



Public awareness on biodiversity conservation and well-being: case of Gunung Mulu National Park, Sarawak

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Accepted: 12 December 2022 / Published online: 28 December 2022
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Abstract Lack of public awareness of biodiversity conservation is the leading cause of biodiversity loss. This needs to be emphasized by stakeholders in the conservation effort, particularly in some major conservation areas, including the UNESCO World Heritage sites of Gunung Mulu National Park (GMNP). As a result of threats such as natural catastrophes, pollution, poaching, and uncontrolled urbanization or human development, GMNP is at risk of being inscribed on the List of World Heritage in Danger. The UNESCO status is possible to be drawn if its criteria are not maintained or degraded due to a lack of emphasis on awareness of the importance of the site. However, it is still limited information on to what extent is the public aware of the importance

of biodiversity conservation in GMNP and its relationship to their well-being. Thus, the study aims to examine the level of awareness (knowledge, attitude, and experience) among local community and visitors in GMNP towards biodiversity conservation; and determine their well-being, specifically on environmental, economic, and social factors concerning conservation awareness. A validated questionnaire was distributed to the visitors ($n=87$) and local community ($n=99$) through an online and face-to-face survey. Based on the awareness constructs, their level of knowledge and experience is high, while attitude portrays a moderate level. The visitors have a higher level of knowledge, attitude, and experience than the local community. The level of education and number of dependents had influenced their awareness of conservation. In terms of well-being, the economic and social factors had significantly predicted awareness accordingly. It shows that the dimensions of the neighborhood, life and social relations, services and facilities, education, culture, and monthly income influence their current level of awareness of biodiversity conservation. The empirical study provides insights into developing a biodiversity conservation framework for GMNP that emphasizes community psychology as part of the social movement toward holistic management in the park.

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Keywords Biodiversity · Knowledge · Attitude · Experience · Well-being

Introduction

Biodiversity is illustrated as an all-encompassing factor that mediates ecosystem functions and influences human well-being through its services. In comparison, biodiversity conservation awareness is defined as how people know the impact of human behaviour on biodiversity (Ministry of Natural Resources & Environment of Malaysia, 2016). The awareness also refers to the people's apprehension about biodiversity issues and knowing about steps to be taken to conserve those (Jalil & Mat Sharif, 2018). Biodiversity can be an element of human well-being, such as social cohesion, happiness, and connections to nature, for some people and some cultures (Naeem et al., 2016). It provides the community with material welfare and livelihoods and contributes to resiliency, security, social relations, health, and freedom of choices and actions (Milkisso, 2020).

Malaysia's National Policy on Biological Diversity (NPBD) stated that government and non-government should take biodiversity conservation issues seriously. Throughout the years, many efforts have been made, but the awareness of biodiversity conservation is still considered at a low level. There are various causes that result in the threat of biodiversity loss. For example, low public awareness of biodiversity conservation is the main cause of biodiversity loss (Baharum et al., 2017). Moreover, the root causes of biodiversity loss are embedded in the way societies use resources (Slingenberg et al., 2009), the failure of economic systems and present policies to value the environment and its benefits (Costanza et al., 1997). The foremost to engage people to be concerned about biodiversity issues is biodiversity awareness (Christmas et al., 2013). According to Mandal et al. (2011), if all this while and in the future, biodiversity plays its essential role in supplying human well-being and existence people still have a low awareness level of biodiversity conservation, the earth will continue facing rapid extinction level. Ultimately, humans will seriously be impacted by biodiversity loss.

Indeed, biological knowledge alone is not sufficient to solve conservation problems. Therefore, the role of the social sciences in solving these problems has become increasingly important (Mascia et al., 2003). The low level of awareness of biodiversity and conservation, as well as conflicts with the authorities, lead to issues in GMNP, including water pollution,

extinction of flora and fauna, degradation of ecosystems, air pollution, and solid waste management. Holistic park management can only be achieved if these problems can be appropriately addressed.

Gunung Mulu National Park (GMNP) is recognised as a World Heritage site by UNESCO because it meets all four World Heritage criteria (UNESCO World Heritage Centre, 2019). However, there are challenges in maintaining the status of GMNP where it possible can be drawn if its criteria are degraded due to a lack of emphasis on awareness of the importance of the site. Internal and external threats might be a threat to a UNESCO site, such as natural disasters, pollution, poaching, uncontrolled urbanisation, human development, and management of the park itself. Threats to can be either proven imminent threats or potential dangers that could have adverse effects on a site (World Heritage in Danger: Compendium II 2009). For example, the community of Penan and Berawan in GMNP, whose livelihood is culturally attached to the forest, are often associated with the state government in relation to logging or deforestation. Assessing the conflicts that arise among the stakeholders and nature itself is crucial for biodiversity sustainability.

This study aims to examine the level of awareness, i.e. knowledge, attitude, and experience, among local community and visitors in GMNP towards biodiversity conservation and determine their well-being, specifically on environmental, economic, and social factors in relation to conservation awareness. Furthermore, the results could benefit and ease the challenge on the side of the park manager and policymakers in managing and maintaining the status of GMNP as a World Heritage Site (WHS) and promoting nature awareness to the public. This study could improve the lack of empirical research on the relationship between biodiversity conservation awareness and well-being in the community that occurs in a WHS. It could also give implications to other WHS management on the aspects of social sustainability that need to be emphasised towards a holistic park development.

Literature review

The Knowledge, Attitude and Practice (KAP) survey was first applied to understand family planning and population studies in the 1950s (Launiala, 2009). It

has yielded a lot of insight for policymakers because it measures the gap between knowledge and action (Babaei et al., 2015). Recently, there are few researchers who use the KAP model for the studies related to COVID-19 pandemic in order to understand the community behaviour (Habib et al., 2021; Ibrahim et al., 2021a, 2021b; Tomar et al., 2021; Yang et al., 2021). KAP framework is utilised as basis of this study which focusing on what individuals know (cognitive domain), feel (affective domain) about a particular issue as well as their associated actions (psychomotor domain) (Zahedi et al., 2014). KAP aims to gauge public knowledge and perception of biodiversity, as well as the public's current actions and willingness to act in favour of these outcomes and it is highly applicable to conservation and management studies and has been applied in many studies in other developing countries (Al Amin et al., 2021; Ali et al., 2020; Pam et al., 2021; Shrestha & Shrestha, 2021; Sophat et al., 2019).

A central theme of much research in biodiversity and ecosystem services is the necessity to “conserve biodiversity to improve human well-being” (Naeem et al., 2012). It is summarized that any other positive effects of biodiversity on the human condition (Sandifer et al., 2015). Nature-based recreation can help promote public health by encouraging physical and mental well-being (Townsend & Ebden, 2006) as well as provide benefits for locals (Ezebilo, 2014). According to Babaei et al. (2015), knowledge is a familiarity, awareness or understanding of a community, such as facts, information, descriptions, or skills towards the topic of interest, which is acquired through experience or education by perceiving, discovering, or learning. Low knowledge about the local environment might point to a lack of awareness on the importance of conserving animal and plant species which influences their well-being (Louv, 2005). Attitude is a settled way of thinking or feeling about something and refers to the community thoughts which may have tended to it (Babaei et al., 2015). Practice demonstrates the acquisition of knowledge (increased understanding of a problem) and any change in attitude caused by the removal of misconceptions about problems that translates into preventive behaviours (Rav-Marathe et al., 2016). Knowledge and attitude are two factors determining behaviour of society and the people in it (Babaei et al., 2015). Practice is behaviours or actions that can avert a degradation of biodiversity.

Methodology

Research area

GMNP is a national park located in Marudi Division, Sarawak, Malaysia (Fig. 1), which has been declared a UNESCO World Heritage Site. This GMNP area covers about 52,864 hectares of the mountainous part of northern Sarawak. It is separate from other developing areas which lie between the headwaters of the Tutuh River and the Medalam River, a tributary of the Limbang River. GMNP acts as a Heart of Borneo corridor which connects the forests of Brunei to the rest of Borneo. Its location along the Brunei-Sabah-Sarawak-North Kalimantan Transboundary Landscape is one of the six priority landscapes in the protected areas of Borneo (WWF, 2017).

GMNP and nearby villages such as Sungai Melinau Village, Batu Bungan Village, Long Iman Village, and Long Terawan Village are inhabited by the majority of Penan and Berawan communities which are an indigenous to the park. Sungai Melinau Village is a settlement with independent houses that located closest to the GMNP headquarters. Therefore, the local community of Sungai Melinau Village from Berawan community is the most engaged in tourism services such as homestay, and transportation (e.g., longboat, and car) in Mulu. Apart from being involved in tourism activities, other local community mostly work as farmer or, fishermen for their livelihood.

The number of tourist arrivals to GMNP in 2019 is recorded at 21,022, which is higher than in 2015, reported at 18,632 tourists (Sarawak Forestry Corporation, 2020). The trend shows that the number of international tourists is almost double that of domestic tourists. However, since the pandemic hit in 2020 and 2021, the data is not available for disclosure by the Sarawak Forestry Corporation due to the tourism industry being progressing slow.

Research technique

The validated questionnaire was disseminated to 99 local communities and 87 visitors from April to July 2021 through convenience sampling. The local community involved are those who live in the settlement areas around GMNP, including Kampung Batu Bungan, Kampung Long Iman, and Kampung Long

