第 48 卷 第 10 期
2021 年 10 月

湖南大学学报（自然科学版）
Journal of Hunan University（Natural Sciences）

Vol. 48 No. 10
October 2021

Open Access Article

Community Participation in River Conservation in the Babon River, Central Java

Tommy Kurniawan[1*], Mohammad Bisri [2*], Pitojo Tri Juwono[2*], Ery Suhartanto[2*], Tiara Sarastika[3*]

[1] Doctoral Program in Water and Water Resources Engineering, Faculty of Engineering, Universitas Brawijaya, Malang, Indonesia

[2] Department of Water Resources, Faculty of Engineering, University of Brawijaya, Jl. MT Haryono No 167 Malang, Indonesia

[3] Department of Geography Education, Faculty of Social Science, Universitas Negeri Yogyakarta, Indonesia

Abstract: River has an important role in the sustainability of the ecosystem. The river provides many benefits to humans, both directly and indirectly. Several rivers in Indonesia are categorized as critical rivers, one of which is the Babon River. As the development subject, the community has a role in river management, planning, utilization, and conservation. Community perception and participation are some of the keys to river conservation. This study aims to examine the community perception of the Babon River starting from the upstream, middle, and downstream, which will be studied further on the river performance index; examine the form of community participation; examine the level of community participation in the conservation of the Babon River. The method used is descriptive, both qualitative and quantitative. The population used is the community that lives on the border of the Babon River, where the samples were selected using the Quota Sampling technique amounting to 1,200 people. Data collection techniques used were observation, interviews, and documentation, and the data were then analyzed descriptively. Perceptions and forms of community participation are examined based on interview data presented in a descriptive tabulation. The level of community participation was assessed using a Likert scale. The community perception of the condition of the Babon River is that the Babon River is classified in moderate level and damaged condition. The community understands the benefits of rivers but still pollutes rivers in the upstream, middle, and downstream areas, which will be studied further on the river performance index. Forms of community participation in river conservation include a high attitude of approval to carry out a river restoration, as long as the community is given compensation for residents' land. More than 60% of the community around the Babon River has not been involved in river conservation, and more than 90% have not joined the river community forum. The level of community participation is in the medium category, the level of knowledge and perception is in the medium-high category, but the community's attitude is classified as low-to-medium. Therefore, integrated river conservation involving the surrounding community needs to be improved.

Keywords: river, community participation, river conservation.

社區參與中爪哇巴邦河的河流保護

摘要: 河流在生態系統的可持續性中發揮著重要作用。河流直接和間接地為人類帶來了許多好處。印度尼西亞的幾條河流被歸類為關鍵河流，其中之一是巴邦河。社區作為發展主體，在河流管理中發揮作用，處於規劃、利用和保護過程中。社區認知和參與是河流保護的一些關鍵。本研究旨在從上游、中游和下游出發，考察社區對巴邦河的感知，並將在河流績效指數上進一步研究；檢查社區參與的形式；檢查社區參與保護巴邦河的程度。所使用的方法是描述性的，包括定性和定量的。使用的人口是居住在巴邦河邊界的社區，在那裡使用配額抽樣技術選擇了 1,200 人的樣本。使用的數據收集技術是觀察、訪談和記錄，然後對數據進行描述性分析。根據描述性表格中提供的訪談數據，對社區參與的看法和形式進行了檢查。

Received: June 14, 2021 / Revised: August 18, 2021 / Accepted: September 27, 2021 / Published: October 30, 2021

About the authors: Tommy Kurniawan, Doctoral Program in Water and Water Resources Engineering, Faculty of Engineering, Universitas Brawijaya, Malang, Indonesia; Mohammad Bisri, Pitojo Tri Juwono, Ery Suhartanto, Department of Water Resources, Faculty of Engineering, University of Brawijaya, Malang, Indonesia; Tiara Sarastika, Department of Geography Education, Faculty of Social Science, Universitas Negeri Yogyakarta, Indonesia

Corresponding authors Tommy Kurniawan, tommy_ccme@yahoo.co.id; Mohammad Bisri, mbisri@ub.ac.id; Pitojo Tri Juwono, pidiaa@yahoo.com; Ery Suhartanto, erysuhartanto@yahoo.com; Tiara Sarastika, tiarasarastika@uny.ac.id

