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People's Perception of Pollution of Communities and Ecosystems: A Qualitative Study in Kuala Kedah, Malaysia

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ABSTRACT

Pollution is a global challenge that threatens human health and ecosystems. Understanding public perception is vital for developing effective policies and promoting sustainability within communities. This study aims to explore local perceptions of pollution affecting communities and ecosystems in Kuala Kedah, Malaysia. It was conducted using a qualitative approach with purposive sampling, and data were collected through semi-structured in-depth interviews. The research examined the experiences, causes, and impacts of pollution on the social, economic, and environmental aspects of local life. Results indicated that pollution in Kuala Kedah mainly originates from human activities, impacting the community's social and economic well-being. The study highlights the importance of public participation in pollution management and offers recommendations for policymakers, academics, and researchers.

Keywords: *Pollution, Community, Ecosystems, Public perception*

BACKGROUND OF THE STUDY

Uncontrolled industrialisation and urbanisation contribute to environmental degradation, leading to air pollution, contaminated water, waste mismanagement, and soil pollution (Ukaogo et al., 2020). This environmental pollution has caused serious problems, making it one of the most significant societal issues of the modern era. Previous research has demonstrated that pollution affects ecosystems; more importantly, it also impacts communities and individuals who rely on nature for their livelihoods, such as farmers and fishermen. The research conducted by Chin et al. (2023) found that disparities in awareness of pollution, arising from differences in education, socioeconomic status, and cultural backgrounds, hinder society's efforts to reduce environmental pollution. Therefore, understanding people's perceptions helps elucidate the social and economic impacts of pollution, enabling the development of effective methods and policies to prevent environmental contamination.

A study examining people's perceptions of pollution across different groups, including local tourists, residents, fishermen, and farmers, should be conducted to understand pollution awareness from diverse viewpoints. In this research, the perceptions of local people in Kuala Kedah, Malaysia, towards pollution were examined, particularly its socio-environmental implications.

Pollution is defined by the United Nations (n.d.) and the University of Maryland Centre for Environmental Science (n.d.) as the presence of 'substances and/or heat' of any type, location, and amount in the air, water, or land, which can cause environmental consequences,

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including harm to humans, animals, and plants. Mandasari and Anggariyani (2024) noted that there are three types of pollution: water, air, and soil.

Water pollution results from human activities that alter the quality of water bodies, including lakes, rivers, seas, and groundwater. Air pollution occurs when toxic chemical substances are present in the air, causing discomfort and risks to humans, animals, and plants, as well as property damage. Soil pollution is caused by human-made chemicals that alter the natural composition of soil.

LITERATURE REVIEW

Previous empirical studies on pollution have provided insights into the relationship between public perception and ecosystems. For example, Omoyajowo et al. (2021) used a quantitative approach to examine public perception, understanding, and sensitivity to microplastic pollution in Lagos Lagoon. A random sample of 120 questionnaires was administered to students, residents, and fishermen, representing 140 respondents. The study's findings indicated that most respondents reported awareness of microplastic pollution. It also noted that most respondents recognised microplastic pollution as a recent issue that could harm human health and recommended that the government take action to educate the public about the impacts of mismanaging plastic waste through campaigns.

Additionally, Maione et al. (2021) carried out an empirical study on public perceptions of air pollution in Europe. This research compared people's perceptions of pollution sources with actual conditions in seven European countries. The study used a quantitative approach, with 16,101 respondents completing the survey, representing diverse socio-economic and political backgrounds across European society. The respondents came from different polluted environments in each country.

The findings showed that the industrial and transportation sectors were the main sources of pollution in all nations. However, respondents' awareness of pollution sources varied by education level and knowledge of pollution. The study also found that age, gender, and place of residence influenced perceptions of air pollution, with these effects remaining consistent across different socioeconomic groups and countries. This indicated that many individuals were not fully aware of the origins of air pollution.

Bakari et al. (2021) investigated the effect of pollution on economic growth in Tunisia. Using annual data from 1961 to 2015, the researchers found that pollution negatively affected long-term economic growth. However, they also noted that the effect on Tunisia's economy was relatively limited, as there remained opportunities to address and mitigate the issue. Additionally, Karamipour and Sarikhani (2023) pointed out that global natural resources face severe challenges due to overexploitation, which could compromise the rights of future generations and threaten the survival of living organisms on Earth.

