Chapter 1
Environmental Awareness Studies in Environmental Management at Terengganu, Malaysia

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Abstract Environment deterioration issues are increasing day by day related to water quality deterioration, sedimentation, flooding, and uncontrollable domestic sewage that affect communities. Awareness of environmental changes is one of the necessary concerns to control the occurrence of damage caused by human needs. The aim of this study is to compare the environmental awareness level among communities and identify the relationship between environmental awareness level and communities' behaviour. This study was conducted to spread the spatial model of environmental awareness among urban and rural communities using GIS. Four hundred and two respondents were selected randomly. The sample size determination was based on the sample size of Krejcie and Morgan. Discriminant Analysis (DA), descriptive analysis, and two-sample t-test were used to analyze the primary data. The result showed that there are five questions which showed significant p-value < 0.05 (SA1 p-value = 0.0297, SA6 p-value = 0.0028, SB4 p-value = 0.0095, SC9 p-value = 0.0229, and SC10 p-value = 0.0023). It proved that the communities'

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knowledge on environmental issues are significant (p-value = 0.0331 < 0.05). There are significant differences between urban and rural communities. From what GIS analysis showed, majority of the people in urban areas in Terengganu are more aware that environmental care is necessary to ensure the well-being of the environment compared rural areas. The government, consumers, business organizations, consumer associations, and other non-governmental organizations have a shared responsibility for the preservation of the environment.

Keywords Rural · Urban · Spatial model · Environmental · Geographic Information Systems (GIS) · Terengganu

1 Introduction

Environmental problems are common and are now creating anxiety around the world. Organizations are being affected by fundamental environmental problems as globalization continues. Environmental and widespread problems affect humans and all living species. The decline in drinking water quality and the extinction of living things like flora and fauna has unsustainably affected the quality and well-being of human life. These problems are contributed to tolerant attitudes. According to Knapp (1999) and Callicott (2000), one of the environmental rehabilitations is through the direct involvement of the responsible individuals by subtly changing the communities' moral attitudes and successful practices from mutual self-interest (anthropocentric) to environmental-oriented (ecocentric). Environmental awareness typically plays an important role in naturally influencing and improving human behaviour towards social environments. Responsible individuals who provide good environmental awareness will properly apply their social attitudes in daily life. This accurate statement is mutually supported by Klockner (2013) who correctly argues that environmental care starts from own individuals. This is precisely because the environmental behaviour is in properly handling environmental disasters. Majority of people in every country are of the view that environmental care needs to be done to ensure the well-being of the environment is unaffected and they are willing to pay high taxes if additional income is spent on environmental programs. According to Laroche et al. (2001), environmental awareness and behaviour are influenced by values, attitudes, and knowledge in routine life.

Environmental concerns require us to be aware of our ways of life that will sustain a negative impact on the environment and try to develop attitudes to current attitudes that seek to maintain and promote the quality of the environment. The involvement of individuals and communities in environmental conservation remains the necessary step in environmental conservation efforts. The knowledge about environmental care depends on the individual's attitude and commitment to environmental behaviour (Jusoh et al. 2018; Sungip et al. 2018). According to Abdul Samad (1990), the 1970s and 1980s started the environmental degradation cases but lack of environmental awareness was one of the factors that contribute towards the

environmental problems. Most communities in Malaysia obtain knowledge about environmental issues and management but they were lacking the awareness to be involved in overcoming the problems.

Various issues and causes of environmental degradation have been discussed. Among them is the problem of population density that migrated to the city due to employment opportunities with lucrative income compared to rural areas. This resulted in the city being forced to receive an urgent population increase. Hence, community awareness of environmental care is vital in ensuring sustainable nature. Educational and technological awareness in reducing environmental problems from constantly undermining nature's pollution leads to a negative impact on human beings. According to Ahmad et al. (2011), the best way to emphasize environmental awareness is through education to provide knowledge on the value and role of the environment. Encourage the generation to be sensitive and aware of environmental care by applying values, knowledge, and efforts in preventing environmental damage. Hence, the purpose of this study is to determine the comparison of environmental awareness between urban and rural residents along Terengganu, a River Basin including Kuala Terengganu and Hulu Terengganu's regions. Table 1.1 shows the total population in a few districts in Terengganu. This study selected Kuala Terengganu as the urban region and Hulu Terengganu as the rural areas because these regions are located along Terengganu River from Jenagor until Kuala Terengganu's city.

