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Correlation Between Community Knowledge Level of River Ecosystem Services and Littering Behavior in Belawan Hilir Sub-watershed

Mariah Ulfa[1,2]*, Bejo Slamet[1], Masrizal Saraan[3], Harry Kurniawan[4]

[1]Faculty of Forestry, Universitas Sumatera Utara, Kampus USU 2 Bekala, Deli Serdang 20353, Indonesia
[2]JATI-Sumatran Forestry Analysis Study Center, Deli Serdang 20353, Indonesia
[3]Yayasan PETAI, Jl.Menteng Indah Blok E2 No.15, Medan Tenggara, Kec. Medan Denai, Kota Medan, Sumatera Utara, Indonesia
[4]Member of Belawan Watershed Forum, Medan, Indonesia

Abstract. Belawan watershed is one of the watersheds that have a primary role in North Sumatra Province. The flow of the Belawan watershed crosses 2 (two) regencies/cities, i.e., Deli Serdang Regency and Medan City. In more detail, Medan City is located in the Belawan Hilir Sub-watershed. Several main rivers in Medan have been polluted and shallowed, as a result of people's habit of littering the river. People who live around the Belawan watershed have a significant role in the sustainability of the river and its ecosystem services. This study aims to analyze the level of community knowledge of river ecosystem services in the Belawan Hilir sub-watershed and to measure the correlation between the community knowledge level and the behavior of river littering. The respondents were sampled using Simple Random Sampling, while the number of samples was calculated using the Slovin formula. Data was collected through structured interviews by compiling a list of questions (questionnaires). The correlation between community knowledge levels and behavior of river littering was determined using spearman correlation analysis. The community knowledge level was 63% (good category). There was a moderate-positive correlation between the community knowledge level and the behavior of river littering (0.512 correlation coefficient). Community awareness can be increased through online-based socialization using social media or by providing more waste management training programs.

Keyword: Belawan Hilir, Community Knowledge, Correlation, Ecosystem Services, Littering Behavior, Watershed

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1 Introduction

A watershed is an area that is an integral part of a river and its tributaries, which functions to accommodate, store and drain water originating from rainfall to lakes or the sea naturally [1].

*Corresponding author at: Faculty of Forestry, Universitas Sumatera Utara, Kampus USU 2 Bekala, Deli Serdang 20353, Indonesia
E-mail address: mariahulfa@usu.ac.id

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The boundary on land is a topography separator, and on the sea is up to the water areas still affected by land activities (Law No. 17 of 2019). Watershed is a complex mega system, including physical, biological, and human systems. Each system and its sub-systems interact with each other. The interrelationship and role of each component considerably determine the quality of the watershed ecosystem. Disturbances to one component of the ecosystem will be felt by others as the nature of a chain impact. The balance of the ecosystem will be secured if the reciprocal conditions between elements run well and optimally [2].

Belawan watershed is one of the watersheds that have a primary role in North Sumatra Province. The flow of the Belawan watershed crosses 2 (two) regencies/cities, i.e., Deli Serdang and Medan. In more detail, Medan is located in the Belawan Hilir Sub-watershed, which is the priority in the management of the sub-watershed level in the Belawan watershed [3]. The rapid city development with the increase in population, water needs, and land conversion from open areas to built-up areas indicate a decrease in catchment areas, such as forests, mixed gardens, cultivated land, and other vegetated lands [4]-[5].

The irresponsible interactions between the community and the natural resources may result in changes that threaten its sustainability. Land cover at the riverside affects the sustainability of river ecosystem services [6]. Therefore, the people who live around the Belawan watershed have a significant role in the sustainability of the river and its ecosystem services. Several main rivers in Medan have been polluted and shallowed, as a result of people's habit of littering the river [7]. During the rainy season, this condition will trigger the flood. In 2020, the local government recorded 32 floods spread across 13 sub-districts with a loss of approximately 40 billion rupiahs (BPBD Medan City, unpublished data).