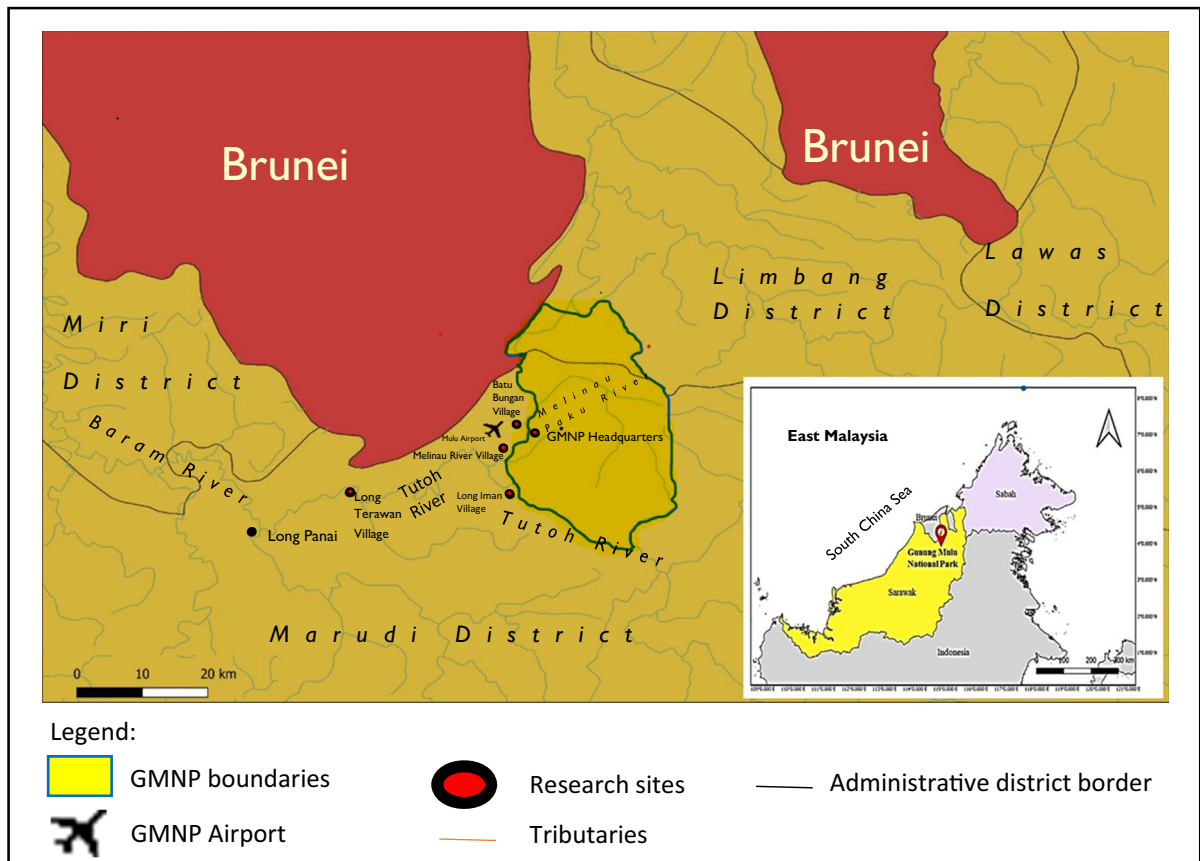


Fig. 1 Location of GMNP, Sarawak, Malaysia

Terawan. To get responses and information from visitors, the online platform Google Form was used due to movement restrictions by the government during the COVID-19 pandemic. The ‘anthropause’ phenomenon refers to the stagnated global tourism industry during this pandemic (Rutz et al., 2020), and there is no movement of visitors in and out of GMNP. Considering this limitation, the online survey is comfortable, non-intrusive and safe, engaging and convenient, and online communication ease and easy to set up (Dodds & Hess, 2021).

In determining the sample design, the question of the specific population parameters which are of interest must be considered (Kothari, 2004). In this study, the respondents must be local communities and visitors who are more than 18 years old. The local community also must live at the study site for more than 5 years. For visitors, they must have visited GMNP within 7 years. These specific requirements indicate

that only local communities and visitors are defined as respondents who participated in this study.

Item development

The quantitative questionnaire was constructed in a single set in a dual language, Malay and English. There is a total of seven sections contained in the questionnaire, each representing Section A-knowledge (K), Section B-attitude (A) and Section C-experience or practices (E), Section D-community well-being (CWB), and Section E-respondent’s demographic background and opinions. Items for K, A, E, and CWB are adapted and revised to suit the local study site from previous studies, namely Boaitay et al. (2018), Buijs et al. (2008), Cummin (1997), European Commission (2013), Macovei (2015), Scottish Natural Heritage (2009), Soga et al. (2016), Spash and

Hanley (1995), Van den Berg (2007), Wiseman and Brasher (2008) and Dunlap et al. (2000).

Item validity and reliability

The first level of content validation for this study was through the collection of literature reviews. Taherdoost (2017) suggested that the approach to the validity of the questionnaire’s items includes literature reviews and follow-up by expert judges. The questionnaire was validated by six experts in environmental sociology and social psychology from the Institute for Environment and Development, Institute of Ethnic Studies, Universiti Kebangsaan Malaysia and Faculty of Humanities, Management and Science, Universiti Putra Malaysia Bintulu Sarawak Campus. Lynn (1986) stated that the number is adequate to validate the survey questions’ contents. The procedure involved a team of experts that demonstrated the items’ relevancy in a questionnaire (Polit & Beck, 2004). The latter approach was used where expert comments were considered, and the questionnaire items were subsequently updated. Finally, the questionnaire items were further validated through a pilot study distributed to visitors and local community. Table 1 summarises the reliability of the construct items.

Table 1 shows the Cronbach’s alpha value of constructed items that have reached the minimum

Table 1 Item reliability for each construct (n = 186)

Construct items	Number of items	Cronbach’s alpha value	Interpretation
Knowledge	5	0.836	High reliability
Attitude	16	0.760	High reliability
Practices/experience	10	0.612	Moderate reliability
Community well-being	7	0.663	Moderate reliability

acceptable value of 0.5. Based on Hinton et al. (2014), the four reliability cut-off values include excellent reliability (0.90 or higher), high reliability (0.70–0.89), moderate reliability (0.50–0.69) and low reliability (0.50 or lower. Although reliability is crucial for the study, it is not enough unless it is coupled with validity (Taherdoost, 2017).

For the practices/experience construct, ten items remained after two items (items 6 and 7) were removed. These statements are removed because both were irrelevant to measure to respondents. In addition, after both items were removed, the Cronbach’s alpha value also increased to 0.66 for the 8 items. Details of the constructed items are attached in Appendix A.3.

Normality test

Prior to data analysis, the normality test was conducted to determine whether the sample data was normally distributed. Table 2 shows the normality test of variables measured in this study. The awareness variable was measured based on a sample of the local community and visitors involved. On the other hand, community well-being is limited to the local community only. Shapiro–Wilk test is the most powerful among the four normality tests for continuous-type alternative distributions (Ogunleye et al., 2018). Based on the analysis, the Shapiro–Wilk test with 95% confidence showed that awareness of local community and visitors, as well as community well-being, were normally distributed, where $p > 0.001$ respectively.

Multicollinearity test

After the normality data had been met, the multicollinearity test was performed to examine the degree of correlation between independent variables through variance inflation factors (VIF). In this study, VIF

Table 2 Normality test of variables

Variable	Group	Sample size, N	Statistic, W	Shapiro–Wilk, <i>p</i>
Awareness	Local community	99	0.987	0.439*
	Visitors	87	0.984	0.342*
Community well-being	Local community	99	0.981	0.166*
	Visitors	N/A	N/A	N/A

* $p > 0.05$ represent normally distributed.

values showed that data were moderately correlated, ranging from 1.027 to 3.992. If the VIF value exceeds 4.0 or by tolerance less than 0.2, it indicates a problem with multicollinearity (Hair et al., 2010). Thus, the principal component analysis should not be performed because there is no high multicollinearity problem.

Data analysis

The data were analyzed using IBM Statistical Package for Social Sciences (Version 24). The mean analysis was used to measure the strength of constructs based on each item. The higher the mean value, the higher the level of awareness constructed toward biodiversity conservation. Cohen's *d* effect size analysis was used to indicate the difference between these two means of the local community and visitors for level of knowledge, attitude, and experience towards biodiversity conservation (McLeod, 2019). Pearson correlation and logistic regression was used to assess the relationship between constructs and sociodemographic factors. Then, the multiple regression also used to examine the well-being factors that influences the local community's awareness in this study.

Results and discussion

Socio-demographics of respondents.

Table 3 shows the demographic background of the local community involved in this study. After excluding the outliers of response, there is a total of 99 respondents, whereby 60.6% ($n=60$) of them are male, while the remaining 39.4% ($n=39$) are female. The majority of respondents (67.7%) are *Orang Ulu*, the Penan and Berawan tribes who are indigenous to GMNP. Most of them have received at least secondary level education, employed and engaged in tourism services in Mulu, such as accommodation and transportation (e.g., longboat and car). Their income in such a tourism sector was less than MYR2,500 per month, which is considered Malaysia's low-income group (Department of Statistics Malaysia, 2020).

Table 4 shows the demographic background of visitors to GMNP. A total of 87 respondents have responded to this study. The average age is 31 to 35 years old, while most are female (52.9%). Most

visitors are Bumiputra, including Malay, Sarawak and Sabah natives. On average, visitors are mostly single compared to the local community, who are mostly married. Furthermore, visitors mostly serve in the government sector as opposed to the local community, which is more likely to be self-employed. Thus, their estimated monthly income is more stable at between MYR2,500 to MYR7,900. On average, these visitors are also first-time visitors to GMNP as well as with friends or colleagues in groups of 1 to 5 persons. The level of education among visitors is also higher than in the local community where they have received tertiary education.

Level of knowledge towards biodiversity conservation

Table 5 shows the overall mean, indicating that knowledge of biodiversity conservation among respondents was high (mean=4.13). All five items show a high value means that range from 4.02 to 4.29. It indicates their strong agreement with each item that concerns the basic concept of biodiversity, consisting of three levels: genetics, species, and ecosystems.

Most respondents (83.4%) have a good knowledge of the term 'endangered species', which refers to animal or plant species that are threatened with extinction (Item 5). This is evidenced by their ability to list some of the endangered species, especially at the species level; regardless, they are from a non-professional group. Contrary to the findings by Hooykaas et al. (2019), which stated that knowledge about species is low among laymen.

Furthermore, the knowledge of fundamental biodiversity was also high when 75.8% of the respondents agreed with Item 1, which stated that biodiversity refers to the diversity of plants and animals that exist. This indicates that they generally know the definition of biodiversity, probably due to the role of local mass media in promoting biodiversity knowledge. The finding proves that media such as newspapers and magazines, radio, television, and the internet play a more significant role in promoting environmental awareness to the public (Kushwaha, 2015).

Item 2 showed that respondents understand the concept of biodiversity at the genetic level through a given key point: different types of mosses and breeds of hornbills are an example. Genetic diversity is just as important to ecosystem function and community

Table 3 The demographic background of the local community (n = 99)

Items	Frequency, n	Percentage, %
Gender		
Male	60	60.6
Female	39	39.4
Ethnic		
Penan	22	22.2
Berawan	45	45.5
Others (e.g. Malay, Iban, Chinese)	32	32.3
Marital status		
Married	73	73.7
Single	24	24.2
Others (e.g. divorced)	2	2
Age		
19–25	7	7.1
26–30	13	13.1
31–39	25	25.3
40–50	20	20.2
More than 50	34	34.3
Level of education		
No formal education	7	7.1
Primary education	20	20.2
Secondary education	58	58.6
Undergraduate (e.g. first degree, diploma, certificates)	13	13.1
Postgraduate (e.g. PhD, Master degree)	1	1
Occupation		
Government servant	14	14.1
Private employee	24	24.2
Self-employed	42	42.4
Retiree	2	2
Student	2	2
Unemployed	15	15.2
Monthly income		
Less than MYR2,500	83	83.8
MYR2,500-MYR4,849	13	13.1
Others (e.g. Prefer not to say)	3	3
Number of dependent		
None	41	41.4
01-Mar	40	40.4
04-Jul	16	16.2
More than 7	2	2

MYR1.00 = USD0.23
(Based on currency exchange in June 2022).

structure as species diversity in terms of underlying mechanisms (Raffard et al., 2019). It showed the importance of public knowledge in supporting biodiversity conservation for a national park. The higher the knowledge of biodiversity, the higher the positive

attitude toward the conservation of natural resources (Aminrad et al., 2013; Hassan, 2017; Ibrahim et al., 2021a, 2021b).