Figure 1.1 shows the models of pro-environmental behaviour which are based on the linear progression of environmental knowledge leading to environmental awareness and concern (environmental attitudes). Pro-environmental behaviours (PEB) are actions that people do in daily life that are comparatively better for the environment in their life. The public outreach and friendly communications efforts from society will fuel behavioural changes among communities, but not adequately in addressing large-scale environmental issues. This manner will be encouraging PEB in daily life which positively influences society and economy in sustainable community development. Besides that, Fig. 1.2 shows the models of predictors of

Table 1.1 The population intensity in District in Terengganu State

Regions	District	Total population (%)
Urban	Kuala Terengganu	186,100 (16.14%)
	Dungun	173,200 (15%)
	Kuala Nerus	175,200 (15.19%)
	Kemaman	175,200 (15.9%)
	Marang	103,300 (8.96%)
Rural	Besut	162,400 (14%)
	Setiu	63,000 (5.46%)
	Hulu Terengganu	82,100 (7.12%)

Source: Unit Perancang Ekonomi Negeri Terengganu (2017)

Fig. 1.1 The models of pro-environmental behaviour

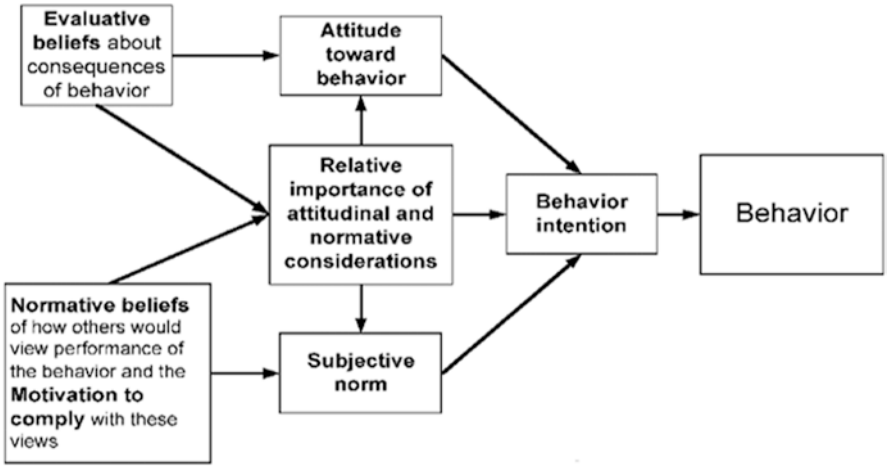


Fig. 1.2 Models of predictors of environmental behaviour. (Source: Kollmuss and Agyeman 2002)

environmental behaviour, which prove that there is high correlation between attitude and behaviour. The increase in knowledge and awareness among communities lead to increase in their PEB. So, the most important, which are the knowledge and awareness of environmental issues, will trigger the communities to preserve and conserve the environment. Now, there are a lot of environmental non-governmental organisations (NGOs) and government agencies struggling for their communication campaigns and strategies on the simplistic assumption that more knowledge will lead to more enlightened communities' behaviour (Kollmuss and Agyeman 2002).

In Malaysia, there are 45 environmental legislations, but they are not very effective in maintaining the quality of the environment as largely shaped sectorals. Awareness of environmental issues begins with individual attitudes. Environmental attitudes are essential in influencing and promoting human behaviour towards the environment. However, the community's attitudes and responsibilities towards environmental issues need to be nurtured through the efforts of responsible parties to encourage communities to engage in environmental comparable activities. The information obtained by the researcher found that the responsible party rarely conducted the review (Memon 2000; Buniamin 2010).

The campaign has less environmental-related activity. Many villagers are proposing organizing environmental activities like cleanest village competitions, campaign recycling programs, and environmental talks at least once every 2 months.

The government is constantly updating environmental protection and enforcing existing environmental laws, actively promoting environmental awareness campaigns, planning balanced development, providing more efficient public facilities, and so on. The government also needs to ensure that each party engages in environmental protection and environmental education. The use of mass media as a medium of information about the environment is important. According to Jahi (2001), media is used in addressing environmental issues through campaigns and seminars in highlighting environmental issues throughout the country. The role of media in environmental literacy through television and documentary campaigns is important.

2 Study Area and Research Methodology

2.1 Study Area: Kuala Terengganu and Hulu Terengganu

The sampling areas along Terengganu River Basin are selected as research locations. Terengganu River Basin is located in the central portion of the State of Terengganu. The catchment area is approximately 4650 km^2 and spans across three districts in Terengganu, which are Kuala Terengganu, Hulu Terengganu, and Setiu. Terengganu River is the main stem that begins from Kenyir Lake and flows eastwards, draining into South China Sea. The entire main stem is approximately 64.4 km long. There are 72 villages along Terengganu River Basin which are from Jenagor until Kuala Terengganu. This study selected randomly 72 villages to distribute the questionnaires. Figure 1.3 shows the map of sampling station including Kuala Terengganu and Hulu Terengganu along Terengganu River Basin, Malaysia.

