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Public Perception of Sunda Pangolin (*Manis javanica*) Conservation Adequacy and Future Initiatives in a University-Based Conservation Area: Evidence from SFERA@UMS, Sabah

Jephte Sompud[1], Ain Suffiah Binti Jamal[1], Jumadil Saputra[2,3], Affendy Hassan[1], Mohamadu Boyie Jalloh[1], Fitri Wulandari[4], Nur Fadzlunnisaa Wakimin[1*]

[1] Faculty of Tropical Forestry, Universiti Malaysia Sabah, Kota Kinabalu 88400, Malaysia
[2] Department of Economics, Faculty of Economics and Business, Universiti Malaysia Sarawak, Kota Samarahan 94300, Malaysia
[3] Centre for Spatially Integrated Digital Humanities, Faculty of Social Sciences & Humanities, Universiti Malaysia Sarawak, Kota Samarahan 94300, Malaysia
[4] Universitas Islam Negeri Raden Mas Said Surakarta, Sukoharjo 57168, Indonesia

Corresponding Author Email: fadzlunnisaa@ums.edu.my

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ABSTRACT

The Sunda pangolin (*Manis javanica*) is a threatened species that faces habitat degradation, poaching, illegal wildlife trade, and other anthropogenic pressures. The study focuses on public perception in terms of the adequacy of conservation and future initiatives for the Sunda pangolin, because it did not measure the outcomes in terms of its biological or ecological status. This study explored awareness, attitude toward conservation, and perceived human threats (PHT) in relation to public perception in terms of conservation adequacy and future initiatives for the Sunda pangolin at SFERA@UMS, a university-based conservation area in Sabah. A quantitative survey method via questionnaire was employed, and data were collected from 377 respondents by convenience sampling using Google Forms. Data were analyzed with SPSS 30 (Statistical Product and Service Solutions) using descriptive statistics, exploratory factor analysis, reliability analysis, Spearman correlation analysis, and multiple linear regression analysis. The findings showed that all constructs met adequate internal consistency. Correlation analysis indicated that awareness, attitude toward conservation, and PHT significantly and positively correlated with public perception. The regression analysis did show that Awareness of the Sunda pangolin (ASP) had a significant positive impact on public perception ($\beta = 0.278$, $p < 0.001$), while attitude toward conservation had a significant positive impact on public perception ($\beta = 0.213$, $p = 0.004$). However, PHT were not a significant predictor after the other variables were introduced ($\beta = 0.001$, $p = 0.993$). This model had the capability to explain 17.8% of the variance in public perception. Hence, the findings indicate that raising awareness and promoting a more positive attitude toward conservation are necessary to enhance public support for adequate Sunda pangolin conservation and future strategies at SFERA@UMS.

1. INTRODUCTION

The Sunda pangolin (*Manis javanica*) is among the most endangered mammal species in Southeast Asia due to habitat loss, poaching, illegal wildlife trade, and human disturbance. Conservation in Sabah is critical not just from an ecological standpoint but also a social one, where public perception and local involvement can aid the future perspective of conservation. However, conservation studies often focus on the biological threats to and the protection of the species. Less is known about how well the public views the conservation of the Sunda pangolin, considering this is within the campus forest environment such as SFERA@UMS.

Despite previous investigations, such as that of research [1], on knowledge, attitudes, and practices on Sunda pangolin conservation in Sabah, the link between conservation awareness, readiness for public participation, and threat recognition skills regarding human interactions is not well understood, particularly in campus forests. Earlier studies have offered significant insights into the public's awareness and attitudes regarding pangolin conservation. Nevertheless, there has been a dearth of research exploring the collective effects of awareness, conservation attitudes, and perceived human threats (PHT) on legislators' perception of the adequacy of conservation and their anticipated actions towards the Sunda pangolin, particularly within a campus forest and university-assisted conservation site like SFERA@UMS. This lack of understanding is significant because effective conservation communication should not only raise awareness but also motivate local involvement and enhance the local community's ability to recognize threats ranging from disturbance challenges, poaching, illegal trade, and human

encroachment.

Compared with research [1], this study contributes an increment in four primary aspects. First, this study focuses specifically on SFERA@UMS, a campus forestry and conservation education site in Sabah. Second, this study adopts a perception-based model that integrates awareness, conservation attitudes, and human-perceived threats into the public perception of Sunda pangolin conservation adequacy and future initiatives. Third, this study includes PHT as the key predictor in the model, and extends the discussion from general awareness and attitudes towards conservation to the impacts of human-perceived threats. Fourth, this study has practical implications for improving conservation communication, education and outreach, human threat recognition activities, and future conservation projects at SFERA@UMS.

Thus, this study aimed to analyze the public perception of the conservation adequacy and future initiatives of the Sunda pangolin at SFERA@UMS and to analyze the role of awareness, conservation attitude, and perceived human threat in shaping such perception.

While conservation measures for the Sunda pangolin (*Manis javanica*) had already been in place, the species and its conservation adequacy and future initiatives were still not widely known. The Sunda pangolin was still not well known as a critically endangered species with an important ecological function through its role in insect population controlling in maintaining the health of the forest [2]. Serious anthropogenic threats to the species still occur in Southeast Asia, with poaching, illegal wildlife trade, deforestation, and rapid urbanisation happening [3]. However, this study highlighted the importance of knowing how the conservation status of the Sunda pangolin was perceived to fulfil community involvement in future conservation initiatives, and minimal awareness of threats was evident. Studying public perceptions is critical in fostering conservation communication, information outreach, and local endorsement for Sunda pangolin conservation at SFERA@UMS.

This study does not assess any specific conservation programs or efforts. Rather, it investigates human perspectives about the adequacy of Sunda pangolin conservation and future initiatives at SFERA@UMS and how awareness, conservation attitude, and perceived human threats may affect future conservation efforts and initiatives.

Hence, this study investigated the significant impact of knowledge, conservation orientation, and the perception of anthropogenic threat on public perception of Sunda pangolin conservation adequacy and future initiatives in SFERA@UMS. Based on the research purposes and theoretical framework, the following hypotheses were established:

H1: Awareness of the Sunda pangolin (ASP) has a significantly positive relationship with the public's perceived Sunda pangolin conservation adequacy and future initiatives at SFERA@UMS.

H2: Conservation attitudes have a significantly positive relationship with the public's perceived Sunda pangolin conservation adequacy and future initiatives at SFERA@UMS.

H3: Perceived human threats have a significantly positive relationship with the public's perceived Sunda pangolin conservation adequacy and future initiatives at SFERA@UMS.

These hypotheses can be used to assess the associations between awareness, attitudes towards conservation, PHT, and public perception of Sunda pangolin conservation adequacy and future initiatives at SFERA@UMS.

2. LITERATURE REVIEW

2.1 Awareness of the Sunda pangolin

Studies indicate that the general ASP (*Manis javanica*) among people varies a lot among individuals in Southeast Asia. According to a study [1], although most non-pangolin inhabitants in Sabah, Malaysia, know that pangolins are critically endangered, as identified by the International Union for Conservation of Nature (IUCN), there is a wide knowledge gap in how the species functions and its behavioral characteristics [1]. This can decrease the participation of communities in conservation programs since, without knowledge of the significance of the species, it is not possible to instill proactive behaviors among the local communities.

Moreover, an article [4] reviewed the phylogenetics of the Sunda pangolin as well as conservation management. They observed that although genetic information is being captured, the understanding of such aspects by the whole society remains limited. The research underlines that increasing awareness concerning both genetic variations and the ecological importance of the Sunda pangolin can help toward more effective joint efforts.

Myths involving the Sunda pangolin promote people's ignorance towards the protection of creatures. Some cultural beliefs and traditional practices, especially in the region where the pangolins are regarded as a medicine source, make it difficult to protect them. According to research [5], such beliefs show that there is an urgent need to conduct education campaigns that can change the perspective on these ideas [5]. This is because such campaigns can explain how pangolins are ecologically important, thus changing their value outside a medical setting.

Moreover, it is revealed in a study conducted by Yodsheewan et al. [6] that, in general, individuals are not aware of the levels of threats to pangolins (poaching and the destruction of habitats), which is the main underlying reason for their endangered status. These threats need to be raised at an awareness level because such facts can arouse the masses and their desire to preserve the environment.

Educational outreach is crucial in increasing awareness among people about the Sunda pangolin and building the ground to support conservation efforts [7], focusing on the vitality of community education as a method of generating population acknowledgment and love of pangolins. Communities can be enlightened through strategic educational programs that will eventually increase the number of community members joining the cause of saving the species. According to Cen et al. [8], the awareness gap might be filled with the use of local knowledge in a conservation framework, forming a more informed society that is willing to take part in the preservation.

2.2 Attitude towards conservation

It has been proven that Local Ecological Knowledge (LEK) is critical in conservation planning of the Sunda pangolin. LEK may be used as a helpful tool in understanding trends related to pangolin exploitation, noting that this kind of

information is essential in predicting proper methods of conservation [9]. The research shows that members of the community have in-depth knowledge of the ecological forces and can inform conservation activities and crack down on illegal activities linked with the pangolin trade. Taking into consideration the indigenous knowledge may improve the outcomes of the legislative actions trying to preserve pangolins.

Suwal et al. [10] discovered that many citizens of Nepal had heard about pangolins and could identify them, but they did not know anything about the ecological, reproductive, and behavioral characteristics of the species. Such a gap compromises efficient conservation practice. An educational program to raise awareness about the environmental value of the Sunda pangolin can create a stronger sense of commitment on the part of the general population.

