Biosaintifika 14 (2) (2022): 147-159 p-ISSN 2085-191X | e-ISSN 2338-7610
Journal of Biology & Biology Education https://journal.unnes.ac.id/nju/index.php/biosaintifika

Water Management Practices and Environmental Attitudes of Riparian Communities in Sapangdaku River, Cebu Island, Philippines

Joje Mar P. Sanchez[1], Reginald Raymund A. Caturza[1], Marchee T. Picardal[1], Judelynn M. Librinca[2], Ruby L. Armada[3], Hedeliza A. Pineda[4], Marnan T. Libres[5], Ma. Lourdes B. Paloma[6], Sherry P. Ramayla[7], and Jay P. Picardal[8]

[1]Science Education Department, College of Teacher Education, Cebu Normal University, Philippines
[2]Science Department, Labogon National High School, Division of Mandaue City, Philippines
[3]Science Department, Mactan National High School, Division of Lapu-Lapu City, Philippines
[4]College of Arts and Sciences, Cebu Technological University-Main Campus, Cebu City, Philippines
[5]Chemistry Department, College of Arts and Sciences, Velez College, Cebu City, Philippines
[6]College of Arts and Sciences, Palompon Institute of Technology, Leyte, Philippines
[7]Biology Department, Philippine Science High School-Central Visayas Campus, Cebu, Philippines
[8]Research Institute of Tropical Biology and Pharmacological Biotechnology (RITBPB), Cebu Normal University, Cebu City, Philippines

*Corresponding Author: sanchezj@cnu.edu.ph

Submitted: 2022-01-17. Revised: 2022-06-29. Accepted: 2022-08-31

Abstract. Understanding the social-ecological dynamics of freshwater ecosystem is critical for effective planning and sustainable use of the resource. The study aimed to determine the socio-demographic profile, anthropogenic activities, water utilization of the residents, and waste disposal practices along the Sapangdaku River. Here, we examined water utilization, waste disposal practices and their corresponding impact to health, and environmental attitudes of riverside dwellers (n=120) in Sapangdaku River by using a standardized social health and environmental attitudes survey, respectively. Results show that while river water is still largely used for bathing and backyard farming, its known function as (a) disposal area of human and animal waste, (b) quarry site for pebbles and sand and (c) laundry area significantly decreased in recent years. Responses revealed that occurrence of very common ailments such as cough, gastroenteric problems and skin problems are partly associated to poor river water quality. In terms of people's environmental attitude, ecocentrism is both positively correlated to environmental movement activism (r=0.445, p=0.000) and human utilization of nature (r=-0.275, p=0.006), putting prime value on the sustainable use of river water that provides benefit to the community. Similarly, environmental movement activism and human utilization of nature (r=-0.327, p=0.001) indicates willingness to participate in environmental activities, hence supported by their decision not to use their environment unfavorably. These findings suggest that community's concern for the river water resulted to increased participation in various strategies to better maximize the use of the river for various purposes. However, efficient management and restoration of river quality require a holistic view of the problem.

Key words: water management, water governance, environmental attitudes, river utilization

How to Cite: Sanchez, J. M. P., Caturza, R. R. A., Picardal, M. T., Librinca, J. M., Armada, R. L., Pineda, H. A., Libres, M. T., Paloma, M. L. B., Ramayla, S. P., Picardal, J. P. (2022). Water Management Practices and Environmental Attitudes of Riparian Communities in Sapangdaku River, Cebu Island, Philippines. *Biosaintifika: Journal of Biology & Biology Education*, *14* (2), 147-159.

DOI: http://dx.doi.org/ 10.15294/biosaintifika.v14i2.36185

INTRODUCTION

Water is one of life's essential components (World Health Organization, 2021), a primary constituent of every living organism and the most important resource known to mankind (Jabeen et al., 2020). Being an abundant compound and vital resource for sustainable living, water makes up 70 percent of the Earth's surface, with this amount 97 percent is in the oceans reservoir, around 2 percent in the form of ice and only 1 percent as freshwater (Catchillar, 2008). Rivers, in particular, have been essential to the needs of the people, especially those residing near the riverbanks. People use the river water for household activities (Picardal et al., 2012; Mirasol, 2014) and agricultural purposes (Bongcayao et al., 2015; Dapar, et al., 2016). Others use the water for bathing, doing the laundry, fishing, irrigation, and recreation (Picardal et al., 2012; Paler et al., 2016). These are only a few of the human activities that influence the condition of the river.

The condition of the water in rivers is greatly challenged because of the increasing human

population, urban developments, and economic activities (Mustapha et al., 2013). Several studies revealed that anthropogenic activities affect the condition of the river in terms of its physicochemical and biological properties (Picardal et al., 2012; Mustacisa et al., 2017; Son et al., 2020). Domestic sewage, agricultural runoffs, and industrial wastes are among the identified factors that influence river water quality (Environmental Management Bureau [EMB], 2014). Human wastes disposed into the river because of the absence of toilets with septic tanks and improper sewage system (Picardal et al., 2012; Bongcayao et al., 2015; Pareja, 2015) and agricultural wastes that contain nitrogen compounds and phosphorus from pesticides, fertilizers and manure from animals (Ikotun, et al., 2012) also add to the degrading water quality of rivers. In general, human activities associated with improper waste disposal methods lead to the degradation of water quality and contamination in rivers.