2.2 Research Methodology

The main study, which was a quantitative survey, was conducted among urban and rural residents along Terengganu River Basin through a self-administered questionnaire. This research instrument was developed using well-established measurement scales identified from previous studies. Based on Krejcie and Morgan (1970), sample size determination is to be necessarily conducted prior to administering the self-completed questionnaire in the field survey. The survey period endures 2 weeks, and the total number of respondents were 402. The selected numbers of respondents based on the estimated populations defended two districts, Hulu Terengganu representing the rural areas and Kuala Terengganu representing the urban areas, where the population exceeds 75,000. The questionnaires consist of four particular sections: respondents' demographics, communities' practices on environmental issues, communities' attitudes towards the environment, and communities' knowledge about environmental awareness in Malaysia. There are two statistical analysis

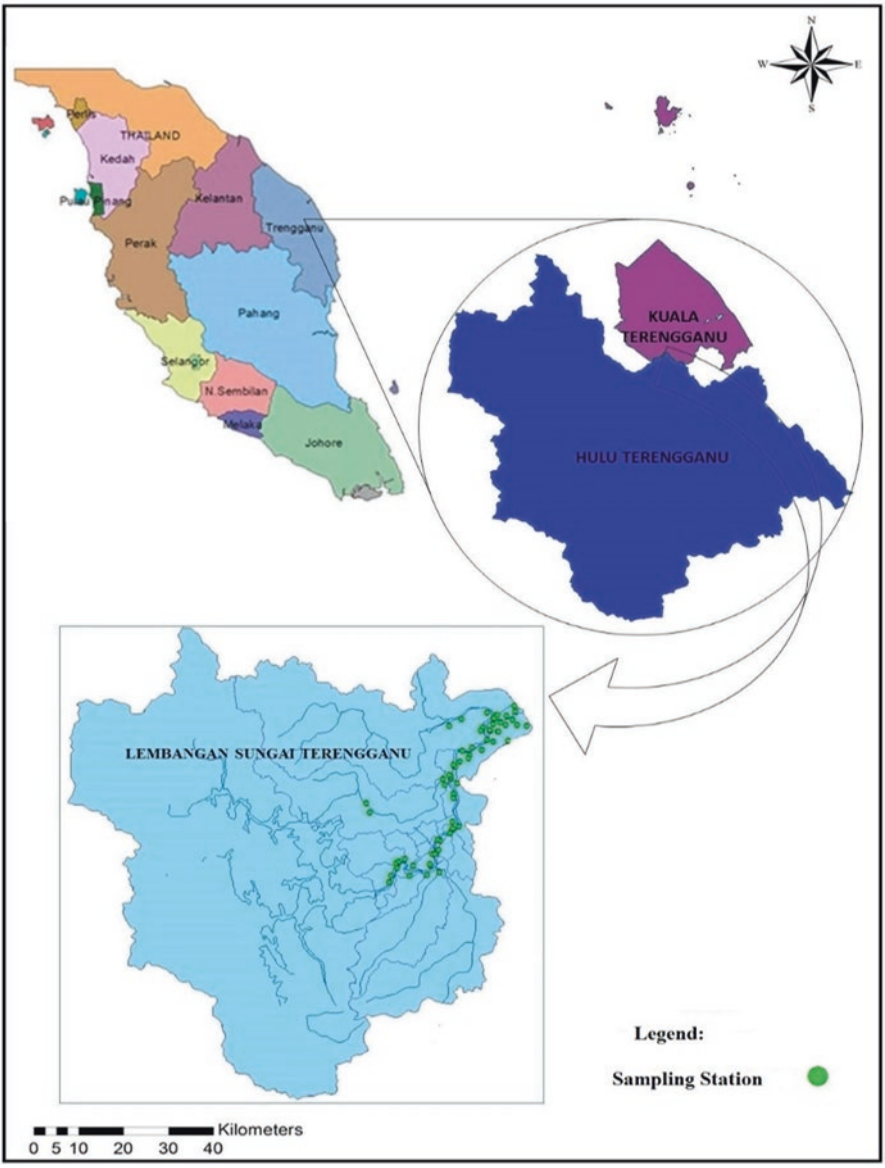


Fig. 1.3 Map of sampling station, Kuala Terengganu, and Hulu Terengganu along Terengganu River Basin, Malaysia

methods applied in this study like hypothesis testing (two-sample t-test) and Discriminant Analysis (DA) (Fig. 1.4).

This analysis was applied to determine the relationship between two or more natural parameters regrading the level of environmental awareness in aspect

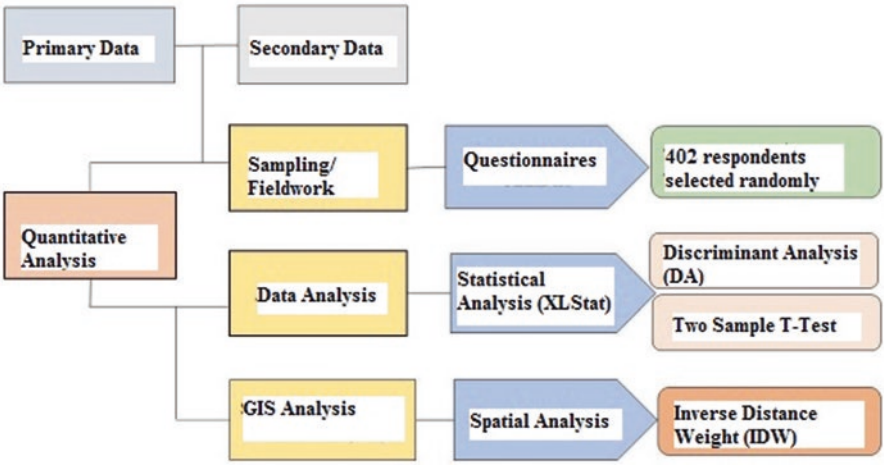
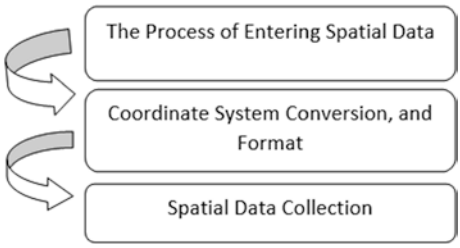