Therefore, a study was conducted to understand why the community, especially those who lived on the riverside, have river littering behavior and to measure their knowledge level related to the rivers and their ecosystem services. This data should contribute to improving stakeholder awareness regarding the Belawan Hilir sub-watershed management. This study aims to analyze the level of community knowledge of river ecosystem services in the Belawan Hilir sub-watershed and to measure the correlation between the community knowledge level and the behavior of river littering.

2 Research Method

Respondents of this study were communities in the Belawan Hilir sub-watershed. Belawan Hilir sub-watershed was located in Medan, North Sumatra Indonesia (Figure 1). In total, there were 95 respondents that were sampled using Simple Random Sampling. The number of respondents was calculated using the Slovin formula (1) [8].

$$n = \frac{N}{1+Ne^2} \quad (1)$$

with: n : The number of samples

N : The number of populations

e^2 : Fault tolerance limit (in this study was 10%)

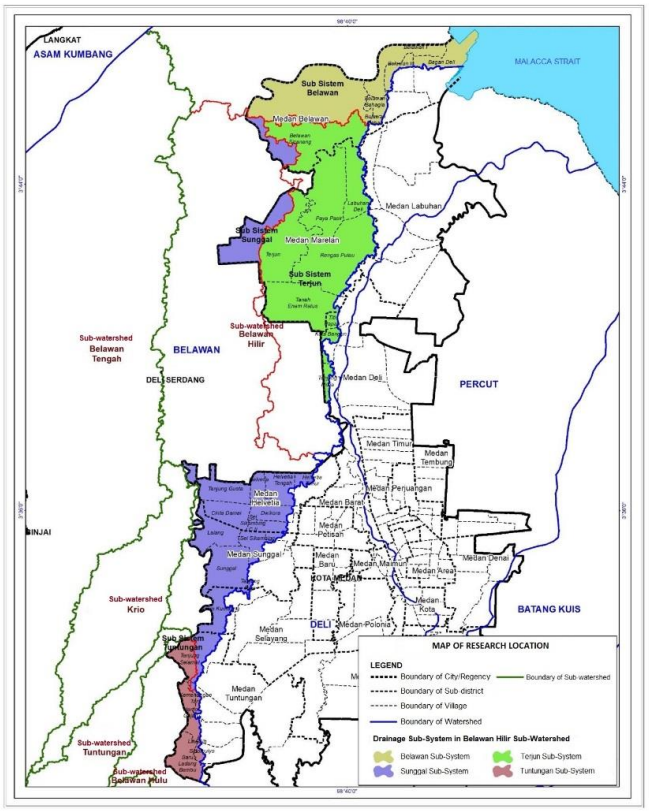

Figure 1 Map of Research Location

The assessment was conducted to measure the community knowledge level regarding several aspects of the river's ecosystem services as a controller of water and flood management. Data was collected through structured interviews by compiling a list of questions (questionnaires) to provide answers to the study hypotheses. Respondents' answers were then quantified using a Likert scale by assigning a score to the answer options (scale 1-5). After that, the total score and ideal score were calculated to determine the respondent's knowledge level (Table 1).

Table 1 The Level of Community Knowledge

Percentage	Level
0 – 20 %	Very bad
21 – 40 %	Poor
41 – 60 %	Moderate
61 – 80 %	Good
81 – 100 %	Excellent

The correlation between community knowledge levels and behavior of river littering was determined using spearman correlation analysis [9]. The correlation coefficient was used to indicate the level of correlation between variables. The positive or negative correlation was determined based on the sign before the correlation coefficient [10].

3 Result and Discussion

3.1 Respondent Characteristics

The respondents were the community that lived in the Belawan Hilir sub-watershed in Medan City. Respondents were dominated by people aged between 55-65 years. Age is one factor that plays a significant role in a person. Increasing age will change physical and psychological aspects. There are four broad categories of physical changes, i.e., changes in size, changes in proportions, the loss of old characteristics, and the emergence of new characteristics. Psychologically, people's age affects their level of thinking and knowledge [11].