One of the most important sources of influence on pangolin conservation attitudes is community participation. Research indicates that the more the local communities are actively involved in the process of making conservation policies or in the management of the resources, the more they will contribute towards conservation of the species. Community-based conservation strategies that would increase the levels of local involvement in conservation initiatives are highly emphasized [11]. This kind of participation strengthens communities and makes conservation activities more locally relevant to the requirements and livelihoods.

According to Emogor et al. [12], economic factors and societal beliefs regarding trade in wildlife animals, including pangolins, can change perceptions regarding pangolin conservation after the COVID-19 pandemic. Tightening up a little bit further, people feel more motivated to conserve when they feel that there is a drop in the populations of wild pangolins, an important correlation that exists between awareness of the vulnerability of the species and the readiness and ability of people to get involved in any conservation initiatives.

Education is the key to changing attitudes toward the preservation of other critically endangered species like the Sunda pangolin. An extremely encouraging level of positive attitude (93.34%) toward pangolin conservation was identified in relation to the local Malaysian population [1]. Their findings imply that the area of creating awareness regarding the ecological role and conservation adequacy, and future initiatives of pangolins, can make a huge difference in gaining public support.

The research highlights the relationship between educational outreach and increased conservation attitude, and it is highly recommended that concerted efforts should be made to create awareness and inculcate habits that may help in saving the pangolins. The study performed by Ghimire et al. [13] highlights the role of locally organized anti-poaching forces in Nepal, and according to the research, appropriate training and incentives enhance regional adherence to the laws of conservation. Engaged, well-informed communities are more likely to view any conservation activity more positively, thereby ensuring that more people become compliant with the conservation mechanisms. Attend conferences, workshops, and symposiums in the same fields or on related counterparts.

2.3 Perceived human threats

Top on the list of perceived threats to the Sunda pangolin is the illicit wildlife trade, which has classified it as one of the most trafficked mammals in the world [14]. Nga et al. [5] reported that the high consequences of such trade, where the capture and further trade of pangolins not only deplete the populations of animals but also could help the development of some rabid diseases such as SARS-CoV-2. This relationship has brought pangolins to the center of the stage of both public health and the conservation of wildlife, as well as increasing attention to risks that consumer relationships in the live animal trade lead to.

The patterns of pangolin trafficking are still under investigation, with some studies indicating a tendency to combine bad routes with other economic and sociocultural dynamics, which makes it a challenging task to intervene in this activity [15]. Also, Zhang et al. [14] claimed that pangolins have also been pulled out of the wild due to the high demand for the meat and scales of pangolins used in traditional medicine, further worsening their declines and the ecological imbalance.

Figure 1. Sunda pangolin (*Manis javanica*) scales syndicate around 109.54 kg in West Kalimantan, Indonesia on 17th February 2024

For example, Figure 1 shows an operation by the SPORC Brigade Bekantan in West Kalimantan, Indonesia, in February 2024 that managed to thwart 109.54 kilograms of Sunda pangolin (*Manis javanica*) scales from being smuggled out of the Sintang Regency to Pontianak and Kubu Raya [16]. The case demonstrates the current danger posed to the existence of pangolins, whose scales continue to be sought after despite the species of CITES and hence afforded national protection. The incident also highlights the importance of raising awareness and community participation towards fighting the trafficking of wildlife, which forms the purpose of the study to determine the degree of influence that individuals have in ensuring their participation in supporting the conservation of pangolins.

Another terrible threat to the sustainability of Sunda pangolins is habitat destruction. When forests are converted to agricultural lands or urban terrains, the natural habitat of these forests is interfered with, resulting in fragmentation and isolation of populations [17]. Research that was carried out by Aziz et al. [18] in Singapore points out that not only does habitat loss contribute to the general reduction of the population but also worsens human-pangolin conflicts through road traffic collisions [18]. The effects emphasise the necessity of combined conservation that also involves the aspect of habitat protection as part of the practice of protecting the pangolins.

2.4 Public perception of Sunda pangolin conservation adequacy and future initiatives

Public awareness regarding the conservation adequacy and future initiatives of the Sunda pangolin sets forth an intermediate perception amongst the locals. A survey in Sabah, Malaysia, identified that the people in the area are aware of the IUCN status of the Sunda pangolin, but there is a lack of information on how and where they can find them, such as on Gaya Island [1]. This ignorance may hinder conservation initiatives, where the participation of people is vital when it comes to taking effective protective actions. Anasari et al. [19] also focus on the necessity of awareness campaigns because local people tend to use natural resources and thus must be included in the conservation initiatives to develop a feeling of responsibility toward their habitat.

The culture beliefs are relevant in pangolin conservation attitudes. Studies show that experiences with local wildlife influence beliefs regarding the need and urgency of conservation practices. In addition to positive attitudes, community engagement in conservation can be associated with community involvement in conservation programs, which are observed in other conservation cases [20]. The legal implications of hunting pangolins should be made known to the population through education in places where the practice is rampant. Indicatively, the risks to pangolins have been well established, and there is a dire need to organize effective awareness programs to educate the population about the pangolin trade being illegal [6, 21].

Conservation policies must promote local knowledge and institutionally formulated conservation policies. Information gathered during the community surveys on local ecology could be crucial, and pangolin studies in Southeast Asia proved that [3]. In addition, Suwal et al. [10] identified people who responded better to participating in the conservation process with higher knowledge of pangolins, emphasizing the importance of educational measures. Nevertheless, local representation in conservation decision-making has been observed to lead to more sustainable results, emphasizing the possibilities of community-based conservation strategies [20].

Hence, educative initiatives are important in addressing misconceptions such as this. In this regard, university-based conservation areas such as SFERA@UMS should conduct research to understand the public's perception of Sunda pangolin conservation adequacy and potential future initiatives. By assessing local beliefs, attitudes, and knowledge, conservationists can create communication messages that will resonate with the public and, hopefully in the long run, have community support behind them and eventually be more effective. Creating a positive public image is essential to the Sunda pangolin's future; for example, creating a feeling of stewardship will lead to more support, lowered threats, and improved conservation.

2.5 Theoretical framework

This study was informed by theoretical frameworks emphasizing the association of awareness, attitudes, and PHT with conservation-related perceptions and support. Specifically, the research was built on the Theory of Planned Behaviour (TPB) and the Environmental Awareness Framework (EAF). TPB was not strictly applied in this study, as behavioural intention was not directly assessed.

The TPB, highlighted by Ajzen [22], serves as an appropriate foundation for investigating the significance of attitude in conservation-related responses. The theory suggests that behaviour can be further explained by attitude towards behaviour, subjective norms, and perceived behavioural control [22]. Nonetheless, attitude towards conservation (ATC) was not investigated in this study as a direct predictor of behavioural intention, but rather regarded as an attitudinal explanatory factor that may be associated with the respondent's perception of conservation adequacy and future-related initiatives concerning the Sunda pangolin at SFERA@UMS.

Besides TPB, the EAF also assists in rationalizing the role of awareness, environmental concern, and perceived recognition of threats in influencing conservation-related perceptions. The framework states that awareness may advance to enhanced concerns and support for conservation-related measures [23]. This study applied a narrow understanding of awareness as related to knowledge of the Sunda pangolin, its ecological importance, and its threatened status; while perceived human threats encompassed awareness of the human-induced pressures of habitat loss, poaching, and illegal wildlife trade.

According to the theoretical framework and proposed hypotheses, the conceptual framework demonstrating the relationship among awareness, ATC, perceived human threats, and public perceptions of conservation adequacy and future trends is shown in Figure 2.

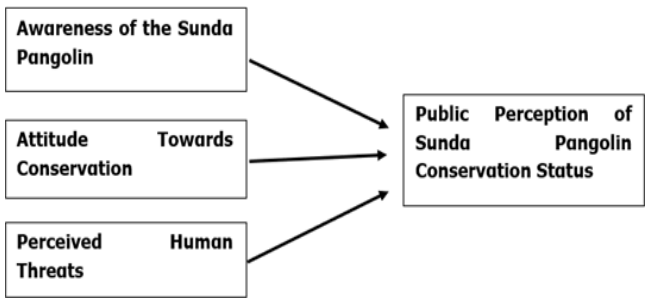

Figure 2. Theoretical framework

Such theoretical positioning is pertinent to the outreach and education functions of SFERA@UMS in awareness creation and conservation communication concerning the Sunda pangolin. However, this should not be taken as presumptive of the manner in which awareness, ATC, and PHT will equally impact the respondents' perception of conservation adequacy and future-related initiatives in the university-based conservation area [24]. Therefore, this study framed the assumption that more knowledge, positive ATC, and perceived recognition of human threats may promote better perception of conservation adequacy and future-related initiatives for the Sunda pangolin at SFERA@UMS.

3. METHODOLOGY

3.1 Study area

This study was conducted at the Sustainable Forest Education and Research Area, Universiti Malaysia Sabah (SFERA@UMS), located within the main campus of Universiti Malaysia Sabah, Kota Kinabalu, Sabah, Malaysia. SFERA@UMS is a university-based forest conservation,

education, and research area managed within the UMS campus landscape. The area is approximately 62 acres (about 25.1 hectares) and has been gazetted as a forest reserve for education and research. The area is one of the remaining forested areas within the UMS campus and serves as a useful area for conservation education, ecological studies, biodiversity monitoring, and nature-based learning activities.