Fig. 1.4 The framework used in the study of rural urban differences in environmental awareness in Terengganu, Malaysia

Fig. 1.5 The spatial data mapping process



knowledge and practice among urban and rural residents in Malaysia. It equally describes the whole data set by excluding the less significant parameters with a minimum loss of initial information (Juahir et al. 2018). Figure 1.5 shows the spatial data mapping process, in this study, the components contained in the application of Geographic Information System (GIS) applications. Important components are hardware, software, procedures, data, and people. Spatial data are available in digital form or a paper map, with the help of a scanner to convert it to digital. In addition, components in GIS have a variety of data analyses and rendering functions that have different formats. There are two types of GIS: spatial data and attribute data. Spatial data are of two types: raster data and vector data. Spatial data is information related to the real coordinate point above the ground (Gidado et al. 2018; Kamarudin et al. 2019).

3 Result and Discussion

3.1 Demographic Profile of Respondents

To further understand the respondents' background, this study examined four elements of the respondents' profile, namely gender, age, education and employment. Table 1.2 presents the frequency and percentage of respondents' demographic profile in this study. Out of the 402 respondents participated in the study, 230 (57%) were male and 172 (43%) were females. Categories of respondent age are 18–25 and above: 28 (7%) are aged 18–20 years old, 23 (6%) aged 21–22 years old, 36 (9%) aged 23–24 years old, and 315 (78%) are aged 25 and above.

According to the education level, 57 (14%) respondents have a PMR certificate, 156 (39%) have SPM certificate, 39 (10%) have STPM/STAM certificate, and 150 (37%) have some level of education in others. Based on the employment sector, 61 (16%) respondents are employed in the government sector, 32 (8%) in the private sector, 189 (46%) self-employed, and 120 (30%) employed in others.

Table 1.2 Information on the background of 402 respondents in Terengganu, Malaysia

Demographics	Frequency	Percent
Gender		
Male	230	57%
Female	172	43%
Age		
18–20	28	7%
21–22	23	6%
23–24	36	9%
25 above	315	78%
Education		
PMR	57	14%
SPM	156	39%
STPM/STAM	39	10%
Others	150	37%
Employment		
Government	61	16%
Private	32	8%
Self-employed	189	46%
Others	120	30%

3.2 Statistical Analysis

3.2.1 Discriminant Analysis (DA)

Based on Table 1.3, for Question 1 Section A (Applying recycling), p-value is 0.0297. For Question 6 Section A (Cycling or walking reduces motor vehicles), p-value is 0.0028. For Question 4 Section B (Pay more for eco-friendly products) p-value 0.0095. For Question 9 Section B (Knowledge of the benefits of natural resources), p-value is 0.0229, and for Question 10 Section C (Knowledge of environmental care), p-value of 0.0023. All the questions having p-value <0.05 showed that there are significant differences between urban and rural areas.

3.2.2 Hypothesis Testing

Table 1.4 and Fig. 1.6 showed descriptive analysis of urban and rural respondents in Terengganu River Basin, the selected questions of urban and rural respondents such as SA1: Practices recycle activities, SA6: Proper waste disposal, SB4: Willing to pay more for buying friendly products environment, SC9: The benefits of natural resources, SC10: The benefit of preserving the environment. Based on SA1, the mean of urban areas is 2.2174 and rural areas is 2.0415. The minimum number of urban and rural areas is 1, while the maximum number of urban and rural areas is 4. This shows that majority of communities agree about SA1 but are still in a simple stage. Based on information obtained, most communities hold mineral bottles and old newspapers for resale. The study conducted by Cheku et al. (2014) found that most respondents in Terengganu implemented recycling practices at a moderate level. According to Minton and Rose (1997), environmentally conscious individuals will buy or save, looking for eco-friendly product information, and recycle. Based on SA6, mean of urban areas is 2.5590 and of rural areas is 2.3071. The minimum number of urban and rural areas is 1, while the maximum number of urban areas is 4 and rural is 9. This shows that majory of communities agree about SA6 but still in a simple stage. As a result of observations, researchers found that most people use motorcycles, instead of cycling and walking, to nearby places. The social and individual benefits of bicycling and walking are myriad, ranging from thrift and individual health to community building. Cycling and walking instead of using

Table 1.3 Significant questions about environmental awareness

No.	Variable	Lambda	F	DF1	DF2	P-value
1.	SA1	0.9882	4.7595	1	400	0.0297
2.	SA6	0.9779	9.0447	1	400	0.0028
3	SB4	0.9833	6.7929	1	400	0.0095
4.	SC9	0.9871	5.2138	1	400	0.0229
5.	SC10	0.9770	9.4328	1	400	0.0023