The respondents not only have a solid understanding of the concept of biodiversity at the genetic level,

Table 4 The demographic background of visitors (n = 87)

Items	Frequency, n	Percentage, %
Gender		
Male	41	47.1
Female	46	52.9
Nationality		
Malaysian	81	93.1
Non-Malaysian	6	6.9
Race		
Bumiputra	63	72.4
Chinese	16	18.4
Indian	2	2.3
Others (e.g. Non-Malaysian which include Caucasian, Bruneian)	6	6.9
Marital status		
Married	38	43.7
Single	49	56.3
Age		
19–25	12	13.8
26–30	16	18.4
31–39	35	40.2
40–50	18	20.7
More than 50	6	6.9
Level of education		
No formal education	1	1.1
Primary education	1	1.1
Secondary education	5	5.7
Undergraduate (e.g. first degree, diploma, certificates)	51	58.6
Postgraduate (e.g. PhD, Master degree)	29	33.3
Occupation		
Government servant	36	41.4
Private employee	21	24.1
Self-employee	11	12.6
Retiree	1	1.1
Student	13	14.9
Unemployed	5	5.7
Monthly income		
Less than MYR2,500	23	26.4
MYR2,500-MYR4,849	27	31
MYR4,850-MYR7,099	23	26.4
MYR7,100-MYR10,959	5	5.7
More than MYR10,959	5	5.7
Others (e.g. prefer not to say)	4	4.6
Number of dependent		
None	44	50.6
01-Mar	33	37.9
04-Jul	8	9.2
More than 7	2	2.3

MYR1.00 = USD0.23
(Based on currency exchange in June 2022).

Table 5 Level of knowledge towards biodiversity conservation (n = 186)

Construct	Item	SD	Percentage, %	Total mean	Mean interpretation
Knowledge	1	0.829	75.8	4.23	High
	2	0.831	72.6	4.08	High
	3	0.918	67.7	4.02	High
	4	0.921	68.8	4.03	High
	5	0.889	83.4	4.29	High
	Total	0.878	73.7	4.13	High

Full details of Item 1 – Item 5 are presented in Appendix 1 (A); Bases of mean score (Low = 1.00–2.49, Moderate = 2.50–3.49, High = 3.50–5.00).

but they can also reach the ecosystem level (Item 3). They have a general understanding of the differences between habitats, such as wetland, coastal, forest, and meadow, when it comes to supporting the survival of various species. This is consistent with the finding by Palacios-Agundez et al. (2014) that the general public recognises the importance of forests for

ecosystem services, which ultimately contribute to their well-being.

While Item 4 indicates that the majority of respondents are aware of endemic species, which are native species that are exclusive to a particular region and cannot be found in other habitats. In promoting Malaysians’ local tourism treasures, the role of NGOs through the appropriate mass media, including the unique to Borneo proboscis monkey, has proven to be highly effective. Although the species is not in GMNP, they are aware of its distribution in several regions, particularly in Sarawak and Sabah. The proboscis monkey was the official mascot for the 2014 Visit Malaysia Year. This exposed the public to the term ‘endemic species’ through local tourism promotion (Ibrahim et al., 2021a, 2021b).

Level of attitude towards biodiversity conservation

Table 6 portrays the level of public attitude, particularly local community and visitors, towards biodiversity and conservation. It is measured using sixteen statements. Table 5 shows the total mean of 3.59, which indicates that the level of attitude among

Table 6 Level of attitude towards biodiversity conservation (n = 186)

Construct	Item	SD	Percentage, %	Total mean	Mean interpretation
Attitude	1	1.321	58.6	3.68	High
	2	1.469	45.7	3.10	Moderate
	3	1.209	46.7	3.48	Moderate
	4	1.240	71.0	3.91	High
	5	1.196	66.6	3.77	High
	6	1.240	30.1	2.81	Moderate
	7	1.299	81.7	4.24	High
	8	1.062	61.3	3.68	High
	9	1.205	53.2	3.50	Moderate
	10	1.164	22.0	2.65	Moderate
	11	1.573	42.5	3.00	Moderate
	12	1.217	81.2	4.26	High
	13	0.902	87.1	4.39	High
	14	1.030	75.8	4.12	High
	15	0.955	73.1	3.97	High
	16	1.304	33.9	2.95	Moderate
Total	1.212	58.2	3.59	Moderate	

Full details of Item 1 – Item 16 are presented in Appendix 1 (B); Bases of mean score (Low = 1.00–2.49, Moderate = 2.50–3.49, High = 3.50–5.00).

respondents towards biodiversity conservation is moderate.

The mean for Item 10 (2.65) is moderate, and it is the lowest compared to other items in the attitude construct. It demonstrates that the respondents perceived that people nowadays are less concerned about issues regarding biodiversity and conservation. Although it is only based on the perspective of the respondents, however, their concern for the public is a good indicator that shows a sign of their concern for conservation issues in the midst of tourism development. This is might in line with a study conducted by Ferrer-i-Carbonell and Gowdy (2007) that there is a positive concern about biodiversity loss on their well-being.

Item 13 is the highest mean for the attitude construct with a value of 4.39. A total of 87.1% of respondents are highly concerned about the loss of local flora and fauna species. This indicates that they feel the loss of certain species of local flora and fauna is a significant loss. The value of their appreciation for some of these local species, including endemic and iconic species such as the Malayan tiger, tapir, proboscis monkey, orangutans, and a hornbill, which represent Malaysia in most events such as Visit Malaysia Year, and Southeast Asian Games promotion is a good indicator of conservation efforts. In fact, the loss of this species is a form of biodiversity destruction, as discussed in Item 10. Individuals that care about biodiversity loss are believed to reveal a psychological connection with other living organisms. Therefore, the positive relationship between well-being and concern about species extinction lends support to those who argue that humans receive positive psychological benefits from caring about other species (Kopnina et al., 2018).

Item 12 shows the second-highest mean of 4.26, which states that the respondents agree that World Heritage Site (WHS) UNESCO's recognition of GMNP is very important. It shows that they have good support for the initiatives implemented by UNESCO towards conservation efforts at the park. It also reflects their good knowledge of the role of WHS status on biodiversity conservation in GMNP. In fact, the status could increase human well-being, especially local community and visitors, as a result of the holistic management of the protected area. The status instigates benefits in terms of local livelihood and tourism in the area.

Item 7 shows a mean of 4.24, which states that the respondents agree that 'nature is from God and needs to be conserved'. This statement also reinforces the high ecocentric spirit among them. Most religious respondents believed that the universe is God's creation, and as good believers, we must take good care of it (Zagonari, 2020).

Although the overall attitude is at a moderate level, it still possesses that they are ecocentric, that is, a good sense of responsibility as custodians of national parks as well as towards holistic biodiversity conservation efforts (Ibrahim et al., 2019). However, based on Table 5, there are seven items that indicate a moderate status (i.e. mean that ranges from 2.34 to 3.66) that need to be emphasised by stakeholders to improve attitudes at a high level among the public, particularly local community and visitors.

Level of experience in biodiversity conservation

Table 7 shows that the overall total mean indicates that the level of experience among respondents

Table 7 Level of experience in biodiversity conservation (n = 186)

Construct	Item	Std. deviation	Percentage	Total mean	Mean interpretation
Experience	1	1.295	51.6	3.39	Moderate
	2	1.282	59.7	3.54	Moderate
	3	1.148	63.4	3.69	High
	4	1.395	40.3	2.98	Moderate
	5	1.186	57.6	3.61	Moderate
	8	1.140	80.7	4.39	High
	9	1.133	81.7	4.28	High
	10	1.523	41.4	2.98	Moderate
	Total	1.263	59.6	3.61	High

Full details of Item 1 – Item 10 are presented in Appendix 1 (C); Bases of mean score (Low = 1.00–2.49, Moderate = 2.50–3.49, High = 3.50–5.00).

toward biodiversity conservation is high, with a value of 3.61. The public’s current experience has a greater possibility to increase to a better level in the future with a good engagement from related stakeholders towards envisioning biodiversity conservation for sustaining human well-being. There are 59.6% of respondents have good experience related to ecocentrism, particularly in biodiversity conservation.

Based on the highest items (i.e. items 8 and 9), most respondents showed a high sense of responsibility in preserving the environment by not picking any plants and animals in the national park without permission. It indicates that they know and comply with the regulations that restrict people from disturbing flora and fauna within the national park. These ecocentric practices or experiences may also be influenced by the environment that drives them to do so. According to item 2, they agreed that peers are individuals who greatly encourage them to care for the environment. Friends are more influential in mobilising outdoor behaviour than families and educational institutions (Jančius et al., 2021).

Meanwhile, both item 10 and 4 has the lowest mean value of 2.98. Only 41.4% of respondents stated that they have participated in programmes organised by non-governmental organisations (NGOs) regarding environmental conservation. With the engagement of government agencies and NGOs through community-based programmes, it can boost local people’s economic status through the benefits of natural resources such as tourism products and small and medium industries (Ibrahim et al., 2019). Emphasising the public’s ability, skills, and knowledge

in utilising the sustainable use of resources is becoming a significant step in environmental conservation efforts.

For Item 4, the percentage of respondents who regularly read environmental books or magazines is less than half, which is 40.3%. This observation is because they are more interested in obtaining information on environmental education through television programmes that are more interactive, as shown by Item 5 (mean = 3.61).

Level of awareness between local community and visitors

Based on Table 8, the level of awareness referred to knowledge, attitude, and experience is significantly different between the local community and visitors. Cohen’s *d* value is acceptable at a value less than 2.00 (Cohen, 1988). The results indicate significant differences in the construct of knowledge, attitude, and experience between the local community and visitors. Overall, visitors’ knowledge, attitude, and experience are higher than the local community based on the mean value in Table 8.

The level of knowledge was significantly higher for visitors than for the local community ($p < 0.001$). The knowledge gap between the local community and visitors is very large compared to attitude and experience. This result could be due to the diverse sociodemographic backgrounds of the respondents.

As presented in the table, the level of attitude of visitors is also significantly higher than the local community. This result contradicted the findings of a similar study in Bako National Park (BNP) that

Table 8 Level of knowledge, attitude, and experience towards biodiversity conservation between local community and visitors (n = 186)

Construct	Frequency, n	Mean	Cohen’s <i>d</i> effect size	Strength of association	<i>p</i> -value
Knowledge					
Local community	99	3.79 (0.65)	1.29	Very large	0.00*
Visitors	87	4.52 (0.47)			
Attitude					
Local community	99	3.44 (0.41)	0.8	Large	0.00*
Visitors	87	3.78 (0.44)			
Experience					
Local community	99	3.33 (0.73)	0.96	Large	0.00*
Visitors	87	3.92 (0.48)			

Figure in parentheses is standard deviation; *Significant at $p < 0.01$.