River water quality and contamination can be affected by several factors, to wit, the occurrence of pathogenic microorganisms (Xu et al., 2019), chemical pollutants (Ogbeide et al., 2016; Paul, 2017), and contaminants brought about by urbanization (Sanchez et al., 2020). These factors ensured a huge ecological and health impact, as contaminated rivers are no longer suitable for human use and incapable to further support plant and animal life (Picardal et al., 2012; Ramayla et al., 2021). Human health risk associated with exposure through drinking water (Picardal et al., 2018), food chain bioaccumulation (Son et al., 2020), and background exposure by living in the vicinity of pollutant sources (Sanchez et al., 2020) were investigated in several river studies. Common diseases associated with dirty water ingestion include gastrointestinal illness (Ogbeide et al., 2016; Nephawe, 2021) such as acute diarrhea, dysentery, hepatitis (Pradhan et al., 2006); other exposure-related skin ailments such as gingival discoloration, adenopathy, dermatologic abnormalities (Akagi et al., 2000); and heavy metal exposure such as mercury intoxication (Paul, 2017). Polluted river water caused by heavy metals, however, can be treated using biosorption activities of Enterobacter agglomerans (Dewi et al., 2019).

Seemingly, river water quality could be associated with human health status, risk, and environmental attitudes. The attitudes and responses they have towards the river can affect the value they place on the water source (Alias, 2019). For example, residents may live proximity to the river but they may fail to develop any emotional ties with it (Braun and Aßheuer, 2011) despite being heavily dependent on the river for subsistent activities such as bathing, washing, and cooking. Hence, understanding the people's environmental attitudes can direct mitigation actions and improve these decisions by evaluating the extent to which the public supports the environment programs (Arif et al., 2022), and the residents to commit to future conservation and rehabilitation efforts.

The same river and human interrelationships must be looked into among the riverine communities living alongside the Sapangdaku River in Toledo City, Cebu where a copper ore mine has been operating within part of the stretch of the river. Sapangdaku River is situated in the Province of Cebu, the Philippines with an estimated terrain elevation of 5 meters above sea level running a long stretch of 9 kilometers within at least seven barangays in the locality (Sanchez et al., 2020; Ramayla et al., 2021). The river water quality could be attributed to the domestic waste disposal practices, utilization (e.g. bathing, washing, quarrying), and possibly affected by the on-going mining operations in the vicinity. Practices of riverside dwellers have affected the Sapangdaku River since the dwellers' activities depend on the river for their livelihood and other resources.

The study aimed to determine the socio-demographic profile, anthropogenic activities, water utilization of the residents, and waste disposal practices along the Sapangdaku River. Moreover, the study looked into the potential health impacts of the practices of dwellers towards the Sapangdaku River, as well as the environmental attitudes of these riparian communities. The determination of these anthropogenic practices and human health relationships can serve as groundwork and onset information for future policy guidelines on the river utilization, management, and preservation; hence, the conduct of the study.

METHODS

Study Area

This study was conducted at communities residing near the Sapangdaku River in Toledo City, Cebu, Philippines. Historically known as Hinulawan River, the river is approximately 12 km long that begins from the mountainous barangay of General Climaco. The waters of the river generally originate from the Malubog Dam

that passes through the local communities of Cambang-ug, Don Juan Climaco Sr., Ilihan, Canlumampao, Sangi, Dumlog and Daanglungsod, and finally drains into the Tańon Strait. Three communities were identified as study sites. These sites are located along and round the downstream (DS) (10°23'28.932"N, 123°39'6.156"E), midstream (MS) (10°21'32.364"N, 123°39'50.544"E) and upstream [US] (10°21'2.592"N, 123°41'34.368"E) portions of Sapangdaku River. The DS community consists mostly of people living outside the constructed dikes, while limited people are residing within the dikes. Trees and vegetation along the riverbed, as well as cattle grazing and fishing, are observed in the same area. The MS site has a community of people who cross the river by foot or by motorcycles. Sand and gravel quarrying, as well as domestic activities, are evident in the area where grasses and trees thrive and cows and goats graze. The US portion has few houses situated near the riverbank where rocks and sand dominate. Large trucks go into the river to collect sand and gravel.

Respondents

Riverside dwellers along the Sapangdaku River participated in the study. Through random sampling, 120 residents were selected as respondents of the study. Thirty of these respondents (25%) came from the DS community, 45 (37.5%) each from MS and US. Most of them were aged 40 to 49 years old. The majority (67.5%) were females and mostly (66.67%) the mother in their household. The mothers are left to care for the needs of the family while the fathers are working somewhere else. Some of the households had retail stores in their houses as a source of income. A large percentage of the respondents (43.33%) were able to study up to the elementary level while 40% had the chance to study until the high school level. A significant number (15.87%) were able to reach the tertiary or the college level.