使用李克特量表評估社區參與水平。社區對巴邦河狀況的看法是，巴邦河被劃分為中等水平和受損狀況。社區了解河流的好處，但仍然污染了上游、中游和下游地區的河流，這將在河流績效指數上進一步研究。社區參與河流保護的形式包括對進行河流修復的高度認可，只要社區在涉及居民土地時給予補償。巴邦河周邊 60%以上的社區沒有參與河流保護，90%以上的社區沒有加入河流社區論壇。社區參與度整體為中等，知識認知水平為中高，社區態度為中低。因此，需要加強涉及周邊社區的綜合河流保護。

关键词： 河流、社區參與、河流保護。

1. Introduction

The river is formed through a natural process influenced by various factors, namely topography, geology, geomorphology, soil, land use, and climate [1]. The river is a source of water that has an important function for life [2, 3]. The sustainability and continuity of the community's livelihoods and the environment need to be maintained by preserving the surrounding area of the river. The water needs increase each year, so it is important to use water resources efficiently and effectively, especially from the river [4]. Due to the need for water, it is necessary to preserve the sustainability of the river.

The river has several functions: water resources, water transportation, economic activities, interaction and socialization, and living things. Water is also used for various daily activities, such as household, agriculture, industrial, etc. Two-thirds of the earth consists of water, but humans can consume not all of the water. Water that is healthy to consume comes from lakes, rivers, groundwater, and springs. River, which is the source of life for living things, must be preserved and managed properly so that this kind of water resource can function without causing disadvantages for the community around the river. According to [5], poor river management causes disasters and river function decline. One of the causes of this condition is the low awareness of the community, which leads to the decrease of the river function.

Some efforts have been made to manage the watershed and the environment, but they have not been integrated properly, especially in terms of the operation and maintenance of the river. [6] stated that it is necessary to conduct reforestation to improve the groundwater absorption and reduce the rate of water runoff to prevent the impact of human activities, especially in the upstream part of the river. The hydrological cycle in Indonesia is starting to be affected by the increasing number of human activities, especially the decreasing quantity and quality of water in Indonesia. This condition is caused by household and industrial waste that is thrown directly into rivers.

The government has carried out various river conservation programs based on interest factors, such as making infiltration wells, revitalizing rivers, cleaning culverts, controlling settlements located on river borders, etc. This fact shows the importance of the government's role in managing rivers. The community also plays an important role in river conservation, and the government acts as the holder of power. Therefore, community participation in maintaining the river is strongly influenced by a formal and informal community [7].

Some examples of human activities that are exploratory to the environment are throwing garbage and waste carelessly in rivers, utilizing the land in river border areas without following their designation, and managing river border areas without thinking about environmental sustainability. This can cause a bad impact on environmental sustainability and trigger environmental damage [8]. Community participation is very important in the whole process, which requires active or passive involvement from an individual or group of people consciously and voluntarily to participate in a program or activity, starting from planning, implementation, evaluation, to utilization.

River water management must be carried out comprehensively by considering the impacts on other areas. The river flows upstream in the highlands, then through the middle area, and finally reach the downstream area have a clear connection. Explorative cultivation activities and low public awareness in the upstream area can negatively affect the downstream area. This problem is also found in this study location, where the Babon River is included in the Babon sub-watershed area in Central Java Province. This sub-watershed is classified as critical, so it requires intensive and integrated management. Previous researchers have never studied problems related to community participation in this location. Thus, this research aims to 1) examine the community perception of the Babon River, starting from the upstream, middle, and downstream for further study on the river performance index; 2) examine the form of community participation; 3) examine the level of community participation in conservation of the Babon River.

2. Materials and Methods

This research is descriptive research, where the research process is to analyze a phenomenon. By applying this approach, the researcher collected the perspective from the respondent's point of view and conducted a study on the situation experienced. The data were obtained from observations and interviews with the community. The types of data used in this study were qualitative data and quantitative data. The research location was the Babon River, which was chosen by considering that the condition of the river is included in the critical category, so it is necessary to conserve the river.

