

# Elevating the Community-Based Approach towards River Management: A Case Study of Squatter's Community in Inanam-Likas River Basin in Sabah, Malaysia

Ramli Dollah, Adi Jafar, Marsitah Mohd Radzi, Nordin Sakke, Mohammad Tahir Mapa and Amrullah Maraining  
Universiti Malaysia Sabah

**Submit :** 2022-09-20

**Received:** 2023-11-11

**Accepted:** 2023-12-30

**Key words:** Community;  
Inanam-Likas river;  
Pollution, SDG; Malaysia

**Correspondent email:**  
[ramlid@ums.edu.my](mailto:ramlid@ums.edu.my)

**Abstract** River pollution is one of the major threats to the environment worldwide, especially in developing countries such as Malaysia. Despite numerous actions, policies, and efforts to alleviate river pollution, the issue continues to threaten environmental sustainability. Drawing from the case study of the Inanam-Likas river basin on the western coast of Sabah, Malaysia, this paper advocates for an enhanced and inclusive approach to squatter communities in river management. This paper emphasises the importance of adopting a multi-stakeholder partnership, aligning with the principles of SDG17 from the Global Partnership for Sustainable Development. It argues that it is essential to recognise squatter communities residing along the riverbanks as key stakeholders, alongside governmental and non-governmental agencies, in the comprehensive management of river ecosystems. This study uses qualitative methods, including field observations, library research, and interviews. A total of 36 participants, including enforcement officers, policy makers, community leaders, and squatter residents, were interviewed to gather insights and information about river management and pollution in this area. Findings from the study reveals that, despite various efforts to address the issue of river pollution in the Inanam-Likas river basin, employing diverse approaches such as enforcement measures, the implementation of waste management technology, and several other strategies, the current initiatives are not proving to be sustainable in effectively managing this complex challenge. The study underscores the need for a more nuanced and sustainable approach that addresses the root causes contributing to river pollution in this area. Hence, this study advocates for a community-based approach to river management policy, facilitated by local authorities and relevant agencies. The absence of support from squatter communities undermines the implementation of effective mitigation strategies and essential policies for river management, thereby presenting a substantial challenge to environmental sustainability due to the persisting threat of river pollution.

©2023 by the authors Indonesian Journal of Geography

This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY NC) license <https://creativecommons.org/licenses/by-nc/4.0/>.

## 1. Introduction

Rivers play a pivotal role in sustaining crucial natural resources essential for various aspects of human life. It serves as indispensable conduits, providing water for all kinds of domestic use, industrial, agricultural activities, energy and making significant contributions to economic development (Hamid et. al. 2011; Neruda et. al., 2012). A river will uplift the geo-strategic of a certain location as the surrounding areas will be potentially to be developed due to their proximity with the river. Indeed, this development will help to revitalise economic growth throughout its surrounding areas. Hence, effective river management is essential to ensure the lasting utility of rivers for the betterment of human well-being. In this light, river management refers to how local authorities and related key actors orchestrated relevant public policy and decision-making related to the management of the river. Undoubtedly, river management should be reasserted continuously as one of the most critical issues in preserving natural resources (Postel & Richter, 2003; Arthington et al., 2010; Atazadeh et al., 2020). The environmental crisis including river pollution has become more prevalent globally and Malaysia is not an exception in confronting the same environmental calamity.

According to the UN World Water Development Report (2022) river pollution is prevalent all over the world (UNESCO, 2022). Almost all state governments in developing countries such as Africa, Asia, and Latin America are at stake in dealing with the crisis of river management. The financial limitations particularly concerning river conservation further impede the effort to contain the river pollution (Conrad & Daoust, 2008; Rosenzweig et al. 2018; Chaudhary & Walker, 2019; Walker, 2020). The situation deteriorates when the conventional top-down approach, which has been prevalent globally, undermines the effectiveness of efforts to address river pollution (Mormont, 1996; Johnson, 2013; Homsy, et. al., 2019; Ouyang et al., 2020).

Previous studies emphasises that industrial and agricultural activities, coupled with sewage waste, stand out as the primary culprits of global river pollution (Samanta, 2013; Arif et al., 2020; Karaouzas, 2016). However, the process of urbanisation attract migration who later become increasingly recognised as a significant contributor to pollution (Jafar et al., 2016; Qin & Liao, 2016; Md Hashim & Man, 2018; Wang et al., 2020). Migration, a global phenomenon involving people moving from one country to another or from rural to urban

areas, often results in the formation of squatter settlements, especially in large cities. In developing countries, the economic disparity between urban and rural areas leads to a higher concentration of people in urban and illegal squatter settlements. This issue is exacerbated when these squatter settlements are concentrated along riverbanks, a pattern observed in various Asian countries. Consequently, squatter settlements and river pollution have emerged as significant challenges, particularly in developing countries (Zhou & Yang, 2014; Saenchat et al., 2019; Marasini & Chidi, 2021). Likewise, in Malaysia, the relationship between squatter settlements and river pollution is recognised as a major issue in the country (Weng, 2005 & 2012; Ismail et al., 2011).

Squatter settlements refer to residents illegally inhabited either on private land or government land (Aiken et al., 1981). The presence of squatters' settlement complicates social problems and economic planning towards local authorities. In Malaysia, the increase of squatter settlements, especially in urban area is a major contributor to the rivers problem adversely affects the urban ecosystem (Md Hashim & Man, 2018; Weng, 2005, 2012). The attitudes of communities residing along river areas significantly contribute to river pollution, as evidenced by the squatters' communities directly dumping domestic waste, including sewage and garbage, into the river (Nayan et al., 2009; Ismail et al., 2011). Kuek et al. (2016) argue that squatter areas contribute to various forms of problems in Malaysia. In their study, the authors suggested the need for tighter regulation in related policies to the environment carried out by the government such "zero squatters" "creating affordable houses", "constant enforcement", among others. Revising these policies will certainly help the government address the consequences of squatters' settlement towards the environment.

In Sabah, squatter settlements are identified as the main cause of river pollution (Ladoni, 2009). These settlements contribute to an unclean environment by dumping waste around the river and lacking proper sanitation and sewage systems. Without a sewage system, waste is often discharged into the sea, posing a significant environmental threat. This problem is widespread in coastal squatter settlements in Sabah (Dollah & Abdullah, 2018).

The increment of squatter settlers further complicates the problem. In February 2020, the Sabah Local Government and Housing Minister, Jaujan Sambakong, stated that there were about 227 squatter areas with a total population of 153,188 throughout Sabah. Kota Kinabalu district is leading the list with 54 squatters' settlements inhabited by 34,17 total population, followed by Sandakan with 34 squatters' settlements with 29,192 people, Tawau with 28 squatters settlements with a total of 15,079 people, and Semporna 18 squatters settlement with (31,292). In Lahad Datu, there are 14 squatter settlements with 21,084 people, while in Beluran, there are 2,640 people, and in Putatan, 10 squatter settlements with 2,206 people (Daily Express, 28 Feb 2020).

Similarly, in the Inanam-Likas river basin, the escalating growth of the population in the riverbank intensifies the challenges of pollution in this are (Ladoni, 2009). Based on the census by DBKK in 2013, there are several major squatters' settlements on the coast of the Likas River. For instance, there are 137 houses in Kg. Muhibbah Likas with a population of 757 people, 85 houses in Kg. Bakau Likas, and 132 houses in Kg. Cempaka Likas with a population of 739 people. However, one of the challenges in addressing the squatter issue is

that not all squatter areas are inhabited by undocumented migrants, as it is generally understood. Instead, there are many local people residing in the area. According to the 2013 DBKK census, several squatter villages in the Likas-Inanam River are predominantly drawn by locals. This illustrates that the factor of nationality, either local or illegal immigrants within the squatters' community are ill-suited to understand the reasons that permeate river pollution throughout the riverbanks in Sabah.

While squatters' settlements significantly contribute to river pollution, their exclusion from decision-making and policy reform processes hinders efforts to address pollution effectively. This paper, drawing insights from the Inanam-Likas River Basin case study, explores the importance of involving squatter communities and their potential contributions to river management. Although past researchers have identified the role of squatter communities as one of the potential stakeholders in pollution-related issues, their inclusion was not specifically discussed. Similarly in the context of Malaysia, the mechanism for the inclusion of the squatter's community as one of the stakeholders of river basin management also remains unclear (Weng 2005; Ismail et. al 2011).