The study site is situated in the campus forest landscape and is surrounded by university built-up facilities, access roads, and residential college areas. The east side of the area is adjacent to several major student residential colleges, such as Tun Fuad Residential College, E Residential College, and Tun Mustapha Residential College, while other portions of the study site are bordered by areas of secondary forest and campus facilities. The vegetation comprises mostly fragmented secondary forest, open-canopy areas, shrubland, grassland, and lowland forest. Other studies have also indicated that the physical environment varied from flat terrain to hilly areas with occasional steep slopes, indicating the heterogeneous physical features of the campus forest.

In mapping the study site, the location of SFERA@UMS was shown using a site map containing the study boundary, coordinate reference, north arrow, scale bar, and key surrounding landmarks. The approximate location of the study area was 6°02′N and 116°07′E in the UMS campus area. The site map was used to represent the spatial context of SFERA@UMS as a campus forest and university-based conservation area, or a conserved area site rather than an outside ecology conservation site.

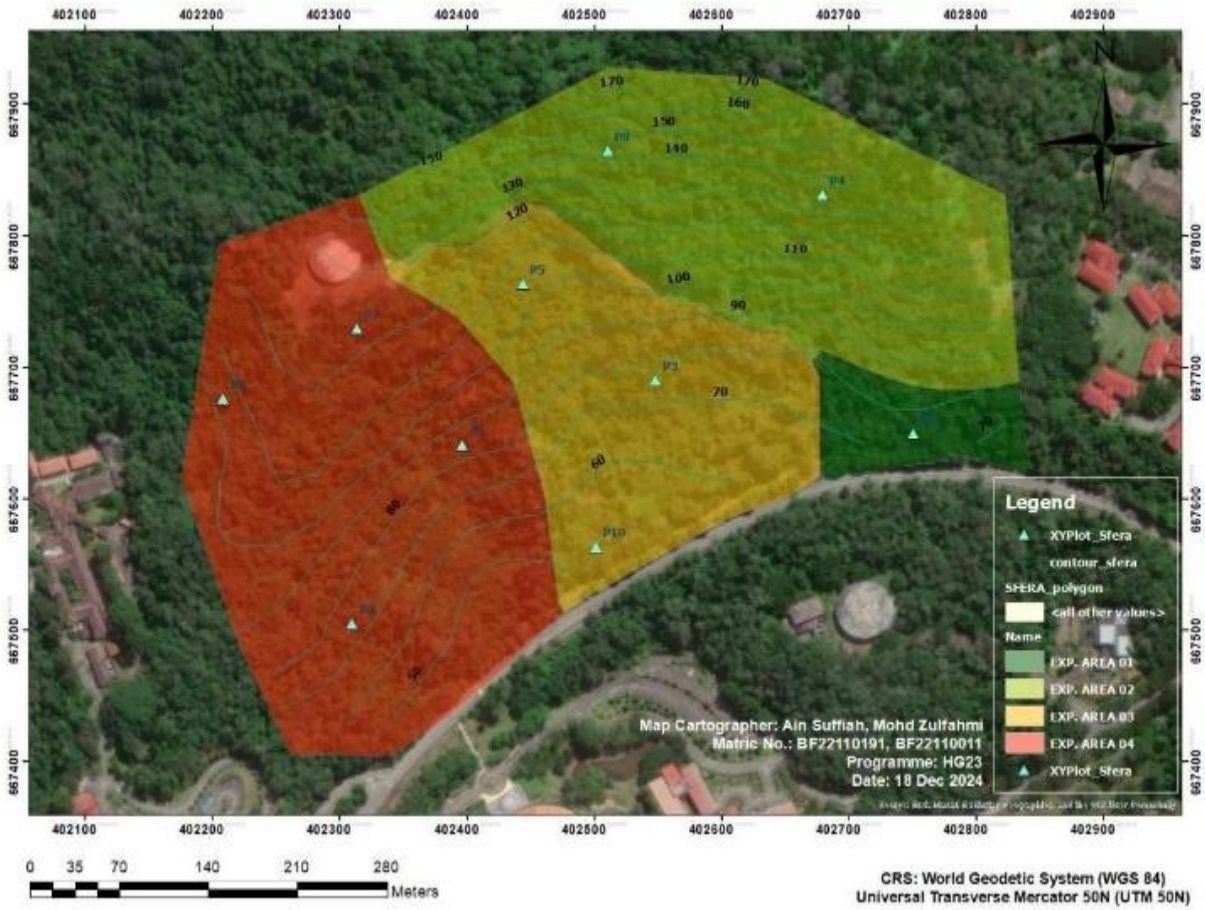

Figure 3. The map of SFERA@UMS

Figure 3 shows the location map of SFERA@UMS in Universiti Malaysia Sabah, Kota Kinabalu, Sabah, Malaysia. Approximate study boundary, coordinate reference, scale bar, north pointer, and other campus landmarks, including nearby access roads and residential college areas. SFERA@UMS is positioned in the UMS campus forest landscape and is a university-based conservation, education, and research site.

3.2 Research design

The research design was utilized in order to describe and analyze the perceptions of the respondents who took part in the study, instead of generalizing the outcomes to the total UMS population. The design may especially work in measuring the awareness and attitudes of the people towards the Sunda pangolin. A quantitative framework enables the procedure of creating statistically analysable data and creating objective judgments about the attitude of the community towards pangolin conservation [25]. The research aims at following three main objectives, which are to assess public ASP at SFERA@UMS, to evaluate public attitudes towards pangolin conservation, and to identify perceptions of human-related threats to the Sunda pangolin.

3.3 Population sample

The target population of this research was the reachable UMS community, which included students, staff, and visitors

with potential exposure (directly or indirectly) to SFERA@UMS and its conservation activities. The population size was determined by the larger accessible university population that could have been investigated through online questionnaire administration. In accordance with Krejcie and Morgan's [26] sample size determination table, a sample size of 377 respondents was found to be sufficient for quantitative analysis. Nonetheless, due to the use of convenience sampling in this study, these findings should not be statistically generalised to the aggregated UMS or greater Sabah populations; instead, these results ought to be seen as empirical insights pertaining to the available respondents surveyed and relative to the UMS/SFERA-related survey. Although this study investigates public perceptions, the coverage is limited to the respondents who are reachable and accessible within the scope, including the UMS students, staff, campus community, visitors, and the public who were reached through the online survey. Hence, the sample is not representative of any wider Muslim population of Sabah.

3.4 Materials, instruments and equipment

In this study, PPC is understood as Public Perception of Conservation Adequacy and Future Initiatives (PPC), thus exploring survey participants' subjective evaluations of the sufficiency of the current conservation initiatives, adequacy of conservation communication, policy and management support, local organisational engagement, and optimism towards future conservation initiatives at SFERA@UMS. PPC should not be interpreted as a biological evaluation of the Sunda pangolin's conservation status, conservation adequacy, and future initiatives.

The questionnaire was designed with five sections, which included demographic profiles, ASP, Attitude on Conservation, PHT, and Public Perception on Sunda pangolin conservation adequacy and future initiatives

The measurement items were adapted from previous studies on environmental awareness, wildlife conservation attitude, local ecological knowledge, public participation in conservation, pangolin conservation, and PHT to endangered species. The awareness items were guided by studies on public knowledge and awareness of pangolin conservation, while the attitude items were informed by conservation attitude and planned behaviour literature. The perceived human threat items were adapted from literature on habitat loss, poaching, illegal wildlife trade, demand for traditional medicine, and community-related threats to pangolin conservation.

The items were contextualised to suit the local context of Sunda pangolin conservation at SFERA@UMS. The changes included changing general wildlife conservation statements to Sunda pangolin; simplification of technical terms for better understandability by respondents; and contextualisation of items to represent local conservation issues such as habitat disturbance, public awareness, illegal wildlife trade, community engagement, and future conservation initiatives. The questionnaire content and understanding were evaluated in a pilot study involving 30 respondents. After analysis, necessary changes were made to the wording and structure of the items. The final questionnaire was designed with a five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree.

The PPC construct has captured respondents' perceptions of the adequacy of the existing conservation efforts, communication, policy and management support, local organisation involvement, and future conservation strategies of the Sunda pangolin at SFERA@UMS. Therefore, it is perceived as a perception-based evaluation of the conservation efforts in the university-based conservation area, rather than as a biological assessment of the species.

The questionnaire items were modified and adapted from previous studies in accordance with the Sunda pangolin conservation at SFERA@UMS; the sources and modification of the questionnaire items are indicated in Table 1. After the adaptation and modification process, the final measurement items to examine awareness, attitude toward conservation, PHT, and public perception of conservation adequacy and upcoming initiatives were specified in Table 2.

Table 1. Source and modification of questionnaire items

Construct	Main Source/Guiding Literature	Modification Made	Rationale
Awareness of the Sunda pangolin (ASP)	Jomes et al. [1]; Ariffin et al. [2]; Suwal et al. [10]	General awareness and conservation knowledge items were revised to focus on Sunda pangolin endangered status, conservation materials, ecological role, illegal wildlife trade, and awareness activities.	To measure respondents' level of awareness and exposure to Sunda pangolin conservation information.
Attitude Towards Conservation (ATC)	Ajzen [22]; Suwal et al. [20]	General conservation attitude items were adapted to focus on biodiversity protection, policy support, personal responsibility, volunteerism, and educational programmes related to Sunda pangolin conservation.	To assess respondents' attitudinal orientation and willingness to support conservation initiatives.
Perceived Human Threats (PHT)	Panjang et al. [3]; Zhang et al. [14]; Yodsheewan et al. [6]	Items were modified to reflect human-related threats, including habitat loss, illegal poaching, traditional medicine demand, community influence, and lack of public awareness.	To measure respondents' perception of major anthropogenic threats affecting Sunda pangolin conservation.
Public Perception of Conservation Adequacy and Future Initiatives	Jomes et al. [1]; Suwal et al. [20]; Cen et al. [8]	Items were adapted to examine respondents' views on current conservation adequacy, media coverage, future conservation adequacy and future initiatives, government policy, and local organisation involvement.	To measure the dependent variable, namely public perception of Sunda pangolin conservation adequacy and future initiatives.