The study by Xuan et al. (2023) found that agricultural activities, such as excessive use of pesticides and fertilisers, were the main contributors to soil and water pollution. Furthermore, socioeconomic disparities, especially among lower-income communities, influenced environmental awareness and behaviour, resulting in these groups facing a disproportionate pollution burden.

The lack of infrastructure for managing plastic waste leads to mismanagement among villagers, who often burn or dump waste directly into the ocean. Plastic pollution has also

threatened villagers' livelihoods, including fishing and seaweed farming (Phelan et al., 2020). Bidayani (2021) stated that fishermen were affected by coastal degradation resulting from tin mining, which led to coastal pollution. These fishermen rely on traditional methods, simple technology, and limited fishing coverage. To support their families, many have additional occupations beyond fishing because of coastal pollution. A study on river pollution in Terengganu found that local people's negative attitudes and behaviours, such as waste dumping, contribute to it (Ismail et al., 2023).

THEORETICAL FRAMEWORK

Julian Steward (1937) explains the relationship between culture and environment within an anthropological framework of cultural ecology. The framework holds that the natural environment influences the cultural practices of societies, from primitive to industrial. The difference between human and social ecology in cultural theory is that the latter focuses on cultural traits and patterns to describe cultural-environmental circumstances rather than using general principles (Steward, 2005, p. 5).

In general, the theory explains how the environment influences human society and behavioural patterns, enabling adaptation to resources, technology, and social organisation, and outlines the problems and solutions. The environment plays a vital role in shaping human society and behavioural patterns, as individuals adjust to resources, technology, and social organisation. The idea suggests that culture is central to economic and subsistence activities. Culture affects various aspects of society, including technology, land use, and land tenure. However, cultures may change over time in different environments, requiring human societies to adapt to technological and productive shifts.

According to Beck (1992), modernisation has given rise to new forms of global risk that require societal adjustments. Ulrich Beck introduced the concept of the risk society in his book 'Risk Society: Towards a New Modernity'. The idea highlights the unknown and unintended consequences that become dominant forces in history and community. Beck notes that most modern risks are created by human activities such as climate change, pollution, nuclear, and radioactive hazards. Industrial pollution causes environmental degradation, harms ecosystems, and affects human health and social life. Contemporary pollution is often considered invisible because it requires a scientific approach to identify chemicals such as radioactive and nuclear substances. Beck (1992) emphasised that society faces pollution due to technological and industrial development. Regarding class-specific risks, he noted that people living in lower-income areas, such as those near industrial sites, are often exposed to various pollutants.

Human activities and natural disasters (i.e., storms, floods, wildfires, volcanoes, and earthquakes) contribute to pollution (United Nations, 2023). Zahoor and Mushtaq (2023) argue that water pollution results from agricultural activities, including the use of chemicals in pesticides and biosolids. Meanwhile, Taha et al. (2021) found that microplastic pollution was affecting marine organisms in Terengganu, Malaysia. This pollution arises from various human activities, including tourism services, commercial fishing, seafood processing, recreational pursuits, sand mining, boat manufacturing, construction, and the operation of coastal businesses such as restaurants.

In summary, the researchers suggest that microplastic pollution harms marine life and ecosystems. Panigrahi and Pattnaik (2020) reported the impact of water pollution on people's livelihoods. Qu (2020) found that sewage discharges from certain chemical companies have

become a common source of water pollution in coastal cities such as Shenzhen, China. Additionally, the increased use of chemicals in industrialised countries has led to the contamination of crops and vegetation (Steven et al., 2020). Furthermore, the Saraswati and Kunti Rivers have been affected by pollution from both natural disasters and human activities. Consequently, residents who rely on these rivers, particularly fishermen, have been unable to meet their needs due to reduced fish production. A similar report by Panigrahi and Pattnaik (2020) highlights that river pollution causes ecological imbalances and threatens the socioeconomic status of fishermen.