Therefore this study advocates for a community-based approach, which will be addressed in further depth later, is seen as a viable alternative to a more practical river management strategy. This aligns with the 2030 Agenda for Sustainable Development and the Sustainable Development Goals (SDG), particularly SDG 17, which explicitly calls for enhancing the Global Partnership for Sustainable Development and emphasises the importance of multi-stakeholder partnerships in achieving this goal (United Nations, 2019). In this context, it is recognised that any actor involved in addressing this issue must collaborate to achieve the goal. Consequently, the squatter communities residing in the vicinity of the riverbanks, contributing to the problem of river pollution in the context of this study, are identified as crucial stakeholders that need to be prioritised in addressing the issue. This is important because several studies in Malaysia and developed countries suggest that communities may lessen this problem via cost-effective management while also effectively addressing other issues, particularly those connected with political constraints (Weng, 2005; Cliche & Freeman, 2016; Forrest et al. 2020).

## 2. Methods

This exploratory qualitative study incorporates an array of data gathering strategies. The collection of primary data involved the use of background information questionnaires (Part A), in-depth interviews (Part B), and on-site observations of squatter communities located along the riverside in the Inanam-Likas River basin. Participants received a Participant Information Sheet (PIS) providing a concise overview of the research background and study context. Additionally, they were given an Informed Consent Form (ICF) that required their signature, indicating their voluntary agreement to participate in the study. Participants were assured of the confidentiality of their identities. The primary focus of the Part A questionnaire was to gather essential demographic information from the participants. These data play a crucial role in identifying and comprehending the characteristics and socioeconomics of the population in this area.

Once completing the Part A surveys, face-to-face interview sessions were held at the convenience of the participants. The interviews were conducted in Malay. The interviews normally

lasted between 20 to 90 minutes, and they were carried out by research team members proficient in qualitative research methods. These interviews were guided by semi-structured questions and captured through the use of audio recording equipment. To uphold confidentiality, participants' identifiers were removed from the transcripts and replaced with "P" code. This segment aimed to explore their perspectives on river management and their perceptions of the squatter groups' involvement in addressing the pollution issue in the Inanam-Likas river basin.

Furthermore, fieldwork and observations were carried out multiple times between January 2020 and December 2021, with a particular emphasis on two predominant squatter settlements in the Inanam-Likas river basin - specifically, Kg. Cempaka and Kg. Gosong. These on-site observations played a crucial role in aiding researchers, particularly in gaining insights into the behaviour and attitudes of the residents regarding waste disposal and pollution issues in the respective areas.

Meanwhile, secondary resources were obtained through library research strategy. Several platforms and database, such as Scopus, WoS MyJurnal and Google Scholar are used to collect information on previous research. There are several key search criteria to identify the theme of this research, such as (1) "community involvement", (2) "river management issues", and (3) "squatter problems". Such relevant keywords are used to collect information on community engagement, such as "community approach" and "community participation". Simultaneously, keywords such as "water management", "river pollution", "squatters" and "immigrants", among others were used to obtain materials related to river-related issues and squatter problems.

As mentioned earlier, this paper investigates into the context of river pollution, focusing on the surrounding localities within the Inanam-Likas River basin. Although the

Inanam-Likas River basin is connected with the Darau River, this study excluded the latter as pollution in the Darau River is less severe than in the Inanam-Likas River basin. In addition to this, the exclusion of the Darau River is also based on the large proportion of squatter settlement of Inanam-Likas River compared to the Darau River. The Inanam-Likas River basin is situated at approximately longitude 137°30'03.88" E and latitude 13°07'34.17" N, extending to longitude 137°35'07.62" E and latitude 13°02'15.58" N (Ladoni, 2009). The Inanam-Likas River covers an estimated area of approximately 5,899 sq km. Noteworthy villages situated along the riverbanks in the squatters' settlements area include Kg. Gosong, Kg. Cempaka, Kg. Cenderamata, Kg. Bakau, Kg. Likas, and Kg. Sg Darau. The figure 1. illustrates the precise location of the Inanam-Likas River basin and the villages lining its shores.

**Target Participants**

The primary emphasis of this study centres on the policy makers, enforcement agencies, village management committee and squatter residents in the Inanam-Likas River Basin. For the squatters resident, to guide the interview process, specific inclusion/exclusion criteria were established, requiring participants to have lived in the riverbank villages for more than 3 years, be 18 years old and above, and be proficient in Malay. A total of 31 participants comprised squatter residents from two squatter villages, namely Kg. Gosong and Kg. Cempaka. Among them, 18 participants were from Kg. Gosong, while 13 participants hailed from Kg. Cempaka. Additionally, the study also conducted interviews with 2 representatives, each serving as a chief village committee for the respective villages.

Furthermore, interviews were conducted with three representatives from the local government, specifically from the Kota Kinabalu City Hall (DBKK). The selection of DBKK as a participant in this study is based on its responsibility for managing issues related to the interests of the local area. It not

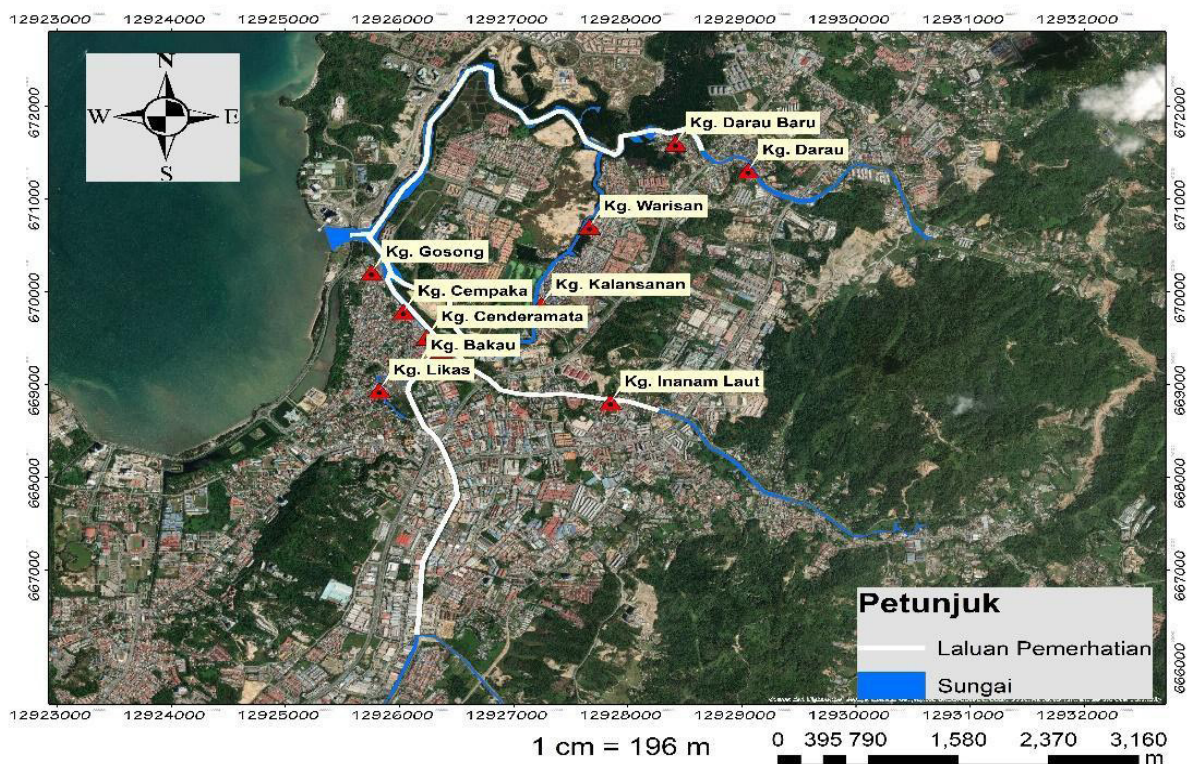


Figure 1. Village and Squatters' Settlement location in the Inanam-Likas River Basin  
Source: Fieldwork, 2020/2021

only serves as a policy-maker but also as an enforcer of these policies. Therefore, engaging this group in understanding river management issues in the area is pivotal. Hence, a total of 36 participants were successfully interviewed in the study, consisting of 2 enforcement officers, a policymaker, 2 village committee leaders, and 31 squatter residents. The inclusion of diverse perspectives from these participants (squatter residents, policymakers, enforcers, village residents, and village management committee) will assist the researcher in analysing how to comprehend the issues that arise between these different parties.