Table 2. Measurement items of the study

Construct	Code	Measurement Item
Awareness of the Sunda pangolin	ASP1	I am aware that the Sunda pangolin is listed as a critically endangered species.
Awareness of the Sunda pangolin	ASP2	I have seen or read materials related to the conservation of the Sunda pangolin.
Awareness of the Sunda pangolin	ASP3	I understand the ecological role that the Sunda pangolin plays in its habitat.
Awareness of the Sunda pangolin	ASP4	I am familiar with the illegal wildlife trade affecting the Sunda pangolin population.
Awareness of the Sunda pangolin	ASP5	I have participated in events or activities aimed at raising awareness about Sunda pangolin conservation.
Attitude towards Conservation	ATC1	I believe that protecting the Sunda pangolin is important for biodiversity.
Attitude towards Conservation	ATC2	I support government policies that promote the conservation of the Sunda pangolin.
Attitude towards Conservation	ATC3	I feel a personal responsibility to contribute to the conservation of the Sunda pangolin.
Attitude towards Conservation	ATC4	I would be willing to volunteer for pangolin conservation projects.
Attitude towards Conservation	ATC5	I believe that educational programmes about the Sunda pangolin can improve conservation initiatives.
Perceived Human Threats	PHT1	I believe habitat loss is a significant threat to the Sunda pangolin.
Perceived Human Threats	PHT2	I think illegal poaching poses a serious risk to the survival of the Sunda pangolin.
Perceived Human Threats	PHT3	I believe that the demand for traditional medicine significantly impacts pangolin populations.
Perceived Human Threats	PHT4	I perceive that local communities play a role in either positively or negatively impacting the conservation of the Sunda pangolin at SFERA@UMS.
Perceived Human Threats	PHT5	I think that lack of awareness among the general public is a major threat to the Sunda pangolin's conservation.
Public Perception of Conservation Adequacy and Future Initiatives	PPC1	I believe that the current conservation initiatives for the Sunda pangolin are sufficient.
Public Perception of Conservation Adequacy and Future Initiatives	PPC2	I think that information and media communication about the Sunda pangolin is adequate.
Public Perception of Conservation Adequacy and Future Initiatives	PPC3	I am optimistic that the future conservation initiatives for Sunda pangolin conservation at SFERA@UMS are adequate.
Public Perception of Conservation Adequacy and Future Initiatives	PPC4	I believe that relevant policies and management actions can effectively support Sunda pangolin conservation at SFERA@UMS.
Public Perception of Conservation Adequacy and Future Initiatives	PPC5	I perceive that local organisations and university-based stakeholders are actively contributing to the Sunda pangolin conservation initiatives at SFERA@UMS.

Table 3. Survey administration and data screening

Item	Description
Overall Research Period	July–November 2025
Actual Survey Data Collection Period	22 August 2025–24 October 2025
Survey Method	Self-administered questionnaire
Distribution Platform	Google Forms
Distribution Channel	Online survey link
Online Responses	377 responses, 100%
Offline Responses	0 responses, 0%
Total Submitted Questionnaires	377
Invalid Questionnaires Excluded	0
Valid Questionnaires Retained for Analysis	377
Conventional Response Rate	Not applicable because the questionnaire was distributed through an open online survey link
Valid Submitted Questionnaires	377 complete responses, representing 100% of submitted questionnaires
Exclusion Criteria	Incomplete questionnaires, duplicate submissions, ineligible respondents, and inconsistent or invalid responses

3.5 Procedure

The complete research process took five months, extending from July to November 2025. The actual data collection occurred from 22 August 2025 to 24 October 2025. Data gathering was performed by utilizing a self-administered online questionnaire, which was produced using Google Forms. The survey link was distributed on the internet to the targeted respondents, consisting of UMS students, staff, visitors, and public individuals who were willing to participate in the study.

All responses were gathered online through the survey during this study, and offline questionnaires were not distributed. Responses for Google Forms were stored and totaled to 377. Prior to analysis, the responses were screened to identify whether there were any incomplete questionnaires, repeated answers, non-qualifying participants, discrepancies, or false answers. Since all questionnaire items were marked mandatory in Google Forms, and no false answers were discovered when the screening technique was conducted, all 377 responses were reviewed in the final analysis. Since the questionnaire was disseminated through a public internet link, it was not possible to determine how many people possessed the survey link. Consequently, no standard response rate could be generated. Nevertheless, all 377 submitted surveys were complete and aligned with analysis standards.

Because the questionnaire was sent using an open online survey link, the exact number of individuals who had the opportunity to view or access the survey link is unknown. Thus, a traditional response rate could not be calculated. However, since all items in the Google Form were compulsory, all 377 submitted questionnaires were complete

and valid for analysis since all items in the Google Form were compulsory. The processes of survey administration and data screening are summarized in Table 3. According to Table 3, all 377 submitted questionnaires were completely filled out and valid for analysis. The demographic characteristics of respondents (age, gender, level of education, respondent category, and environmental module enrolment) are shown in Table 4.

Table 4. Demographic analysis

Variable	Category	Frequency	Percent (%)	Valid Percent (%)
Age	Under 18	15	4.00	4.00
	18–24	261	69.20	69.20
	25–34	64	17.00	17.00
	35–44	24	6.40	6.40
	45–54	12	3.20	3.20
	Above 54	1	0.30	0.30
	Total	**377**	**100.00**	**100.00**
Gender	Male	70	18.60	18.60
	Female	307	81.40	81.40
	Total	**377**	**100.00**	**100.00**
Level of Education	No formal education	8	2.10	2.10
	Primary education	1	0.30	0.30
	Secondary education	32	8.50	8.50
	Pre-university	44	11.70	11.70
	Bachelor's degree	271	71.90	71.90
	Master's degree	19	5.00	5.00
	Doctorate	2	0.50	0.50
	Total	**377**	**100.00**	**100.00**
Respondent Category	UMS student	227	60.20	60.20
	Public member of UMS	75	19.90	19.90
	Visitor	75	19.90	19.90
	Total	**377**	**100.00**	**100.00**
Enrolment in Environmental Module	Yes	317	84.10	84.10
	No	60	15.90	15.90
	Total	**377**	**100.00**	**100.00**

3.6 Data collection

The data collection phase aims to achieve a diverse and adequately sized sample to ensure the validity of the research findings. Data were collected over a period of 5 months (July-November) using online (Google Forms) distribution methods.

Respondents were approached during educational activities, forest walks, or visits to the SFERA area, and were asked to voluntarily participate in the survey. The online link was also shared through UMS student platforms and conservation-related social media groups. The research tool applied in this research was a self-completed structured questionnaire intended to evaluate the awareness, attitudes, and perception levels of the people as far as the conservation of the Sunda pangolin (*Manis javanica*) is concerned.

3.7 Data analysis techniques

SPSS was used to analyze the data: descriptive statistics (frequencies, percentages, means, standard deviations), reliability testing (Cronbach's Alpha, which should be accepted at a ≥ 0.70), Spearman's correlation to test the relationships between variables, and multiple linear regression tests to test the predictiveness of awareness, attitudes, and perceived threats on the perceived public. The ethical implications were taken care of by obtaining informed consent, ensuring anonymity and confidentiality, the right to withdraw at any time, and restricting the usage of the data to academic use.

4. RESULTS AND DISCUSSION

4.1 Demographic analysis

A total of 377 respondents participated in this study. All demographic items recorded valid responses with no missing data. The analysis includes respondents' age, gender, level of education, respondent category, and their enrolment in the environmental module.

The respondents were categorized into six age groups. The largest group was 18-24 years with 261 respondents (69.2%), followed by 25-34 years with 64 respondents (17.0%). The remaining respondents were under 18 years (15 respondents, 4.0%), 35-44 years (24 respondents, 6.4%), 45-54 years (12 respondents, 3.2%), and above 54 years (1 respondent, 0.3%). Although most respondents were adults, individuals under 18 years old were also included because part of the study population consisted of secondary school students who come to UMS. These students are relevant to the research as they represent the younger generation whose awareness, attitudes, and perceptions toward wildlife conservation are important for long-term conservation success. The gender distribution indicates that 307 respondents (81.4%) were female and 70 respondents (18.6%) were male. Most respondents held a Bachelor's degree (271 respondents, 71.9%). This was followed by Pre-university (44 respondents, 11.7%), Secondary education (32 respondents, 8.5%), and Master's degree (19 respondents, 5.0%). A smaller number of respondents reported no formal education (8 respondents, 2.1%), a Doctorate (2 respondents, 0.5%), and Primary education (1 respondent, 0.3%). All the respondents have no problems with reading and writing. Respondents with no

formal education were included because the study aimed to be inclusive of all segments of the community, not only those with higher academic backgrounds. Environmental awareness and perceptions toward conservation are influenced not only by formal schooling. Respondents were categorized into three groups. Most respondents were UMS students (227 respondents, 60.2%). The remaining respondents were equally distributed between public members of UMS and visitors, with each group comprising 75 respondents (19.9%). In terms of environmental module enrolment, 317 respondents (84.1%) reported that they were enrolled in an environmental module, while 60 respondents (15.9%) reported that they were not enrolled.

