. Despite this, the quality of roadways in the community obtained a lower score (RII = 0.631), highlighting issues in maintenance of accessibility or infrastructure. Poor road conditions may impact transportation access and efficiency and to healthcare, education, and others for the indigenous community. Enhancing infrastructure could improve community engagement and overall well-being.

Health represented one of the most positively scored components, with respondents reporting high levels of satisfaction with their present health state (RII = 0.824). This reflects the community's general perception of well-being, which may be influenced by active lifestyles and traditional practices. The satisfaction on quality of healthcare services was also rated positively with (RII = 0.740), even though there may still be limitations in specialty and accessibility. Respondents stated that people in their community live longer live (RII = 0.729), which could be explained to strong family relationships and traditional health practices. Within the limited formal health infrastructure, these responses may represent practice on traditional medication such as herbalism, spiritual beliefs of nature, and others. These findings emphasise how resilient the community's health is, and it was critical to strengthen the current healthcare infrastructure.

The most common response in the education category was satisfaction with educational facilities (RII = 0.752), suggesting that the community finds schools and learning settings to be generally acceptable. Reading and writing skills were valued (RII = 0.742), indicating that the population's fundamental literacy is beneficial. However, involvement in tertiary education was rated lower (RII = 0.687), indicating a lack of chances for higher education. This could be due to economic constraints or geographic distance and lack of exposure to the significance of tertiary education. Improving educational opportunities beyond the secondary level may aid in long-term community development.

In terms of housing, respondents were quite satisfied with the sufficient supply of water (RII = 0.792), which is necessary for daily life and cleanliness. Additionally, satisfaction with present housing conditions received a high score (RII = 0.776), suggesting that the majority of families are content with their living arrangements. However, the power supply's sufficiency scored lower (RII = 0.654), indicating either uneven access to electricity or poor infrastructure. Access to electricity is essential for communication, health, and education, particularly in times of emergency.

Strong civic awareness was demonstrated by social participation, with voter registration receiving the highest rating (RII = 0.811), followed by participation in community events (RII=0.800) and (RII=0.732) for engagement with NGO activities. The most popular cultural and recreational activity was watching television for entertainment (RII = 0.616), demonstrating the importance of media in regular life. Besides, the presence of tourists had moderate value at (RII=0.562) and accommodations like hotels and homestays, had the lowest value (RII = 0.512), showing that areas had underdeveloped infrastructure of tourism. Further development of nature-based and cultural tourism has the potential to promote cultural exchange and economic benefits.

In conclusion, despite experiencing obstacles in financial matters, educational opportunities, and infrastructure, the Temiar community maintains a strong feeling of well-being, particularly in areas such as safety, health, and social participation. Their resiliency appears to come from cultural ideals, traditional habits, and strong communal ties rather than material prosperity. While there are gaps in areas like employment safety, access to higher education, and reliable electricity, the community nevertheless rates high satisfaction in many elements of daily life, such as safety and security, health and air quality, social participation. Moving forward, efforts to assist the Temiar should focus on increasing access and opportunities while preserving their traditional identity and way of life.

Regression Analysis

Regression analysis is a method for summarising data from observations by calculating the dependent variable's mean and variance based on variations in multiple independent variables (Chiozza, 2022). Figure 2 displays the regression analysis of climate change and quality of life. The regression analysis statistics for climate change and their impacts on quality of life were detailed in Table 5. Climate change was one of the study's independent factors, while life quality was its dependent variable.

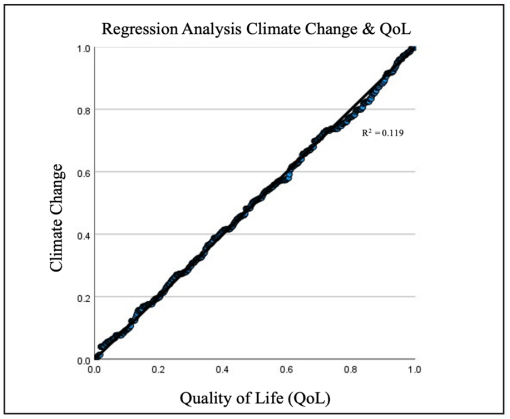


Figure 2. Regression analysis of climate change and quality of life (QoL)
Source*:* Author's work