### **Data Analysis**

All interviews were transcribed verbatim and thoroughly crosschecked against the audio recordings by members of the research team to ensure accuracy. The information was then categorised into specific themes and integrated with findings from other methods, such as background surveys, observations, and secondary data from library research. These themes were subsequently refined using quotations from the participants. This combined approach aims to comprehensively explore key themes related to river pollution and management challenges in the specified area including the exploration delves into comprehending the role of a community-based approach across various sectors, particular attention is given to recognising limitations in river management, especially in the context of the Inanam-Likas river basin and finally, these findings contribute to the author's advocacy for the community's inclusion as a pivotal stakeholder in the management of the Inanam-Likas river basin.

### **3. Result and Discussion**

Examining the ethnic composition, the majority of participants belong to the local Bajau community (66.7 percent), Suluk (15.2 percent), Iranun (9.1 percent), Bugis (6.1 percent), and Dusun (3 percent). In terms of education, 48.5 percent of participants have completed secondary education, while 30.3 percent have not received any formal education. Additionally, 12.1 percent attended only primary school, and a smaller percentage, around 9.1 percent, pursued higher education at the college or university level.

The squatters' community is consistently linked low-income groups, which impedes their full engagement in any programme initiated by government (see for example Mpofo, 2012; Marasini & Chidi, 2021). Based on the total number of participants documented during the fieldwork, the average income of the population in squatters' settlements varies. This variation has been meticulously recorded during the fieldwork. The study reveals that the earnings of the population in this area range from RM500 to RM1,000 (24.2 percent) and those earning between RM1,500 and RM2,000 (21.2 percent) of the population. About 6.1 percent of participants earned an income below RM500. Based on these income data, it can be stated that the majority of the population living in the Inanam-Likas River consists of low socio-economic backgrounds. This is important because these factors will greatly influence how the population will react and respond to the possibility of their inclusion as a possible stakeholder in river management.

River pollution is a common problem that has existed for a long time throughout all states in Malaysia. According to the Malaysian Department of Environment (2017), derived from a comprehensive analysis of 5,697 samples of river water collected from 891 manual monitoring stations spanning

477 rivers nationwide, there was a 1% rise in river pollution compared to the preceding year, 2016.

Out of 46%, accounted for 219 out of 477 rivers that have been monitored show a clean quality water index. The remaining 207 (43%) of the rivers have been moderately polluted, while 11% were severely polluted. This report also found that the Likas River is categorised in class III, as semi-polluted, and the Inanam River is ranked in class II of the water pollution index. Existing studies identified various reasons why these river basins are polluted. These include industrial factors, the existence of villages on the riverbanks, squatter issues, and several other factors (Ladoni, 2009; Weng, 2005 & 2012). However, it is noteworthy that, in the Inanam-Likas Basin, squatter settlements are considered the most significant root of this problem. The observations along the river and within squatter areas undeniably demonstrate a substantial contribution of the squatter settlements to river pollution in the surrounding area. The results point to residents in this community utilising the river as a primary dumping site for all types of waste.

### **Community Concept and Community-Based Approach**

Community is frequently characterised as a social group sharing common qualities, interests, or geographical proximity. This definition encompasses a sense of affiliation, reciprocal support, and interaction among its members, cultivating a collective sense of belonging and overall well-being. Researchers underscore that communities can take various forms, such as geographical communities, online communities, or communities of interest, each displaying unique dynamics and effects. Communities are groups of people or organisations with diverse characteristics connected by social bonds, sharing similar perspectives, and engaging in joint action. They often exist in the same geographic location and play a significant role in the management of natural resources, including river-related issues (see for example McMillan & Chavis, 1986; Baland & Platteau, 2000; MacQueen et al., 2001; Musavengane & Simatele, 2017; Saenchat et al., 2019; Bauwens et al., 2022).

Therefore, based on this, one can contend that a society comprises a diverse array of beliefs, interests, shared values, and commitments. This is what brings members of a community of various races, faiths, occupations, and living standards to live together. As such, the squatter community can be seen as a collection of human groups that engage in mutual interaction. Interactions between individuals in a community and their surrounding environment create what is known as "community ecology". It is widely accepted that community participation is critical to the success of any joint government-community program, as it enhances project efficiency, effectiveness, and sustainability (Baland & Platteau, 2000; Piper, 2005; Kayat & Nor Ashikin, 2006; Sten Hansen & Mäenpää, 2008; Carr, 2015; Musavengane & Simatele, 2017; Saenchat et al., 2019; Saat, 2019). Hence, recognising squatter communities as a crucial stakeholder in comprehending this issue positions them significantly in river sustainability management. This underscores the importance of employing a community-based approach to understand their role effectively.

Understandably, the community-based approach refers to how the community will actively participate in expressing their opinions and problem-solving toward their common interests. These strategies are grounded in the belief that local communities possess the knowledge and capacity for action

and change. However, the effectiveness of these strategies is not universally guaranteed and can be influenced by factors such as coordination, collaborations, and community engagement. Despite these challenges, community-based approaches have the potential to result in more equitable and just decisions, context-appropriate innovations, and lasting impacts. The community-based approach entails active community participation in expressing opinions and problem-solving for common interests. This mechanism anticipates communities actively planning, developing, and solving issues, including environmental concerns, through preventive methods and intervention strategies. Nevertheless, this requires communities to identify factors causing problems, formulate potential solutions, and collaborate to address the issues effectively (Van Bibber, 1997; Wenger & Snyder, 2000; Wismer & Mitchell, 2005; Sen, 2016; Rey-Mazón et al., 2018).

On the other hand, the community-based approach is not a recent idea since it is widely used in various sectors such as community involvement in tourism (Kayat & Nor Ashikin, 2006; Butler & Hinch, 2007; Lau, Kabu, Lobang, 2019), environmental issues and river management (Mullikin & Smith, 2002; Wismer, 2005; Ablah et al., 2016; Commodore et al., 2017); conflict and natural disasters (Maskrey, 1989; UNHCR, 2008; Kelman & Mercer, 2014; De la Poterie & Baudoin, 2015; Acosta et al. 2018; Abdul Rahman, 2018; Shafiei Moghaddam et al., 2023); health programme (South, et al., 2019; Shafiei Moghaddam et al., 2023) and urban development (Vidal, 1995; Supriyanto et al., 2021). Several other studies argue there is a need for the inclusion of the relevant stakeholders in the issue of river sanitation to alleviate river contamination (Piper, 2005; Weng, 2005; Carr, 2015; Sten Hansen & Mäenpää, 2008; Ismail et al., 2011; Sen, 2016; Saenchat, et al. 2019; Ouyang, et al. 2020). However, the engagement of communities has been minimal in the context of river management especially in squatter areas, as discussed in this paper.

### ***Assessing strategies for river pollution mitigation in the Inanam-Likas river basin***

This study explores several initiatives taken aimed at mitigating the pervasive pollution in this area. Regrettably, despite the multifaceted attempts, their effectiveness has been compromised, failing to attain their objectives due to a several critical factors. Noteworthy among these endeavours are enforcement, Garbage Bin Preparation and the Communal Cleaning Campaign, Resettlement and Relocation of the Squatters Area, the Garbage Trap Technology and Gazette Policy of the Squatter Settlement. This section systematically examines the concerted efforts and inherent challenges to the river management in the Inanam-Likas river basin.