Tools and Data Collection

The socio-health survey [SHS] adapted with modifications from the close-ended questionnaire of Picardal et al. (2012) was utilized for the data collection. The first part of SHS dealt with the socio-demographic profile of the respondents, as well as the water utilization and anthropogenic activities in the river, and waste disposal practices of respondents near the vicinity of the river.

The second part asked about the potential health impacts with items concerning the infliction and causes of illnesses and the form of medications they administered. Another tool was the environmental attitudes survey [EAS]. The first part of EAS dealt with four constructs of environmental attitudes (ecocentric concern [EC], environmental movement activism [EMA], human utilization of nature [HUN], and altering nature [AN]), and twenty selected questions from the Environmental Attitudes Inventory (EAI) were used to measure these constructs. The twelve specific scales of EAI were developed to consider the multidimensional and hierarchical nature of environmental attitudes (Milfont & Duckitt, 2010). The second part consisted of five Likert-type questions that assessed the respondents' level of agreement with statements about the use of Sapangdaku River for livelihood and subsistence.

The researchers notified all the concerned barangay captains through written correspondence for the conduct of a socio-health study. Upon approval, the researchers met with the barangay health workers [BHWs] to inform them of the study and their assistance in the accomplishment of its goal. Administration of the survey questionnaires was done with the aid of three BHWs who were trained by the principal researchers beforehand. The respondents were asked to answer these questions orally using the language and words they were most comfortable with. They answered all questions in approximately ten minutes on average.

Data Analysis

The data collected from the socio-health survey were presented using tables and graphs, highlighting the frequency and percentage of the responses. The results of the environmental attitudes survey were analyzed using the Pearson r correlation tested at $\alpha=0.05$ using the statistical package for the social sciences (SPSS).

Ethical Considerations

The researchers asked the permission of the barangay captains for the implementation of the survey questionnaires with the aid of the BHWs through formal correspondence. After the consents were received, the researchers oriented the BHWs and the respondents on the intent, scope, and confidentiality of the research. The respondents were assured of the confidentiality of their responses and the observance of their anonymity. Furthermore, the researchers sought the respondents' consent for their inclusion in the study. All respondents had expressed their consent for the facilitated survey.

RESULTS AND DISCUSSION

Demographic Profile of the Riverside Dwellers in Sapangdaku River

The demographic profile of the riverside dwellers along the Sapangdaku River is shown in Table 1.

The riverside dwellers accounted for in the study were 143 household members in the DS site, 221 members in the MS, and 207 members in the US. In these three study sites, the average household is composed of five persons, and the majority have an estimated monthly income of less than $US 202. Only a handful have an income of more than $US 1,013 and they reside in the MS portion; none of the DS and US households have this income. About gender, the DS and US areas are dominated by males (n=87, 107 respectively) while the US, by females (n=115). In terms of age, the majority of the residents across the study sites are relatively younger people (aged 0-29 years), while the minority are middle and old age adults (aged 30 years and above). The MS registered the most middle-age adults (n=37) while the US listed the most number of senior adults (n=19). As to educational attainment, the majority of the US residents attained high school level (n=96), while DS and MS dwellers are mostly at the elementary level (n=71, 92 respectively). More college-level or graduates dwell on the MS and US areas (n=53, 30 respectively). The relationship between age and education is apparent in this portion.

Anthropogenic Activities in the River

Figure 1 shows the different residents' activities that involve or done around the Sapangdaku River.

Based on Figure 1, riverside dwellers have experienced doing activities that involve or done around the Sapangdaku River in Toledo City. In their previous experiences, 34.17% of the residents have tried bathing in the river; 30.83%, washing the laundry; and 25%, watering the plants. Less than a fourth of the residents have experienced using the river water to clean their garage cars, to fish, to dispose of human and animal wastes, to bathe their animals, and to do quarrying activities. These activities have since been done near and around rivers, as rivers are the cradle of civilization and the sites where water is used for domestic, agricultural, and industrial purposes (Picardal et al., 2012; Bongcayao et al., 2015). Bathing, watering the plants and fishing show that the river has been used for beneficial purposes. However, other activities such as waste disposal and quarrying suggest that the residents have started to decrease the water quality of the river even in the past, as these activities provide major sources that pollute the river (Ikotun et al., 2012; Maglangit et al., 2014; Paler et al., 2016).