Table 9 Association between constructs (n = 186)

Construct	<i>r</i>	Correlation
Knowledge vs. attitude	0.378**	Moderate
Attitude vs. experience	0.254**	Weak
Knowledge vs. experience	0.457**	Moderate

**Pearson correlation is significant at $\alpha=0.01$.

Table 10 Association between awareness variable and sociodemographic

	Awareness		
	Knowledge	Attitude	Experience
Type of respondents (local community or visitors)	0.539**	0.369**	0.426**
Race of visitors		0.234**	
Ethnic	0.236*		0.217*
Marital status	0.225**	0.247**	
Age	-0.306**	-0.221**	-0.242**
Education level	0.530**	0.470**	0.542**
Income level	0.242**	0.236**	0.175*
Number of dependent	-0.168*		
Do you think that UNESCO status is important?	0.156*		

**Correlation is significant at $\alpha=0.01$ (2-tailed).

*Correlation is significant at $\alpha=0.05$ (2-tailed).

the local community has a higher attitude towards biodiversity conservation than visitors (Ibrahim et al., 2021a, 2021b). A good sense of belonging to BNP among the local community is a good indicator that encourages them to take care of this area, which has been their identity for a long time. However, in GMNP, the local community has a lower sense of belonging that needs to be emphasised by stakeholders. It is due to the local community of GMNP has a cultural heterogeneity that is different to that in BNP, where their society is more homogeneous. The Penan and Berawan have conflicts over employment opportunities and land ownership in

the park area. The dissatisfaction between them and the government is also the cause of the lower level of attitude than visitors in the context of biodiversity conservation efforts. Xu et al. (2022) stated that socio-economic factors such as gender, age, income, education, marital status, acceptance to pay, and willingness to reside in the community (for an extended period of time) could influence people's attitudes towards biodiversity conservation in the area.

The level of experience for the visitors is also significantly higher than the local community. Further multiple regression analysis (Table 10) would elucidate this phenomenon through the relationship between the constructs of awareness and the sociodemographic of the respondents.

Association between knowledge, attitude, and experience constructs

Pearson correlation was used to assess the strength of the relationship and describes how closely two variables are associated with each other. The value of 0 (minimum) indicates no relationship, while the value of 1 (maximum) indicates a perfect linear relationship (Peeters, 2016; Winter et al., 2016). The results showed that the constructs are positively correlated, ranging from weak to moderate (Table 9). Although the correlation between these constructs is not high, it is still clear that knowledge is related to exposure to biodiversity (experience) and positive attitudes towards nature and animals (Hooykaas et al., 2019).

Table 10 shows the significant correlation coefficient, *r*, which ranges from low to moderate (-0.156 to 0.542) between the awareness variable and sociodemographic. There is a significant correlation between awareness (knowledge, attitude, and experience) and sociodemographic. There is a moderately negative relationship between age and level of knowledge, attitude and experience towards biodiversity conservation. From the correlation, it can be concluded that the older generation tends to have a lower level of awareness (knowledge, attitude, and experience) than the younger generation.

Table 11 The regression coefficient for predicting knowledge on biodiversity conservation

Variables	Overall model (n = 186)	
	β	<i>p</i>
Type of respondent (local community or visitor)	0.452 (0.128)	0.001***
Gender	0.026 (0.084)	0.757
Race	-0.020 (0.069)	0.773
Marital status	-0.072 (0.103)	0.484
Age	-0.046 (0.043)	0.287
Education	0.189 (0.058)	0.001***
Occupation	0.014 (0.034)	0.682
Income	-0.003 (0.046)	0.946
Number of dependent	-0.084 (0.063)	0.184
Constant	3.079 (0.336)	0.000
R ²	0.358	
R ² adj	0.352	
F(9, 176)	10.905****	

β = unstandardized regression coefficients; Figure in parentheses is standard error; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$.

Table 12 The regression coefficient for predicting attitude towards biodiversity conservation

Variables	Overall model (n = 186)	
	β	<i>P</i>
Type of respondent (local community or visitor)	-0.032 (0.091)	0.729
Gender	0.025 (0.060)	0.677
Education	0.159 (0.041)	0.000****
Occupation	-0.048 (0.025)	0.050*
Race	0.140 (0.049)	0.005***
Marital status	0.107 (0.073)	0.145
Age	-0.024 (0.030)	0.431
Income	0.019 (0.033)	0.557
Number of dependent	-0.009 (0.045)	0.834
Constant	2.905 (0.239)	0.000
R ²	0.284	
R ² adj	0.247	
F(9, 176)	7.749****	

β = unstandardized regression coefficients; Figure in parentheses is standard error; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$.

Regression for predicting knowledge, attitude, and experience

Multivariate regression was conducted to predict knowledge, attitude, and experience constructs. Based on the analyses, knowledge was statistically significant, with an R² of 0.358, which quantifies how much the independent variables determine the dependent variable in terms of proportion of variance. Based on Table 11, two of the nine predictor variables were statistically significant. The results indicated that type of respondent and education were the best variables in predicting the respondents' scores on the knowledge scale. Previous research has demonstrated that a high degree of education will provide communities with a better understanding of current concerns concerning biodiversity and its benefits (Challcharoenwattana & Pharino, 2016; Ezebilo et al., 2012).

The attitude model in Table 12 also was statistically significant. It had an R² of 0.284, which quantifies how much the independent variables determine the dependent variable in terms of proportion of variance. According to the coefficients table (Table 11), three of the nine predictor variables were statistically significant. The results indicated that race, education, and occupation were the best variables in predicting the respondents' scores on the attitude scale.

This study shows that those who have received higher education are more likely to have a positive attitude. This is in line with the findings of a study by Caruso et al. (2021) and Schlegel and Rupf (2010) that ecocentric traits among individuals are also influenced by higher education levels. In this model, the race and education predictor shows a positive sign. On the other hand, occupation showed that individuals who serve in the government sector are more likely to have a better attitude than others. They might be more familiar with the government efforts and policies toward biodiversity conservation in Malaysia because they are part of it. Thus, loyalty to the government is the main value instilled in the government servant. Civil service ethics influence the behaviour and discipline of Malaysia's civil servants and encourage ethical values, which include ecocentrism (Tjiptoherijanto, 2012). The attitude model is also influenced by race, which shows a positive coefficient that is non-Bumiputra have a better attitude than Bumiputra (Malay, Sarawak, and Sabah natives). It portrays that they have a better sense of belonging

Table 13 The regression coefficient for predicting experience towards biodiversity conservation

Variables	Overall model (n = 186)	
	β	<i>p</i>
Type of respondent (local community or visitor)	0.201 (0.133)	0.134
Gender	−0.110 (0.087)	0.209
Race	−0.018 (0.072)	0.804
Marital status	−0.214 (0.107)	0.048**
Age	−0.031 (0.044)	0.485
Education	0.333 (0.060)	0.000****
Occupation	−0.014 (0.036)	0.694
Income	−0.040 (0.048)	0.408
Number of dependent	−0.101 (0.065)	0.123
Constant	2.919 (0.350)	0.000
R ²	0.326	
R ² adj	0.291	
F(9, 176)	=9.456****	

β = unstandardized regression coefficients; Figure in parentheses is standard error; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$.

than Bumiputra, who are prouder and appreciate their natural heritage, particularly GMNP (Ibrahim et al., 2021a, 2021b). These values also instil a more responsible attitude towards environmental conservation, which is an asset that might contribute to their well-being.

The experience model in Table 13 indicates statistically significant, with 32.6% of the variance explained by the model quantifying how much the independent variables determine the dependent variable. According to the coefficients table, 2 of the 9 predictor variables were statistically significant. The results indicated that marital status and education were the best variables in predicting the respondents' scores on the experience scale, $p < 0.001$.

Marital status shows that married individuals are more likely to have a better level of experience than singles. This may be because those who have held responsibilities as parents have better exemplary values to teach to their children than singles. Parents play an important role in the agentive socialisation role in their engagement with children on

Table 14 The regression coefficient for predicting awareness of biodiversity conservation

Variables	Overall model (n = 186)	
	β	<i>p</i>
Type of respondent (local community or visitors)	0.207 (0.077)	0.008***
Gender	−0.020 (0.051)	0.697
Race	0.034 (0.042)	0.415
Marital status	−0.060 (0.062)	0.340
Age	−0.034 (0.026)	0.195
Education	0.227 (0.035)	0.000****
Occupation	−0.016 (0.021)	0.439
Income	−0.008 (0.028)	0.778
Number of dependent	−0.065 (0.038)	0.089*
Constant	2.968 (0.203)	0.000
R ² adj	0.482	
F(9, 176)	=20.094****	

β = unstandardized regression coefficients; Figure in parentheses is standard error; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$.

pro-environmentalism (Iwaniec & Curdt-Christian-sen, 2020).

As the knowledge and attitude model, education is also seen as a factor in predicting the level of experience in this study. Education was observed to significantly impact villagers' experience (participation) in biodiversity conservation initiatives (Truong, 2022).

Multivariate analysis for overall awareness scale

The multiple regression analysis was employed to examine the biodiversity conservation awareness among the public, particularly the local community and visitors to GMNP. Multiple regression is a statistical procedure that assesses the relationship between a dependent variable and several predictor variables (Petchko, 2018).

In the present analysis, the awareness variable was employed as the dependent variable. It was defined operationally from the mean score between the construct of knowledge, attitude, and experience in this study. Respondents with high scores for the mean total for the three constructs were considered more

likely to have a higher level of awareness than those with low scores. The independent variables were sociodemographic, such as type of respondent, gender, race, marital status, age, education, occupation, income, and the number of the dependent.

This model was statistically significant. It had an R^2 of 0.507, which indicates that the regression model explained 50.7% of the variance in the respondents' scores for the awareness scale. It also possesses a moderate model based on interpretation suggestions for social science by Ferguson (2009). The value also exceeds the recommended minimum effect size of 0.04.

According to the coefficients table, 2 of the 9 predictor variables were statistically significant. The results indicated that type of respondent and education were the best variables in predicting the respondents' scores on the awareness scale. Table 14 indicates the results of the analysis.

Respondents with a high level of education had a higher level of score than others on the biodiversity conservation awareness scale. This regression analysis clearly shows that the type of respondent greatly influences the awareness scale, as explained in Tables 8 and 10.

Although visitors have a higher level of awareness than the local community, income and employment that are often associated with them are insignificant in this study. In fact, it has been proven that the high educational background of respondents leads to a better level of awareness. A total of 91.9% of visitors who have participated in this survey showed that they had received tertiary education compared to the

percentage of the local community, which is only 14.1%.

This awareness may exist among them due to the environment that drives them to be ecocentric since they were in previous educational institutions. Furthermore, many environmental programs are organized by clubs and associations at the institutions. Formal education is critical for exposing society to biodiversity conservation (Kamri, 2018). These findings demonstrated that the higher the degree of education, the more aware the public is of the need for environmental conservation (Abrina & Bennett, 2020; Ariyo et al., 2018; Castillo-Eguskitza et al., 2019; Ren et al., 2020). It also supports those peers were the individuals who most motivated them to do so based on the mean analysis for item 2 in the experience construct (Table 7).

The number of dependents is significantly different at 10% of the significance level. The majority of local community and visitors involved in this study do not have dependents. Most are 50 years old and no longer have dependents for the local community because their children are married and choose to migrate to cities for better employment opportunities. Meanwhile, visitors are still a bachelor and have no dependents. Other predictors, namely gender, race, marital status, age, occupation, and income, showed no statistically significant relationship to the dependent variable.