Table 5
Regression analysis statistics

Observations	450
Sum of weights	450
R^2	0.119
Adjusted R^2	0.097
Mean Square	1.260
F	5.363
Std Deviation	0.328
Sig. F	<0.001

R^2 value affects the dependence between the independent and dependent variables. From the table above, it is shown that $R^2 = 0.119$ indicates that approximately 11.9% of climate change was affecting the quality of life. Therefore, it was concluded that climate change (independent variables) had no influence on the quality of life (dependent variable) on Temiar indigenous community. The significant Sig.F value shown <0.01, hence this study demonstrated there is still a statistically relationship between the climate change (independent variable) and the quality of life (dependent variable) on the Temiar indigenous community. Overall, the indigenous communities' quality of life was multifaceted and complicated, and it's not exclusively influenced by climatic elements.

This trend was observed among the Sámi indigenous people in northern Scandinavia. Timlin et al., (2021) reported the Sámi indigenous groups in northern Scandinavia were shown to have a minimal statistical correlation between climatic change and their well-being despite the environmental challenge. Tyler et al. (2021) found that, while the Sámi reindeer herders are very vulnerable to impacts of climate change (e.g., shifting snow patterns, vegetation changes), their opinion of quality of life remains resilient. Same as the Temiar community, The Sámi, adapted to environmental pressures using non-linear coping methods and prioritised the significance of self-determination and cultural preservation over physical or economic indicators (Jaakkola et al., 2018).

Similarly, Hosen et al., (2020) examined the viewpoints of indigenous communities in the Kinabatangan region of Sabah regarding the effects of climate change and their adaptive strategies. Based on the research, these communities rely heavily on the Kinabatangan River and the ecosystems, are suffering from the negative consequences of climatic anomalies, such as frequent flooding, extended droughts, and biodiversity loss. Despite these difficulties, socioeconomic factors, cultural values, and resource accessibility had a higher impact on communities' climate adaptation encouragement and participation than direct environmental changes. Pimid et al., (2022) stated the importance of utilising indigenous knowledge and community participation will be resulting in building effective climate adaption measures.

The quality of life of Temiar indigenous community influenced by various sociocultural, spiritual, economic, and environmental elements. Although the genuine threats posed by climate change, like changing precipitation patterns, increasing temperatures, and disruptions to traditional food sources, its immediate effect on individuals' assessments of their quality of life may not be apparent. The community could adapt to environmental changes in non-linear and culturally established manners due to their social resilience, traditional ecological knowledge, and robust social cohesion.

Besides, indigenous perspectives on well-being can differ from the typical well-being measures used in academic studies. The Temiar community's understanding of well-being may be more significantly shaped by their spiritual connections to the land, preservation of legacy, and harmonious communal relationships than by economic or physical metrics affected by climate change. The gap between indigenous perspectives and measurement tools may contribute to the observed diminished statistical correlation. To accurately clarify the multifaceted and interconnected impacts of climate change on indigenous populations such as the Temiar, next research should employ qualitative methodologies and incorporate culturally relevant indicators.

CONCLUSION

In summary, this research investigated the impact of climate change on quality of life of the Temiar indigenous people and observed the role of resilience together with the traditional knowledge in shaping their adaptative strategies. Although the Temiar community faces a number of environmental stresses, including deforestation, shifting weather patterns, and economic vulnerabilities, the results show that these factors do not substantially lower their subjective quality of life. Significantly, the Relative Importance Index (RII) found that the most valued aspects of well-being were air quality (RII = 0.820), health satisfaction (RII = 0.824) and public safety (RII = 0.866), which suggests that the Temiar people's resilience based on their close relationship with nature, traditional ecological knowledge, and strong community's social resilience.

Quality of life and climate change only had a weak direct association, according to regression analysis ($R^2 = 0.119$), suggesting that other ecological, social, and cultural aspects are more important. These adaptive capacities promote the community's ability to maintain well-being and function as a buffer against the most severe impacts of climate change. The significance of inclusive, culturally based climate adaption plans that respect indigenous knowledge systems and social structures is confirmed assuring that development and environmental governance initiatives are in line with the reality and values of indigenous peoples. Indigenous communities like the Temiar need to strengthen their ecological practices and social resilience to align with goals like SDG 3 (Good Health and Well-Being), SDG 13 (Climate Action), and SDG 15 (Life on Land).