#### ***a. Enforcement initiatives and the concurrent challenges***

One of the strategies to deal with the issue of river pollution in this area is through the implementation of law and regular enforcement by relevant agencies (Interview P34, 15 Jan. 2020 & P36, 13 Feb 2020). Even among the participants who are squatter residents in this area believe that the regular presence of enforcement agencies might alleviate the river pollution (Interview, P3, 15 Feb 2020; P10, 7 Mar 2020; P14, 11 Jul 2021). The prevailing mind-set within the public sphere within the local residents in this area appears to attribute the entire management of the Inanam-Likas River to the local authorities, notably the City Hall of Kota Kinabalu (DBKK). There exists a perceptual inclination that no other entities are as prominently

acknowledged for their dedication to environmental preservation through the dual avenues of law enforcement and conservation endeavours as the DBKK. This perspective underscores a notable reliance on the DBKK, emphasising its perceived centrality in the collective consciousness concerning the river's governance and ecological sustenance (Interview P13, 10 Jul. 2021 & P29, 27 Nov. 2021). Unfortunately, contrary to such perceptions, empirical findings derived from fieldwork observations and insights articulated by community leaders in this area demonstrate a difference from this assumption. The presence of local enforcement agencies, ostensibly assumed to serve as a deterrent, has not effectively deterred the dumping of waste into the river as seen in the Inanam-Likas river basin (Interview, P1 & P2, 11 Jan. 2020).

The effectiveness of local authorities' enforcement efforts is hampered by inconsistencies, thereby impeding financial resources and the overall implementation of enforcement programs. The execution of laws and agency enforcement in addressing river-related issues is constrained not only by financial limitations but also by the availability of human resources. This is exemplified by the presence of enforcement agency personnel responsible for consistently and effectively executing the policy, as highlighted in interviews (P34, 15 Jan. 2020 & P36, 13 Feb. 2020). Additionally, enforcement policies are predominantly influenced by the social and political priorities set by head of a department; make it difficult for the enforcement agencies in maintaining consistency in their operations (Interview, P34, 15 Jan. 2020). Although consistent enforcement is seen as critical in addressing the problem of river pollution in the Inanam-Likas River basin, it is also a difficult issue to implement due to financial constraints and limited workforce capacities.

#### ***b. Garbage Bin Preparation and the Communal Cleaning Campaign***

Apart from that, the DBKK also led communal cleaning work campaigns, including the provision of garbage bins in the river basin. Various activities have been carried out to clean the riverbank area. The communal cleaning work known as 'Gotong-royong' is held almost every year (Interview, P1, 11 Jan. 2020; P7, 16 Feb. 2020; P10, 7 Mar. 2020; P21, 25 Aug. 2021; P36, 13 Feb. 2020). During the communal cleaning work that was carried out in 2019, it was a successful campaign, and it gained positive feedback from a variety of parties (Interview, P1, 11 Jan. 2020). However, in 2020, it was cancelled due to the threat of the COVID-19 pandemic and subsequent declaration of the Movement Control Order (MCO). Apart from that, a series of door-to-door campaigns by the DBKK were also conducted for the same reason.

Unfortunately, this practice is limited to the squatters' area that is promulgated as a gazetted village (Interview, P1 and P2, 11 Jan. 2020). Therefore, squatter settlements along the Inanam-Likas River, such as Kg. Gosong, Kg. Cempaka, Kg. Cenderamata, Kg. Bakau, Kg. Likas, and Kg. Sg Darau, that have not been officially gazetted are facing a significant lag in benefiting from various social programs initiated by local authorities. One participant involved in this study expressed the perception that exists within the government and the public, perceiving the majority of residents in these squatters' settlements as "illegal immigrants who should be get rid and sent back to their home countries ... instead of engaging and educating them" (Interview, P3, 15 Feb. 2020). However, the community leader in this area contradicts this perception,

asserting that not all residents in these settlements are illegals (Interview P1 & P2, 11 Jan. 2020).

Several reasons prevent the local authorities from fully engaging with the squatters' community. These are because the area is difficult to access, the village is not well regulated, and many others (Interview, P34, 15 Jan. 2020). However, the exclusion from social programs has the potential to impact communities of squatters across various villages in the Inanam-Likas river basin, particularly in terms of their awareness regarding pollution and river management. This exclusion contributes to the persistent issue of continuous waste disposal in the affected areas, making the problem of river pollution increasingly critical. Moreover, interview participants also highlighted that it has become a culture for residents in this area to dispose of their waste directly into the river. "It's not wrong because everyone throws their rubbish into the river" (Interview, P7 to 16 Feb. 2020). It is not surprising, then, if there is a perception that the community and the surrounding squatter settlements are the main contributors to the sanitation and pollution problems in the Inanam-Likas River.

#### *c. Resettlement and Relocation of the Squatters Area*

The issue of squatter settlements represents a critical concern within the context of the state of Sabah. This is due to the fact that, in addition to social issues such as crime, illegal electrical and water connections, and various other challenges, squatter areas, especially those situated along riverbanks or in water villages, are considered contributors to problems related to waste, cleanliness, and pollution (Kuek et al., 2016; Miwil, 24 May 2023). Furthermore, among enforcement agencies, especially municipal authorities, resettlement and relocation of squatter settlements were common strategies to deal with the issue (P35, 12 Feb 2020). A similar perception can be found among political parties and the general public in the state, where there is a consensus that the resettlement and relocation of squatter areas represent the best approach to managing river pollution (Miwil, 24 May 2023; Kuek et al., 2016).

However, although the relocation and resettlement of squatter settlement are seen as the best way to manage the river pollution, previous experiences by the local authorities have shown that these efforts posed a difficult task. The local authority had to bear millions of ringgit for that reason, as this was the case during the administrations of former Sabah Chief Ministers Yong Teck Lee (1996-1998) and Chong Kah Kiat (2001-2003) (Dollah & Abdullah, 2018). During the Chong Kah Kiat administration, the state government implemented a squatter demolition policy throughout the State of Sabah. Although it was initially thought to be effective in addressing the squatter issue in Sabah, the government realised that the squatters' settlements are populated by both local population and foreigners (Wan Hassan & Dollah, 2007). As a result, the government was forced to implement a relocation policy for some of this population, particularly the local people. This new resettlement effort necessitated substantial fiscal spending by the state government, which has sparked local protests from the squatter's community on the new location of their resettlement (Dollah & Abdullah, 2018). As a result, while squatter resettlement is seen as one of the alternatives to manage the pollution issue in Inanam-Likas River, it is also not a practical solution without social awareness and education as they might also emulate similar attitudes in the dumping of waste that will eventually lead to similar pollution problems in the new settlement area (P35, 12 Feb. 2020).

#### *d. The Garbage Trap Technology*

Aside from the engagement of the law and agency enforcement; the authorities have been seen attempting to control garbage in this environment by various techniques, including the use of nets to do away with garbage in the river area. However, as P35 who have an experience work in DBKK for almost 30 years points out, this strategy is a short-term solution that requires a lot of resources because it only addresses problems in the river area without addressing the underlying issues, namely the attitude of the local population (Interview P35, 12 Feb. 2020). Manifestly, while the garbage traps technology strategy ostensibly offers effective strategy in mitigating river pollution, it fails to constitute a sustainable long-term solution. The exacerbating daily accumulation of waste and the concomitant rise in maintenance costs attendant to the management of this technology present formidable challenges. Consequently, strategies for river management should not exclusively hinge upon technological interventions; rather, they necessitate the integration of alternative, more sustainable approaches to deal with this problem effectively over a longer period of time.

#### *e. Gazette Policy of the Squatter Settlement*

Furthermore, there was also a proposal for squatter areas to be gazetted as village areas as a simple way to solve the issue (Doksil, 2020). It assumes that once all villages along the Inanam-Likas River riverbank are gazetted, it will solve the issues. However, the gazetting policy alone is unlikely to solve the pollution predicament in the village. While gazetting may offer immediate relief, a comprehensive plan should go beyond this and encompass continuous monitoring, on-going community education, and periodic reassessment to effectively address the ever-evolving environmental challenges.

The core problem lingers due to a widespread lack of awareness, extending not only to residents in squatter areas but also to those residing within the officially gazetted village (Interview, P36, 13 Feb. 2020). In fact, the prospect of officially gazetting village poses a formidable challenge for the local authorities in the times ahead. This is due to the intricacies involved in expanding the monitored zones for enforcement, a task that is bound to complicate their efforts owing to factors such as a shortage of personnel, financial limitations, and more. As elucidated during an interview (P34, 15 Jan. 2020), participants highlighted that, despite the policy's inception aimed at combatting pollution in the Inanam-Likas River, its execution grapples with various hindrances. These obstacles encompass political interference, financial restrictions, the socioeconomic status of squatter communities, the influx of immigrants in these areas, and a myriad of other influencing factors.