4.2 Descriptive analysis

Based on Table 5, descriptive statistics were calculated for all items pertaining to the four study constructs, namely ASP, ATC, PHT, and PPC. All items were measured using a five-point Likert scale, from 1 = strongly disagree to 5 = strongly agree. The descriptive statistics of each item, including the minimum, maximum, mean, and standard deviation, are presented in Table 5.

According to the refined descriptive statistics, the mean values of ASP were noted between 2.30 and 4.47, and their standard deviations were recorded between 0.872 and 1.318. The highest mean was obtained for ASP1, where respondents noted their ASP being listed as critically endangered (M = 4.47, SD = 0.872). The lowest mean was obtained for ASP5, which referred to participation in events or activities meant to raise awareness about Sunda pangolin conservation (M = 2.30, SD = 1.318). This finding shows that while the respondents had a general awareness of this species' endangered status, their direct efforts to participate in conservation awareness activities were low.

As for ATC, the mean values were noted between 4.07 and 4.65; the standard deviations were recorded between 0.735 and 1.070. The highest mean was obtained for ATC2, referring to the willingness to support government policies aimed toward promoting the conservation of the Sunda pangolin (M = 4.65, SD = 0.758). It shows that respondents were mostly favourable on the topic related to Sunda pangolin conservation and support for conservation-related policies.

In regard to PHT, the mean values were noted between 4.29 and 4.67, while the standard deviations were recorded between 0.722 and 0.931. The highest mean was recorded in PHT2, referring to illegal poaching being harmful to the survival of the Sunda pangolin (M = 4.67, SD = 0.732). Thus, the respondents strongly identified human-related threats, especially poaching, as affecting Sunda pangolin conservation.

For PPC, the mean values were noted between 2.98 and 4.08, while the standard deviations were recorded between 0.955 and 1.276. The highest mean was recorded (M = 4.08, SD = 0.955) for PPC3, while the lowest mean was recorded for PPC1, regarding whether current conservation initiatives are perceived as sufficient (M = 2.98, SD = 1.176). This indicates that the respondents are moderately optimistic about future conservation initiatives, although they do not believe that current conservation initiatives are sufficient.

Additionally, not all items were reverse-coded (i.e., reverse coding is converted to a range of values that relate to the statement). Higher scores represented greater agreement with the items, while lower scores suggested less agreement with the items.

Based on the distributions of responses in Table 6, the effects of the factors measured can be further explained. Most of the questions about ATC and Perceived Human Threats had high percentages for "strongly agree" responses, indicating positive feelings towards conservation actions and identifying human factors as a threat. For instance, ATC2 had a "strongly agree" rate of 75.6%, while PHT2 had a stronger "strongly agree" rate of 77.2%. In contrast, ASP5 was lower, with 9.3% strongly agreeing and 38.5% strongly disagreeing with participating in awareness. Distributions were more moderate for PPC items, especially PPC1 and PPC2, where neutral was high. Skewness values show a negative skew for most items, indicating agreement, while ASP5 was positively skewed, as fewer were doing conservation awareness activities.

Table 5. Descriptive analysis

Subject	N	Minimum	Maximum	Mean	Std. Deviation
ASP1	377	1	5	4.47	0.872
ASP2	377	1	5	3.17	1.267
ASP3	377	1	5	3.54	1.216
ASP4	377	1	5	3.99	1.240
ASP5	377	1	5	2.30	1.318
ATC1	377	1	5	4.63	0.747
ATC2	377	1	5	4.65	0.758
ATC3	377	1	5	4.30	0.910
ATC4	377	1	5	4.07	1.070
ATC5	377	1	5	4.59	0.735
PHT1	377	1	5	4.58	0.758
PHT2	377	1	5	4.67	0.732
PHT3	377	1	5	4.29	0.931
PHT4	377	1	5	4.41	0.833
PHT5	377	1	5	4.58	0.722
PPC1	377	1	5	2.98	1.176
PPC2	377	1	5	3.06	1.276
PPC3	377	1	5	4.08	0.955
PPC4	377	1	5	3.75	0.993
PPC5	377	1	5	3.67	1.053
Valid N	377				

Note: ASP = Awareness of the Sunda pangolin; ATC = Attitude towards Conservation; PHT = Perceived Human Threats; PPC = Public Perception of Conservation Adequacy and Future Initiatives. None of the items were reverse-coded. Higher scores indicate a greater degree of agreement with the statement.

Table 6. Frequency distribution of response options and skewness for measurement items

Item	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)	Mean	SD	Skewness
ASP1	1.9	1.9	8.8	22.3	65.3	4.47	0.87	-1.922
ASP2	12.7	15.9	31.6	21.0	18.8	3.17	1.27	-0.146
ASP3	7.4	12.2	25.7	27.9	26.8	3.54	1.22	-0.482
ASP4	7.7	6.6	10.9	28.1	46.7	3.99	1.24	-1.177
ASP5	38.5	21.2	21.2	9.8	9.3	2.30	1.32	0.668
ATC1	1.6	0.5	5.0	18.8	74.0	4.63	0.75	-2.632
ATC2	1.9	1.1	2.9	18.6	75.6	4.65	0.76	-2.898
ATC3	1.9	2.4	12.5	30.5	52.8	4.30	0.91	-1.417
ATC4	3.7	3.2	22.0	24.7	46.4	4.07	1.07	-1.029
ATC5	1.3	0.8	4.5	24.1	69.2	4.59	0.73	-2.380
PHT1	1.1	1.3	6.1	21.5	70.0	4.58	0.76	-2.195
PHT2	1.6	0.8	3.7	16.7	77.2	4.67	0.73	-2.923
PHT3	2.1	1.3	16.2	26.0	54.4	4.29	0.93	-1.347
PHT4	1.1	1.9	10.6	28.1	58.4	4.41	0.83	-1.523
PHT5	1.1	0.8	5.0	25.5	67.6	4.58	0.72	-2.195
PPC1	13.0	18.6	37.7	18.6	12.2	2.98	1.18	0.001
PPC2	14.1	18.8	32.1	17.5	17.5	3.06	1.28	-0.004
PPC3	2.4	1.6	22.8	32.4	40.8	4.08	0.95	-0.929
PPC4	2.9	3.7	36.1	30.0	27.3	3.75	0.99	-0.434
PPC5	3.4	7.4	34.2	28.4	26.5	3.67	1.05	-0.409

Note: ASP = Awareness of the Sunda pangolin; ATC = Attitude towards Conservation; PHT = Perceived Human Threats; PPC = Public Perception of Conservation Adequacy and Future Initiatives.

4.3 Exploratory factor analysis

Exploratory Factor Analysis was performed to determine the construct validity of measurement items based on Table 7. Kaiser-Meyer-Olkin was 0.896, indicating that the data were appropriate for factor analysis. Bartlett's Test of Sphericity was significant, $\chi^2(190) = 3673.176$, $p < 0.001$, verifying that the correlation matrix was suitable for factor analysis.

Based on Table 8, the factor loadings for the total items retained fell between 0.540 and 0.847, which is above the acceptable standard limit of 0.50. Thus, all the measurement items were retained for further analysis.

Table 9 explained the total variance by construct. The proportions of variance explained by each construct were from 48.581% to 65.585%. This demonstrated that the measurement items fitted the constructs and validated the scale (construct validity).

Table 7. The Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity

Test	Value	Interpretation
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.896	Meritorious / suitable for factor analysis
Bartlett's Test of Sphericity, Approx. Chi-Square	3673.176	Significant
df	190	—
Sig.	<0.001	Suitable for factor analysis

Table 8. Exploratory factor analysis results

Construct	Item	Factor Loading	Cronbach's Alpha	Decision
Awareness of the Sunda pangolin	ASP1	0.540	0.730	Retained
Awareness of the Sunda pangolin	ASP2	0.803	0.730	Retained
Awareness of the Sunda pangolin	ASP3	0.802	0.730	Retained
Awareness of the Sunda pangolin	ASP4	0.587	0.730	Retained
Awareness of the Sunda pangolin	ASP5	0.709	0.730	Retained
Attitude towards Conservation	ATC1	0.812	0.854	Retained
Attitude towards Conservation	ATC2	0.847	0.854	Retained
Attitude towards Conservation	ATC3	0.842	0.854	Retained
Attitude towards Conservation	ATC4	0.689	0.854	Retained
Attitude towards Conservation	ATC5	0.847	0.854	Retained
Perceived Human Threats	PHT1	0.845	0.854	Retained
Perceived Human Threats	PHT2	0.831	0.854	Retained
Perceived Human Threats	PHT3	0.752	0.854	Retained
Perceived Human Threats	PHT4	0.798	0.854	Retained
Perceived Human Threats	PHT5	0.770	0.854	Retained
Public Perception of Conservation Adequacy and Future Initiatives	PPC1	0.734	0.794	Retained
Public Perception of Conservation Adequacy and Future Initiatives	PPC2	0.794	0.794	Retained
Public Perception of Conservation Adequacy and Future Initiatives	PPC3	0.595	0.794	Retained
Public Perception of Conservation Adequacy and Future Initiatives	PPC4	0.777	0.794	Retained
Public Perception of Conservation Adequacy and Future Initiatives	PPC5	0.798	0.794	Retained

Table 9. Total variance explained by construct

Construct	Eigenvalue	Variance Explained (%)	Interpretation
Awareness of the Sunda pangolin	2.429	48.581	Acceptable
Attitude towards Conservation	3.279	65.585	Good
Perceived Human Threats	3.201	64.023	Good
Public Perception of Conservation Adequacy and Future Initiatives	2.766	55.323	Acceptable

Table 10. Reliability analysis

Construct	Number of Items	Cronbach's Alpha	Interpretation
Public Perception of Conservation Adequacy and Future Initiatives	5	0.730	Acceptable
Awareness of the Sunda pangolin	5	0.854	Good
Attitude towards Conservation	5	0.854	Good
Perceived Human Threats	5	0.794	Acceptable

4.4 Reliability analysis of constructs

Table 10 presents the results of the reliability analysis for all constructs used in the study. Reliability was assessed using Cronbach's Alpha (a) to determine the internal consistency of items under each variable.