The latest education levels of respondents varied, ranging from those without education (4%), elementary school (19%), junior high school (12%), senior high school (54%), diploma (3%), and undergraduate (8%). The latest education level of the dominant respondent was senior high school. Education may influence public perception of a problem. The majority of respondents work as entrepreneurs (29%), traders (16%), employees (14%), daily laborers (13%), civil servants (3%), BUMN employees (1%), and motorcycle taxis (1%). As many as 23% of the respondents were housewives.

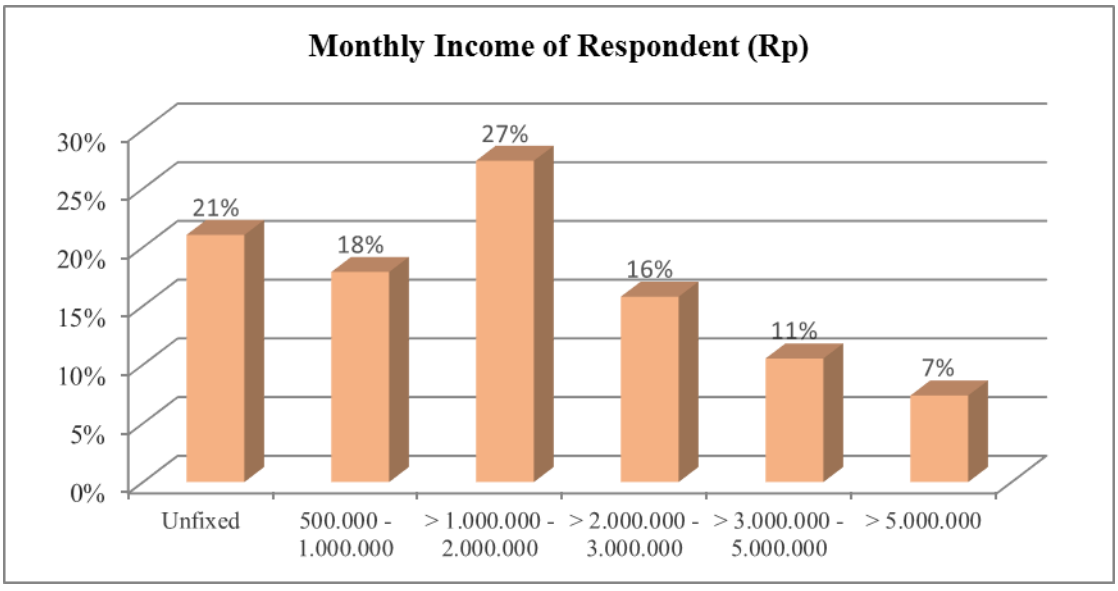

Figure 2 Monthly Income of Respondent in Rupiahs

Based on the interview, respondents who have an unfixed monthly income were 21%, while the remaining 79% of respondents had varying amounts of income (Figure 2). The level of income is one of the considered factors forming people's knowledge, perceptions, and behavior [12].

3.2 Community Knowledge Level

Knowledge is an impression in the human mind by using the five senses. It is also the result of remembering everything, including recalling events that have occurred either intentionally or unintentionally and occur after someone makes observations on a particular object [11]. Knowledge can be defined as individual understanding based on experience, events, and/or phenomena obtained from sense, either through sight, hearing, smell, taste, or touch [8]. Most human knowledge is obtained through the eyes and ears. Knowledge is a significant domain in building people's behavior [13].