IMPLICATION OF THE STUDY

This research brought importance implications for community-based initiatives and policy development. Firstly, the findings underscore the significance of social resilience and traditional ecological knowledge (TEK) in the Temiar indigenous community's capacity to endure and adjust to environmental change. Although the negative consequences of climate change like floods, drought, and others environmental challenges, the community maintains a high quality of life. This demonstrates that resilience is more than just material conditions; it is also profoundly established in community unity, cultural practices, and a strong connection to the environment.

Second, the study emphasises the necessity for culturally aware and inclusive climate adaptation policy. As the regression analysis showed that the direct impact of climate change on perceived quality of life is only slight ($R^2 = 0.119$), it is clear that other sociocultural and spiritual elements have equally or even more of a direct effect. Therefore, in order to be genuinely effective, climate adaptation methods need to be comprehensive and take into account indigenous perspectives and knowledge systems.

In addition, this study supports the Sustainable Development Goals (SDGs) of the UN, including SDGs 3 (Good Health and Well-Being), 13 (Climate Action), and 15 (Life on Land). The relationship between indigenous resilience, community well-being, and environmental sustainability is supported by empirical data analysed in this research. Besides, it also highlights the importance for giving indigenous voices greater representation in environmental governance. Thus, incorporating indigenous knowledge into decision-making procedures can promote more culturally relevant, egalitarian, and adaptable solutions to climate concerns.

LIMITATIONS AND RECOMMENDATION FOR FUTURE RESEARCH

One of the limitations is the dependence on the quantitative approach. The cultural complexity and complex views of well-

being for the Temiar community may not be well captured by the use of standardised measures and questionnaires. To further comprehend indigenous experiences and values, future research should include qualitative techniques like participatory methods, in-depth interviews, and ethnographic investigations. Furthermore, the regression analysis's low R^2 value (0.119) suggests that a large portion of the variation in quality of life cannot be entirely attributed to climate change alone. This demonstrates the complexity of well-being, which is impacted by a range of social, spiritual, cultural, economic, and environmental elements. Future research has to consider creating multivariate models that incorporate elements like social capital, land attachment, spirituality, and governance involvement. Community reactions to climate change and its effects are shifting throughout time. Future studies should investigate how indigenous communities' ability to adapt to climate-related difficulties is impacted by their access to government assistance, healthcare, education, and disaster response.

ACKNOWLEDGEMENT

This study was supported by the Ministry of Higher Education (MOHE) through Fundamental Research Grant Scheme (FRGS/1/2023/WAB08/UNISZA/02/1) provided by Ministry of Higher Education of Malaysia (MOHE).

REFERENCES

Aich, A., Dey, D., & Roy, A. (2022). Climate change resilient agricultural practices: A learning experience from indigenous communities over India. *PLOS Sustainability and Transformation, 1*(7), Article e0000022.

Akanwa, A. O., Okedo-Alex, I. N., Joe-Ikechebelu, N. N., & Chatterjee, U. (2022). Persistent climate-driven floods: A voiced case of indigenous women experiencing ecosocial and health risks in a South-East community in Anambra State, Nigeria. In *Indigenous people and nature* (pp. 495-523). Elsevier.

Alizadeh, H., & Sharifi, A. (2022). Social resilience promotion factors during the COVID-19 pandemic: Insights from Urmia, Iran. *Urban Science, 6*(1), Article 14.

Anik, A. H., Sultan, M. B., Alam, M., Parvin, F., Ali, M. M., & Tareq, S. M. (2023). The impact of climate change on water resources and associated health risks in Bangladesh: A review. *Water Security, 18*, Article 100133.

Arora, S., Bhatt, R., Sharma, V., & Hadda, M. S. (2023). Indigenous practices of soil and water conservation for sustainable hill agriculture and improving livelihood security. *Environmental Management, 72*(2), 321-332.

Atanga, R. A., & Tankpa, V. (2021). Climate change, flood disaster risk and food security nexus in Northern Ghana. *Frontiers in Sustainable Food Systems, 5*, Article 706721.

Arbuzova, E., & Kubrina, L. (2024). Human health and the ecosystem: The relationship between ecological status and quality of life. *Reliability: Theory & Applications, 19*(SI 6 [81]), 692-697.