Furthermore, a more pressing concern is that the efforts undertaken by the local authorities are more focused on managing the river's garbage issues. Although a significant sum of money has been used and designated for addressing river pollution, the solution can be considered a short-term measure. This is because the disposal of waste into the river is escalating daily, while the available permanent funding and manpower are insufficient to manage this issue effectively. The management approach implemented in this area, as undertaken by the authorities, is a short-term strategy in addressing this problem, and it is incapable of sustaining a long-term solution. Efforts for the long-term measure to mitigate the root cause of river pollution remain vague. In this regard, P35 indicated that

'mid-set' changes are needed among these societies to resolve the problem of waste pollution (Interview P35, 12 Feb. 2020). Therefore, the inclusion of the squatters' community can be perceived as one of the critical strategies to river pollution in the Inanam-Likas River. This includes their participation in the river cleanliness preservation campaign alongside the coastal river. During the interview, several participants, particularly community leaders expressed a similar sentiment (Interviews P1 and P2, Jan. 11, 2020). Their argument is that the problem can only be solved if people take part in efforts to clean up the river. The claim says that the problem will not go away unless the residents are actively involved in these kinds of programmes. This perspective underscores the centrality of community involvement in effecting substantive change and ameliorating the environmental concerns associated with river pollution. In addition, P2 recognises the need for including the village people in a more comprehensive strategy to solve the situation. This problem has been ongoing and is getting worse every day (Interview, P2, 11 Jan. 2020)

### ***The community-based approach: Participation of the Inanam-Likas River Basin squatters' community in river management***

As mentioned earlier, the active involvement of squatter communities in the management of the Inanam-Likas River is crucial for effectively tackling river pollution in the suburban areas of Kota Kinabalu. It appears imperative that initiatives and strategies shift from a top-down to a bottom-up approach, taking into account the specific interests and constraints of the squatter communities. However, there are challenges in accomplishing the task of involving these squatter communities. As mentioned earlier, these difficulties include the public's mentality, the involvement of local authorities, and the preparedness of policymakers in the state government. Recognising that a community-based approach and the involvement of squatter communities in river management pose challenges, various issues and strategies need to be formulated and executed to attain this objective. Drawing insights from information gathered in this study, this section explores potential strategies to effectively engage squatter communities along the Inanam-Likas River, as revealed in interviews with participants.

#### ***a. Changing the Perceptions of Enforcers, Local Authorities and Policy Makers***

The most challenging task in waste management in the Inanam-Likas river basin is to change the negative perception of the municipal authorities and policymakers at the state government level towards residents of squatters' community. Therefore, if issue of river pollution in this are need to be addressed, strategies to foster the participation of squatter communities in the river basin involves shifting the negative perceptions among law enforcement, local authorities, civil society, and policymakers towards these communities are paramount (Interview P35, 12 Feb. 2020). This is very evident in the context of the squatter community residing in this area, where squatter settlements have typically been viewed negatively by enforcement agencies. Almost all participants among the residents in the squatter area involved in this study acknowledge that they are often perceived as 'aliens' and a problem for the security agencies. Participant 3 (P3), for example, stated,

"It is clear that living in squatter settlements is a constant struggle. The enforcement agencies often view us as outsiders, and this perception becomes a significant hurdle in our daily lives. We are consistently labelled as 'aliens,' and it's disheartening because we are part of this community, facing challenges and striving for a better life like everyone else. There is a pressing need to change this perception and address the issues faced by the squatter community positively."

"For a long time, we have been targeted by the government, especially the enforcement agencies such as police and DBKK, who always accuse us of being the cause of all the problems in this area. We don't even know why ..."

(Interview P3, 15 Feb. 2020)

Meanwhile, P20 asserts that poverty and powerlessness may contribute to this issue. This renders them the 'scapegoat' for all the problems occurring in this area. P20 states,

"I am puzzled as to why the enforcement treats us so poorly. It's as if just because we are poor and powerless, all the issues in this area are blamed on us, from theft problems to the issue of garbage in the river"

(Interview P20, 25 Aug. 2021)

Recognising the existence of this negative perception issue, a change in perspective is necessary among these enforcers towards the squatter residents in this area. This shift is crucial for understanding the challenges encountered by squatter communities and promoting their active participation in various activities, especially communal cleaning initiatives.

The direct impact of this negative perception is that the residents in this area also perceive enforcers, local authorities, and policymakers as their adversaries (Interview P7: 16 Feb. 2020; P10, 7 Mar. 2020). If the perception issue on both sides is not addressed, the situation will worsen, making it increasingly challenging to establish a smart partnership between the two parties. This effect becomes particularly evident when, as a consequence, all social community programs and campaigns initiated by all local authorities only involved the outside community but excluded the squatter community. As squatter communities are increasingly marginalised, they gradually disregard the river as part of their lives, leading to domestic waste and sewage being released into the river, thus causing pollution (Interview P20, 25 Aug. 2021). Apparently, addressing and altering these perceptions is critical for successful community engagement and participation in environmental programs.

In this regard, it believes that all parties; from law enforcement to local government to policymakers, must change their perceptions and recognise this community as one of the most important stakeholders and "assets" toward the sustainability of the Inanam-Likas river basin's (as discussed below). Failure of their inclusion will continue to affect the assumption that the squatter's community is the "number one enemy" of the local authorities, which will further prolong the river pollution in the basin area (Interview P1, 11 Jan. 2020; P2, 11 Jan. 2020). Additionally, the biggest stumbling block in waste management in the Inanam-Likas river is to change the mind-set and attitude of the municipal authorities and policymakers at the state level.

### *b. Turning Squatter Communities into a key stakeholder in river management*

Several preliminary studies have shown that river management needs various engagements from all stakeholders, from the government to the local communities in river sustainability (Mullikin & Smith, 2002; Wismer, 2005; Ablah *et al.*, 2016; Commodore *et al.*, 2017). Similarly previous study in Malaysia also indicates same issue (Weng, 2005 & 2012 and Ismail *et al.* 2011). Building on this foundation, the present study conducted in the Inanam-Likas river basin asserts the necessity of including squatter communities as key stakeholders in the pursuit of river sustainability within the specific context of this area. This community should be regarded as a critical asset in maintaining the river's cleanliness. Their role in this context extends beyond mere acknowledgment; it involves understanding that, as inhabitants of the area, they play a crucial part in influencing the overall environmental health of the river. As we delve into strategies for river sustainability in the Inanam-Likas area, it becomes evident that engaging with and involving the squatter community is not just a necessity but a strategic imperative. By recognising their impact and involving them as stakeholders, we can develop targeted initiatives to address the root causes of pollution and work collectively towards ensuring the long-term cleanliness and ecological well-being of the Inanam-Likas River (Interview, P35, 12 Feb. 2020; P36, 13 Feb. 2020).

Nevertheless, achieving this goal requires time to execute the engagement of a community-based approach. In the context of the Inanam-Likas River, given these squatter communities' socio-economic status and educational backgrounds, this community-based approach should be focused on win-win solutions. However, it needs guidance from other agencies, either municipal authorities or non-governmental organisations (NGOs) to consolidate the engagement with local communities. The squatter residents in this area feel that they cannot bring about transformation without the support. As expressed by P13 during the interview, "We understand the importance of river cleanliness, but we don't know what needs to be done. Here we're just want to survive ... Without support and assistance from all sides, pollution issues in this area will persist" (Interview, P13, 10 Jul. 2021). Another participant mentioned, "... dumping garbage into the river has become a culture for the residents here. We've been practicing this for decade, and it will continue to do it ... unless there is sustained support" (Interview, P29, 27 Nov. 2021).