The research area covers upstream to downstream along 16.1 kilometers. Upstream is in Plamongansari village, Pedurungan district, Semarang until downstream is in Trimulyo village, Genuk district, Semarang, as shown in Figure 1. The population used in this study was the community that lived on the Babon River border. The sampling technique used was quota sampling, which considers certain elements in the study to the desired quota or amount [9]. Researchers took a sample of 1,200 people from upstream to downstream on the Babon River border. Sampling was initiated by dividing the buffer area as far as 400 meters from the river body, along 16.1 km, to determine the location limits of respondents from upstream to downstream. After that, 100 sampling points were determined by dividing the grid of the same size from upstream to downstream. Each point has three respondents that give their perception and level of participation. Respondents were selected using the purposive sampling technique based on existing land use patterns while considering the ease of access, cost, and time so that the sample points represent community participation. This research was conducted in March 2021.

Fig. 1 Research locations in Babon sub-watershed

Based on the Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia No. 28/PRT/M/2015, the borderline is an imaginary line in which there is much interaction between human activities and rivers. The boundaries of river boundaries are presented in Figure 2. Community participation is the involvement of an individual or group in an activity. River conservation is river management that can provide products and services as expected without reducing the function of the forest and causing unwanted environmental impacts. Data collection techniques in this study were observation, interviews, and documentation. The analytical technique used in this research was a descriptive analysis that was conducted qualitatively and quantitatively.

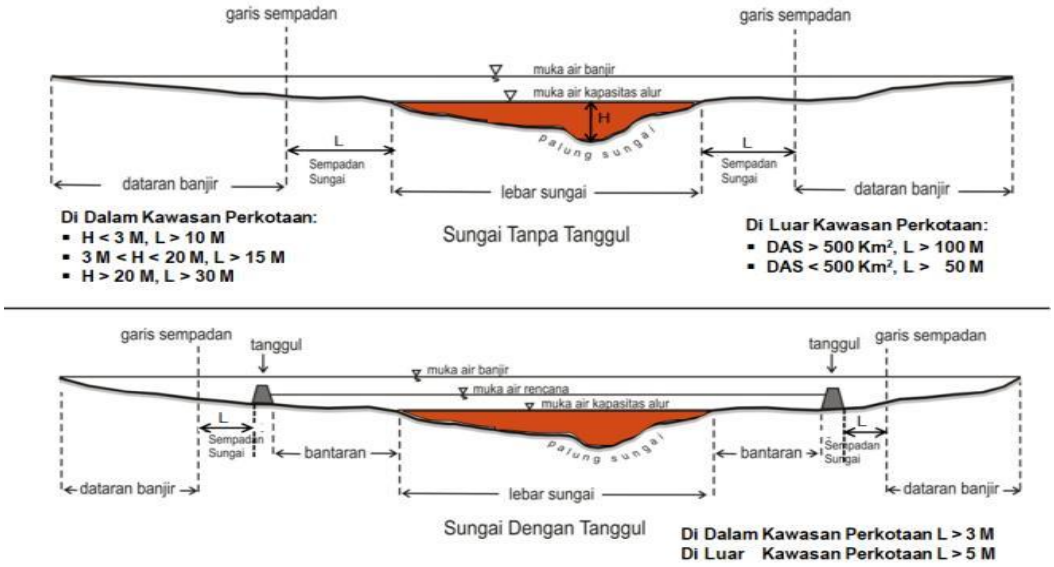

Fig. 2 River border sketch [20]

Identification of the condition of the Babon River was obtained from the results of observations and literature studies. Perceptions and forms of community participation in the Babon River were obtained from interviews consisting of the community's knowledge, perceptions, and attitudes. The knowledge parameter consists of four indicators: understanding of river benefits, river conditions, border ownership, and sources of information on river improvement. The perception parameter uses two indicators: the perception of the use of river borderland and the response to the river improvement plan. The form of community participation was examined through the parameters of community attitudes in river conservation, which consist of 6 indicators, namely the activity of throwing garbage and waste in rivers, community involvement in river conservation, community willingness to join the River Community Forum, attitudes of approval to river restoration plans, and attitudes towards river restoration activities that can affect their land.