Table 2 Community knowledge of several aspects of the river's ecosystem services

No	Aspects	Score	Category
1	River ecosystem services in water management and flood control	59%	Moderate
2	The permitted river utilization	57%	Moderate
3	Several activities in the river space required a permit	45%	Moderate
5	The prohibition of littering the river	80%	Good
6	The impacts of littering the river	82%	Excellent
7	Utilization of rivers is prohibited from causing pollution and causing disruption of river flow and/or collapse of riverbanks	64%	Good
8	The impacts of irresponsibility river utilization and not considering the ecosystem integrity.	66%	Good

The level of community knowledge related to river ecosystem services in water management and flood control was in the moderate category (59%). It explained that in general, the community was sufficiently aware that rivers have a major influence on water management and flood control. The community also had a moderate level of knowledge regarding the permitted river utilization. River utilization by the community was presented in figure 3. Nevertheless, some of the utilization was inappropriate and was able to harm river water quality [14].

The level of community knowledge related to several activities in the river space that required a permit was in the moderate category (45%). It indicated the lack of information in the community. The authority may perform periodic socialization, announcement sign installation, and booklet distribution for educating the public. Meanwhile, the community had a good level of knowledge about the prohibition of littering the river, with a score of 80%. Following the survey results that 69% of the people do not litter the river. They were informed by the village hall management, Indonesian National Army, health officer, signposts in the river-side area, news on television, social media, and organizations such as BWA (Bakti Wanita Asia). In line with this, the community knowledge level regarding the impacts of littering the river was 82%. This value was categorized as an excellent knowledge level indicating that dominantly the

community understands the rationale of the prohibition of littering the river, as well as the impacts that emerge if the river was polluted by waste and garbage.

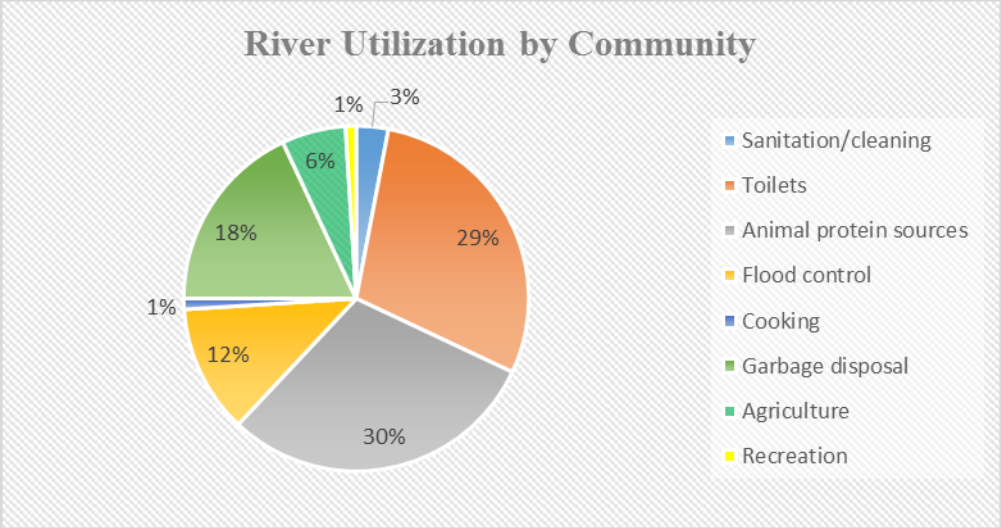

Figure 3 River utilization by the community

The prohibition of polluting rivers should not be a new theory for the community, especially for those who live around the Belawan watershed. It was illustrated by the level of public knowledge that the use of rivers is prohibited from driving pollution and generating disruption of river flow and/or the collapse of river cliffs was in a good category (64%). The majority of people understand that there is a regulation for river utilization. In addition, some provisions must be obeyed and maintained. Therefore, the use of the river does not interfere with its main ecological function.

The community also has a level of knowledge that was in the good category regarding the impacts of irresponsibility river utilization and not considering the ecosystem integrity (66%). In general, the community already had a complete picture of the provisions for river utilization, why they must be obeyed, and what impacts will occur if the utilization was inappropriate to the recommendations and applicable rules. Optimal river conditions with biodiversity, cleanliness, and comfortableness are potential in the ecotourism development [15] as a sustainable river utilization, which can provide ecological and economical benefits to the community [16]-[17].