Berkes, F., Tsai, H. M., Bayrak, M. M., & Lin, Y. R. (2021). Indigenous resilience to disasters in Taiwan and beyond. *Sustainability, 13*(5), Article 2435.

Biggs, R., Clements, H., de Vos, A., Folke, C., Manyani, A., Maciejewski, K., ... Schlüter, M. (2021). What are social-ecological systems and social-ecological systems research? In *The Routledge handbook of research methods for social-ecological systems* (pp. 3-26). Routledge.

Bihari, S. (2023). Cultural heritage and indigenous knowledge: Reviving traditions for future generations. In *Sustainable development goals in SAARC countries: Key issues, opportunities and challenges* (Vol. 1, pp. 24-32).

Boehm, S., & Schumer, C. (2023). *10 big findings from the 2023 IPCC report on climate change*. World Resources Institute. https://www.wri.org/insights/2023-ipcc-ar6-synthesis-report-climate-change-findings

Bogdanova, E., Andronov, S., Soromotin, A., Detter, G., Sizov, O., Hossain, K., ... Lobanov, A. (2021). The impact of climate change on the food (in) security of the Siberian Indigenous peoples in the Arctic: Environmental and health risks. *Sustainability, 13*(5), Article 2561.

Bynoe, P. (2015). *Case study on the impact of climate change on agriculture on an Indigenous community in Guyana*. United Nations Development Programme. https://www.undp.org/latin-america/publications/case-study-impact-climate-change-agriculture-indigenous-community-guyana

Carmen, E., Fazey, I., Ross, H., Bedinger, M., Smith, F. M., Prager, K., ... Morrison, D. (2022). Building community resilience in a context of climate change: The role of social capital. *Ambio, 51*(6), 1371-1387.

Chiozza, G. (2022). Regression analysis. In *Handbook of research methods in international relations* (pp. 447-467).

Clarke, B., Otto, F., Stuart-Smith, R., & Harrington, L. (2022). Extreme weather impacts of climate change: An attribution perspective. *Environmental Research: Climate, 1*(1), Article 012001.

Coalson, J. E., Anderson, E. J., Santos, E. M., Madera Garcia, V., Romine, J. K., Luzingu, J. K., ... Ernst, K. C. (2021). The complex epidemiological relationship between flooding events and human outbreaks of mosquito-borne diseases: A scoping review. *Environmental Health Perspectives, 129*(9), Article 096002.

Dalyan, M., Suma, M., Sosrohadi, S., & Andini, C. (2024). Harmony and sustainability: Traditional ecological knowledge systems of the Kaluppini Indigenous people. *International Journal of Religion, 5*(6), 82-92.

Daeli, W., Ayostina, I., & Robyn, B. (2019). *"Sasi laut" for marine conservation practices in eastern Indonesia*. WRI Indonesia. https://wri-indonesia.org/en/insights/sasi-laut-marine-conservation-practices-eastern-indonesia

Datta, R., & Kairy, B. (2024). Decolonizing climate change adaptations from Indigenous perspectives: Learning reflections from Munda Indigenous communities, coastal areas in Bangladesh. *Sustainability, 16*(2), Article 769.

Das, A., Gujre, N., Devi, R. J., & Mitra, S. (2021). A review on traditional ecological knowledge and its role in natural resources management: North East India, a cultural paradise. *Environmental Management*.

Das, K. V., Jones-Harrell, C., Fan, Y., Ramaswami, A., Orlove, B., & Botchwey, N. (2020). Understanding subjective well-being: Perspectives from psychology and public health. *Public Health Reviews, 41*(1), Article 25. https://doi.org/10.1186/s40985-020-00142-5

De Garine-Wichatitsky, M., Binot, A., Ward, J., Caron, A., Perrotton, A., Ross, H., ... Echaubard, P. (2021). "Health in" and "health of" social-ecological systems: A practical framework for the management of healthy and resilient agricultural and natural ecosystems. *Frontiers in Public Health, 8*, Article 616328.

Department of Statistics Malaysia. (2023). *Malaysian well-being index 2023*. Department of Statistics Malaysia.