Further multiple regression analyses for the type of respondents were conducted separately with the same variables. The regression model for local communities and visitors significantly predicted the awareness

Table 15 Mean analysis of respondents' well-being (n = 99)

Bases of mean score (Poor = 1.00–2.49, Moderate = 2.50–3.49, Good = 3.50–5.00).

Pillars	Dimension	Mean	Std. deviation	Satisfaction level
Environment	Environment	4.39	0.806	Good
Economic	Income	2.46	1.264	Poor
Social	Neighbourhood	4.44	0.823	Good
	Life and social relation	4.43	0.797	Good
	Services and facilities	3.26	1.389	Moderate
	Education	4.08	1.007	Good
	Culture	4.09	0.882	Good

among respondents. This model accounts for 34.9% and 58.2% of the variance in local community and visitors, respectively, to have awareness within their society. For the local community, education, income, and the number of dependents contributed significantly to the model. For visitors, only education has contributed to the model (see Appendix B.1). The regression model for visitors shows a lower significant value at $p < 0.1$ than the local community model. This result may be due to the small sample size for visitors compared to the local community.

Specifically, it was proven that education had determined the awareness of respondents who are male, female, single, married, middle and old aged generation, young generation, non-government employee, not working (e.g. unemployed, retiree, and student), has monthly income (less than MYR2501), has dependent, no dependent, and indigenous people (see Appendix B). It is noted that married respondents have a better awareness level than single based on their significance, coefficient, and variance. Similarly, middle and old age indicate better than the young generation in terms of awareness. Respondents who have dependents have a better awareness level than those without dependents. The type of respondent only predicts the level of awareness of respondents who had no dependents.

Awareness scale and its relation to the well-being of the local community

The well-being of the local community is dependent on environmental, economic and social factors that are closely related to their daily lives. This well-being is also subjective based on each individual's different perspectives. Table 15 shows the mean analysis of respondents' well-being measured through their level of satisfaction with the environmental, economic, and social pillars. Based on the mean, the environment (4.39) and social (4.06) are at good satisfaction levels. On the other hand, economics (2.46) showed that they were not satisfied with the current monthly income due to the COVID-19 pandemic challenge situation in their area. This pandemic led to the phenomenon of 'anthropause' that referred specifically

Table 16 The regression coefficient of well-being for predicting awareness towards biodiversity conservation by the local community

Pillars	Overall model (n=99)	
	β	p
Environment	-0.105 (0.067)	0.119
Economics	0.075 (0.034)	0.028**
Social	0.221 (0.087)	0.013**
Constant	2.897 (0.281)	0.000
R ²	0.140	
R ² adj	0.113	
F(3, 95)=5.148***		

β =unstandardized regression coefficients; Figure in parentheses is standard error; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$.

to a considerable global slowing of modern human activities, notably travel (Rutz et al., 2020). The tourism industry is almost paralysed due to the absence of visitors in GMNP as well as restriction movement control orders by authorities.

The satisfaction level for the services and facilities dimension shows that it is at a moderate level compared to other dimensions, including neighbourhood, life and social relations, education, and culture. This finding is because they demand to have services and facilities be improved in their area, including water supply, electricity and internet. Based on narrative and observation, they are currently still using untreated water, which differs from residents outside of their area. Some of them still use rain and river water as the main source of drinking water in their daily life. Furthermore, the telephone and internet networks are also very limited in GMNP and adjacent areas compared to Long Terawan. Residents in Long Terawan have received free high-speed internet access facilities through the Sarawak Rural Broadband Network (My SRBN) initiative starting from April 2021. Thus, residents in GMNP and surrounding areas also expect the same facilities as those in Long Terawan. To achieve community-based natural resource management, the government's facilitative role is necessary (Emilia et al., 2013).

The awareness variable was employed as the dependent variable, while the independent variables were well-being pillars, such as environment, economics, and society. This model was statistically significant. It had an R^2 of 0.140, which quantifies how much the independent variables determine the dependent variable in terms of proportion of variance. This indicates that the regression model explained 14.0% of the variance in the respondents' scores for the awareness scale. It also possesses a low model for social science by Ferguson (2009). According to the coefficients table (Table 16), 2 of the 3 predictor variables were statistically significant. The results indicated that economics and social pillars were the best variables in predicting the respondents' scores on the awareness scale.

Conclusion and caveats

Overall, the level of awareness of the respondents is still deemed to be considerable, but the level of attitude must be enhanced because its value is only moderate, whereas knowledge and experience are at a high level. After being refined, the gap between the local community and visitors in terms of knowledge, attitude, and experience is immense. This is due to several sociodemographic factors that influence their broad sense level of awareness. Based on the mean scores for knowledge, attitude, and experience, it is evident that visitors demonstrate a higher level of awareness than the local community.

The level of biodiversity conservation awareness is influenced by the type of respondents (e.g., local community or visitors), their level of education, and the number of their dependents. However, through regression analysis, the sociodemographic factors that influence the awareness variable, as measured by the indicators of knowledge, attitude, and experience, can be seen clearly. The level of education and the type of respondent influence the level of awareness. While education, occupation, and race also influence a respondents' attitude. Similarly, to knowledge and attitude, respondents with a high level of education also have a high level of experience, but marital status also provides insight into this concept. The relationship between biodiversity

conservation awareness and community well-being is supported by this study. Enhancing well-being via its indicators, which are economic and social pillars, has a substantial impact on conservation awareness.

It is proposed that future work at GMNP should include an assessment of species knowledge administered by relevant stakeholders. Intervention programmes should be implemented over a period of time to educate and assess the local community's level of knowledge regarding biodiversity conservation in this GMNP. Aspects of social psychology play a significant role in biodiversity and conservation, which must be managed holistically by all nation-pride-holding parties in GMNP. This study will aid government and policymakers in developing a more effective strategy for promoting sustainable environmental management and conservation initiatives.

Acknowledgements We would like to thank to the respondents who were willing to participate in this survey. Thanks to Acaditor Malaysia for proofreading the manuscript. Special thanks are also due to Mr. Modin anak Ambau, Miss Erra Fazira Abdul Rahim, Mr. Farhan Ismat and those who contributed directly or indirectly in the completion of this study.

Author contributions All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by MSNI. The first draft of the manuscript was written by him, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Funding The authors did not receive support from any organization for the submitted work.

Declarations

Competing interest The authors declare no competing interests.

Ethical approval The authors would like to thank Sarawak Forestry Corporation (reference number: SFC.PL&RS/2020–005), Borsarmulu Park Management and the Universiti Putra Malaysia Ethics Committee for Research involving Human Subjects (JKEUPM) (reference number: JKEUPM-2020–403) for the approval to conduct the study in this area.

Consent to participate The informed consent was obtained from the participants in this study and the protocol was approved by the JKEUPM.

Appendix 1

Item	Statement
(A) Level of knowledge towards biodiversity conservation	
1	Biodiversity is a measure of the number of different species of plants and animals in an area (e.g. the birds and plants at Mulu)
2	Biodiversity is a measure of the extent of genetic variation within a species (e.g. the different type of moss, different breeds of hornbill)
3	Biodiversity means the number of different ecosystems within a specific area such as the wetlands, the coast, the forest, the meadows
4	Endemic species (e.g. proboscis monkey, Malayan tiger, tapir) is a species that can only be found in a specific geographic area due to isolation, soil and climate
5	Endangered species is species of wild animal and plants that is threatened with extinction
(B) Level of attitude towards biodiversity conservation	
1	I think the goal of biodiversity conservation itself is a threat to our country's continued economic prosperity
2	I think the biodiversity issues and problems should be left to experts
3	I think the demand for economic growth which concern on some environmental restrictions related to biodiversity issues is less important
4	I do not think any of us can contribute significantly to solving the problem of biodiversity issues
5	I am not willing to sacrifice my possessions or money to deal with biodiversity issues and issues
6	I think science & technology can solve all biodiversity issues and problems
7	I think nature is a gift from God that does not necessarily need to be preserved
8	I think almost all human activities cause biodiversity loss
9	I think that the exploitation of natural resources for basic human needs must be developed even though it may result in loss of habitat and wildlife populations
10	I think that people are too concerned about biodiversity issues and problems
11	The road that connects Gunung Mulu to other areas should be built
12	World Heritage Site UNESCO's recognition on Gunung Mulu is not very important
13	I do not feel anything about the extinction of local species of flora and fauna
14	To be honest, there is nothing I can do to help stop the degradation of the world's biodiversity
15	I think we will lose some of the endemic / unique species (e.g., proboscis monkey, orangutan, Malayan tiger, tapir) that are the major contributors to biodiversity worldwide
16	I think the loss of biological diversity of domestic animals for food production is less serious than a similar loss of wildlife
(c) Level of experience/ practices towards biodiversity conservation	
1	Do you participate in outdoor activities such as camping, hiking, plogging, rafting, caving?
2	Do your family members encourage you to take care of the environment?
3	Do your friends encourage you to take care of the environment?
4	Do you read environmental books or magazines?
5	Do you watch television for environmental channel?
6	Do you see other tourists littering indiscriminately?
7	Do you advice the irresponsible tourists to not litter indiscriminately?
8	Do you hunt the animals?
9	Do you pick the plants?
10	Do you participate in any non-government organization (NGO) membership/ programme for environmental/ biodiversity conservation?
(D) Community well-being (for local community respondents only)	
1	Are you satisfied with the surrounding environment (air, water, land)?
2	Are you satisfied with the people who live in this community?

Item	Statement
3	Are you satisfied with the life of the community here?
4	Are you satisfied with the services and facilities here?
5	Are you satisfied with the education facilities provided to the children here?
6	Are you satisfied with the income and living costs here?
7	Are you satisfied with the culture of the community here?

Appendix 2

Variables	Local community (n=99)				Visitors (n=87)			
	β	SE	<i>p</i>	VIF	β	SE	<i>p</i>	VIF
(A) Regression coefficient for predicting awareness on biodiversity conservation by type of respondents								
Gender	-0.076	0.007	0.327	1.064	0.023	0.067	0.732	1.092
Race	-0.000	0.105	1.000	1.048	0.042	0.043	0.340	1.304
Marital status	-0.117	0.089	0.193	1.449	-0.014	0.092	0.876	2.028
Age	-0.020	0.036	0.582	1.559	-0.013	0.041	0.756	2.024
Education	0.287	0.054	0.000****	1.360	0.146	0.046	0.002****	1.027
Occupation	-0.014	0.035	0.692	1.069	-0.015	0.025	0.545	1.314
Income	0.179	0.098	0.069*	1.080	-0.034	0.028	0.221	1.337
Number of depend-ent	-0.096	0.056	0.090*	1.429	-0.039	0.051	0.447	1.441
Constant	2.957	0.329	0.000		3.557	0.307	0.000	
R ²	0.349							
R ² adj	0.291							
	F(8, 90)=6.031****				F(8, 78)=1.800*			

β = unstandardized regression coefficients; Beta = standardized regression coefficients; SE = standard error of b; * $p < .1$, ** $p < .05$, *** $p < .01$, **** $p < .001$.