Overall, the average level of knowledge of the respondents was 63% and was in a good category (61-80%). Although the respondents had a good level of knowledge, the data showed that there were people who still use rivers as a garbage disposal, which was 18% of the total respondents. The behavior of littering can be influenced by various factors, one of them was knowledge level [18]. Therefore, a correlation analysis was performed between the community knowledge level and the behavior of river littering. The results of the analysis were shown in Table 3.

Table 3 Correlation Analysis Results between Community Knowledge Levels and Behavior

Variable	Correlation Coefficient	Sig. (2-tailed)
Knowledge Levels	0,512**	0,00

** significant correlation on the level of confidence 99% (0,01)

The analysis results indicated that there was a positive correlation between the community knowledge level and the behavior of river littering, with a correlation coefficient of 0.512. It means that the correlation was in a moderate category [10]. The higher the level of knowledge, the higher the level of behavior, in this case, interpreted as river littering behavior. It is in accordance with the previous findings that there was a correlation between the level of knowledge and the behavior of disposing of waste [19]-[20]. Knowledge is an important domain, but not the only one, in shaping one's behavior [13].

Based on interviews, several reasons that drove respondents in littering the rivers were the limited land, lack of garbage disposal facilities and waste collectors staffs, garbage burning difficulties during the rainy season, inconvenience fog from garbage burning, and malodorous piled garbage. Littering the river is a reflection of the lack of public awareness about maintaining the cleanliness of the river and the environment or it could be due to the lack of existing facilities and infrastructure (Figure 4) . Previous research by [21] also found that the absence of trash can facilities and garbage trucks was the main factor driving the people of Weleri Village, Kendal Regency to throw garbage into the Damar River. The availability of proper facilities has a positive influence on people's behavior in disposing of waste [20],[22].

Figure 4 Littering the river as the lack of public awareness is happenened in some locations; (a) Badera River and (b) Bangun City River.

Indifference, character, and daily habits seem to play a role in this case. The absence of strict action in the form of fines or other penalties also makes the bad habit repeated and tends to be contagious within community groups. Previous research has also explained that the community around the Sekanak River has good knowledge regarding clean and sanitation behavior,

nevertheless, 20% of the community has not implemented their knowledge by still littering the river [14].

Another concerning aspect was the litter type in the river. The litters were food waste (24%), residual production materials such as fabric (4%), and plastic (3%). The frequency of waste disposing of was ranging from 1 to 7 days, and various weights were 0.5-7 kg per waste disposal. The residual of production materials, such as fabric, was up to 7 kg in weight. Fabric and plastic were types of undecomposed waste. [23] found that the Nagase River frequently contained litter types of plastic bags. The continuous accumulation of this garbage type will reduce the river's capacity and ability to drain water. Especially if it occurs along with siltation due to sedimentation originating from accelerated erosion [24].

The government plays a significant role in raising public awareness regarding river ecosystem services [14]. The government should provide more education and training programs in waste management to the community, for instance: planning for household waste collection [25] and managing the waste banks [26]. Dominantly, the community (82%) has never attended the mentioned program. As many as 8% of the community stated that they had participated in various training programs, i.e., garbage disposal, composting, producing bags from used plastic, and creating souvenirs. These programs were held by PKK women organization, school units, students, local governments, and the private sector.

Some of the efforts made to foster an attitude of caring for the environment were through the preparation of community empowerment guidelines, distribution of leaflets on waste management, procurement of trash cans, and submissions for waste transportation [21]. Moreover, the government can initiate various programs to raise the participation of the young generation in all stages of watershed management (planning, implementation, monitoring, and evaluation stage) [7]. Online-based socialization in social media could be more encouraged to attract the young generation [27].

4 Conclusion

The community knowledge level was 63% (good category). There was a moderate-positive correlation between the community knowledge level and the behavior of river littering (0.512 correlation coefficient). Community awareness can be increased through online-based socialization using social media or by providing more waste management training programs.

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