Table 1. Demographic profile of household members along the Sapangdaku River

Socio-demographic profile		DS (n=143)	MS (n=221)	US (n=207)
Average No. of household members		4.6 ≈ 5	4.9 ≈ 5	4.6 ≈ 5
Gender	Males	87	106	107
	Females	56	115	100
Age	0-9 years old	24	42	42
	10-19 years old	36	52	48
	20-29 years old	34	44	38
	30-39 years old	7	27	30
	40-49 years old	18	37	13
	50-59 years old	13	11	19
	60 years old and above	8	9	19
Highest Education Attainment	No education	17	17	15
	Elementary level	44	59	96
	High school level	71	92	68
	College level	8	53	30
Estimated Monthly Income per Household	Less than $US 202	21	31	33
	$US 202-405	6	7	9
	$US 405-1,013	3	2	3
	$US 1,013-3,040	0	2	0
	$US 3,040 and above	0	3	0

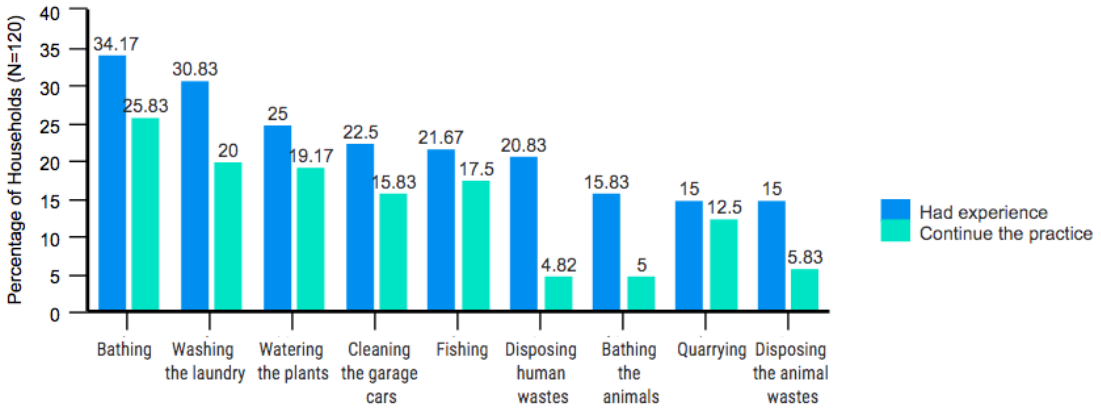

Figure 1. Activities of residents in Sapangdaku River

In the current situation of the communities around the Sapangdaku River, the percentage of residents involved in anthropogenic activities in the area has decreased. Activities such as disposing of the human and animal wastes, bathing by people and of animals, and doing the laundry using the river water decreased the most. This may be explained by the increase of Toledo City Water District users who have availed, with their own expense, of cleaner water in the area. Access to clean, fresh, and dependable water is fundamental in people's activities (Samra and Fawzi, 2011). However, residents have not significantly decreased their use of water to clean their garage cars and water the plants that could be attributed to the fact that river water is used for cleaning and for saving money from the use of district water. Other water sources are considered for irrigation and non-essential activities (Makino et al., 2016). Fishing is continuously practiced for sustenance while quarrying activity remains ongoing because of the continuous demand for sand and gravel. Elfidasari et al. (2018) cautioned such anthropogenic activities that increases disposal of heavy metal on river as it bioaccumulates on aquatic organisms causing them unsuitable for human consumption in the long run.

The latter has since destroyed the water's equilibrium and its activity has not significantly declined since. The downward trend of common anthropogenic activities in the Sapangdaku River area may be attributed to residents having other sources of clean water such that from Toledo City Water District [TCWD] and water purifying stations. Past events may also have lessened the activities around the river. In 1999, approximately 5.7 million cubic meters of sulfuric acid spilled into the river because a clogged drain tunnel that caused major fish kill in the riverine and coastal waters of Toledo City, Philippine Working Group on Mining of the Environmental Science for Social Change (MESSC, 2008). Classification of the river as a source with poor water quality (EMB, 2014) may have also contributed to such a decrease in anthropogenic activities.

Water Utilization of Riverside Households

Respondents revealed different modes of using water. Most of the residents admitted to utilizing more than one water source in doing their household activities. Some stated that when there is water interruption, they opted to use other sources of water (i.e. collected rainwater in bathing and washing the laundry). Figure 2 shows the residents' main sources of water when carrying out the various activities of the household.

The water utilized by most residents is from the TCWD, where there are over 60% consumers of the district water. More than 60% use the district water for bathing and cooking food, while more than 50% use such water for flushing human wastes and washing laundry. Only 5% of the residents drink water coming to the water district. People prefer to use district water. The water is considered safe, potable, and affordable because district water undergoes bacteriological and chlorination tests (Nakagome and Takagi, 2008).