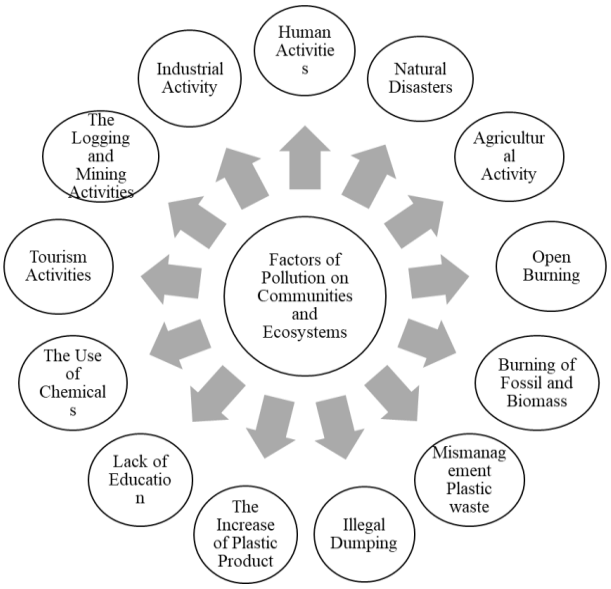
On the other hand, Ritchie et al. (2023) believe that waste mismanagement contributes to pollution. In their study, they estimated that between 1 and 2 million tonnes of plastic waste are in the oceans, posing a threat to marine species and ecosystems. Ibrahim and Mat Noordin (2020) found that plastic helps reduce food waste, but illegal dumping and improper handling of plastic contribute to ocean pollution. The increased use of everyday plastic products, such as takeaway food packaging, straws, cups, and spoons, contributes to plastic pollution in Nigeria (Dumbili & Henderson, 2020).

According to the Health Effects Institute (2024), burning fossil fuels and biomass, among other things, causes air pollution that later leads to greenhouse gas emissions and global warming. According to Puteh et al. (2024), open burning is a major contributor to air pollution in Malaysia, driven by farmers' traditional practice of burning crop residue to clear cropland for the next crop. Hu and He (2023) supported the view that climate change and air pollution in China are increasing due to the lack of individual prevention strategies and effective governing policies.

The United Nations (2023) emphasises that pollution leads to productivity losses, increased healthcare costs, and ecosystem damage. The impact of pollution on human health is significant, particularly among children, leading to increased health care costs and economic disparities. It also threatens fundamental human rights globally, including the rights to life, health, food, water, sanitation, housing, development, and a healthy environment.

Zahoor and Mushtaq (2023) highlighted that pollution is a significant issue that has disastrous impacts on the environment, human well-being, and the economy. For instance, the Health Effects Institute (2024) has determined that air pollution has resulted in the loss of millions of lives and has caused asthma, heart or lung issues, preterm births, stillbirths, and miscarriages. Another study by Fuller et al. (2020) emphasised that pollution contributes to economic losses by increasing health degradation and mortality. Yang (2020) demonstrated that polluted air impairs physical activity. In general, people participated less in outdoor leisure sports programmes to avoid unhealthy air pollution.

Figure 1. Theoretical framework of people's perception of pollution on communities and ecosystems



METHODOLOGY

This research employed a qualitative approach, using in-depth interviews and respondent observation for data collection. Purposive sampling was used to identify study respondents. The respondents were selected based on specific characteristics to gather data that would help meet the research objectives. Consequently, the respondents included fishermen, farmers, residents of Kuala Kedah, and local tourists at Leman Beach.

The study was conducted in Kuala Kedah, focusing on the Kuala Kedah Sea and the Kuala Kedah River. These are vital to local fishermen and farmers because water is the community's most critical resource. The Kuala Kedah Sea is essential to fishermen, who rely on fish and other marine resources for their livelihoods. Meanwhile, farmers rely on water from the Kuala Kedah River for their crops, particularly for paddy cultivation to maintain soil fertility.

A set of semi-structured interview questions was developed based on previous research. Before the interview, participants were informed of the research aims to facilitate the process and provided consent. The interviews were conducted in Malay because most of the respondents were not fluent in English. A total of 13 interviews were carried out for this study. Each interview lasted between 30 and 45 minutes per respondent. The Malay interviews were translated into English to simplify analysis. The data were presented as findings derived from the interviewees' statements.

The data were analysed using thematic analysis, the most commonly used and appropriate method in qualitative research. The data were categorised into themes based on codes derived from words, phrases, and sentences identified during data collection. After the thematic process, the themes were reviewed and, when necessary, refined to ensure data validity. The themes were described and given suitable names to facilitate analysis. The table below presents the thematic analysis from the interviews. The sample was selected only when respondents' responses became repetitive, and no new themes emerged, indicating that saturation had been reached.