Recognising this situation clearly indicates that the issues of waste disposal and pollution will persist as long as the community in this area is not actively involved in these activities. They are part and parcel of the problem and, therefore, they should be considered key stakeholders for sustainable river management. As discussed above, despite several initiatives and efforts taken to address pollution problems in this area, these alone will not resolve the issue. The only sustainable approach to managing this problem is through the active engagement of the community. However, understanding that this community lacks agency and cannot act independently underscores their need for support and assistance from all parties. As such, the local authorities or NGOs should initiate a proactive step and action to enable the inclusion of the squatters' communities in river management (P1, 11 Jan. 2020). Evidently, without the assistance of the squatters' community, efforts toward river sustainability will be doomed to fail and the squatters' community will continue their culture and practice of dumping waste into the river.

### *c. Awareness and Educational Campaign*

Awareness and educational initiatives toward greater inclusion can also be consolidated by acknowledging the presence of these squatter communities. This would enable awareness and knowledge among today's generation on the environmental concerns, particularly in rivers sustainability as the lifeblood of human life (Turnbull, 2002). The aim of community awareness and educational campaigns about the importance of rivers and other environmental concerns is to make people more alert to and more informed about the environmental issues that affect their lives. This approach will not only assist them in gaining information that will be helpful in their everyday lives, but it will also enable them to develop expertise, values, and commitments individually and collectively in dealing with issues relating to river sustainability and environmental issues (Samsudin & Iksan, 2015; Saenchat, *et al.*, 2019; Ouyang, *et al.* 2020).

While these efforts appeared to be simple and straightforward, it requires engagement by all parties in the context of squatter communities in the Inanam-Likas River. It is paramount to remember that raising awareness and educating squatter communities is a difficult task as knowledge and socio-economic concerns remain the most stumbling hurdles among the squatters' communities in the river basin because of the socio-economic status of squatters' communities in the Inanam-Likas river basin (Interview P1 & P2, 11 Jan. 2020; P35, 12 Feb. 2020). However according to P35, if public awareness and educational campaigns are well-implemented, carefully planned, and positively involve the communities directly in the program, it would be able to change the mind-set on how communities will think and act about their environment (Interview, P35, 12 Feb. 2020). Indeed, this sentiment was echoed by several participants, particularly resident squatters in this area. They expressed their willingness to actively participate in various activities, embrace collaboration, and engage in socialisation processes with both 'outsiders' and authorities. Moreover, they are open to embracing any changes that can contribute to the common good and betterment for the area (Interview, P3, 15 Feb. 2020; P7, 16 Feb. 2020; P13, 10 Jul. 2021; P20, 25 Aug. 2021; P33, 27 Nov. 2021).

### *d. Employing Persuasion and Intimidation Strategies*

Navigating the active participation of the local population in any initiatives led by authorities poses a significant challenge, primarily rooted in issues of compliance and the community's willingness to embrace change (Sten Hansen *et al.*, 2008; Suhaimi, 2021). This challenge is mirrored in the context of river management within the Inanam-Likas river basin. Previous evidence underscores that engaging resident in squatters area in various programs remains a formidable task for municipal authorities and law enforcement (Interviews P34, 15 Jan. 2020; P35, 12 Feb. 2020; P36, 13 Feb. 2020). This sentiment is echoed by a majority of participants, mostly squatter residents interviewed during this study, who perceive maintaining the 'status quo' as the best option. One participant highlighted the difficulty in altering habits, stating that "changing the habit (dump rubbish into the river) is the most challenging task for residents in this area" (Interview P20, 25 Aug. 2021). Notably, a community leader acknowledged the complexity of fostering voluntary community involvement, attributing the reluctance to socio-economic factors prevalent in the area. The majority of the population grapples with

poverty, rendering the resolution of this issue seemingly insurmountable (Interview P2, 11 Jan. 2020).

Recognising this challenge, several participants in this study believe that a crucial strategy for involving squatter communities is to combine persuasion and intimidation tactics to solve the problem effectively (Interview P2, 11 Jan. 2020; P10, 7 Mar. 2020; P13, 10 Jul. 2021; P34, 15 Jan. 2020). Persuasion encompasses a wide range of activities, including public awareness and educational campaigns. Intimidation refers to an aggressive approach to dealing with this problem, such as law enforcement. Contemporary enforcement and awareness campaigns are used to employ intimidation and persuasion strategies. However, applying these techniques, especially in issues involving squatter communities, would require additional inputs (Interview, P34, 15 Jan. 2020; P36, 13 Feb. 2020).

However, one of the participants recognises that the intimidation strategy is unsuitable in the context of the environment, particularly the cleanliness of rivers in Sabah. P35 who was worked for DBKK explained that this intimidation technique is inappropriate in the case of waste management in the Inanam-Likas river because it could potentially trigger protests (Interview P35, 12 Feb 2020). However, on the other hand, many of the residents of the squatter community as well as their leaders and also enforcement agencies who participate in this study sees it differently. They believe that the persuasion and intimidation technique is the most effective way to deal with the issues. (Interview P1 & P2, 11 Jan. 2020; P3, 15 Feb. 2020; P7, 16 Feb. 2020; P14, 11 Jul. 2021; P29, 27 Nov. 2021; P34, 15 Jan. 2020 & P36, 13 Feb. 2020). Here persuasion tactics will include, for example, changing specific rules and regulations to enable squatter areas to access clean water and electricity like other village areas. Such leverage can both convince and intimidate the residents in this squatter region into protecting and preserving the river's value and its natural environment in the area (Interview, P1, 11 Jan. 2020).

Apart from that, another strategy for intimidation and persuasion is creating a classification of the village zone (Interview, P2, 11 Jan. 2020). In this situation, the cleanliness of the squatter housing areas can be categorised or classified into multiple zone divisions in these squatter villages. It is important to create a monitoring structure to ensure the efficacy of this system, including the organisational structure, whether it is made up of villagers or law enforcement officials. Depending on cleanliness, these zones require monitoring through visitation every 3 to 6 months. This 'zoning' approach is a physiological strategy that includes persuasion and intimidation among these squatter communities. P2 confident that if this strategy is asserted that the meticulous execution of this strategy has the potential to significantly enhance the cleanliness of the Inanam-Likas River within the squatter communities.

#### *e. Turning threat into opportunity: Transforming the squatter community into a cheap and effective workforce*

The socio-economic conditions of the people who live in squatter areas are one of the key obstacles to achieving social cohesion among communities in squatter areas. As previously said, most people in this area earn between RM1,000 and RM1,500 each month. It would be difficult for these communities to survive with this low average income, especially in urban environment. Surviving on such modest earnings is particularly challenging in an urban setting, leaving

little time for community engagement beyond the demands of work and basic survival (Interviews P1 & P2, 11 Jan. 2020; P35, 12 Feb. 2020). This issue, however, can be transformed into potential opportunity. In this situation, the local government might start a new type of employment in cleaning for this community, especially jobs involving collecting trash (Interview P1, 11 Jan. 2020).

This is not impossible to implement since some of the residents of this area are already engaged in the river's garbage cleaning works. Furthermore, it aligns with the existing reality where a significant portion of the squatter community is involved in what is commonly known as 5Ds work (Dirty, Demeaning, Dangerous, Demanding, and Difficult) (Interviews P15, 11 Jul. 2021; P22, 25 Aug. 2021). This strategy is seen not only to clean the river but also to support the sustainable development program of the community. In essence, it offers a viable pathway to address both environmental concerns and socio-economic challenges faced by these marginalised communities.

#### *f. Establishing an informal institution of Squatter Villages Administration*

Traditionally, there is no established institution that oversees the squatter zones. This is because squatter settlements are identified as illegal settlements, so there is no community administration in the area (Interview P34, 15 Jan. 2020; P35, 12 Feb. 2020; P36, 13 Feb. 2020). However, many participants, especially community leaders believe this issue requires a new change because the squatter community can be perceived advantage and a stakeholder in the long-term feasibility and viability of the river's management (Interview P1 & P2, 11 Jan. 2020). The local authorities or state government must take a proactive measure by establishing a squatter community management system to accomplish this aim. This squatter village institution is considered vital, especially in assisting in administering and managing the squatter settlement. While these administrative institutions can be informal, they may function under the supervision of the law enacted by the local authorities. Without having an organisational command system over the squatter community, further problems may arise, not just in terms of river management but also in terms of other concerns in squatter areas. Any programs and policies that include the squatter community can be potentially executed if there is a hierarchy and the community is seen as a significant player (Interview P1 & P2, 11 Jan. 2020).