The residents also have public wells where the well water is used mostly for washing the laundry, flushing of human wastes, cooking food, and bathing. Around 11% of the residents drink water from the wells. Other residents also use rainwater that they store during the rainy seasons. Rainwater is mostly used for flushing of wastes, washing laundry, and bathing. Only a few residents use rainwater for cooking food and drinking. The use of water from public wells and rain collectors provide water that is environment-friendly and cost-effective and offers residents free and

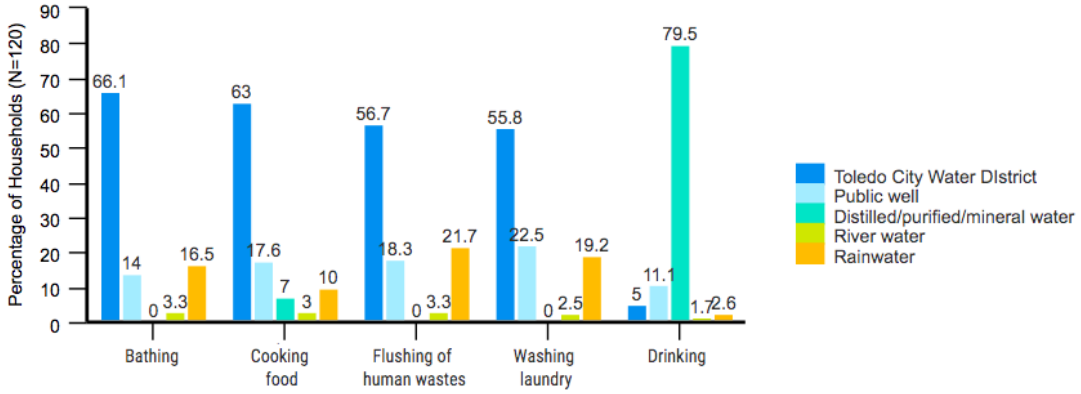

Figure 2. Different modes of water utilization by riverside dwellers of Sapangdaku River

relatively safe water for their families (de Vera et al., 2012).

The residents use distilled, purified or mineral water (79.5%) primarily for drinking exclusively. This water has passed through purification processes and obtained acceptable results for water quality parameters such as pH, coliform counts, and heavy metal content (World Health Organization [WHO], 2021. Due to the purification process, distilled, purified or mineral water entails higher price than other sources of water (Nephawe et al., 2021). Since it is costlier, the residents almost solely use it for drinking. Very few residents (7%) use purified water in cooking, while none of them use purified water in bathing, flushing of human wastes, and washing laundry. Riverine water has been utilized the least by the residents. Less than 4% of the residents use river water for bathing, flushing human wastes, and washing laundry. A surprising 2.5% and 1.7% of them use river water for cooking food and drinking, respectively. However, they do not get the water directly from the river. Instead, they dig a small hole in the riverbed where they can collect water for cooking purposes.

Waste Disposal Practices of the Riverside Households

Riverside dwellers in the Sapangdaku River have three modes of disposal practices. These practices are seen in Figure 3.

Three most common waste disposal practices have been identified. The residents identified these practices to include (1) throwing into non-cemented canals, (2) burying in the ground, and (3) burning in open areas. Waste disposal through garbage collection was observed in the Sapangdaku River area but was only done in the midstream site. The upstream and downstream areas do not have a regular collection; hence, garbage collection practice is not common in the area. Garbage collection together with the three

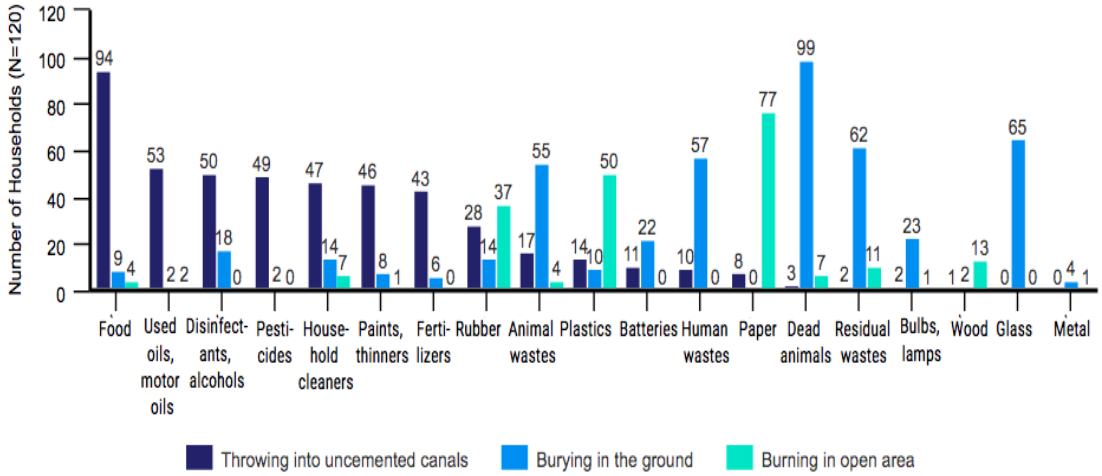

Figure 3. Waste disposal practices of riverside dwellers in Sapangdaku River

most common disposal practices are also practiced in Catbalogan City, Samar (Irene, 2014) as well as in Butuanon, Mandaue City (Picardal, et al., 2012).