Table 1: Thematic analysis of the interviews

Raw Data	Initial Codes	Sub-themes	Main Themes
'We can see many plastics are thrown everywhere in these areas. People like to put their rubbish everywhere, which makes the environment look messy and dirty.'	Rubbish was thrown everywhere	Poor waste management	Causes of pollution
'The pollution I noticed the most in Leman Beach is plastic pollution. Every time I visited, the plastic waste increased, making the beach dirty.'	Increase in plastic waste	Plastic pollution	Causes of pollution
'My late brother, who also works as a farmer, has been diagnosed with the 4th stage of cancer because of the effects of pesticides. The effects of pesticides might take time, but once they happen, it is really bad for people's health.'	The negative effect of pesticides on health	Negative effect on health	Impacts of pollution
'For the farmers, we used 'racun siput gondang' (pesticide for golden apple snail), which makes the snails drunk and die, but it also affects other animals that live in the paddy fields, such as freshwater fish, and this pesticide stays for two to three days. I often saw many fish in paddy fields die due to the pesticides used by the farmers.'	Many fish died because of pesticides.	Extinction of animals	Impacts of pollution

RESULTS AND FINDINGS

The study respondents were chosen based on their characteristics, experience, and knowledge about pollution in Kuala Kedah. The respondents included three fishermen familiar with the Kuala Kedah River, four people living near Taman Kota Nelayan River, two local farmers, and four residents at Leman Beach, of different genders and ages. Anonymity was preserved by replacing respondents' real names with pseudonyms to maintain confidentiality throughout the analysis, in line with ethical research standards.

People's Perception of the Causes of Pollution from Communities and Ecosystems

Respondents identified waste and litter as a significant source of pollution in Kuala Kedah. They highlighted the uncontrolled disposal of waste, including plastic, straw, and polystyrene, which pollutes waterways and harms marine life. Mrs Azah, a resident of Kuala

Kedah for 30 years, believed that poor rubbish disposal contributed to river pollution.

'*The uncontrolled dumping of waste causes river pollution*.'

Mrs Shida, a housewife who lived in Kuala Kedah for more than 30 years, stated the exact cause of plastic pollution in that area. She stated that:

'*We can see that many plastics are thrown everywhere in these areas. People like to put their rubbish everywhere, which makes the environment look messy and dirty.*'

One respondent noted that the river's condition differed before it was polluted with waste and plastic. Mr Kasim, a Kuala Kedah resident for over 35 years who worked as a taxi driver, said:

'*The environment is littered with rubbish everywhere in the river. People like to throw rubbish around rather than use the bins provided. The rivers are less beautiful than before because they are filled with waste. Historically, the river was covered with grass, but people removed it to improve water quality. Now, waste such as plastic containers and bottles is carelessly thrown into it after use.*

Visitors to Leman Beach were concerned about the plastic pollution in the area. One of the visitors noted that the pile of waste kept increasing every time she visited the beach. Miss Farah, a 26-year-old female, visited Leman Beach once a month and stated:

'The pollution I noticed the most in Leman Beach is plastic pollution. Every time I visited, the plastic waste increased, making the beach dirty.'

Based on the interview, some respondents were concerned about the rise in ambient temperature resulting from open burning in paddy fields. Mr Ahmad, a farmer, reported that some farmers burned paddy fields after harvesting in Kuala Kedah. The findings supported the following statement:

'They (farmers) also burn the paddy field after harvesting, which results in open burning and increases the ambient temperature.'

Mrs Azah, an eyewear consultant, concurred:

'Air pollution happens due to open burning, such as burning garbage and straw from paddy fields.'

In addition, according to the respondents, the causes of pollution in Kuala Kedah were fertilisers, pesticides, oil spills, and toxic waste. One respondent mentioned that farmers use fertiliser, which leads to soil and water pollution. Mr Amin, a 28-year-old farmer with over ten years of experience, stated:

'Some farmers used fertilisers that are not recognised by the Minister of Agriculture, which caused soil and water pollution.'

Meanwhile, Mr Badrul, a farmer for more than 30 years, noted that pesticide use during windy conditions may have contributed to pollution in Kuala Kedah. He mentioned that:

'The use of pesticides using drones during windy conditions caused pollution because

people usually use them when there is no wind. The use of drones is intended to reduce the impacts of pesticides on farmers, but it has now become a new problem. Using drones is not wrong, but the way we use them causes pollution, which may affect many plants near the house, damaging and killing them.'