Table 1.4 Descriptive analysis of urban and rural respondents in Terengganu River Basin, Terengganu

	Urban				
Statistic	SA1	SA6	SB4	SC9	SC10
No. of observations	161	161	161	161	161
Minimum	1.0000	1.0000	1.0000	1.0000	1.0000
Maximum	4.0000	4.0000	4.0000	4.0000	3.0000
1st Quartile	2.0000	2.0000	2.0000	1.0000	1.0000
Median	2.0000	3.0000	2.0000	2.0000	1.0000
3rd Quartile	3.0000	3.0000	3.0000	2.0000	2.0000
Mean	2.2174	2.5590	2.4783	1.6087	1.4969
Variance (n−1)	0.7462	0.5231	0.4886	0.5022	0.3641
Standard deviation (n1)	0.8638	0.7232	0.6990	0.7086	0.6034
	Rural				
No. of observations	241	241	241	241	241
Minimum	1.000	1.000	1.000	1.000	1.000
Maximum	4.0000	9.0000	4.0000	4.0000	4.0000
1st Quartile	2.0000	2.0000	2.0000	1.0000	1.0000
Median	2.0000	2.0000	2.0000	2.0000	2.0000
3rd Quartile	2.0000	3.0000	3.0000	2.0000	2.0000
Mean	2.0415	2.3071	2.2863	1.7552	1.6846
Variance (n−1)	0.5483	0.7803	0.5469	0.3273	0.3585
Standard deviation (n−1)	0.7405	0.8834	0.7395	0.5721	0.5987

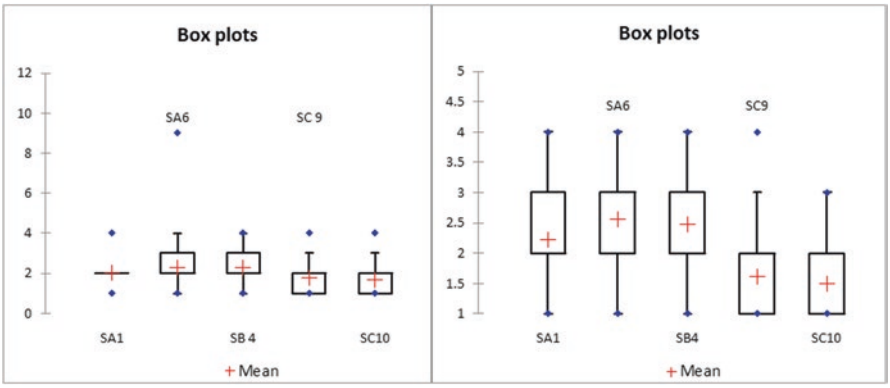


Fig. 1.6 Urban and rural box plots

motorcycles allows the community to reduce fossil fuels and pollution associated with other environmental damage (Komanoff et al. 1993).

Based on SB4, mean of urban areas is 2.4783 and mean of rural areas is 2.2863. The minimum number of urban and rural areas is 1, while the maximum number of urban and rural areas is 4. This shows that majory of communities agree about SA6 but still in a simple stage. According to Mamun et al. (2018), in their study, there are

findings that exhibit that the level of perceived behavioural control among the respondents has a significantly positive effect on their payment behaviour for environmentally friendly products. Based on SC9, mean of urban areas is 1.6087, while the rural areas is 1.7552. The minimum number of urban and rural areas is 1, while the maximum number of urban and rural areas is 4. Most urban and rural communities agree on this question. The mean value among urban and rural areas' respondents of SC10 is 1.4969 and 1.6846 respectively. Based on Table 1.4 recorded the minimum number (Likert scales' answer) among urban and rural respondents is 1 and the maximum number among urban and rural areas' respondents are 3 and 4 respectively. These data indicate the mean values proved the both of urban and rural areas' respondents agree with the SC10 (the benefit of preserving the environment). The minimum number of urban and rural areas is 1, and the maximum number of urban areas is 3, while rural is 4. This indicates that most residents agree with SC10 questions.

3.2.3 Hypothesis Testing (Two-Sample t-Test)

Hypothesis Testing (two-sample t-test) was conducted to see the comparison between urban and rural areas related to practices, attitudes, and knowledge on environmental issues. Based on Table 1.5, p-value of community practice on environmental issues is 0.0826, which showed that there are no significant differences with urban and rural communities' practices on environmental issues (p-values > 0.05). It indicates that urban and rural communities have a balanced practice in maintaining the environment. Most respondents practices to preserve the environment are applying to recycle. They keep and sell recyclable materials such as old newspapers, bottles, and glass. This statement which is proved from the mean values of urban and rural areas' respondents as 2.2174 and 2.0415 respectively that the majority of respondents agreed to practice the recycling process.