As indicated in Table 10, each of the constructs achieved Cronbach's alpha values above the recommended threshold of 0.70, ranging from 0.730 to 0.854, suggesting acceptable to good internal consistency. Therefore, the questionnaire was reliable in measuring the awareness of Sunda pangolin (*Manis javanica*), attitudes towards conservation, PHT, and the public perception of Sunda pangolin conservation adequacy and future initiatives.

4.5 Normality test

Normality testing was conducted on the mean scores of each construct using the Kolmogorov-Smirnov test and the Shapiro- Wilk test. It analysed all mean scores for Public perception of Sunda pangolin conservation adequacy and future initiatives (PPC_MEAN), Awareness of the Sunda pangolin (ASP_MEAN), Attitude towards Conservation (ATC_MEAN), and Perceived Human Threats (PHT_MEAN). The findings are shown in Table 11.

The results indicated that all variables (PPC_MEAN, ASP_MEAN, ATC_MEAN, and PHT_MEAN) were not normally distributed ($p < 0.05$). Therefore, non-parametric statistical methods were used for further analysis.

4.6 Correlation analysis

Spearman correlation analysis was conducted to determine the relationships between the study variables. It analysed all mean scores for Public perception of Sunda pangolin conservation adequacy and future initiatives (PPC_MEAN), Awareness of the Sunda pangolin (ASP_MEAN), Attitude towards Conservation (ATC_MEAN), and Perceived Human Threats (PHT_MEAN). The correlation results are reported in Table 12.

Table 11. Normality test

Variables	Kolmogorov- Smirnov		Shapiro-Wilk	
	Statistic	Sig.	Statistic	Sig.
PPC_MEAN	0.063	<0.001	0.981	<0.001
ASP_MEAN	0.208	<0.001	0.777	<0.001
ATC_MEAN	0.218	<0.001	0.762	<0.001
PHT_MEAN	0.070	<0.001	0.979	<0.001

Table 12. Correlation analysis

Variable	PPC_MEAN	ASP_MEAN	ATC_MEAN	PHT_MEAN
PPC_MEAN	1.000			
ASP_MEAN	0.372**	1.000		
ATC_MEAN	0.260**	0.393**	1.000	
PHT_MEAN	0.173**	0.318**	0.634**	1.000

Note: Correlation is significant at the 0.01 level.

Spearman correlation analysis was performed to analyse the relationship among Public Perception of Conservation Adequacy and Future Initiatives (PPC_MEAN), Awareness of the Sunda pangolin (ASP_MEAN), Attitude towards Conservation (ATC_MEAN), and Perceived Human Threats (PHT_MEAN). The analysis revealed that all variables correlated positively and significantly. PPC_MEAN had a significant correlation with ASP_MEAN ($\rho = 0.372$, $p < 0.001$), ATC_MEAN ($\rho = 0.260$, $p < 0.001$), and PHT_MEAN ($\rho = 0.173$, $p = 0.001$). The strongest correlation was found between ATC_MEAN and PHT_MEAN ($\rho = 0.634$, $p < 0.001$, suggesting a moderate to strong positive relationship between attitude and PHT.

4.7 Regression assumption tests

Before performing multiple regression analysis, a number of diagnostic tests were conducted to assess the extent to which the regression assumptions were met. These included Multicollinearity, residual normality, residual independence, linearity, and influential point diagnostics. Multicollinearity was tested by Tolerance and Variance Inflation Factor (VIF)

values. Results indicated that all tolerance values were above 0.10 and all VIF values were below 10, with the highest VIF value being 2.389. This showed that there was no strong multicollinearity in the regression model.

Spearman correlation analysis indicated that the strongest relationship among predictors was between ATC and Perceived Human Threat (PHT), ρ = 0.634, $p < 0.001$. Although this provided evidence of moderate-to-high conceptual overlap among the two predictors, the VIF and tolerance values were acceptable. Hence, the overlap was not indicative of serious multicollinearity, but was considered when interpreting the unique contribution of each predictor in the regression model.

Residual normality was tested using the Kolmogorov-Smirnov test on standardised residuals. The result was not statistically significant, implying that the residuals were normally distributed. Residual independence was tested using the Durbin-Watson statistic. Results indicated a value of 1.852. This value was close to 2, indicating that residuals were independent. Linearity was tested using the Ramsey RESET test. The test was not statistically significant, indicating that there was no evidence of non-linearity in the model. Influential points were assessed using Cook's distance. The maximum Cook's distance value was 0.058, which was below the conventional threshold of 1.00, suggesting that there were no highly influential observations that distorted the regression estimates. Table 13 presents the regression assumption test results, which are summarised.

Table 13. Regression assumption tests

Assumption	Test / Criterion	Result	Interpretation
Multicollinearity	Tolerance > 0.10; VIF < 10	Minimum tolerance = 0.419; maximum VIF = 2.389	No severe multicollinearity
Predictor Overlap	Spearman correlation between ATC and PHT	ρ = 0.634, $p < 0.001$	Moderate-to-high overlap; interpretation requires caution
Residual Normality	Kolmogorov-Smirnov test on standardised residuals	K-S = 0.036, $p = 0.702$	Residuals approximately normal
Residual Independence	Durbin-Watson statistic close to 2	Durbin-Watson = 1.852	No serious autocorrelation
Linearity	Ramsey RESET test, $p > 0.05$	F = 0.917, $p = 0.339$	No evidence of non-linearity
Influential Points	Cook's distance < 1.00	Maximum Cook's distance = 0.058	No highly influential cases

Table 14. Multiple linear regression analysis

Predictor	B	Std. Error	β	t	*p*-Value	Tolerance	VIF
Constant	1.414	0.286	—	4.945	<0.001	—	—
Awareness of the Sunda pangolin, ASP	0.278	0.052	0.278	5.230	<0.001	0.780	1.282
Attitude towards Conservation, ATC	0.213	0.087	0.213	2.935	0.004	0.419	2.389
Perceived Human Threats, PHT	0.001	0.090	0.001	0.009	0.993	0.445	2.248

Note: Model summary: $R^2 = 0.178$, Adjusted $R^2 = 0.171$, $F(3, 373) = 26.844$, $p < 0.001$. VIF: Variance Inflation Factor.

4.8 Regression analysis

Multiple linear regression analysis was performed to determine how Awareness of the Sunda pangolin (ASP_MEAN), Attitude towards Conservation (ATC_MEAN), and Perceived Human Threat (PHT_MEAN) would affect Public Perception of Conservation Adequacy and Future Initiatives (PPC_MEAN). The multiple linear regression result is shown in Table 14.

The present study used multiple linear regression analysis to determine the contribution of Awareness of the Sunda pangolin (ASP_MEAN), Attitude towards Conservation (ATC_MEAN), and Perceived Human Threats (PHT_MEAN) to Public Perception of Conservation Adequacy and Future Initiatives (PPC_MEAN). The final regression model was significant, $F(3, 373) = 26.844$, $p < 0.001$. The model explained 17.8% of the variance in PPC_MEAN and had an R^2 value of 0.178 and an adjusted R^2 value of 0.171, indicating reasonable explanatory power. It has been established in earlier studies that several cognitive, attitudinal, and contextual factors affect public perceptions of wildlife conservation [26]. Likewise, wildlife attitude studies have revealed that conservation-related perceptions are multidimensional and could be influenced by psychological, social, and contextual factors [27].

The regression analysis showed that ASP_MEAN was a significant predictor of PPC_MEAN (β = 0.278, $p < 0.001$). ATC_MEAN was also a significant predictor (β = 0.213, $p = 0.004$). Conversely, PHT_MEAN was not a significant predictor of PPC_MEAN after incorporating ASP_MEAN and ATC_MEAN predictors into the model (β = 0.001, $p = 0.993$). Thus, awareness and ATC were significant predictors of public perception of conservation adequacy and future initiatives, while PHT did not exhibit a significant effect when one controlled for the effects of other predictors in the multiple regression analysis.

4.9 Discussion

The findings of this study ought to be considered within the confines of SFERA@UMS as a campus forest and university-based conservation area. Although this study investigates public perception, the survey data collection was limited to respondents who participated in the survey in SFERA@UMS and UMS-related indicator contexts, including UMS students, staff, campus community, visitors, and the public, via the online survey. Therefore, the results ought not to be applied broadly to Malaysia's population of Sabahans. This implies that the results are limited to site-specific empirical evidence regarding how awareness, ATC, and PHT may predict respondents' perception of adequacy and future initiatives of Sunda pangolin conservation at SFERA@UMS.

The correlation results demonstrated that ASP was positively and significantly associated with PPC (ρ = 0.372, *p*

< 0.001). The regression analysis also reaffirmed that awareness was a positive and significant predictor of public perception ($\beta = 0.278$, $p < 0.001$). Hence, Hypothesis 1 was supported. This suggests that the respondents with more ASP, including its ecological roles and threatened situation, are more likely to evaluate conservation adequacy and future initiatives. This finding is in agreement with prior studies which demonstrate that knowledge about the subject and awareness of conservation is key to boosting conservation perception and support [1]. In the SFERA@UMS context, this demonstrates that education such as conservation programmes, interpretive communication, and outreach campaigns based on awareness remains a crucial strategy to enhance and promote public understanding of Sunda pangolin conservation.