Variables	Male (n=101)				Female (n=85)			
	β	SE	<i>p</i>	VIF	β	SE	<i>p</i>	VIF
(B) Regression coefficient for predicting awareness on biodiversity conservation by gender								
Type of respond-ents	0.099	0.119	0.407	2.687	0.249	0.106	0.021**	2.380
Race	-0.027	0.067	0.685	1.208	0.076	0.053	0.155	1.255
Marital status	-0.149	0.093	0.113	1.753	0.014	0.086	0.873	1.729
Age	-0.049	0.036	0.183	1.829	-0.020	0.038	0.597	1.563
Education	0.277	0.059	0.000****	2.484	0.197	0.043	0.000****	1.891
Occupation	-0.011	0.031	0.722	1.183	-0.018	0.029	0.538	1.311
Income	0.008	0.039	0.841	1.575	-0.023	0.041	0.581	1.727
Number of dependent	-0.057	0.051	0.261	1.488	-0.109	0.061	0.080*	1.299
Constant	3.138	0.299	0.000		2.824	0.251	0.000	
R ²	0.47				0.582			

Variables	Male (n = 101)				Female (n = 85)			
	β	SE	<i>p</i>	VIF	β	SE	<i>p</i>	VIF
R ² adj	0.424					0.538		
	F(8, 92) = 10.189****	F(8, 76) = 13.215****						

β = unstandardized regression coefficients; Beta = standardized regression coefficients; SE = standard error of b; * p <.1, ** p <.05, *** p <.01, **** p <.001.

Variables	Single (n = 73)				Married (n = 111)			
	β	SE	<i>p</i>	VIF	β	SE	<i>p</i>	VIF
(c) Regression coefficient for predicting awareness on biodiversity conservation by marital status								
Type of respondents	0.177	0.120	0.144	2.424	0.173	0.115	0.133	2.593
Gender	0.004	0.085	0.960	1.384	-0.041	0.071	0.565	1.101
Race	0.005	0.083	0.948	1.359	0.041	0.052	0.435	1.311
Age	-0.053	0.042	0.211	1.370	-0.002	0.039	0.958	1.383
Education	0.216	0.082	0.010**	2.251	0.237	0.043	0.000****	1.970
Occupation	0.023	0.033	0.482	1.764	-0.046	0.032	0.155	1.214
Income	0.061	0.061	0.322	2.169	-0.017	0.035	0.630	1.699
Number of dependent	-0.049	0.071	0.496	1.078	-0.078	0.048	0.103	1.152
Constant	2.768	0.263	0.000		2.923	0.251	0.000	
R ²	0.413				0.500			
R ² adj	0.339				0.461			
	F(8, 64) = 5.624****				F(8, 102) = 12.766****			

β = unstandardized regression coefficients; Beta = standardized regression coefficients; SE = standard error of b; * p <.1, ** p <.05, *** p <.01, **** p <.001.

Variables	Young (n = 108)				Middle and old-aged (n = 78)			
	β	SE	<i>p</i>	VIF	β	SE	<i>p</i>	VIF
(D) Regression coefficient for predicting awareness on biodiversity conservation by age								
Type of respondents	0.186	0.087	0.034**	2.144	0.280	0.165	0.095*	3.023
Gender	-0.036	0.060	0.555	1.054	0.004	0.095	0.965	1.078
Race	-0.010	0.062	0.876	1.191	0.024	0.064	0.711	1.341
Marital status	-0.001	0.068	0.994	1.376	-0.187	0.132	0.162	1.334
Education	0.190	0.053	0.001***	1.900	0.250	0.056	0.000****	2.128
Occupation	0.010	0.026	0.696	1.487	-0.036	0.039	0.365	1.104
Income	0.034	0.043	0.422	1.816	-0.035	0.044	0.419	1.774
Number of dependent	-0.079	0.052	0.131	1.307	-0.071	0.060	0.240	1.261
Constant	2.917	0.203	0.000		2.885	0.291	0.000	
R ²	0.395				0.502			
R ² adj	0.346				0.444			
	F(8, 99) = 8.091****				F(8, 69) = 8.698****			

β = unstandardized regression coefficients; Beta = standardized regression coefficients; SE = standard error of b; * $p < .1$, ** $p < .05$, *** $p < .01$, **** $p < .001$.

Variables	Primary and secondary education (n=92)				Tertiary education (n=94)			
	β	SE	<i>p</i>	VIF	β	SE	<i>p</i>	VIF
(E) Regression coefficient for predicting awareness on biodiversity conservation by level of education								
Type of respondents	0.208	0.241	0.391	2.043	0.336	0.099	0.001	1.192
Gender	-0.055	0.096	0.568	1.042	0.009	0.067	0.899	1.066
Race	0.041	0.104	0.694	1.364	0.049	0.048	0.310	1.288
Marital status	0.007	0.110	0.947	1.357	-0.028	0.086	0.746	1.693
Age	-0.045	0.043	0.293	1.277	-0.046	0.043	0.286	1.910
Occupation	-0.037	0.043	0.389	1.064	-0.010	0.026	0.713	1.370
Income	0.040	0.086	0.644	1.844	-0.009	0.030	0.777	1.419
Number of dependent	-0.076	0.064	0.242	1.320	-0.001	0.054	0.987	1.434
Constant	3.584	0.381	0.000		3.556	0.280	0.000	
R ²	0.104		0.146					
R ² adj	0.017		0.065					
	F(8, 83)=1.202 at p=0.308		F(8, 85)=1.811					

β = unstandardized regression coefficients; Beta = standardized regression coefficients; SE = standard error of b; * $p < .1$, ** $p < .05$, *** $p < .01$, **** $p < .001$.

Variables	Government servant (n=50)				Non-government employee (n=45)			
	β	SE	<i>p</i>	VIF	β	SE	<i>p</i>	VIF
(F) Regression coefficient for predicting awareness on biodiversity conservation by occupation								
Type of respondents	0.071	0.170	0.680	2.763	0.241	0.112	0.035**	2.247
Gender	0.012	0.102	0.907	1.215	-0.032	0.076	0.671	1.099
Race	0.025	0.102	0.803	1.502	0.035	0.057	0.545	1.266
Marital status	-0.079	0.130	0.545	1.946	-0.025	0.083	0.765	1.531
Age	-0.086	0.066	0.203	1.657	-0.024	0.038	0.519	1.662
Education	0.120	0.084	0.164	2.402	0.242	0.044	0.000****	1.752
Income	0.021	0.063	0.746	2.057	0.009	0.036	0.794	1.535
Number of dependent	0.011	0.092	0.907	1.614	-0.067	0.054	0.220	1.493
Constant	3.688	0.420	0.000		2.696	0.272	0.000	
R ²	0.227				0.542			
R ² adj	0.076				0.501			
	F(8, 41)=1.506 at p=0.185		F(8, 89)=13.158****					

Variables	Not working (e.g. unemployed, retiree, student) (n=38)			
	β	SE	<i>p</i>	VIF
Type of respondents	0.073	0.193	0.710	3.819
Gender	-0.157	0.119	0.200	1.262
Race	0.033	0.085	0.701	1.305

Variables	Not working (e.g. unemployed, retiree, student) (n = 38)			
	β	SE	<i>p</i>	VIF
Marital status	0.127	0.198	0.525	3.992
Age	0.061	0.050	0.232	2.598
Education	0.267	0.096	0.009***	3.078
Income	-0.210	0.135	0.130	1.321
Number of dependent	-0.122	0.065	0.071*	1.163
Constant	2.955	0.389	0.000	
R ²	0.608			
R ² adj	0.500			
	F(8,29) = 5.629*****			

β = unstandardized regression coefficients; Beta = standardized regression coefficients; SE = standard error of b; * $p < .1$, ** $p < .05$, *** $p < .01$, **** $p < .001$.

Variables	Less than MYR2501 (n = 106)				More than MYR2500 (n = 73)			
	β	SE	<i>p</i>	VIF	β	SE	<i>p</i>	VIF
(G) Regression coefficient for predicting awareness on biodiversity conservation by income								
Type of respondents	0.166	0.115	0.152	2.278	0.133	0.115	0.253	1.297
Gender	0.013	0.067	0.852	1.088	-0.056	0.084	0.513	1.173
Race	0.005	0.065	0.939	1.215	0.048	0.062	0.448	1.235
Marital status	-0.152	0.083	0.070*	1.978	0.043	0.099	0.665	1.605
Age	-0.004	0.030	0.901	1.943	-0.051	0.056	0.367	1.665
Education	0.368	0.050	0.000*****	2.151	0.100	0.054	0.068*	1.305
Occupation	-0.032	0.031	0.313	1.342	-0.032	0.040	0.420	1.183
Number of dependent	-0.118	0.045	0.009***	1.366	-0.021	0.070	0.770	1.465
Constant	2.700	0.244	0.000		3.550	0.402	0.000	
R ²	0.583				0.194			
R ² adj	0.549				0.093			
	F(8, 97) = 16.968***				F(8, 64) = 1.925*			

β = unstandardized regression coefficients; Beta = standardized regression coefficients; SE = standard error of b; * $p < .1$, ** $p < .05$, *** $p < .01$, **** $p < .001$.

Variables	No dependent (n = 85)				Has dependent (n = 101)			
	β	SE	<i>p</i>	VIF	β	SE	<i>p</i>	VIF
(H) Regression coefficient for predicting awareness on biodiversity conservation by number of dependent								
Type of respondents	0.223	0.110	0.046**	2.493	0.165	0.111	0.141	2.531
Gender	-0.002	0.074	0.974	1.120	-0.003	0.073	0.967	1.113
Race	0.055	0.056	0.333	1.310	-0.013	0.062	0.829	1.194
Marital status	-0.030	0.087	0.735	1.515	-0.105	0.091	0.253	1.204
Age	-0.037	0.033	0.254	1.520	-0.012	0.042	0.783	1.458
Education	0.157	0.052	0.003*****	2.090	0.278	0.048	0.000*****	2.142
Occupation	0.008	0.030	0.789	1.352	-0.044	0.031	0.154	1.140

Variables	No dependent (n = 85)				Has dependent (n = 101)			
	β	SE	p	VIF	β	SE	p	VIF
Income	0.030	0.048	0.541	1.738	-0.010	0.036	0.776	1.638
Constant	3.007	0.269	0.000		2.822	0.307	0.000	
R ²	0.456				0.545			
R ² adj	0.399				0.505			
	F(8, 76) = 7.965****				F(8, 92) = 13.755****			

β = unstandardized regression coefficients; Beta = standardized regression coefficients; SE = standard error of b; * $p < .1$, ** $p < .05$, *** $p < .01$, **** $p < .001$.