## **4. Conclusion**

In summary, the discussion highlights the global and particularly pronounced environmental threat of river pollution, with a specific focus on developing nations like Malaysia, exemplified by the experiences observed in the Inanam-Likas river basin. Despite concerted efforts, the study finds that current initiatives, encompassing enforcement measures and waste management technology, lack the sustainability needed to effectively manage river pollution in this area. This realisation underscores the imperative for a more refined and sustainable approach that delves into the fundamental causes contributing to the persistent pollution in the area. The paper strongly advocates for an enriched and inclusive river management approach, placing significant emphasis on the imperative of addressing the challenges posed by squatter communities along riverbanks. Aligning with the principles of SDG17, the study asserts the

need to recognise squatter communities as vital stakeholders alongside governmental and non-governmental agencies in the management of river ecosystems. Furthermore, the research contends that a community-based approach to river management policy, spearheaded by local authorities and pertinent agencies, is essential. It asserts that the lack of support from squatter communities not only hampers but fundamentally undermines the implementation of effective mitigation strategies and policies for river management. This absence of support emerges as a substantial hurdle to environmental sustainability, underscoring the enduring threat of river pollution in the Inanam-Likas river basin. The study, therefore, signals the pressing need for collaborative action and cooperative solutions to address the persistent challenge of river pollution in similar environments.

## Acknowledgement

This article is based on research conducted by researchers at Faculty of Social Sciences and Humanities, Universiti Malaysia Sabah under a grant financed by Universiti Malaysia Sabah (UMS) and DBKK (GKP0029-2019). The authors want to thank all parties who contributed to the success of this research

## References

- Abdul Rahman, H. (2018). Community based approach towards disaster management in Malaysia. *Asian Journal of Environment, History and Heritage*, 2(2): 55-66
- Ablah, E., Carroll, B., Brown, J., & Bronleewe, T. (2016). A community-based participatory research approach to identifying environmental concerns. *Journal of environmental health*. 75(5): 14-19
- Acosta JD, Burgette L, Chandra A, Eisenman DP, Gonzalez I, Varda D, et al. (2018) How community and public health partnerships contribute to disaster recovery and resilience. *Disaster Medicine and Public Health Preparedness*. 12(5): 635-43.
- Aiken et. al. (1981). Squatters and squatter settlements in Kuala Lumpur. *Geographical Review*, 71: 158-175
- Arif, A., Malik, M.F., Liaqat, S., Aslam, A., et. al. (2020) Water pollution and industries. *Pure and Applied Biology*. 9(4): 2214-2224.
- Arthington, A.H., Naiman, R.J., McClain, M.E., Nilsson, C. (2010). Preserving the biodiversity and ecological services of rivers: new challenges and research opportunities. *Freshwater Biology*. 55(1): 1-16
- Atazadeh, E.; Barton, A.; Shirinpour, M.; Zarghami, M.; Rajabifard, A. (2020). River management and environmental water allocation in regulated ecosystems of arid and semi-arid regions – A review. *Fundamental and Applied Limnology*. 193(4): 327-345
- Baland, J.M., Platteau, J.P. (2000) *Halting Degradation of Natural Resources: Is There a Role for rural Communities?* New York: Oxford University Press
- Bauwens, T., Schraven, D., Drawing, E., Radtke, J., Holstenkamp, L., Gotchev, B., Yildiz, O. (2022) Conceptualizing community in energy systems: A systematic review of 183 definitions. *Renewable and Sustainable Energy Reviews*, 156: 111999
- Butler, R. & T. Hinch (eds.). (2007). *Tourism and indigenous peoples*. Oxford and Burlington: Butterworth-Heinemann
- Carr, G. (2015) Stakeholder and public participation in river basin management—an introduction. *WIREs Water*, 2(4): 393-405 <https://doi.org/10.1002/wat2.1086>
- Chaudhary, M. & Walker, T.R (2019) River Ganga pollution: Causes and failed management plans. *Environment International*, 117: 327-338 DOI: 10.1016/j.envint.2019.02.033
- Cliche, L., & Freeman, L. (2016). Applying integrated watershed management in Nova Scotia: A community-based perspective from the clean Annapolis river project. *International Journal of Water Resources Development*, 33(2): 1-17.
- Commodore, A., et. al. (2017). Community-based participatory research for the study of air pollution: A review of motivations, approaches, and outcomes. *Environmental Monitoring and Assessment*. 189(378): 1-30
- Conrad, C.C. & Hilchey, K.G. (2011). A review of citizen science and community-based environmental monitoring: Issues and opportunities. *Environmental Monitoring and Assessment*, 176: 273-291
- Daily Express (28 Feb 2020) Sabah has 227 squatter colonies, total population 153,188
- De la Poterie AT, Baudoin M. (2015) From Yokohama to Sendai: approaches to participation in international disaster risk reduction frameworks. *International Journal of Disaster Risk Science*. 6(2): 128-39
- Doksil, M. (2020). Move to gazette squatter colonies in Sabah as proper villages. *Daily Express*. February 29, 2020
- Dollah, R. & Abdullah, K. (2018) The securitization of migrant workers in Sabah, Malaysia. *Journal of International Migration & Integration*. 19(3): 717-735.
- Forrest, S. A., Trell, E.-M., & Woltjer, J. (2020). Emerging citizen contributions, roles and interactions with public authorities in Dutch pluvial flood risk management. *International Journal of Water Resources Development*, 1-23.
- Homsy, G.C.; Liu, Z.L.; Warner, M.E. (2019) Multilevel governance: Framing the integration of top-down and bottom-up policymaking. *International Journal of Public Administration*. 42: 572-582.
- Ismail, H. et. al. (2011). Sikap komuniti setinggan tebingan sungai: Pencemaran alam sekitar dan pengurusannya. *Jurnal Perspektif*, 3(1): 1-12
- Jafar, A., Mapa, M.T. & Sakke, S. (2016). Impak aktiviti pembangunan terhadap trend kekerapan dan magnitud banjir di lembangan sungai Menggatal, Kota Kinabalu, Sabah. *Kinabalu*, 18: 97-116
- Johnson, T. (2013) The politics of waste incineration in Beijing: The limits of a top-down approach? *Journal of Environmental Policy & Planning*. 15: 109-128.
- Karaouzas, I. (2016). Agro-Industrial Wastewater Pollution in Greek River Ecosystems. In: Skoulkidis, N., Dimitriou, E., Karaouzas, I. (eds) *The Rivers of Greece. The Handbook of Environmental Chemistry*, 59. Springer, Berlin, Heidelberg. [https://doi.org/10.1007/698\\_2016\\_453](https://doi.org/10.1007/698_2016_453)
- Kayat, K. & Mohd. Nor, N.A. (2006). Penglibatan ahli komuniti dalam program pembangunan komuniti: Satu kajian ke atas program homestay di Kedah. *Akademika*. 67(1): 77-102
- Kelman, I. & Mercer, J. (2014). A knowledge integration tool for disaster risk reduction including climate change. Dalam Lopez-Carresi, M., (eds.). *Disaster management: International lessons in risk reduction, response and recovery*, London: Earthscan
- Kuek, J.N., Abdullah, Y.A., Hamdan, H. (2016) Eradicating Squatters through Resettlement Programme: A Conceptual Paper. MATEC Web of Conferences 66, 00023 DOI: 10.1051/mateconf/20166600023 [https://www.matec-conferences.org/articles/mateconf/pdf/2016/29/mateconf\\_ibcc2016\\_00023.pdf](https://www.matec-conferences.org/articles/mateconf/pdf/2016/29/mateconf_ibcc2016_00023.pdf)
- Ladoni, A.M.H. (2009). The sources of pollution in the Likas and Inanam river basin in Kota Kinabalu, Sabah, Malaysia. *Sosiohumanika*, 2(1): 89-106.
- Lau, E., Kabu, M., Lobang, S. (2019) Development of Community-Based Tourism Monbang Village – Alor, Indonesia. Proceedings of the 1st International Conference on Engineering, Science, and Commerce, ICESC 2019, 18-19 October 2019 <https://eudl.eu/pdf/10.4108/eai.18-10-2019.2289941>
- MacQueen, K. M. et. al. (2001). What is community? An evidence-based definition for participatory public health. *American Journal of Public Health*, 91(12), 1929-1938