Waste disposal practices of the residents depend on the type of wastes that they throw. Most of the residents (n=94) throw their food into the non-cemented canals. This practice may be because food is biodegradable and it decomposes in a short period. Most residents also use the same disposal practice for used oils (n=53), disinfectants and alcohols (n=50), pesticides (n=49), household cleaners (n=47), paint thinners (n=46) and fertilizers (n=43). These substances are usually in the liquid state and are usually thrown into non-cemented canals because these wastes can only be washed away. Paul (2017) attributed this throwing of garbage into canals to the lack of proper waste disposal system in the area.

Another disposal practice done by the residents is burying the wastes in the ground. Most of the respondents do this practice to dead animals (n=99), a common practice in the Philippines. This is acceptable but it should be done 22.86 meters away from any water supply and 1.22 higher than public wells (Department of Environmental Sciences [NH-DES, 2009). Residents usually bury glass (n=65) and bulbs (n=23) when they want to dispose of them. Glass products do not decompose easily and should be recycled instead of being disposed of (Farraji et al., 2016). The people also bury residual, human, and animal wastes (n=62, 57, 55 respectively). They usually do this because burying can maximize decomposition and provide nourishment to the soil. Although there is no direct evidence on the effects of the waste disposal on the water quality of the river, residents' prolonged practices on burying wastes in the ground may affect the environment negatively. Ikotun, et al. (2012) and Ogunmakinde et al. (2019) noted that inappropriate ways of managing domestic waste might pollute underground sources of water supply.

Combustible wastes such as paper (n=77), plastic (n=50), rubber (n=37), and wood (n=13) are usually disposed of through burning them. Burning of garbage is prohibited in the Republic Act 8749 also known as the Philippine Clean Air Act because of its impact on air quality. Despite the implemented laws about the burning of garbage, several people still do so. Alias (2019) explained that the burning of household garbage is unavoidable especially if the area is far from the garbage truck collection pick up points. In the absence of a regular collection of garbage, households must rely on other means of waste management practices.

Noticeably, waste management by throwing into the river is not heavily practiced in the three study areas. The result might have been due to the mandate of the Department of Environment and Natural Resources - Provincial Environment and Natural Resources Office [DENR – PENRO] concerning the protection of the Sapangdaku River. The officials of the barangays along the river together with PENRO personnel designated some riverside dwellers to report those who throw wastes into the river and these reported people will be penalized accordingly. Most of the residents also reported that going into or near the river to throw their garbage is just a waste of time. In the downstream portion, the construction of high concrete floodwalls that separate the communities from the river may also be a factor that prevents them from throwing wastes directly into the river.

Health Impact

Figure 4 shows the prevalence of diseases and the corresponding percentages of the residents inflicted with such diseases.

Taking into account all the kinds of diseases identified, a remarkable very high percentage of the households have been inflicted with cough (89.16%) and as much as 62.50% have experienced flu. Diarrhea (47.50%) is also high among the different gastrointestinal illnesses contrary to barely 6.67% for amoebiasis. Meanwhile, of the several skin diseases considered, a substantial number of households have been inflicted with ringworm (23.33%), athlete's foot (22.50%), and ap-ap - Tinea versicolor (20.83%). These values for the incidence of skin ailments are at a very close range, which might be attributed to a common cause.

Congruent to the percentage of diseases experienced by households as previously illustrated, the frequency of affected household members shown in Figure 1-b revealed the largest value for cough, followed by flu and diarrhea. Skin ailments (e.g. ringworm, athlete's foot, pimples, and ap-ap) are also of consistently considerable value. These results are at certain distinct aspects comparably similar to a locally conducted river study situated in urban vicinity where an essentially high incidence of cough, flu, and diarrhea among the riparian community has been reported (Picardal et al., 2012). In this current study, the respondents claimed that cough and flu