The section about community attitudes towards environmental issues found that p-value is 0.0826. It indicates that there are no significant differences between urban and rural areas (p-value > 0.05). The attitudes of communities towards environmental issues with urban and rural are balanced. Environmental attitudes, such as contributing a small portion of the income to the environment, do not waste evenly, do not open burning, and so on. Parallel to the Center for Science and Research

Table 1.5 Hypothesis testing (two-sample t-test) related to communities' practices, attitudes, and knowledge

No.	Details	p-value
1.	Community practice on environmental issues	0.0826
2.	Community attitudes towards environmental issues	0.5058
3.	Community knowledge of environmental issues	0.0331

Information Technology (MASTIC) from 1998 to 2004 which states that environmental awareness in society is increasing (MASTIC, 1998). The result of community knowledge on environmental issues found that p-value is 0.0331 and shows that there are significant differences between urban and rural areas on their knowledge of environmental issues (p-value < 0.05).

The attributed mean of urban is 17.3975 and rural 18.4440, which shows that rural communities have more knowledgeable environmental issues compared to urban communities. The information obtained finds the respondent able to access information through mass media, such as Facebook, Instagram, Twitter, and WhatsApp. Community knowledge of environmental issues is important. This is discussed by Kollmuss and Agyeman (2002) in the preliminary model of PEB around knowledge of the environment and its conservation, which plays an important role in determining behavioural patterns of attitudes toward the environment.

3.2.4 Geographic Information System (GIS) Analysis

The researcher applied the Geographic Information System (GIS) technique to develop an environmental awareness model among urban and rural areas' respondents in Terengganu based on the knowledge, attitude and practice about the environment.

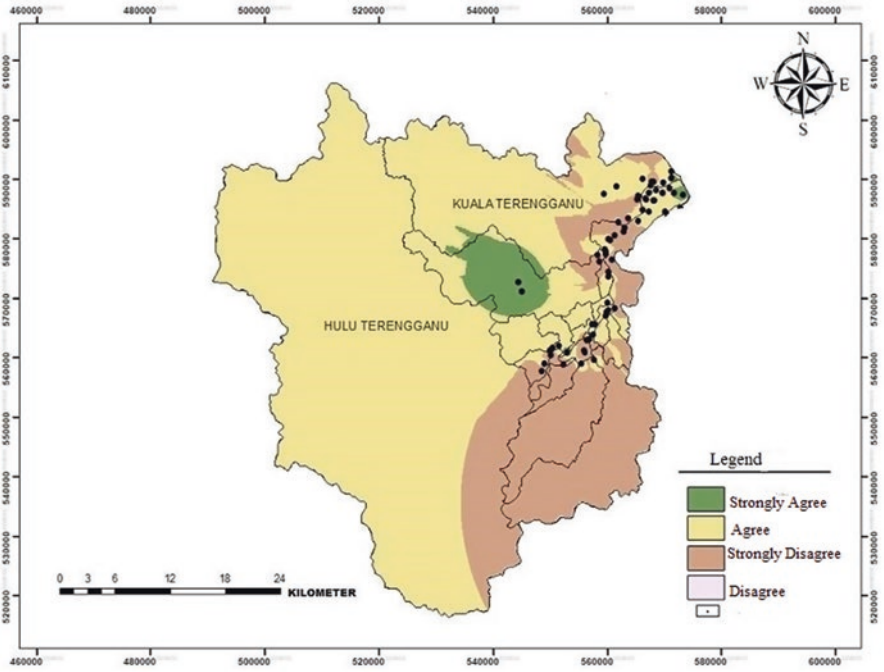


Fig. 1.7a Distribution of rural–urban differences in environmental awareness about practicing recycling process

(i) Practice recycling process

Figure 1.7a proves that most of the villages along the urban areas, such as Kampung Bukit Tunggal, Kampung Buluh Gading, Kampung Bukit Kandis, Kampung Pulau Kambing, Kampung Bukit Kecil, and Batu Buruk, much agree to practice recycling process. While the spatial distribution showed mostly the respondents in Hulu Terengganu's district such as Kampung Chapu dan Kampung Tok Lawit disagree to practice recycling process in their life. Overall, it can be recorded mostly in urban areas where most of the respondents agree to practice recycling compared to the communities in rural areas.

(ii) Willing to pay more for environmentally friendly products

Based on Fig. 1.7b, majority of the communities in urban areas strongly agree to willing to pay more for environmentally friendly products, such as Kampung Teluk Belara, Kampung Buluh Gading, and Kampung Gelogor. But there are a few areas that disagree to pay more for environmentally friendly products, such as Kampung Pulau Kudat, Kampung Telaga, and Kampung Butut, which are situated in the district of Hulu Terengganu. According to Chan and Lau (2000), the communities who have higher environmental awareness and attitudes will affect their behaviour. Attitudes and knowledge will trigger the consumers willing to pay more for environmentally friendly products which do not affect the environment and reduce the environmental deterioration level (Fazli and Teoh 2006).