A fisherman was concerned about toxic waste from the industrial areas. Mr Ali, a 60-year-old male, believed that waste was reducing fish production in the river.

'Toxic waste disposal into the river. Upstream of the river, there is an industrial area. Previously, there used to be all kinds of fish, but since the industrial area was created, the number of fish has reduced; it might be due to toxic waste disposal from the factories.'

In addition, a 23-year-old local tourist who visited Leman Beach twice a month stated that toxic waste from oil spills had contaminated the beach.

'The sea has also been polluted with plastic waste and toxic waste from the oil spills from the boats.'

People's Perception of the Impacts of Pollution on the Communities and Ecosystems

The present study demonstrated that residents of Kuala Kedah are aware of the impact of pollution on their community and environment. For example, many respondents highlighted the negative effects of pollution on public health. They mentioned that, due to pollution, their family members, friends, and residents of Kuala Kedah are experiencing health problems. Mr Hamid, a 55-year-old fisherman with over 20 years of experience, observed the effects of water pollution on the fishing industry.

'There are health effects for fishermen when the sea and river are polluted, which cause illness, such as itching and skin diseases.'

Local tourists at Leman Beach concurred that pollution harms public health.

'Pollution is harmful to people's health. Many people easily catch illnesses such as the flu, coughs, and asthma.' (Miss Farah)

'This pollution impacts people's health. For example, the sea was contaminated with toxic waste, and children who bathe and accidentally swallow the seawater develop diarrhoea because it was polluted. My family members have experienced health issues due to pollution. For instance, my niece, who was swimming at Leman Beach, fell ill and had diarrhoea, probably because she swallowed the seawater.' (Miss Alia)

Mr Badrul shared his brother's health condition, which was attributed to exposure to pesticides while he was a farmer.

"My late brother, who also works as a farmer, has been diagnosed with the 4th stage of cancer because of the effects of pesticides. The effects of pesticides might take time, but once they happen, it is awful for people's health.'

Some respondents mentioned that air pollution, including smoke from open burning and factory emissions, affects people's health, causing shortness of breath and asthma. Mrs Jamilah, a 31-year-old female and resident of Kuala Kedah who visited Leman Beach four

times every week, mentioned:

> *'Pollution causes various diseases, for example, skin conditions, because of the increase in ambient temperature, and shortness of breath due to smoke from open burning. Based on my experience, I easily get sick, such as fever, cough, and difficulty breathing, when exposed to hot weather for a long time.'*

Meanwhile, Mr Kasim, 68, stated that many of his friends had become ill due to air pollution. Mr Kasim shared that:

> *'There are many of my friends who have become unwell, such as cough and shortness of breath, because of the unclean air from the smoke from the open burning and the smoke from boats.'*

Mr Ali, a fisherman with over 17 years of experience after retiring from the military, stated that the cause of asthma and shortness of breath in Kuala Kedah is the smoke from the fertiliser factory. He mentioned that:

> *'Back then, when the fertiliser factory was built, many people faced shortness of breath and asthma because of the smoke from the factory.'*

In addition, some respondents highlighted that pollution in Kuala Kedah disrupted natural habitats. Muhammad, a 17-year-old high school student and a regular visitor to Leman Beach, emphasised that the road construction in the beach area disrupted the habitats of local animals.

> *'Due to road construction, many animals have lost their habitats, such as numerous monkeys that roam in Leman Beach. I often observed the monkeys from the small jungle near the beach areas start roaming into the beach and nearby villages after the road construction began, which disturbed the locals because the monkeys were quite wild.'*

Mrs Zaitun, a 63-year-old housewife who resided in Kuala Kedah for more than 30 years, mentions that:

> *'Plastic waste has adverse effects, particularly on fish in rivers and the sea. This pollution has disrupted the ecosystem. Moreover, many trees near my house have died because of the effects of pesticides used in paddy fields, since my house is near paddy fields.'*

Additionally, residents of Kuala Kedah reported that pollution harmed aquatic life. Pollution caused animal extinctions and reduced fish and seafood production. Mr Amin, a young farmer, explained the effects of pesticides used by farmers on animals in paddy fields. He claimed that:

> *'For the farmers, we used 'racun siput gondang' (pesticide for golden apple snail), which makes the snails drunk and die, but it also affects other animals that live in the paddy fields, such as freshwater fish, and this pesticide stays for two to three days. I often saw many fish in paddy fields die due to the pesticides used by the farmers.'*

Mr Hamid highlighted the problem faced by fishermen due to pollution. He stated that fish and clams were affected by pollution. This led to a decline in fish and clam production. He said that:

'Pollution causes some of the fish to die, which they shouldn't. The fish that aren't mature yet are dead, and the clams in the ground are contaminated by long-term pollution. We observe this frequently: young fish are targeted, they need time to grow, and it takes a long time for fishermen to catch them. When this happens, the catch for fishermen decreases.'

In contrast, Mr Iman, a fisherman with over 20 years of experience, assumed that the pollution did not affect the fish. He claimed that:

'I think the fish is not really contaminated because the plastic waste accumulates near the 'bakat air' (between the surface and deeper water layers). So I think the fish are safe to eat because they are not contaminated with plastics or toxic waste.'

Additionally, the respondents highlighted the impact of pollution on the incomes of fishermen who rely on the sea for their livelihoods. One of the respondents, a fisherman (Mr Hamid), stated that fishermen had to take on other part-time jobs because they could not rely solely on fishing to cover their daily expenses.

'When we go fishing, the sources of the sea decrease, and our daily expenses are limited. We need to have other initiatives, such as finding part-time jobs to cover our daily expenses at home; we cannot just hope for a catch because the fish in the sea keep decreasing.'

Another fisherman respondent supported him. Mr Ali mentioned that:

'For fishermen, pollution has led many to shift to land-based work. Some fishermen have not gone to the sea for a long time, and some have retired, jobless, and changed professions. It is because when they go to the sea, they cannot catch any fish, they face less income, and expenses exceed income, so the fishermen change to other jobs.'

Additionally, another respondent indicated that pollution limited outdoor activities and disrupted work hours. Mr Badrul, a 55-year-old farmer, explained that, because of the hot weather and the use of pesticides by the drone, his working time was shortened, and as a result, he could finish his work on time. Mr Badrul clarified that:

'Because of pollution, the environmental temperature increases. For example, we go to the paddy field at 7 a.m. and need to return home before 10 a.m., as we cannot work for long in the hot weather. However, it was different before this; we could be in the paddy field until 1 p.m. It has shortened our working time in the paddy field, and we cannot finish our job on time. Moreover, nowadays, people use drones to spray pesticides, so we need to go home because it interferes with our work in the paddy field.'

DISCUSSION

Various human activities contribute to pollution in Malaysia's lower estuary region, including tourism, commercial fishing, seafood processing, recreational activities, sand mining, boat manufacturing, construction, and coastal businesses such as restaurants (Taha et al., 2021, p. 7). Furthermore, poor plastic waste management leads to one to two million tonnes of plastic waste entering the oceans each year, worsening environmental impacts (Ritchie et al., 2023). A study of river pollution in Terengganu found that local residents' negative attitudes

and behaviours toward rivers, such as waste dumping, contribute to pollution (Ismail et al., 2023). Consequently, the present study was conducted to explore residents' perceptions in Kuala Kedah, Malaysia, regarding the causes and effects of pollution on the community and ecosystem.

Overall, the study found that most residents of Kuala Kedah identified poor waste management as the primary cause of pollution. This was preceded by other sources of pollution in the area, including open burning, pesticide use, oil spills, and improper disposal of toxic waste by residents. The study also observed plastic and solid waste on the ground near the beach and along the coastline. Its findings on farmers' traditional practice of burning harvest residue to prepare land for new planting align with Puteh et al. (2024), who identified open burning from agricultural activities as the primary source of air pollution in Malaysia. Consequently, the study recognised that open burning from farming practices poses a significant problem in rural areas, contributing to air pollution and climate change.

Additionally, the research found that pesticide and fertiliser use, as well as toxic waste disposal, contribute to pollution in rural regions such as Kuala Kedah. Human activities related to agriculture, particularly the use of chemicals such as pesticides and biosolids, have been identified as causes of water pollution (Zahoor & Mushtaq, 2023). Qu (2020) also reported that sewage discharges from chemical companies, a common issue in coastal cities, frequently cause water pollution.