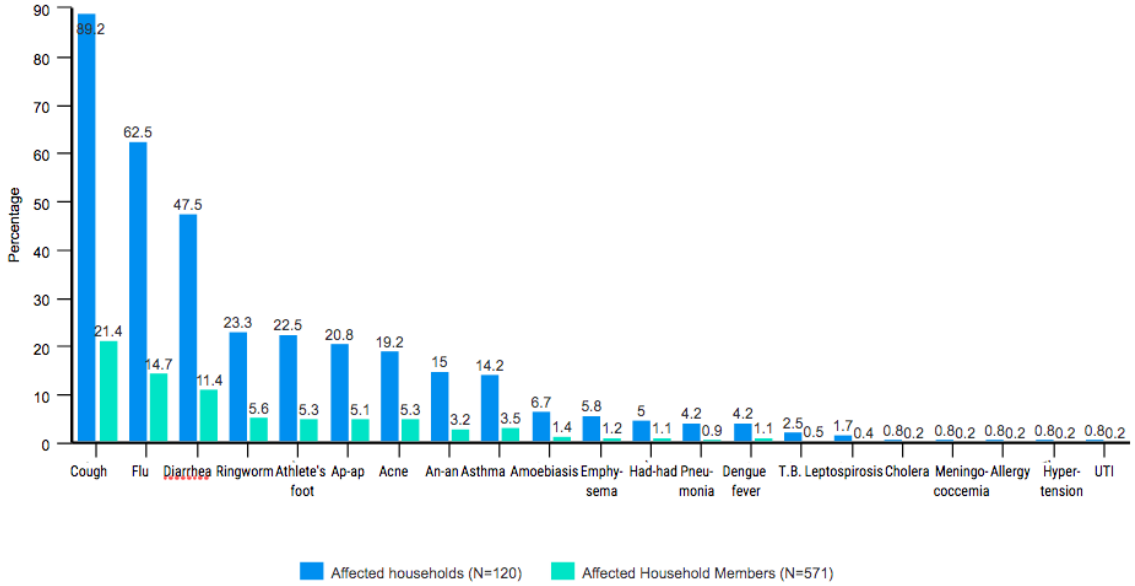

Figure 4. Percentage of households and household members inflicted with diseases

could be caused by the air from the river (12.79%) or transmitted from other people (10.69%). Although the occurrence of cough and flu could not be directly attributed to the river since roughly 18.87% of the respondents believed that the immediate causes cannot be determined with absolute certainty. Furthermore, the incidence of diarrhea among the riverside dwellers of the Sapangdaku River corroborates with the results of previous studies. It is reported that this gastrointestinal ailment is directly linked to river water contamination (Paul, 2017; Xu et al., 2019; Son et al., 2020) and from food and water microorganisms as causative agents (Pachepsky et al., 2011; Picardal et al., 2012; Nephawe, 2021).

Skin diseases, particularly ap-ap, were notably observed to several children and even adults. Ringworm, athlete's foot, and ap-ap were remarkably linked to the dirty river water in the community. Around 13.84% of the respondents strikingly described contact to river water primarily through swimming or bathing and walking across the Sapangdaku River, which was widely considered the most probable cause of contacting the skin-related illness. The frequency of these water contacts is significantly correlated to the rate of acquired infections (Ismail et al., 2014). As presented earlier, while cough and flu may not be influenced by exposure to the river, diarrhea could have been derived from the ingestion of contaminated water from the river utilized for washing, bathing, and drinking. The majority of the respondents treat these diseases through consultation with a public doctor (51.36%), but as much as 38. 57% opted for self-medication.

It is evident in the data obtained from the survey that the health aspects of the residents near the Sapangdaku River are affected by the utilization and practices vis-à-vis the river condition. Various diseases can be associated with dirty river water (Picardal et al., 2012) as caused by the pathogens present in the water source (Pachepsky et al., 2011). Water-borne diseases are a common incidence in household communities relying on contaminated river water for general domestic use (Nephawe, 2021). Recent study by Sanchez et al. (2020) reported that the river has high counts of total coliform in the downstream where most of the people dwell, as well as high counts of fecal coliform across sites in the river. Another research conducted by Ramayla et al. (2021) revealed that pollution tolerant macroinvertebrates are found along the river particularly in the downstream, indicating the presence of pollution in the area.

River water quality is more likely to be affected by anthropogenic activities (Arif et al., 2022) that seemed inevitable considering the above-mentioned status quo. With these possible agricultural, domestic, and industrial discharges, river water could be contaminated (Picardal et al., 2012; Paul, 2017). Consequently, the river condition reasonably affects the health condition of people who relied heavily on it. The implications of this study provide a probable link to the health issues (diseases afflicted riparian communities) and the utilization of and current

Table 2. Correlations of the constructs for environmental attitudes

Correlated constructs	r-value	p-value
Ecocentric concern and Environmental movement activism	0.445*	.000
Ecocentric concern and Human utilization of nature	-0.278*	.006
Ecocentric concern and Altering nature	0.003	.973
Environmental movement activism and Human utilization of nature	-0.327*	.001
Environmental movement activism and Altering nature	-0.102	.316
Human utilization of nature and Altering nature	0.016	.880

river condition of Sapangdaku.

Environmental Attitudes of the Riverside Dwellers

The table of correlations showing the relationship between the measures for the four constructs of environmental attitudes could be found in Table 2.

As shown in Table 2, a moderately positive correlation existed between EC and EMA. One possible interpretation of this could be that the more aware and concerned the respondents were of their environment, the more likely they were to actively participate in activities aiming to address environmental concerns. This could be viewed as a positive result if the goal of the local government was to involve the public in the decision-making and implementation processes of river management projects. A weak negative correlation could also be observed between EC and HUN. This supported the notion that the more aware and concerned the respondents were of their environment, the less likely they were to use it adversely. This weak yet significant negative correlation seemed to support the previously explained correlation between EC and EMA, suggesting that the respondents' ostensible willingness to participate in environmental activities was justified by their decision not to use their environment unfavorably. This interpretation was further supported by the weak yet significant negative correlation between EMA and HUN. Environmentally responsible behaviors of people are associated with their involvement in the implementation of policies such as implemented by local government units (Yaun et al., 2021) and conservation efforts (Sanchez et al., 2018; Sanchez et al., 2021). This behavior may be related to the respondents' environmental knowledge, including sustainable knowledge (Celades et al., 2021). People's environmental awareness and green initiatives are factors affecting knowledge, thereby contributing to their environmental attitudes (Sanchez & Alejandro, 2020). Furthermore, there are no significant correlations existed between EC and AN, EMA and AN, and HUN and AN. These results agreed with the study of Sanchez et al. (2021), stating that environmental constructs may have no to weak significant relationships with one another, including knowledge and attitudes.