Photos of conditions in the field complemented the first descriptive analysis of the condition of the Babon River. Next, a descriptive analysis of perceptions and forms of community participation was presented through tabulation of data, while the level of community participation in rivers was shown using a Likert scale assessment. Likert scale was used to convert qualitative data into quantitative. This study used three assessment scores, namely (3) know/agree, (2) doubtful, and (1) do not know/disagree. The assessment of the level of community participation was carried out on 12 questions with 1,200 respondents. The results of the interviews were then weighted and analyzed quantitatively by changing the ordinal values into interval values. The value of this interval was used as an indicator to determine the low, medium, and high classes.

3. Results and Discussion

3.1. Condition of the Babon River

Babon River is one of the rivers in the Jratunseluna River Basin and is included in the Dolog Penggaron watershed unit, which plays a role in the hydrological process. The Babon River flows from the Pucang Gading Weir to the north through two sub-districts, namely Pedurungan district and Genuk district, emptying into the Java Sea in Sayung district. The Baboon Sub-watershed plays an important role in the sustainability of the ecosystem in the Semarang area and its surroundings. Human activities on land use such as settlements, agriculture, and industry will trigger environmental problems in the Baboon Sub-watershed [10]. Problems can arise in all parts, namely in the upstream, middle, and downstream areas. Downstream areas usually experience flooding, water pollution, decreased biodiversity, and sedimentation. This will disturb the balance of the ecosystem in a sub-watershed.

Based on the field observations, the land use types in the Babon sub-watershed were 70% of open land, 27% of closed land, and the remaining 3% of the river body. Open land consisted of 30% grassland, 34% plantation/garden, and 6% dry land/field. Meanwhile, the closed land consisted of 26.6% for settlements and places of activity and 0.4% for buildings. The division of the upstream, middle, and downstream areas in the Babon sub-watershed can be identified through the dominance of land use. The Babon sub-watershed is located in the middle of the city so that settlements dominate the upstream, and there are still open lands such as grasslands, plantations, and dry fields. In the middle area, it is found that there was an intensive change in land use into residential and building. Meanwhile, the downstream area was for dense residential land and some open land in coastal areas.

Fig. 3 Photos at Pucang Gading Weir on the Babon River

Fig. 4 Photos in the Middle Area of the Babon River

Fig. 5 Photos at the Downstream Area of the Babon River

The downstream area of the Babon River received waste from the upstream and middle parts, which were from industrial, agricultural, and household waste. According to [11], there are several factors/industrial activities in the waters near the mouth of the Babon River. Waste processed at the Babon River estuary comes from the manufacture of motorcycles, papermaking, shrimp packaging, and factories in the Terboyo Industrial Estate on the banks of the Babon River. Some of them dumped the waste directly or

indirectly into the water. Under these conditions, aquaculture, industry, and family settlements have increased water pollution and environmental stress.

3.2. Respondent's Characteristics

Respondents' characteristics were identified from four parameters, namely age, sex, education, and occupation. Overall, people dominated the respondents at 40-50 years, followed by 30-40 years. This indicates that the respondents have met the age criteria (mature) and can answer questions according to their experience. Based on sex, the respondents were dominated by males, which is not much different from the number of female respondents; there is gender equality in this study. High school/vocational high school graduates dominated the educational background of the respondents, which means that the community around the Babon River already has a fairly good education so that they can respond to problems in the surrounding environment. The dominance of the respondent's occupation was private employees, and this is following the conditions of the research location environment, which is in the form of urban areas so that there are many factories as a place to work for the community. In detail, the respondents' characteristics were presented through the graph in Figure 6. The respondents ' characteristics were differentiated based on the upstream, middle, and downstream areas, presented in Table 1.