The ATC was also significantly and positively correlated with PPC ($\rho = 0.260$, $p < 0.001$). In the regression model, ATC was a significant positive predictor of public perception ($\beta = 0.213$, $p = 0.004$), thus Hypothesis 2 was supported. This finding implies that the more conservation-positive attitudes the respondents had, the more likely they were to view conservation adequacy and future initiatives positively. Despite the fact that the TPB explains behavioural intention rather than perception generally, the finding suggests that attitude may still serve as an attitudinal explanation factor in tandem with respondents' evaluation of conservation initiatives, communications, policy support, and future conservation initiatives in the setting of SFERA@UMS [22]. Thus, strengthening conservation-positive attitudes through educational initiatives via the environment, such as education programmes to campus-based conservation initiatives or public engagement, should be a priority.

The PHT significantly and positively correlated with public perception at the bivariate level ($\rho = 0.173$, $p = 0.001$). However, PHT did not significantly predict public perception using the multiple regression model after awareness and ATC were included ($\beta = 0.001$, $p = 0.993$). Thus, Hypothesis 3 was not supported. This indicates that the visibility of human-associated threats is not solely perceived to identify future initiatives and conservation adequacy. This phenomenon can be explained by positing that threat visibility needs to manifest itself in a clearer awareness, conservation communication, and practical engagement to affect evaluation-based perceptions. This means that the respondents may understand that human detriments include habitat loss, poaching, illegal wildlife trade, and demands for traditional medicine; however, the established visibility of these threats may not necessarily affect them to positively evaluate differences in conservation initiatives.

The non-significant effect of PHT can also have a relation with the conceptual overlap with ATC. It was shown that a moderate to strong association ($\rho = 0.634$, $p < 0.001$) between PHT and ATC was demonstrated. Although regression diagnostic test results showed the VIF values fell below the conventional threshold and therefore did not significantly indicate that severe multicollinearity existed, this overlap indicated that part of the explanatory information captured by PHT may also overlap with conservation attitude information. Consequently, the PHT's unique effect was comparatively smaller as the awareness and attitude were simultaneously added to the regression model. However, this result ought to be taken carefully, as it does not imply that human threats are generally irrelevant for Sunda pangolin conservation. Rather, it demonstrates that perception needs to translate into awareness, communication, and positivity in conservation attitudes can significantly exhibit a stronger association with degree-level evaluation in this model context, even compared to perceived threats.

Regarding the corrected regression model, the corrected model was statistically significant, $F(3, 373) = 26.844$, $p < 0.001$, and explained 17.8% of the variance in PPC. This suggests modest explanatory consistency. Despite awareness and ATC being statistically significant predictors, the R^2 value shows that only 17.8% of the variance was explained by the model, where 82.2% of the variance remained unexplained, suggesting that the model ought to be taken cautiously. Additional factors included, but were not limited to the factors of direct exposure to SFERA@UMS conservatory activities, trust in conservatory institutions, media exposure, subject norms, perceived behavioural control, past wildlife exposure, and actual participation in conservation programming may predict how they perceive the conservatory's adequacy and future initiatives.

The findings can be elucidated using the TPB and EAF, as TPB was not inferred as a strict behavioural intention model. TPB explains how attitude is a crucial element regarding collective conservation-related responses. EAF elucidates how awareness may predict concern and support for conservation measures [22, 23]. In this study, awareness and attitudes towards conservation gained significance in predicting respondents' perception of the Sunda pangolin at SFERA@UMS. However, the PHT did not achieve statistical significance after the inclusion of the other two predictors in the model, indicating that threat recognizability is not merely sufficient to predict conservation perception unless accompanied by awareness, communication, and a conservation-positive attitude.

The findings also provide a link between the public perception literature and nature-based sustainable design. Nature-based conservation solutions include but are not limited to habitat protection, ecological restoration, conservation education trails, interpretive signage, low-impact visitor management, and community-based monitoring activities in the SFERA@UMS ecological context. However, the solutions' success depends on ecological suitability, social acceptance, and public engagement. When UMS and the campus community are aware of the Sunda pangolin and possess a relatively positive attitude regarding conservation, the proposed nature-based conservation makes it easier to gain acceptance and support from the public.

Thus, the social foundation can be predicated on public perception as a basis for nature-based conservation planning in the campus forest context. For instance, at SFERA@UMS, habitat restoration zones or protection zones will undeniably serve as a better conservation initiative if the campus community and visitors see the benefits attached to its restoration for Sunda pangolin conservation. Similarly, conservation signage, guided educational trails, and awareness programmes can elucidate ecologically designed support and learning processes via public understanding. The findings further imply that SFERA@UMS management can extend current conservation initiatives by combining ecological restoration and communication, awareness, and attitude strengthening into core future initiatives.

4.10 Implications of the study

There are some implications of this study. In terms of

practical implications, the results indicate that conservation communication at SFERA@UMS should focus on two areas: the first one is to maintain awareness-building programs, and the second one is to enhance threat-oriented education, particularly of less visible threats such as habitat degradation and landscape change. The recommendation is substantiated by the fact that the importance of awareness and perceived threats is significant in terms of their predictive value in terms of forming a perception among the population. In the case of outreach design, it is that campaigns must not merely be used to propagate "support conservation" messages but also convey clear, locally specific threat pathways and what actions alleviate such threats.

Secondly, implications for policy and programs. As this awareness and threat perception can play a key role in shaping the collective perception, this evidence can be used by SFERA@UMS and conservation stakeholders such as educators, NGOs, and campus sustainability units to explain more specific awareness modules, guided forest-learning classes, and interpretive signage that directly ties human behaviours to pangolin dangers. These actions can reinforce perception of conservation and, finally, participation.

These findings offer significant insights for nature-based sustainable design and conservation planning in SFERA@UMS, as the impact of public awareness and ATC directly influenced the perception of Sunda pangolin conservation adequacy and future actions; it could be recommended to integrate ecological design, public engagement, and conservation communication into all conservation actions or policy-making. However, although PHT were not significantly predicted by the regression model, information about them is important to enhance awareness of conservation and education. Nature-based conservation solutions such as habitat-sensitive pathways, conservation education trails, interpretive boards, restoration zones, and visitor management systems should be designed in tandem with awareness campaigns and participatory education programs. This can enhance public understanding, improve local support, and increase the implementation effectiveness of conservation initiatives. On the management side, public perception data are useful to conservation planners in assessing if the community is ready to accept nature-based conservation solutions. Higher public support can lead to higher acceptance of habitat protection measures, whereas lower awareness shows a need to familiarize local communities with them before designing conservation interventions. Hence, the study offers a social evidence base for designing conservation strategies that are ecologically appropriate, socially acceptable, and compatible with campus forest.

In theory, this study makes an academic contribution to research on conservation perception, as awareness and changes in attitude toward conservation have contributed to public perception of the conservation adequacy and future initiatives at SFERA@UMS. Though the TPB usually refers to the intention of an action, this study did not measure the intention; thus, were added as an attitudinal explanatory variable rather than being a TPB approach to the intention pathway. The non-significant effect of PHT indicates that awareness of the threats was not enough to shape perception of the conservation adequacy without being followed by awareness of conservation, conservation communication, and action. Future studies may have to enhance the model by including subjective norms, perceived behavioural control, behavioural intention, and actual conservation action.

4.11 Limitations of the study

Although it offers some valuable insights, there are several limitations, which should be noted. First, the convenience sampling method was employed in this research at SFERA@UMS, which implies that participants were selected according to the convenience factor, and not based on a random mechanism. Due to this fact, the sample is not likely to be representative of the larger population that is not present at the university. Consequently, the results can be subject to the perception of a particular group of people who are more familiar with conservation information, and the findings cannot be generalised to other communities or populations.

Second, self-reported data from questionnaires were used in the study, which may lead to bias. There is also a possibility of the respondents providing answers that they think are right or acceptable in society since conservation is regarded as a positive value. This may make the findings seem more pro-conservation. Third, the research employed a cross-sectional design and only gathered information at one time. As much as this technique is effective in establishing the relationship among variables, it does not demonstrate cause and effect or how perceptions are likely to vary over time. Thus, the research is unable to establish the causality of awareness or threat perceptions on the intensification of conservation perceptions, just that there is a relationship.

This study is limited due to the convenience sampling techniques and the composition of respondents. Since the respondents were predominantly UMS students, staff, campus community members, visitors, and on-site accessible public, the findings of this paper cannot be generalised to the overall Sabah population. Therefore, future studies should be carried out using a larger and more diverse sample, including local communities, conservation agencies, rural settlements, and other public populations, to enhance the generalisability of findings.

This is a list of limitations of the study in terms of the explanatory power of the regression model. Although the model explained 27.3% of the variance in public perception towards Sunda pangolin conservation adequacy and future initiatives, a greater part of the variance was unexplained. This signifies that other relevant factors such as direct conservation exposure, trust in conservation institutions, media influence, environmental values, prior wildlife experience, and socio-demographic characteristics may influence public perception too. Future studies should incorporate these variables to build a more comprehensive model of public perception towards Sunda pangolin conservation.