Dhimal, M., Bhandari, D., Dhimal, M. L., Kafle, N., Pyakurel, P., Mahotra, N., ... Müller, R. (2021). Impact of climate change on health and well-being of people in Hindu Kush Himalayan region: A narrative review. *Frontiers in Physiology, 12*, Article 651189.

Doke, K., Affinnih, H. O., Yuan, Q., Gasco-Hernandez, M., Gil-Garcia, J. R., Bogdanov, P., & Zheleva, M. (2021, June). Improving emergency preparedness and response in rural areas. In *Proceedings of the 4th ACM SIGCAS Conference on Computing and Sustainable Societies* (pp. 66-78).

Ford, J. D., King, N., Galappaththi, E. K., Pearce, T., McDowell, G., & Harper, S. L. (2020). The resilience of Indigenous peoples to environmental change. *One Earth, 2*(6), 532-543.

Frisch, M. B. (2024). Quality-of-life inventory. In *Encyclopedia of quality of life and well-being research* (pp. 5794-5797). Springer International Publishing.

Ghorbani, M., Eskandari-Damaneh, H., Cotton, M., Ghoochani, O. M., & Borji, M. (2021). Harnessing Indigenous knowledge for climate change-resilient water management - Lessons from an ethnographic case study in Iran. *Climate and Development, 13*(9), 766-779.

Gustafsson, M. T., & Schilling-Vacaflor, A. (2022). Indigenous peoples and multiscalar environmental governance: The opening and closure of participatory spaces. *Global Environmental Politics, 22*(2), 70-94.

Harangody, M., Vaughan, M., Richmond, L., & Luebbe, K. (2022). Hālana ka manaʻo: Place-based connection as a source of long-term resilience.

Harefa, D. (2024). The influence of local wisdom on soil fertility in South Nias. *Jurnal Sapta Agrica, 3*(2), 18-28.

Holling, C. S. (1973). *Resilience and stability of ecological systems. Annual Review of Ecology and Systematics, 4(1),* 1-23. https://doi.org/10.1146/annurev.es.04.110173.000245.

Hosen, N., Nakamura, H., & Hamzah, A. (2020). Adaptation to climate change: Does traditional ecological knowledge hold the key? *Sustainability, 12*(2), Article 676.

Jaakkola, J. J., Juntunen, S., & Näkkäläjärvi, K. (2018). The holistic effects of climate change on the culture, well-being, and health of the Saami, the only Indigenous people in the European Union. *Current Environmental Health Reports, 5*, 401-417.

Jerez, M. M. (2021). *Challenges and opportunities for Indigenous peoples' sustainability.* Retrieved from: *https://desapublications.un.org/policy-briefs/undesa-policy-brief-101-challenges-and-opportunities-indigenous-peoples*

Lansbury Hall, N., & Crosby, L. (2022). Climate change impacts on health in remote Indigenous communities in Australia. *International Journal of Environmental Health Research, 32*(3), 487-502.

Magdalena, S., & Citra, Z. (2025). Factors affecting the occurrence of cost overrun based on relative importance index (RII) on toll road projects. *Rekayasa Sipil, 19*(1), 120-127.

Malik, I. H., Ford, J. D., Winters, I., Hunter, B., Flowers, N., Quincey, D., ... Way, R. G. (2025). Monitoring climate change impacts, Indigenous livelihoods and adaptation: Perspectives from Inuit community of Hopedale, Nunatsiavut, Canada. *Cambridge Prisms: Coastal Futures, 3*, Article e10.

Mallick, M., Singh, P. K., & Pandey, R. (2024). Harvesting resilience: Tribal home-gardens as

socio-ecological solutions for climate change adaptation and sustainable development in a protected area. *Journal of Cleaner Production, 445*, Article 141174.

Mardero, S., Schmook, B., Calmé, S., White, R. M., Chang, J. C. J., Casanova, G., & Castelar, J. (2023). Traditional knowledge for climate change adaptation in Mesoamerica: A systematic review. *Social Sciences & Humanities Open, 7*(1), Article 100473.

Maslow, A. H. (1943). A theory of human motivation. *Psychological Review, 50*(4), 370-396.

Mayar, K., Carmichael, D. G., & Shen, X. (2022). Resilience and systems - A review. *Sustainability, 14*(14), Article 8327.