Variables	Indigenous people (n = 67)				Non-indigenous people (n = 32)			
	β	SE	p	VIF	β	SE	p	VIF
(I) Regression coefficient for predicting awareness on biodiversity conservation by type of local community								
Gender	-0.052	0.094	0.580	1.073	-0.130	0.147	0.385	1.343
Marital status	-0.191	0.107	0.081*	1.555	0.031	0.167	0.854	1.634
Age	-0.021	0.040	0.595	1.544	-0.064	0.085	0.455	2.244
Education	0.357	0.067	0.000****	1.471	0.007	0.118	0.955	1.622
Occupation	-0.021	0.045	0.649	1.078	0.036	0.075	0.637	1.660
Income	0.293	0.170	0.089*	1.090	0.187	0.132	0.171	1.403
Number of dependent	-0.084	0.062	0.183	1.372	-0.166	0.111	0.149	1.623
Constant	2.706	0.357	0.000		3.911	0.754	0.000	
R ²	0.430				0.272			
R ² adj	0.362				0.060			
	F(7, 59) = 6.356****				F(7, 24) = 1.284			

β = unstandardized regression coefficients; Beta = standardized regression coefficients; SE = standard error of b; * $p < .1$, ** $p < .05$, *** $p < .01$, **** $p < .001$.

References

- Abrina, T. A. S., & Bennett, J. (2020). Using choice modelling to estimate the non-market benefits of coral reef restoration in the Philippines. *Ocean and Coastal Management*, 185(October 2019), 105039. <https://doi.org/10.1016/j.ocecoaman.2019.105039>
- Al Amin, M. A., Adrianto, L., Kusumastanto, T., & Imran, Z. (2021). Community knowledge, attitudes and practices towards environmental conservation: Assessing influencing factors in Jor Bay Lombok Indonesia. *Marine Policy*, 129(March), 104521. <https://doi.org/10.1016/j.marpol.2021.104521>
- Ali, L., Grey, E., Singh, D., Mohammed, A., Tripathi, V., Gobin, J., & Ramnarine, I. (2020). An evaluation of the public's knowledge, attitudes and practices (KAP) in Trinidad and Tobago regarding sharks and shark consumption. *PLoS ONE*, 15(6), e0234499. <https://doi.org/10.1371/journal.pone.0234499>
- Aminrad, Z., Sayed Zakariya, S. Z., Hadi, A. S., & Sakari, M. (2013). Relationship between awareness, knowledge and attitudes towards environmental education among secondary school students in Malaysia. *World Applied Sciences Journal*, 22(9), 1326–1333. <https://doi.org/10.5829/idosi.wasj.2013.22.09.275>
- Ariyo, O., Okojie, L., & Ariyo, M. (2018). Villagers willingness to pay for forest conservation in Ibadan, Oyo State, Nigeria. *Asian Journal of Agricultural Extension, Economics & Sociology*, 23(4), 1–14. <https://doi.org/10.9734/ajaees/2018/40142>
- Babaei, A. A., Alavi, N., Goudarzi, G., Teymouri, P., Ahmadi, K., & Rafiee, M. (2015). Household recycling knowledge, attitudes and practices towards solid waste management. *Resources, Conservation and Recycling*, 102, 94–100. <https://doi.org/10.1016/j.resconrec.2015.06.014>
- Baharum, A., Rusli, N. M., Kua, E., Sen, J., Hidayah, N., Zain, M., & Ahmad, I. A. (2017). *Biodiversity awareness using mobile application: Ikimono Mikke Biodiversity*

- Awareness Using Mobile Application : *Ikimono Mikke*. <https://doi.org/10.1109/ICTC.2017.8190998>
- Boaitey, A., Goddard, E., & Hailu, G. (2018). Conserving biodiversity in farm animals: Do farmer and public biodiversity knowledge and awareness matter? *Society and Natural Resources*, 31(8), 960–976. <https://doi.org/10.1080/08941920.2018.1450912>
- Buijs, A. E., Fischer, A., Rink, D., & Young, J. C. (2008). Looking beyond superficial knowledge gaps: Understanding public representations of biodiversity. *International Journal of Biodiversity Science and Management*, 4, 65–80. <https://doi.org/10.3843/Biodiv.4.2>
- Caruso, F., Talamo, A., Perovic, P., Sillero–Zubiri, C., & Alrichtter, M. (2021). Human–jaguar coexistence: Social factors influencing jaguar conservation in Southern Bolivia. *Kempffiana*, 17(2), 1–17.
- Castillo–Eguskita, N., Hoyos, D., Onaindia, M., & Czajkowski, M. (2019). Unraveling local preferences and willingness to pay for different management scenarios: A choice experiment to biosphere reserve management. *Land Use Policy*, 88(March 2018), 104200. <https://doi.org/10.1016/j.landusepol.2019.104200>
- Challcharoenwattana, A., & Pharino, C. (2016). Wishing to finance a recycling program? Willingness–to–pay study for enhancing municipal solid waste recycling in urban settlements in Thailand. *Habitat International*, 51, 23–30. <https://doi.org/10.1016/j.habitatint.2015.10.008>
- Christmas, S., Watson, A., & Miskelly, C. (2013). *Engaging people in biodiversity issues* (Issue May).
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. In J. Cohen (ed.); 2nd ed. Lawrence Erlbaum Associates Publishers.
- Costanza, R., Costanza, R., Arge, R., Groot, R. D., Farber, S., Grasso, M., & Hannon, B. (1997). The value of the world’s ecosystem services and natural capital. *Nature*, 387(May), 253–260. [https://doi.org/10.1016/S0921-8009\(98\)00020-2](https://doi.org/10.1016/S0921-8009(98)00020-2)
- Department of Statistics Malaysia. (2020). Household income and basic amenities survey report 2019. In *Household income and basic amenities survey report 2019*. https://www.dosm.gov.my/v1/index.php?r=column/cthemByCat&cat=120&bul_id=TX00TmRhQ1N5TUxHVWN0T2VjbXJYZz09&menu_id=amVoWU54UT10a21NWmdhMjFMMWcyZz09
- De Winter, J. C. F., Gosling, S. D., & Potter, J. (2016). Supplemental material for comparing the pearson and spearman correlation coefficients across distributions and sample sizes: A tutorial using simulations and empirical data. *Psychological Methods*, 21(3), 273–290. <https://doi.org/10.1037/met0000079.supp>
- Dodds, S., & Hess, A. C. (2021). Adapting research methodology during COVID–19: Lessons for transformative service research. *Journal of Service Management*, 32(2), 203–217. <https://doi.org/10.1108/JOSM-05-2020-0153>
- Dunlap, R. E., Van Liere, K. D., Mertig, A. G., & Jones, R. E. (2000). Measuring endorsement of the new ecological paradigm: A revised NEP Scale. *Journal of Social Issues*, 56(3), 425–442. <https://doi.org/10.1038/nenergy.2016.91>
- Emilia, F., Hendarto, B., & Taruna, T. (2013). Pengelolaan sumber daya alam berbasis masyarakat dalam upaya konservasi daerah Aliran Sungai: Studi kasus desa keseneng, kecamatan sumowono, kabupaten semarang, jawa tengah. *Bonorowo Wetlands*, 3(2), 73–100. <https://doi.org/10.13057/bonorowo/w030202>
- European Commission. (2013). *Flash eurobarometer 379: attitudes towards biodiversity* (Issue November).
- Ezebilo, E. E. (2014). Maintenance of public amenity to improve access to nature area: Does distance and expected economic benefits matter? *Journal of Environmental Studies and Sciences*, 4(3), 240–249. <https://doi.org/10.1007/s13412-014-0181-0>
- Ezebilo, E. E., Sandström, C., & Ericsson, G. (2012). Browsing damage by moose in Swedish forests: Assessments by hunters and foresters. *Scandinavian Journal of Forest Research*, 27(7), 659–668. <https://doi.org/10.1080/02827581.2012.698643>
- Ferguson, C. J. (2009). An effect size primer: A guide for clinicians and researchers. *Professional Psychology: Research and Practice*, 40(5), 532–538. <https://doi.org/10.1037/a0015808>
- Ferrer–i–Carbonell, A., & Gowdy, J. M. (2007). Environmental degradation and happiness. *Ecological Economics*, 60(3), 509–516. <https://doi.org/10.1016/j.ecolecon.2005.12.005>
- Habib, M. A., Dayyab, F. M., Iiyasu, G., & Habib, A. G. (2021). Knowledge, attitude and practice survey of COVID–19 pandemic in Northern Nigeria. *PLoS ONE*. <https://doi.org/10.1371/journal.pone.0245176>
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis*. In *Australia : Cengage* (7th ed.). Pearson Prentice Hall.
- Hassan, S. (2017). Environmental attitudes and preference for wetland conservation in Malaysia. *Journal for Nature Conservation*, 37, 133–145. <https://doi.org/10.1016/j.jnc.2017.04.004>
- Hinton, P. R., McMurray, I., & Brownlow, C. (2014). *SPSS explained* (2nd ed.). Routledge/Taylor & Francis Group.
- Hooykaas, M. J. D., Schilthuizen, M., Aten, C., Hemelaar, E. M., Albers, C. J., & Smeets, I. (2019). Identification skills in biodiversity professionals and laypeople: A gap in species literacy. *Biological Conservation*, 238(108202), 1–10. <https://doi.org/10.1016/j.biocon.2019.108202>
- Ibrahim, M. S. N., Abdul–Halim, S., Ishak, M. Y., & Hassan, S. (2021a). The local community awareness on Langkawi UNESCO Global Geopark status: Case of Kampung Padang Puteh, Langkawi, Malaysia. *International Journal of Geoheritage and Parks*, 9(2), 233–241. <https://doi.org/10.1016/j.ijgeop.2021.02.009>
- Ibrahim, M. S. N., Adam Assim, M. I. S., Johari, S., Wan Mohammad, S. K., & Hassan, S. (2021b). Influence of knowledge, attitude, and experience towards biodiversity conservation: Case study of Bako National Park, Sarawak Malaysia. *The Malaysian Forester*, 84(2), 255–270.
- Ibrahim, M. S. N., Halim, S. A., & Ishak, M. Y. (2019). The impacts of tourism development on community well–being in Langkawi: The case of Kampung Padang Puteh, Mukim Kedawang. *Journal of Marine and Island Cultures*, 8(2), 61–88. <https://doi.org/10.21463/jmic.2019.08.2.06>
- Iwaniec, J., & Curdt–Christiansen, X. L. (2020). Parents as agents: Engaging children in environmental literacy in