So, in conclusion to this study, this study used convenience sampling in this study which has limited representativeness of the findings. The sample included students, staff, visitors, and the public. However, respondents were selected based on their availability and willingness to participate in the study. Hence, the findings should be interpreted as empirical evidence of the insights of the respondents in this study but not as generalisable evidence about the entire UMS population. Future studies may use probability sampling or stratified sampling to study a more representative sample across the different respondent groups.

5. CONCLUSION AND RECOMMENDATIONS

In conclusion, this study offers support that the perception of Sunda pangolin conservation adequacy and future initiatives at SFERA in UMS is impacted by the most significant factors: awareness and acknowledgment of threats associated with humans. Though the general response of the respondents was positive to conservation, positive attitude orientation could not determine conservation perception when it was subject to awareness and threat recognition. The model explained 27.3% of the variation in public perception, suggesting other factors also influence perception; it acknowledged key limitations such as convenience sampling, self-reported answers, and cross-sectional design before suggesting future research using better sampling, mixed methods, and longitudinal or experimental approaches. These results demonstrate the necessity of conservation programs to enhance not only general support but also closer knowledge of the threats and clear ways of community action. Through awareness campaigns, threat-based communication, and participatory opportunities, SFERA@UMS and other key conservation stakeholders can work towards more efficient, long-term conservation initiatives for the Sunda pangolin and the rest of the world.

Further investigations should enhance the assessment of the attitude by including more specific behavioral and site-based aspects of the attitude, and behavioral indicators, including willingness to be involved in SFERA@UMS conservation activities, willingness to report threats to wildlife, and direct involvement in conservation education programmes. This may improve the ability of the attitude construct to help explain PPC.

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REFERENCES

[1] Jomes, E.E., Tuh, F., Lintangah, W., Sompud, J. (2023). The knowledge, attitude and practice of local Sabahan in Malaysia on Sunda pangolin. Biodiversitas Journal of Biological Diversity, 24(9): 4702-4710. https://doi.org/10.13057/biodiv/d240910

[2] Ariffin, M., Nan, M.B.C. (2018). Sunda pangolin protection and trade-related crimes: Assessing local community knowledge in Kedah, Malaysia. Journal of Sustainability Science and Management, 13(1): 169-180.

[3] Panjang, E., Lim, H.Y., Thomas, R.J., et al. (2024). Mapping the distribution of the Sunda pangolin (*Manis javanica*) within natural forest in Sabah, Malaysian Borneo. Global Ecology and Conservation, 52: e02962. https://doi.org/10.1016/j.gecco.2024.e02962

[4] Sitam, F.T., Salgado-Lynn, M., Denel, A., et al. (2023). Phylogeography of the Sunda pangolin, *Manis javanica*: Implications for taxonomy, conservation management and wildlife forensics. Ecology and Evolution, 13(8): e10373. https://doi.org/10.1002/ece3.10373

[5] Nga, N.T.T., Latinne, A., Thuy, H.B., et al. (2022). Evidence of SARS-CoV-2-related coronaviruses circulating in Sunda pangolins (*Manis javanica*) confiscated from the illegal wildlife trade in Viet Nam. Frontiers in Public Health, 10: 826116. https://doi.org/10.3389/fpubh.2022.826116

[6] Yodsheewan, R., Sukmak, M., Sangkharak, B., Kaolim, N., Ploypan, R., Phongphaew, W. (2021). First report on detection of Babesia spp. in confiscated Sunda pangolins (*Manis javanica*) in Thailand. Veterinary World, 14(9): 2380-2385. https://doi.org/10.14202/vetworld.2021.2380-2385

[7] Naim, N.B.M., Saputra, J., Hassan, A., et al. (2026). Investigating ecotourism as a sustainable strategy for supporting Sunda pangolin conservation in Malaysia. International Journal of Sustainable Development and Planning, 21(4): 1855-1863. https://doi.org/10.18280/ijsdp.210435

[8] Cen, P., Sun, J., Wang, Q., et al. (2023). Only Sunda and Chinese pangolin (Pholidota) are naturally distributed in China. Integrative Zoology, 18(4): 704-709. https://doi.org/10.1111/1749-4877.12697

[9] Kicheleri, R.P., Hughes, C., Kimaro, M.H., et al. (2025). Local ecological knowledge insights into the distribution and activity patterns of Temminck's pangolin in Ruaha Landscape, Tanzania. Ecology and Evolution, 15(8): e71987. https://doi.org/10.1002/ece3.71987

[10] Suwal, T.L., Gurung, S., Bakhunchhe Shrestha, M., Ingram, D.J., Pei, K.J.C. (2022). Human dimensions of pangolin conservation: Indigenous and local knowledge, ethnozoological uses, and willingness of rural communities to enhance pangolin conservation in Nepal. Journal of Ethnobiology, 42(3): 1-18. https://doi.org/10.2993/0278-0771-42.3.7

[11] Sharma, H.P., Rimal, B., Zhang, M., et al. (2020). Potential distribution of the critically endangered Chinese pangolin (Manis pentadactyla) in different land covers of Nepal: Implications for conservation. Sustainability, 12(3): 1282. https://doi.org/10.3390/su12031282

[12] Emogor, C.A., Zabala, A., Adaje, P.O., Clark, D., Nielsen, K.S., Carmenta, R. (2023). Stakeholder preferences for pangolin conservation interventions in south-east Nigeria. People and Nature, 5(3): 1010-1026. https://doi.org/10.1002/pan3.10477

[13] Ghimire, P., Raut, N., Khanal, P., Acharya, S., Upadhaya, S. (2020). Species in peril: Assessing the status of the trade in pangolins in Nepal. Journal of Threatened Taxa, 12(8): 15776-15783. https://doi.org/10.11609/jott.5698.12.8.15776-15783

[14] Zhang, F., Yu, Y., Wu, S., Mahmood, A., Yu, J., Min, Y. (2020). Reducing pangolin demand by understanding motivations for human consumption in Guangdong, China. Frontiers in Ecology and Evolution, 8: 574161. https://doi.org/10.3389/fevo.2020.574161

[15] Phuyal, N., Sadadev, B.M., Khulal, R., et al. (2023).

Assessing illegal trade networks of two species of pangolins through a questionnaire survey in Nepal. Journal of Threatened Taxa, 15(1): 22381-22391. https://doi.org/10.11609/jott.8036.15.1.22381-22391
[16] Nijman, V. (2023). Effect of CITES Appendix I listing on illegal pangolin trade as gauged from seizure reports in Indonesia. European Journal of Wildlife Research, 69: 105. https://doi.org/10.1007/s10344-023-01736-5
[17] Nash, H.C., Wirdateti, Low, G.W., et al. (2018). Conservation genomics reveals possible illegal trade routes and admixture across pangolin lineages in Southeast Asia. Conservation Genetics, 19(5): 1083-1095. https://doi.org/10.1007/s10592-018-1080-9
[18] Aziz, M.K., O'Dempsey, A., Ng, B.C., et al. (2025). Georeferencing Sunda pangolin *Manis javanica* records in Singapore. Oryx, 59(1): 65-68. https://doi.org/10.1017/S0030605324000206
[19] Anasari, S.D., Pusparini, W., Andayani, N. (2021). Predicting the distribution of Sunda pangolin (*Manis javanica* Desmarest, 1822) in Way Canguk Research Station, Bukit Barisan Selatan National Park, Lampung. Journal of Tropical Biodiversity and Biotechnology, 6(1): 58612. https://doi.org/10.22146/jtbb.58612
[20] Suwal, T.L., Gurung, S., Johnson, P.J., Shrestha, M.B., Parker, K., Pei, K.J.C. (2023). Attitudes to pangolins and factors affecting their conservation in a human-dominated landscape in Nepal. Conservation Science and Practice, 5(9): e13009. https://doi.org/10.1111/csp2.13009
[21] Lee, J., Hughes, T., Lee, M.H., et al. (2020). No evidence of coronaviruses or other potentially zoonotic viruses in Sunda pangolins (*Manis javanica*) entering the wildlife trade via Malaysia. EcoHealth, 17(3): 406-418. https://doi.org/10.1007/s10393-020-01503-x
[22] Ajzen, I. (1991). The theory of planned behavior. Organizational Behavior and Human Decision Processes, 50(2): 179-211. https://doi.org/10.1016/0749-5978(91)90020-T
[23] Ochieng, C.N., Thenya, T., Shah, P., Odwe, G. (2021). Awareness of traditional knowledge and attitudes towards wildlife conservation among Maasai communities: The case of Enkusero Sampu Conservancy, Kajiado County in Kenya. African Journal of Ecology, 59(3): 712-723. https://doi.org/10.1111/aje.12872
[24] Boso, À., Álvarez, B., Pérez, B., Imio, J.C., Altamirano, A., Lisón, F. (2021). Understanding human attitudes towards bats and the role of information and aesthetics to boost a positive response as a conservation tool. Animal Conservation, 24(6): 937-945. https://doi.org/10.1111/acv.12692
[25] Bisi, F., Gagliardi, A., Cremonesi, G., et al. (2019). Distribution of wildlife and illegal human activities in the Lampi Marine National Park (Myanmar). Environmental Conservation, 46(2): 163-170. https://doi.org/10.1017/S0376892918000486
[26] Krejcie, R.V., Morgan, D.W. (1970). Determining sample size for research activities. Educational and Psychological Measurement, 30(3): 607-610. https://doi.org/10.1177/001316447003000308
[27] Hasan, S.M., Csányi, S. (2023). Attitude index of local communities toward wildlife and their management methods in Malaysia. Diversity, 15(2): 202. https://doi.org/10.3390/d15020202