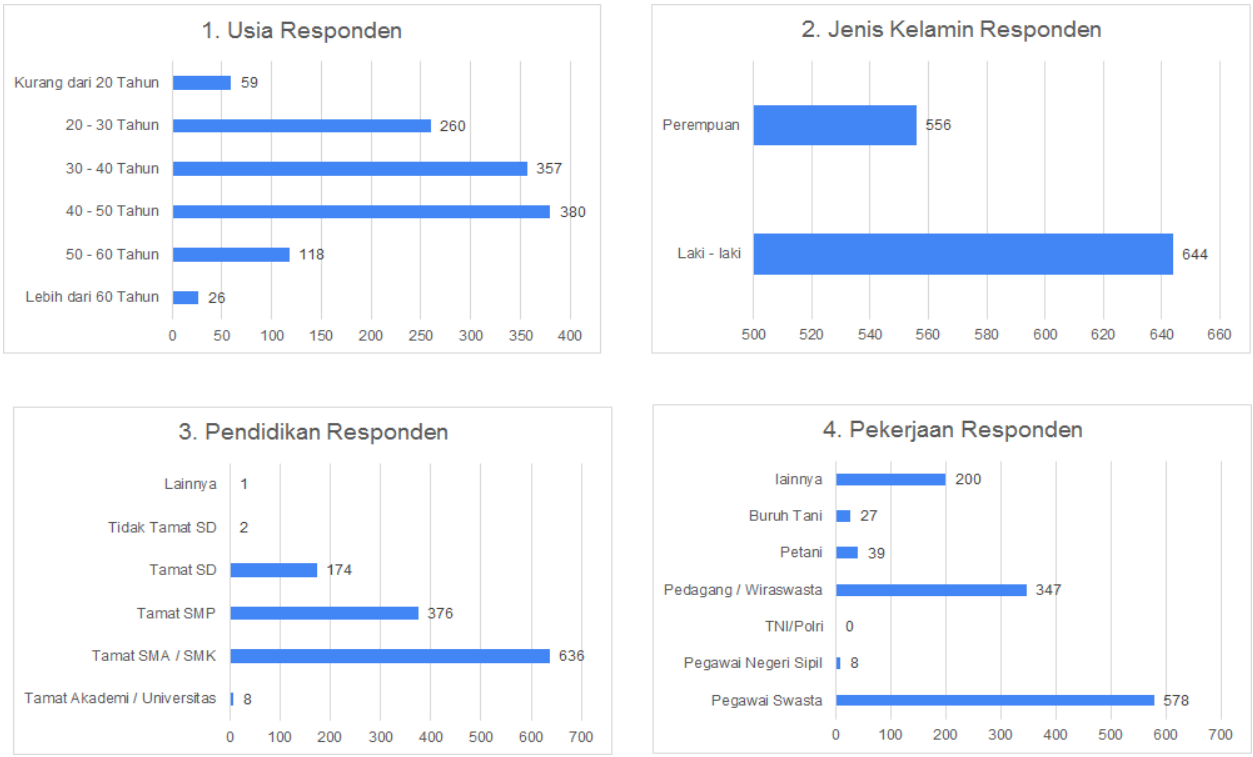

Fig. 6 Respondent's characteristics

Table 1 Respondent's characteristics (Own study, 2021)

Parameter	Upstream	Middle	Downstream
Age	>60 years (5%)	>60 years (1%)	>60 years (1%)
	50-60 years (13%)	50-60 years (8%)	50-60 years (9%)
	40-50 years (34%)	40-50 years (28%)	40-50 years (33%)
	30-40 years (24%)	30-40 years (32%)	30-40 years (33%)
	20-30 years (21%)	20-30 years (25%)	20-30 years (18%)
	<20 years (3%)	<20 years (6%)	<20 years (6%)
Sex	Male (60%)	Male (52%)	Male (49%)
	Female (40%)	Female (48%)	Female (51%)
Education	University (2%)	University (3%)	University (0%)
	Senior High School (44%)	Senior High School (43%)	Senior High School (60%)
	Junior High School (34%)	Junior High School (46%)	Junior High School (28%)
	Elementary School (20%)	Elementary School (8%)	Elementary School (12%)
Occupation	Private employee (39%)	Private employee (52%)	Private employee (53%)
	Civil servant (1%)	Civil servant (1%)	Civil servant (1%)
	Wiraswasta (27%)	Wiraswasta (27%)	Wiraswasta (33%)
	Farmer (10%)	Farmer (0%)	Farmer (0%)
	Farm worker (7%)	Farm worker (0%)	Farm workers (0%)
	Others (16%)	Others (20%)	Others (13%)

Based on Table 1, the data were analyzed by gender and education. The results of the analysis showed that 1) the total percentage of male respondents was 53.72% and female respondents were 46.28%; 2) in the upstream area, the percentage of male respondents was 60.66%, and female respondents was 39.34%; 3) in the middle area, the percentage of male respondents was 51.6%, and female was 48.4%; and 4) in the downstream area, the percentage of male respondents was 48.87%, and female was 51.12%. The data are shown in Figure 7. Gender mainstreaming strategies are needed to ensure that all levels of society can be involved in the development process and its benefits.