Furthermore, pollution causes severe impacts on the environment, human well-being, and the economy. This study explored public perceptions of pollution's effects, focusing on health, income, tourism, ecosystems, jobs and employment, and recreation. Most respondents agreed that pollution negatively affects human health. This aligns with the Health Effects Institute's (2024) findings that air pollution harms human health, leading to conditions such as asthma, cardiovascular disease, and respiratory diseases. Respondents consistently associated pollution with an increase in various diseases, including skin conditions, cancer, asthma, influenza, and fever. This indicates that public awareness of pollution as a health risk is relatively high.

The study respondents recognised the environmental impacts of pollution, such as ecosystem disruption and biodiversity loss. They also expressed concern about how pollution affects aquatic ecosystems, natural habitats, and the climate. For example, Taha et al. (2021) highlighted the effects of microplastic pollution on marine and terrestrial ecosystems. Poor management of plastic waste contributes to environmental pollution, with between 1 and 2 million tonnes of plastic entering the oceans, threatening wildlife and ecosystems (Ritchie et al., 2023).

Furthermore, the findings highlighted the impacts of pollution on respondents' economic and employment outcomes. They recognised pollution as a factor affecting tourism and job opportunities. The findings indicated that those dependent on the natural environment, such as fishermen and farmers, were most affected by pollution, resulting in reduced employment and lower incomes. Water pollution also caused ecological imbalance and threatened fishermen's socioeconomic status. Fishermen relying on the Saraswati River faced financial difficulties due to pollution, which decreased fish productivity and hindered their ability to meet daily food needs (Panigrahi & Pattnaik, 2020).

Additionally, pollution restricted outdoor activities. Climate change further limited outdoor work and recreation to avoid exposure to hot weather, disrupting daily routines. Yang

(2020) demonstrated that polluted air affects physical activity and outdoor leisure sports by encouraging avoidance of contaminated areas. Villagers faced challenges in livelihoods, including fishing and seaweed farming, due to ocean plastic pollution (Phelan et al., 2020).

This study examined perceptions of pollution and explored individual experiences of its causes and impacts among Kuala Kedah residents. The study translated perceptions by contextualising them through sociological and anthropological theories, namely Julian Steward's theory of cultural ecology and Ulrich Beck's risk society theory. It is determined that human activities were the principal cause of environmental pollution, affecting human health and socio-economic conditions.

From the perspective of cultural ecology theory, Julian Steward emphasised that the environment plays a crucial role in shaping society and behavioural patterns, thereby adapting to resources, technology, and social organisation. The findings revealed that people were aware that human activities and lifestyles significantly contributed to environmental degradation. The widespread use of plastic and toxic waste was regarded as a factor that could influence human behaviour and culture, necessitating societal adjustment. For example, the respondents had adapted to pollution, and the development of technology and social organisation demonstrated that the environment had influenced societal cultural practices.

Conversely, Ulrich Beck's risk society theory highlights that modernisation has introduced new forms of global risks, resulting in societal adjustments. Beck (1992) asserts that the environment is endangered by contemporary risks associated with human activities, including pollution, climate change, and nuclear and radioactive hazards. In this study, respondents expressed concerns about pollution from human activities, which disrupt ecosystems, pose health hazards, drive economic decline, and cause other adverse effects. This demonstrates that pollution harms the environment and natural ecosystems, which, in turn, affects people's health and social life.

CONCLUSION

The research aimed to examine residents' perceptions of pollution and its effects on communities and ecosystems in Kuala Kedah. Analysing people's experiences with pollution, their awareness levels, contributing factors, and impacts provided a thorough understanding of how environmental issues are perceived. The study revealed significant gaps in awareness and differences in perceptions of pollution across occupations and characteristics. It also found that the adverse effects of pollution on ecosystems and communities were more readily recognised among individuals with exposure to environmental education. Additionally, the area of study was important for understanding how rural residents approach ecological preservation.

The findings of this study emphasise the significance of the environment to society. This could eventually inform the development of educational campaigns and government policies. Moreover, this research will contribute to future studies exploring how public behaviour and activities influence environmental pollution. There are some limitations to this study. It focused exclusively on a rural area and involved a small group of respondents. As a result, it may not have captured all aspects of pollution factors and effects in urban areas, or the perceptions of different occupations or professions. Therefore, further research is necessary to gain a more comprehensive understanding of pollution in other regions.

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