- China. *Sustainability (Switzerland)*. <https://doi.org/10.3390/su12166605>
- Jalil, N. J., & MatSharif, Z. (2018). Factors Affecting the Awareness of Biodiversity Conservation Among Students in Malaysia Private University. *International Journal of Engineering & Technology*, 7(4.35), 791–795.
- Jančius, R., Gavenauskas, A., & Ūsas, A. (2021). The influence of values and the social environment on the environmental attitudes of students: The case of Lithuania. *Sustainability (Switzerland)*. <https://doi.org/10.3390/su132011436>
- Kamri, T. (2018). Willingness to pay for conservation in gunung gading national park willingness to pay for conservation in Gunung Gading National Park. *Asian Journal of Quality of Life*, 3(9), 207. <https://doi.org/10.21834/ajqol.v3i9.91>
- Kopnina, H., Washington, H., Taylor, B., Piccolo, J., & J. (2018). Anthropocentrism: More than just a misunderstood problem. *Journal of Agricultural and Environmental Ethics*, 31(1), 109–127. <https://doi.org/10.1007/s10806-018-9711-1>
- Kothari, C. R. (2004). *Research methodology: Methods and techniques* (2nd ed., Vol. 148). New Age International Publishers.
- Kushwaha, V. S. (2015). Mass media in disseminating environmental awareness. *International Journal of Research-GRANTHAALAYAH*, 3(9), 2–5.
- Launiala, A. (2009). How much can a KAP survey tell us about people's knowledge, attitudes and practices? Some observations from medical anthropology research on malaria in pregnancy in Malawi. *Anthropol Matters*, 11, 1–13. <https://doi.org/10.22582/am.v11i1.31>
- Louv, R. (2005). *Last Child in the Woods: Saving Our Children from Nature-deficit Disorder*. Atlantic Book.
- Lynn, M. R. (1986). Determination and quantification of content validity. *Nursing Research*, 35(6), 382–386. <http://ijoh.tums.ac.ir/index.php/ijoh/article/view/26>
- Macovei, O.–I. (2015). Applying the theory of planned behavior in predicting pro–environmental behavior: The case of energy conservation. *Acta Universitatis Danubius. (Economica)*, 11(4).
- Mandal, F. B., Chatterjee, C., & Ghosh, A. (2011). Ecosystems and human well–being. *Journal of Environment & Sociology*, 8(1), 25–42.
- Mascia, M. B., Brosius, J. P., Dobson, T. A., Forbes, B. C., Horowitz, L., McKean, M. A., & Turner, N. J. (2003). Conservation and the social sciences. *Conservation Biology*, 17(3), 649–650. <https://doi.org/10.1046/j.1523-1739.2003.01738.x>
- McLeod, S. A. (2019). *What does effect size tell you?* Simply Psychology. <http://www.simplypsychology.org/effect-size.html>
- Milkisso, K. P. (2020). Undergraduate university students' knowledge, attitude and behavior towards biodiversity. *Journal of Tropical Forestry and Environment*, 10(02), 39–50.
- Ministry of Natural Resources and Environment of Malaysia. (2016). *National policy on biological diversity 2016–2025*. Ministry of Natural Resources and Environment.
- Naeem, S., Chazdon, R., Duffy, J. E., & Prager, C. (2016). *Biodiversity and human well–being : An essential link for sustainable development*. December. <https://doi.org/10.1098/rspb.2016.2091>
- Naeem, S., Duffy, J. E., & Zavaleta, E. (2012). The functions of biological diversity in an age of extinction. *Science*, 336(6087), 1401–1406. <https://doi.org/10.1126/science.1215855>
- Ogunleye, L. I., Oyejola, B. A., & Obisesan, K. O. (2018). Comparison of common tests for normality. *International Journal of Probability and Statistics*, 7(5), 130–137. <https://doi.org/10.5923/j.ijps.20180705.02>
- Palacios–Agundez, I., Fernández de Manuel, B., Rodríguez–Loinaz, G., Peña, L., Ametzaga–Arregi, I., Alday, J. G., Casado–Arzuaga, I., Madariaga, I., Arana, X., & Onaindia, M. (2014). Integrating stakeholders' demands and scientific knowledge on ecosystem services in landscape planning. *Landscape Ecology*, 29(8), 1423–1433. <https://doi.org/10.1007/s10980-014-9994-1>
- Pam, G., Turshak, L. G., Chaskda, A. A., Mundi, F., & Agboola, B. (2021). Understanding the drivers of children's nature knowledge, attitudes and perceptions and the implications for the future of Nigeria's biodiversity. *Journal of Research in Forestry, Wildlife & Environment*, 13(2), 74–83.
- Peeters, M. J. (2016). Practical significance: Moving beyond statistical significance. *Currents in Pharmacy Teaching and Learning*, 8(1), 83–89. <https://doi.org/10.1016/j.cptl.2015.09.001>
- Petchko, K. (2018). Results, discussion, and conclusion. In *How to write about economics and public policy* (pp. 271–300). Elsevier Inc. <https://doi.org/10.1016/b978-0-12-813010-0.00014-4>
- Polit, D. F., & Beck, C. T. (2004). *Nursing research: Principles and methods* (1st ed.). Lippincott, Williams, & Wilkins.
- Raffard, A., Santoul, F., Cucherousset, J., & Blanchet, S. (2019). The community and ecosystem consequences of intraspecific diversity: A meta–analysis. *Biological Reviews*, 94(2), 648–661. <https://doi.org/10.1111/brv.12472>
- Rav–Marathe, K., Wan, T. T. H., & Marathe, S. (2016). A systematic review on the KAP–O framework for diabetes education and research. *Medical Research Archives*, 4(1), 1–21.
- Ren, Y., Lu, L., Zhang, H., Chen, H., & Zhu, D. (2020). Residents' willingness to pay for ecosystem services and its influencing factors: A study of the Xin'an River basin. *Journal of Cleaner Production*, 268, 122301. <https://doi.org/10.1016/j.jclepro.2020.122301>
- Rutz, C., Loretto, M. C., Bates, A. E., Davidson, S. C., Duarte, C. M., Jetz, W., Johnson, M., Kato, A., Kays, R., Mueller, T., Primack, R. B., Ropert–Coudert, Y., Tucker, M. A., Wikelski, M., & Cagnacci, F. (2020). COVID–19 lockdown allows researchers to quantify the effects of human activity on wildlife. *Nature Ecology and Evolution*, 4(9), 1156–1159. <https://doi.org/10.1038/s41559-020-1237-z>
- Sandifer, P. A., Sutton–Grier, A. E., & Ward, B. P. (2015). Exploring connections among nature, biodiversity, ecosystem services, and human health and well–being: Opportunities to enhance health and biodiversity conservation. *Ecosystem Services*, 12, 1–15. <https://doi.org/10.1016/j.ecoser.2014.12.007>
- Sarawak Forestry Corporation. (2020). *Visitors statistic from 2015–2019*. <https://www.sarawakforestry.com/visitor-statistics/>

- Schlegel, J., & Rupf, R. (2010). Attitudes towards potential animal flagship species in nature conservation: A survey among students of different educational institutions. *Journal for Nature Conservation*, 18(4), 278–290. <https://doi.org/10.1016/j.jnc.2009.12.002>
- Scottish Natural Heritage. (2009). *Commissioned Report 334: National Baseline Survey of Biodiversity Awareness and Involvement*. <https://www.cbd.int/cepa/doc/uk-scotland-snh.pdf>
- Shrestha, B., & Shrestha, A. (2021). Assessment of nature guide 's perception towards biodiversity conservation in Chitwan national park using knowledge, attitude and practice (KAP) Approach. *Journal of Environmental Sciences*, 7(August), 61–73.
- Slingenberg, A., Braat, L., Windt, H. Van Der, Rademaekers, K., Eichler, L., & Turner, K. (2009). *Study on understanding the causes of biodiversity loss and the policy assessment framework* (Issue October).
- Soga, M., Gaston, K. J., Yamaura, Y., Kurisu, K., & Hanaki, K. (2016). Both direct and vicarious experiences of nature affect children's willingness to conserve biodiversity. *International Journal of Environmental Research and Public Health*, 13(6), 12. <https://doi.org/10.3390/ijerph13060529>
- Sophat, S., Chandara, P., & Claassen, A. H. (2019). Assessment of local community perceptions of biodiversity conservation in the 3S rivers of cambodia: using a knowledge, attitudes, and practices (KAP) approach. In *Advances in global change research* (Vol. 64, Issue January, pp. 199–216). https://doi.org/10.1007/978-3-319-90400-9_12
- Spash, C. L., & Hanley, N. (1995). Preferences, information and biodiversity preservation. *Ecological Economics*, 12(3), 191–208. [https://doi.org/10.1016/0921-8009\(94\)00056-2](https://doi.org/10.1016/0921-8009(94)00056-2)
- Taherdoost, H. (2017). Determining sample size; How to calculate survey sample size. *International Journal of Economics and Management Systems*, 2(2), 237–239. <http://www.iiar.org/iiar/journals/ijems>
- Tjiptoherijanto, P. (2012). *Civil service reform in Malaysia : Commitment and consistency* (No. 4; May 2012, Vol. 2, Issue 4). <http://econ.fe.ui.ac.id/workingpage>
- Tomar, B. S., Singh, P., Nathiya, D., & Suman, S. (2021). Indian community 's knowledge, attitude, and practice toward COVID – 19. *Indian Journal of Social Psychiatry*, 37, 48–56. <https://doi.org/10.4103/ijsp.ijsp>
- Townsend, M., & Ebden, M. (2006). *Feel blue*. In Deakin University.
- Truong, D. D. (2022). Community awareness and participation in biodiversity conservation at Phong Nha–Ke Bang National Park, Vietnam. *Biodiversitas Journal of Biological Diversity*, 23(1), 581–592. <https://doi.org/10.13057/biodiv/d230163>
- UNESCO World Heritage Centre. (2019). *World heritage list: The criteria for selection*. UNESCO World Heritage Centre. <https://whc.unesco.org/en/criteria/>
- Van den Berg, H. (2007). *Feeling & thinking in attitudes*. Kurt Lewin Instituut.
- Wiseman, J., & Brasher, K. (2008). Community wellbeing in an unwell world: Trends, challenges, and possibilities. *Journal of Public Health Policy*, 29(3), 353–366. <https://doi.org/10.1057/jphp.2008.16>
- World Heritage in Danger. (2009). *Compendium, II*, 59. <https://doi.org/10.1371/journal.pone.0221947>
- WWF. (2017). *Updates on Heart of Borneo Programme*.
- Xu, L., Xu, W., Jiang, C., Dai, H., Sun, Q., Cheng, K., Lee, C. –H., Zong, C., & Ma, J. (2022). Evaluating communities' willingness to participate in ecosystem conservation in Southeast Tibetan Nature Reserves China. *Land*, 11(2), 207. <https://doi.org/10.3390/land11020207>
- Yang, K., Liu, H., Ma, L., Wang, S., Tian, Y., Zhang, F., Li, Z., Song, Y., & Jiang, X. (2021). Knowledge, attitude and practice of residents in the prevention and control of COVID–19: An online questionnaire survey. *Journal of Advanced Nursing*, 77(4), 1839–1855. <https://doi.org/10.1111/jan.14718>
- Zagonari, F. (2020). Comparing religious environmental ethics to support efforts to achieve local and global sustainability: Empirical insights based on a theoretical framework. *Sustainability (switzerland)*, 12(2590), 36. <https://doi.org/10.3390/su12072590>
- Zahedi, L., Sizemore, E., Malcolm, S., Grossniklaus, E., & Nwosu, O. (2014). Knowledge, attitudes and practices regarding cervical cancer and screening among haitian health care workers. *International Journal of Environmental Research and Public Health*, 11, 11541–11552. <https://doi.org/10.3390/ijerph111111541>

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