Gender equality means that men and women can develop optimally without being constrained by their sex. Meanwhile, gender justice means that men and women have different needs that must be met. The forms of gender and justice equality include access, participation, control, and benefits. Gender mainstreaming in the implementation of river management includes planning, implementation, monitoring, and evaluation processes. It is expected that all levels of society can carry out the development process.

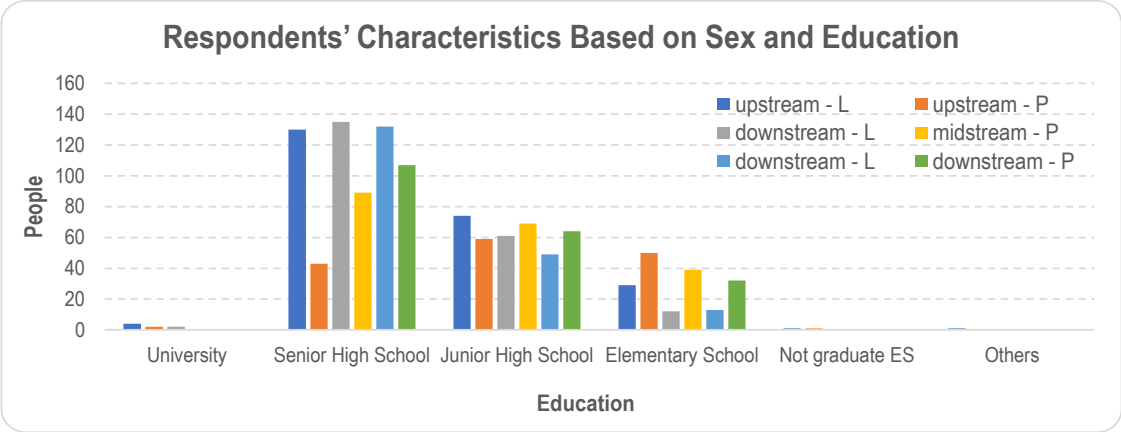

Fig. 7 Respondents' characteristics based on sex and education

The government has mandated gender mainstreaming through Presidential Instruction No. 9 of 2020 concerning PUG in national development, the Minister of Home Affairs Regulation No. 15 of 2008 General Guidelines for the Implementation of Gender Mainstreaming in the Regions, as has been enhanced by the Minister of Home Affairs Regulation No. 67 of 2011 concerning amendments to the Minister of Home Affairs Regulation No 15 of 2008, and Regulation of the Governor of Central Java Province No. 71 of 2017 concerning the Implementation of Gender Mainstreaming in the Province of Central Java.

Based on the data, it can be concluded that the determinants of perception on river management were male respondents whose educational background was Senior High School (61.74%), followed by female respondents (43.13%), with a comparison of PUG data of 46.28%.

3.3. Community Perception toward the Babon River

Perception is a person's process of understanding information about his/her environment through either sight, hearing, smell, feeling, or appreciation [12]. Community perception is defined as a series of processes experienced by the community in understanding an object, situation, or event relationship through the media of sight, hearing, smell, feeling, and appreciation. Therefore, the respondents' characteristics affect the community perception of the river. The community perception of the river describes how much understanding of the importance of the river. [13] explains that community perception also affects community participation in river management.

The majority of people around the Babon River understood the benefits of the river, >60% of the community were able to explain the benefits of the river, namely as a water provider, a source of irrigation of rice fields, and a breeding ground for river biota. The community perception of the condition of the Babon River was that the condition of the river was included in the moderate to damaged category. The condition of the Babon River in the upstream area was in the moderate category (38%), damaged category (36%), and polluted category (16%). The condition of the river in the middle area was in the medium category (73%), and the condition of the river in the downstream area was in the moderate category (44%) and damaged category (48%). The details of the data are presented in Table 2.