The respondents' levels of agreement on river utilization are summarized in Figure 5, highlighting the juxtaposition among those who strongly agree or disagree with the stated activities.

Almost all riverside dwellers (98.0%)

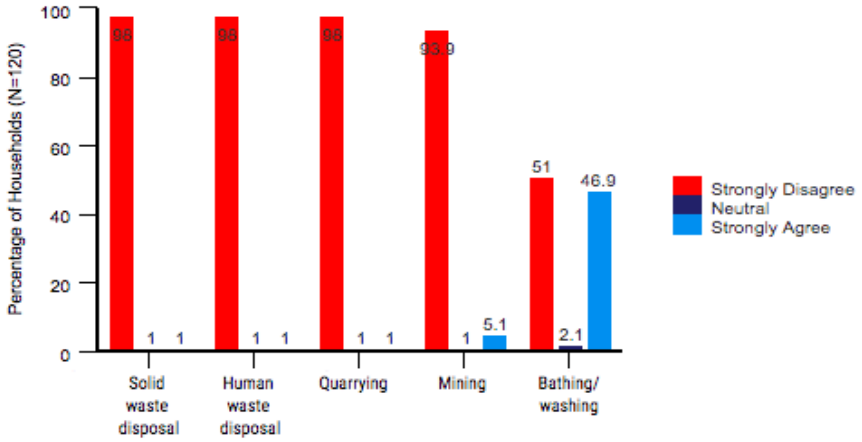

Figure 5. Residents' level of judgment on river utilization

dissented the idea of using the Sapangdaku River as a dumping site for solid waste. As reported by the residents through the interview, people were living near the river who were designated by the DENR-PENRO as stewards of the portion of the river near them. They were tasked to monitor and report solid waste disposal activities near the river. This could explain the almost unanimous opinions of the respondents when it came to the use of the river for solid waste disposal. Similar to solid waste disposal, almost all dwellers (98.0%) dissented the use of rivers for human waste disposal. Not all the residents living along the coast of the river had their lavatory in their houses, but those in the downstream portion were allowed to use the restroom of the abattoir near their residence. Those living in makeshift houses had made their comfort rooms in their vicinity without connecting it to the river. This could be explained by the possibility of the respondents' considering the river as a resource for bathing or washing, as previously mentioned.

Moreover, the residents almost unanimously (98.0%) strongly disagreed on the use of the river for quarrying, or the extraction of sand, gravel, and other materials for construction use. However, there have been observed rampant quarrying activities along the riverside. They were a few residents who were spotted filling up used cement sacks with sand from the riverbed, intending to process and sell them to the other locals. More conspicuous were the trucks that were loading tons of sand from the upstream portion of the river.

There were also heaps of processed sand along the coast of the midstream portion of the river, although no trucks or workers were spotted. It seemed as though quarrying was still vehemently practiced, despite the residents' dissenting opinions on it. The majority of the locals (93.9%) opposed the use of the river as a mining site or as a receiver of waste from mining operations. The residents living within the area were well aware of the existence of a mining corporation in proximity, but they did not disclose any knowledge nor awareness of its operations. They did, however, share their disapproval for the possible use of the river as a dumping ground for mining waste, regardless of whoever could be responsible for such use.

Finally, the riparian inhabitants' opinions were divided in terms of the river's use for bathing or washing. Almost half of them (51.0%) strongly disagreed on the idea, while the other half (46.9%) agreed to it. Some residents admitted that they used the river as a source of water for washing their clothes and bathing occasionally, although their frequency of use reportedly declined due to the worsening quality of the river water.

CONCLUSION

This study provided a comprehensive understanding of the environmental practices and attitudes of riparian communities, and how they influence sustainable use and management of Sapangdaku river. Domestic use of river water for basic household activities is closely associated to their waste disposal practices, but health-related ailments, although reported, cannot be strictly attributed to poor water quality. Confounding factors may play a significant role in how riverside communities respond to and addressed water rehabilitation issues or how they practice sustainable use of river water. These variations in environmental attitude are likewise influenced by socio-economic status, educational background, and previous exposure to the positive impact of environmental stewardship. Planning and management are deemed essential in the rehabilitation of the river, but this must be equally participated by the various sectors in the community.

ACKNOWLEDGEMENT

The authors wish to extend their heartfelt gratitude to the Brgy. official and BHWs of Dumlog, Don Juan Climaco Sr. and Cambang-ug in Toledo City, Cebu for the support of this study. The authors also thank the riverside dwellers who participated in the study.

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