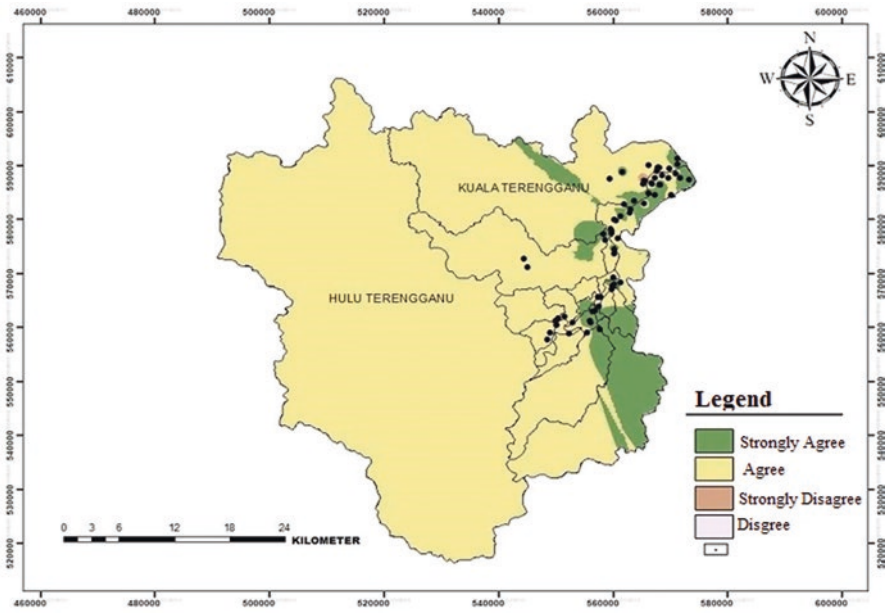


Fig. 1.7b Distribution of rural–urban differences in environmental awareness about the willingness to pay more for environmentally friendly products

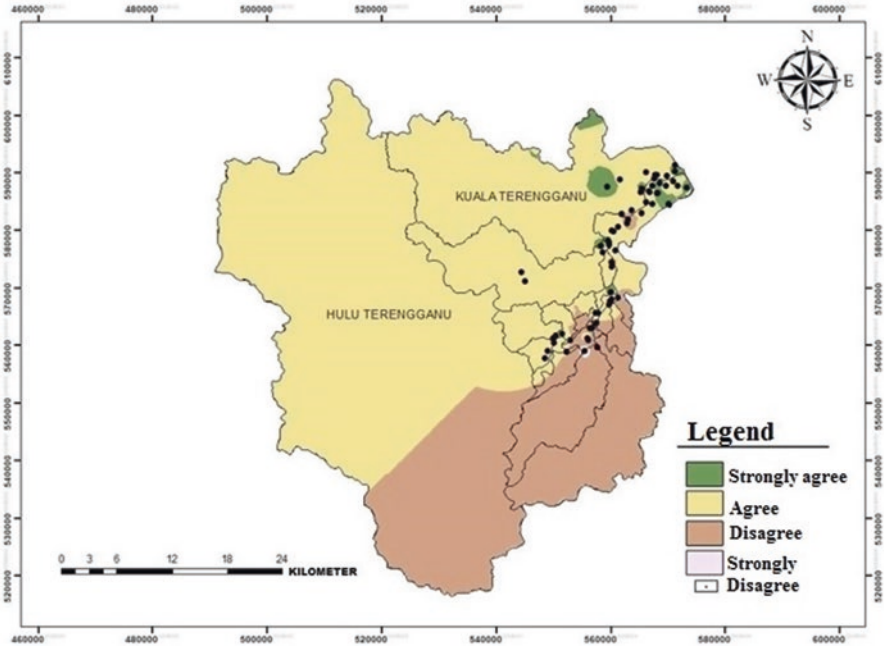


Fig. 1.7c Distribution of rural–urban differences in environmental awareness about the knowledge of the existence of recycling centres

(iii) Knowledge of the existence of recycling centers

Figure 1.7c shows that the communities around Kampung Teluk Belara, Kampung Gelugor, Kampung Seberang Takir, and Batu Buruk (Kuala Terengganu's District) have the knowledge of the existence of recycling centers. In the southern part of Terengganu, the communities in Kampung Chapu, Kampung Lawak, Kampung Dura, and Kampung Jenagor have knowledge about that but most of them disagree with recycling centers' activities. Overall, the urban communities are aware and have knowlegde about recycling center in their areas compared to rural communities.

(iv) Knowledge of waste disposal properly and benefits of natural resources

Figure 1.7d recordeds, 99% of communities in Kampung Belara, Kampung Gelugor, Kampung Kuala Bekah, Kampung Pulau Kambing, and Batu Buruk, represented as urban areas, have knowledge of waste disposal properly. Besides that, there are disagreements on the question (knowledge of waste disposal properly) among the communities around Kampung Pulau Nering and Kampung Por (Hulu Terengganu).

It can be concluded that the urban communities were more sensitive and knowledgeable about environmental protection than the rural communities. Knowledge of proper waste disposal is important to maintain the well-being of the environment and to avoid evironmental deterioration.