The various responses of the community toward the river conditions in the upstream, middle, and downstream areas are influenced by the characteristics of the community. The perception of the upstream community showed that the attitude of throwing garbage in the river was quite influential on the condition of the river in the middle and downstream. This can be seen from the response of the upstream community that the condition of the river was being damaged because it was polluted by garbage and industrial waste. The community in the middle view the

river conditions as being in the moderate category because, in this area, the community can still benefit from the river and receive only a little negative impact from the Babon River. The downstream area receives the impact of garbage and waste disposal activities from the upstream and middle parts, so that community perception regarding the condition of the river was in the moderate-damaged category.

The river border as a buffer zone for the river body is a natural ecosystem not used for certain land uses. The community's perception of the Babon River on river borders was low, especially for land use in the form of settlements. The surrounding community used the Babon River border for land or land use in gardens, fields, and shrubs. This is also supported by the perception from the community, who stated that the ownership of river borderland was the property of the local government. Based on Table 2, it is shown that >90% of the community do not use river borders for settlements, considering the dangers that may occur. Furthermore, >50% of the community revealed that the land on the river border belongs to the local government, which should not be used arbitrarily.

The community perception showed that the condition of the river being categorized as moderate-damaged triggers the emergence of certain river repair activities, whether conducted by the government, private, or academic programs. The community obtained information about the river improvement plan from several media, namely the village government, newspapers, electronic media, the River Basin Center, Regency Public Works, and Provincial Public Works. About >50% community in the upstream and downstream areas received information related to river improvement plans through the Village Government. This showed that the village organization was quite good at managing village communities. This is different from the middle area, where >85% of the community gets river improvement plans through newspapers/electronic media.

The community perception of the river improvement plan was in the high category, which means the community agreed with the improvement plan. The community in the upstream had the highest perception, followed by the downstream community, and the lowest one was in the middle community. This fact was influenced by sources of information related to river improvement plans, where the community in the middle area obtained information from electronic media, which is considered less reliable than information obtained from the village government. The percentage of information sources and community approval perceptions regarding the river improvement plan are presented in Table 2.

Table 2 Percentage of Dominance in Community Perception of the Babon River (Own study, 2021)

Parameters	Upstream	Middle	Downstream
River benefits	Yes, understand the river benefits (86%), consists of male (60%) & female (40%)	Yes, understand the river benefits (62%) %), consists of male (51.78%) & female (48.22%)	Yes, understand the river benefits (79%) consists of male (49.52%) & female (50.48%)
River condition	Good (1%) Moderate (38%) Damaged (36%) Severely damaged (8%) Polluted (16%) Do not know (1%) Responded by male (60.66%) & female (39.34%)	Good (4%) Moderate (73%) Damaged (15%) Severely damaged (0%) Polluted (7%) Do not know (0%) Responded by male (51.48%) & female (48.52%)	Good (7%) Moderate (44%) Damaged (48%) Severely damaged (0%) Polluted (1%) Do not know (1%) Responded by male (48.87%) & female (51.13%)
Perception towards river border	Do not use the river border as a settlement (97%)	Do not use the river border as a settlement (95%)	Do not use the river border as a settlement (100%)
-Utilize the river border	Owned by the regional government (51%)	Owned by the regional government (50%)	Owned by the regional government (65%)
-Ownership of land of the river border	Responded by male (60.79%) & female (39.21%)	Responded by male (51.86%) & female (48.14%)	Responded by male (48.8%) & female (51.2%)
-Perception towards River Improvement	The source of information is the village government (52%)	Sumber informasi dari surat kabar/media elektronik (86%)	Sumber informasi dari PemDes (60%)
-Information on River Improvement	Agree with the river improvement plan (92%)	Setuju dengan rencana perbaikan sungai (55%)	Setuju dengan rencana perbaikan sungai (71%)
-Plan of River Improvement	Is responded by male L (61.13%) & female (38.87%)	Responded by male (52.12%) & female (47.88%)	Is responded by male (50.15%) & female (49.85%)

3.4. Forms of Community Participation in the Conservation of the Babon River

Management of the river environment can be interpreted as awareness in preserving and improving the river environment so that the community's basic needs can be fulfilled. In terms of the efforts to fulfill human survival, each community group perceives basic needs, which vary and change from time to time. Therefore, environmental management must be flexible [14]. The scope of protection and management of the river environment by community participation starts with planning, utilization, control, maintenance, supervision, and law enforcement.