Menteri, J. P. (2012). *Kualiti hidup Malaysia 2011*. Retrieved from: https://ekonomi.gov.my/sites/default/files/2020-03/kualitihidup2011.pdf

Moya, J., & Goenechea, M. (2022). An approach to the unified conceptualization, definition, and characterization of social resilience. *International Journal of Environmental Research and Public Health, 19*(9), Article 5746.

Muin, A., & Rakuasa, H. (2023). Sasi Laut as a culture of natural resources conservation to overcome the tragedy of the commons in Maluku Province. *International Journal of Multidisciplinary Approach Research and Science, 1*(3), 277-287.

Muluneh, M. G. (2021). Impact of climate change on biodiversity and food security: A global perspective - A review article. *Agriculture & Food Security, 10*(1), 1-25.

Nguyen, T. T., Grote, U., Neubacher, F., Do, M. H., & Paudel, G. P. (2023). Security risks from climate change and environmental degradation: Implications for sustainable land use transformation in the Global South. *Current Opinion in Environmental Sustainability, 63*, Article 101322.

Nutakor, J. A., Zhou, L., Larnyo, E., Addai-Danso, S., & Tripura, D. (2023). Socioeconomic status and quality of life: An assessment of the mediating effect of social capital. *Healthcare, 11*(5), Article 749.

Imbulana Arachchi, J., & Managi, S. (2023). The role of social capital in subjective quality of life. *Humanities and Social Sciences Communications, 10*(1), 1-10.

Ismail, I. N., Kamarudin, M. K. A., Simin, M. H. A., Ismail, W. N. A. T., & Abd Wahab, N. (2024a). Planning for quality of life: An assessment of Indigenous communities in Malaysia. *Planning Malaysia, 22*.

Ismail, I. N., Kamarudin, M. K. A., Ismail, W. N. A. T., Abd Wahab, N., Saudi, A. S. M., Toriman, M. E., ... Ariadi, S. (2024b). A review on chemometrics and climate change: Insights from Malaysia case study. *Applied Environmental Research, 46*(3).

Kaplan, R. M., & Hays, R. D. (2022). Health-related quality of life measurement in public health. *Annual Review of Public Health, 43*(1), 355-373.

Kwa, Y. C., Suboh, N., Kay, D. S. W., Lee, C. I. S., Walsh, C. L., & Goodson, M. L. (2024). Perceptions of climate change and associated health impacts among communities in Johor River Basin, Malaysia. *The Medical Journal of Malaysia, 79*(4), 397-407.

Ostrom, E. (2009). A general framework for analyzing sustainability of social-ecological systems. *Science, 325*(5939), 419-422. https://doi.org/10.1126/science.1172133

Pimid, M., Nasir, M. R. M., Scian, J., Ahmad, A. G., Abdul Mutalib, A. H., & Perijin, J. (2022). Indigenous Kinabatangan perspectives on climate change impacts and adaptations: Factors influencing their support and participation. *Sustainability, 14*(11), Article 6459.

Philip, J., Newman, J., Bifelt, J., Brooks, C., & Rivkin, I. (2022). Role of social, cultural and symbolic

capital for youth and community wellbeing in a rural Alaska Native community. *Children and Youth Services Review, 137*, Article 106459.

Rachmad, Y. E. (2022). *Social resilience theory*.

Rahman, S. A. A., Zuki, F. N. C., Abdullah, A., Ibrahim, I., Asmawi, M., & Razak, R. A. (2025). Navigating progress and preservation: Village leaders' perspective on sustainability challenges among Indigenous communities of Selangor, Malaysia. *Journal of Umm Al-Qura University for Engineering and Architecture, 16*(3), 869-878.

Rai, S. C., & Mishra, P. K. (2022). Traditional Ecological Knowledge and Resource Management: a Conceptual framework. *In Springer eBooks* (pp. 1-11). https://doi.org/10.1007/978-3-031-16840-6_1.

Rarai, A., Parsons, M., Nursey-Bray, M., & Crease, R. (2022). Situating climate change adaptation within plural worlds: The role of Indigenous and local knowledge in Pentecost Island, Vanuatu. *Environment and Planning E: Nature and Space, 5*(4), 2240-2282.

Redvers, N., Aubrey, P., Celidwen, Y., & Hill, K. (2023). Indigenous Peoples: Traditional knowledges, climate change, and health. *PLOS Global Public Health, 3*(10), Article e0002474.