- Marasini, M. & Chidi, C.L. (2021) Vulnerability Assessment of Squatter Settlement in Butwal Sub-Metropolitan City, *Nepal Journals Online (NepJOL)*. 20(21): 47-58
- Maskrey, A. (1989). Disaster mitigation: A community based approach. Oxfam: Oxford
- McMillan, D.W & Chavis, D.M. (1986) Sense of community: A definition and theory. *Journal of Community Psychology*. 14(1): 6-23
- Md Hashim, N. & Man, S. (2018). Tanggapan, kesedaran dan motivasi masyarakat terhadap penggunaan air hujan sebagai bekalan alternatif bandar. *Geografia*. 14(3): 37-52.
- Miwil, O. (24 May 2023) Sabah DCM says gazetting squatter settlements the most realistic solution. *New Straits Times*. <https://www.nst.com.my/news/nation/2023/05/912980/sabah-dcm-says-gazetting-squatter-settlements-most-realistic-solution>
- Mormont, M. (1996). Towards concerted river management in Belgium, *Journal of Environmental Planning and Management*, 39(1): 131-142
- Mpofu, B. (2012) Perpetual 'Outcasts'? Squatters in peri-urban Bulawayo, Zimbabwe. *Afrika Focus*. 25(2): 45-63
- Mullikin, T.S & Smith, N.S. (2002). Community participation in environmental protection. *UCLA Journal of Environmental Law and Policy*, 21(1): 75-95
- Musavengane, R., & Simatele, D. (2017) Significance of social capital in collaborative management of natural resources in Sub-Saharan African rural communities: a qualitative meta-analysis. *South African Geographical Journal*. 99(3): 267-282
- Nayan, N, et. al. (2009). Perubahan gunatanah dan tahap kualiti air sungai di bandaraya Ipoh, Perak. *Malaysian Journal of Environmental Management*, 10(2): 115-134.
- Neruda, M., Tichonova, I.V., & Kramer, D. (2012). Theoretical and Practical Aspects of Rivers Revitalization. *Journal of Earth Science and Engineering*, 3: 145-154
- Ouyang, J.; Zhang, K.; Wen, B.; Lu, Y. (2020) Top-Down and Bottom-Up Approaches to Environmental Governance in China: Evidence from the River Chief System (RCS). *International Journal of Environmental Research and Public Health*, 17: 7058. <https://doi.org/10.3390/ijerph17197058>
- Piper, J.M. (2005) Partnership and participation in planning and management of river corridors. *Planning Practice and Research*. 20(1): 1-22
- Postel, S. & Richter, B. (2003) *Managing water for people and nature*. London: Island Press
- Qin, H., Liao, T.F. (2016) The association between rural-urban migration flows and urban air quality in China. *Regional Environmental Change*. 16: 1375-1387 <https://doi.org/10.1007/s10113-015-0865-3>
- Rey-Mazón, P., Keysar, H., Dosemagen, S., D'Ignazio, C., Blair, D. (2018) Public Lab: Community-Based Approaches to Urban and Environmental Health and Justice. *Science and Engineering Ethics*. 24: 971-997
- Rosenzweig, B. R., et. al. (2018). Pluvial flood risk and opportunities for resilience. *WIREs Water*, 5, e1302: 1-18
- Saat, G. (2019). "Komuniti", sebagai Konsep dan Metod dalam Penyelidikan Sains Sosial: Tafsiran Sosiologikal. *Akademika*. 89(3): 53-62
- Saenchat, P., Udomkijmongkol, C., Swasthaisong, S., Phosing, P. (2019) Community-Based Natural Resource and Environmental Management in Songkram River Basin, Tha Kon Community, Sakon Nakhon Province, Thailand. *Asian Political Science Review*, 3(1): 89-97
- Samanta, S. (2013). Metal and pesticide pollution scenario in Ganga River system. *Aquatic Ecosystem Health & Management*. 16(4): 454-464. <https://doi.org/10.1080/14634988.2013.858587>
- Samsudin, N.A. & Iksan, Z.I.. (2015). Kesedaran alam sekitar melalui aplikasi sendiri alam sekitar (KAKAS). *Jurnal Personalia*. 18(2): 23-31
- Sen, S. (2016) Community-Based Management Approaches: Towards Sustainable Biodiversity Conservation. *The Beats of Natural Sciences*. 3(2): 1-6 Available at SSRN: <https://ssrn.com/abstract=3633924>
- Shafiei Moghaddam P, Sohrabizadeh S, Jahangiri K, Hashemi Nazari S. (2023) Effective Community-Based Disaster Management Approaches for Promoting the Health of Disaster Affected Communities: A Systematic Review. *Journal of Iranian Medical Council*. 6(1): 4-17.
- South, J., Bagnall, A-M., Stansfield, J.A., Southby, K.J., Mehta, P. (2019) An evidence-based framework on community-centred approaches for health: England, UK. *Health Promotion International*, 34(2): 356-366, <https://doi.org/10.1093/heapro/dax083>
- Sten Hansen, H. and Mäenpää, M. (2008) An overview of the challenges for public participation in river basin management and planning. *Management of Environmental Quality*, 19(1): 67-84. <https://doi.org/10.1108/14777830810840372>
- Suhaimi, S. (2021). Challenges of Public Participation: A Qualitative Study. *South Asian Journal of Social Sciences and Humanities*, 2(5): 100-109. <https://doi.org/10.48165/sajssh.2021.2507>
- Supriyanto, E., Saputra, J., Rachmawati, M., Nugroho, F. (2021) Community Participation-Based Smart City Development. Proceedings of the First Multidiscipline International Conference, MIC 2021, 30 October 2021, Jakarta, Indonesia <https://doi.org/10.4108/eai.30-10-2021.2315776>
- Turnbull, J. (2002). Values in educating for citizenship: Sources, influences and assessment. *Pedagogy, Culture & Society*, 10(1): 123-134.
- UNESCO (2022) The United Nations World Water Development Report 2022: groundwater: making the invisible visible, <https://unesdoc.unesco.org/ark:/48223/pf0000380721>
- UNHCR. (2008). A Community-based Approach in UNHCR Operations. Geneva: UNHCR
- United Nations (2019) Department of Economic and Social Affairs: Sustainable Development Goals: SDG17: Partnerships for the Goals, <https://www.un.org/sustainabledevelopment/sdgbookclub/>
- Van Bibber, M. (1997). *It takes a community*. Canada: Medical Services Branch
- Vidal, A.C. (1995) Reintegrating disadvantaged communities into the fabric of urban life: The role of community development. *Housing Policy Debate*. 6(1): 169-230
- Walker, T.R., (2020) Enforcement Required to Control Sources of Ganges River Pollution (May 13, 2020). Available at SSRN: <http://dx.doi.org/10.2139/ssrn.3599955>
- Wan Hassan, W.S. & Dollah, R.. (2007). Impak kehadiran pendatang Filipina di kampung Air di Sabah, *Jurnal Kinabalu*, 15: 89-114.
- Wang, S., Gao, S., Li, S., Feng, K. (2020) Strategizing the relation between urbanization and air pollution: Empirical evidence from global countries. *Journal of Cleaner Production*. 243: 118615 <https://doi.org/10.1016/j.jclepro.2019.118615>
- Weng, C.N. (2005). Sustainable management of rivers in Malaysia: Involving all stakeholders, International. *Journal of River Basin Management*, 3(3): 147-162.
- Weng, C.N. (2012). Managing urban rivers and water quality in Malaysia for sustainable water resources. *Water Resources Development*, 28(2): 343-354
- Wenger, E., & Snyder, W. M. (2000). Communities of practice: The organizational frontier. *Harvard Business Review*, 78: 139-145.
- Wismer, S., & Mitchell, B. (2005). Community-based approaches to resource and environmental management. *Environments*, 33(1), <https://link.gale.com/apps/doc/A134857443/AONE?u=googlescholar&sid=bookmark-AONE&xid=172b4ab3>
- Zhou, D. & Yang, X. (2014). From migrant workers to new urban migrants: A concept and an approach, *The Anthropologist*, 18(1): 53-63