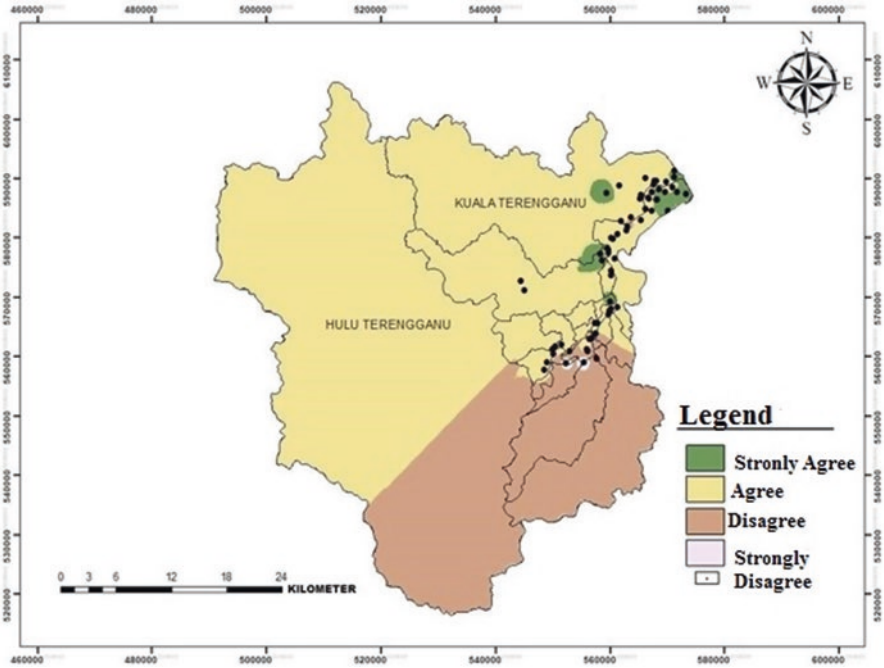


Fig. 1.7d Distribution of rural-urban differences in environmental awareness on the knowledge of waste disposal

Figure 1.7e showed, the communities in Kampung Teluk Belara, Kampung Seberang Takir, Pasar Payang, Batu Buruk, Kampung Banggol Paradong, Kampung Buluh Gading, Kampung Banggol, Kampung Pulau Rusa, and Kampung Ladang strongly agree and have knowledge on the benefits of natural resources. In the south of Terengganu, such as Kampung Butut and Kampung Buluh, there is diagreement and lack of knowledge on the benefits of natural resources in their life.

Overall, majority of rural communities disagree on the knowledge of waste disposal properly and benefits of natural resources compared to urban communities. The rural communities did not pay attention to environmental awareness and did not really apply their environmental knowledge in their life.

4 Conclusion

The practice, attitude, and knowledge of environmental issues are essential to enhance the community ability to care for the environment, in order to achieve environmental consciousness and ethics, values and attitudes, and skills and behaviours in Malaysia. The effectiveness of education and the development of the environment must be from the early age, especially from the parents. In addition, all parties,

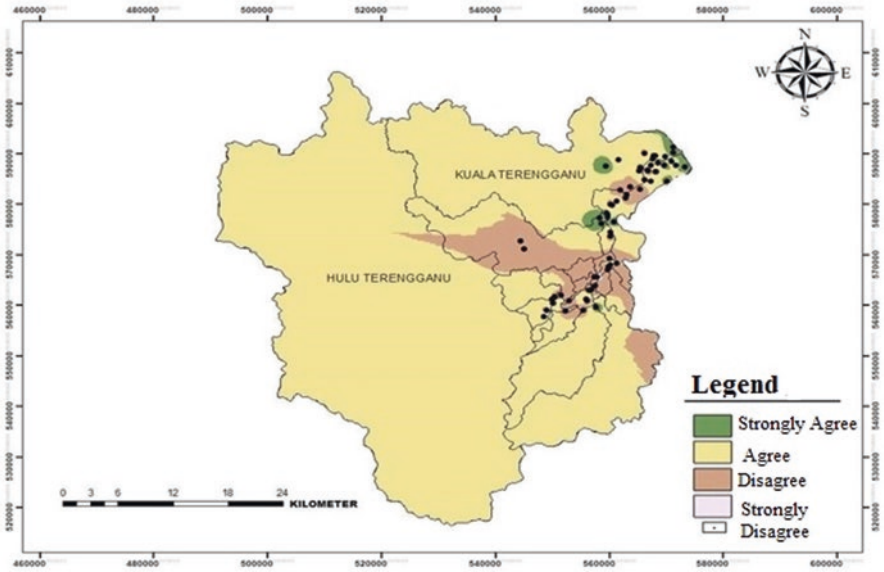


Fig. 1.7e Distribution of rural–urban differences in environmental awareness on the knowledge of the benefits of natural resources

especially the government, the private sector, and all levels of society, should work together and move on to solve the problem of environmental issues. Besides that, appropriate actions and programs need to be done to improve existing activities to ensure the level of commitment, attitudes, and behaviours to care and environmental importance. Various parties should be involved in planning various activities that can impact the local community.

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