Ricart, S., Castelletti, A., & Gandolfi, C. (2022). On farmers' perceptions of climate change and its nexus with climate data and adaptive capacity: A comprehensive review. *Environmental Research Letters, 17*(8), Article 083002.

Sahani, M., Othman, H., Kwan, S. C., Juneng, L., Ibrahim, M. F., Hod, R., Zaini, Z. I., Mustafa, M., Nnafie, I., Ching, L. C., Dambul, R., Varkkey, H., Phung, V. L. H., Mamood, S. N. H., Karim, N., Abu Bakar, N. F., Wahab, M. I. A., Zulfakar, S. S., & Rosli, Y. (2022). Impacts of climate change and environmental degradation on children in Malaysia. *Frontiers in Public Health, 10*, Article 909779. https://doi.org/10.3389/fpubh.2022.909779

Saleem, A., Anwar, S., Nawaz, T., Fahad, S., Saud, S., Ur Rahman, T., Khan, M. N. R., & Nawaz, T. (2024). Securing a sustainable future: The climate change threat to agriculture, food security, and sustainable development goals. *Journal of Umm Al-Qura University for Applied Sciences, 11*(3), 595-611. https://doi.org/10.1007/s43994-024-00177-3

Saul, J. (2022). *Collective trauma, collective healing: Promoting community resilience in the aftermath of disaster*. Routledge. https://doi.org/10.4324/9781003231448.

Singapore Management University. (2024). *Social resilience*. https://resilience.smu.edu.sg/resilience-framework/social-resilience

Sutherland, S., & Adams, M. (2019). Building on the definition of social and emotional wellbeing: An Indigenous (Australian, Canadian, and New Zealand) viewpoint. *ab-Original: Journal of Indigenous Studies and First Nations and First Peoples' Cultures, 3*(1), 48-72.

Taufek, T. E., Nor, N. F. M., Jaludin, A., Tiun, S., & Lam, K. C. (2021). Public perceptions on climate change: A sentiment analysis approach. *GEMA Online Journal of Language Studies, 21*(4), 209-233. https://doi.org/10.17576/gema-2021-2104-11

Taylor, K., Ratcliffe, J., Bessarab, D., & Smith, K. (2023). Valuing Indigenous quality of life: A review of preference-based quality of life instruments and elicitation techniques with global older Indigenous populations. *Social Science & Medicine, 336*, Article 116271.

Teoli, D., & Bhardwaj, A. (2023). *Quality of life*. In *StatPearls*. StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK536962/

Terpstra, J., Lehto, R., & Wyatt, G. (2021). Spirituality, quality of life, and end of life among Indigenous peoples: A scoping review. *Journal of Transcultural Nursing, 32*(2), 161-172.

Timlin, U., Ingimundarson, J. H., Jungsberg, L., Kauppila, S., Larsen, J. N., Nordström, T., Scheer, J., Schweitzer, P., & Rautio, A. (2021). Living conditions and mental wellness in a changing climate and environment: Focus on community voices and perceived environmental and adaptation factors in Greenland. *Heliyon, 7*(4), Article e06862. https://doi.org/10.1016/j.heliyon.2021.e06862

Tyler, N. J., Hanssen-Bauer, I., Førland, E. J., & Nellemann, C. (2021). The shrinking resource base of pastoralism: Saami reindeer husbandry in a climate of change. *Frontiers in Sustainable Food Systems, 4*, Article 585685.

Ufie, A., Awaru, A. O. T., & Kamaruddin, S. A. (2023). Sasi Laut as a form of ecological and economic intelligence of Indigenous community in Kei Islands. In *Indonesian Annual Conference Series* (pp. 358-368).

Veenhoven, R. (2024). Quality of life (QOL), an overview. In *Encyclopedia of quality of life and well-being research* (pp. 5668-5671).

Yang, F., Wen, X., Aziz, A., & Luhach, A. K. (2021). The need for local adaptation of smart infrastructure for sustainable economic management. *Environmental Impact Assessment Review, 88*, Article 106565.

Zhai, L., & Lee, J. E. (2024). Investigating vulnerability, adaptation, and resilience: A comprehensive review within the context of climate change. *Atmosphere, 15*(4), Article 474.