According to [15], every business plan or activity that can cause significant impacts requires management so that the environment can tolerate these impacts.

River management agencies must carry out environmental management at each activity stage following the impacts, especially community perception. The management of community perception is carried out by using socio-economic, institutional, and technological approaches. The socio-economic approach describes the socio-economic aspects, the institutional approach determines the relevant institutions, and the technological approach describes the technology used to control impacts. Furthermore, community participation has been stated in Government Regulation no. 22 of 2021 Article 160.

Ideally, there are efforts to protect and manage the environment in five indicators of community participation for river conservation. The first indicator, according to the results in Table 3, showed that the attitude of the community towards river pollution through activities of disposing of garbage and waste was quite high, where >50% of the community around the Babon River considered that polluting the environment was commonplace and happened a lot there. The increase in perception also occurred in the middle and downstream areas that had received garbage and waste from upstream. The percentage of the community perception toward river pollution activities was presented in Table 2. The habit of throwing garbage in rivers showed a decline in water culture, which is a very dangerous condition for the life of a generation [16] because the river is the lifeblood that supplies water directly or indirectly for the needs of the community, such as the need for drinking water, irrigation, industry, etc.

The second indicator is that >60% of the community living in the upstream, middle, and downstream areas of the Babon River border were not involved in river conservation. This showed that the community had not been invited to participate in conservation efforts, even though the community was in direct contact with the river. The percentage level of community involvement in each upstream, middle, and downstream section was presented in Table 3. The community around the Babon River has not felt integrated river management. Therefore, the Government needs to encourage & conduct socialization in the community to increase community participation in river management. The forms of activities that can be carried out are 1) the clean river movement; 2) the City Without Slums Program (KOTAKU), which is a program to build an integrated system for handling slums, where local governments lead and collaborate with stakeholders in planning and implementation, as well as promoting community participation, community development, & empowerment activities for river care, and others.

The third indicator in river conservation effort is the community involvement in the River Community Forum. The River Community Forum consists of community, business actors, government, universities, and others to maintain the river. Based on the interviews, >90% of the community living on the Babon River border were not involved in the River Community Forum. This condition showed no good organization in river conservation efforts among the Babon River border communities. The percentage level of community involvement in the River Community Forum in each upstream, middle, and downstream section was presented in Table 3.

[17] explained that community perception of social understanding can be obtained from socialization activities, including transferring knowledge and information from expert groups, such as academics and scientists, to the public. The knowledge and understanding of the community is the initial capital in increasing community social participation in efforts to conserve the Babon River. Through community participation in river community forums, the awareness of the importance of protecting the river environment increases. [18] explained that the existence of river communities can improve river conditions through various river conservation activities. Community participation through participation in this river community is an important thing to realize sustainable river management.

The form of community participation in river conservation is also shown through the fourth indicator, community approval to the river improvement plan. The perception of the river's condition categorized as moderate to damaged raises community approval to carry out river repairs. The community hopes that the river improvement plan can change the condition of the river for the better. Based on Table 3, the communities in the upstream, middle, and downstream areas of the Babon River stated that they agreed, and even the community in the middle area stated that they strongly agreed with the river improvement plan. The government and the private sector have carried out socialization programs to conserve the Babon River. The thing to improve is community involvement in river conservation activities.

The fifth indicator deals with river restoration. The river improvement plan certainly brings positive and negative impacts. The positive impact is an improvement in the performance of the river so that its sustainability can be maintained without harming the surrounding environment. Negative impacts of the river improvement plan also occur, one of which is the possibility of river restoration, which will affect community land. The community gave various responses regarding this condition, including wanting compensation for land affected by river restoration, holding deliberations, making agreements, and not agreeing with river restoration by some people. Based on Table 3, it is known that >75% of the community in each area of the upstream, middle, and downstream \ asked for compensation because the community had lost land due to the river restoration program. River

restoration programs can benefit the community, aiming to reduce flood risks that often occur downstream.

Table 3 Percentage of dominance indicators of community participation in river conservation efforts (Own study, 2021)

Characteristics	Upstream	Middle	Downstream
Attitude towards the river -Throwing garbage -Throwing waste	Throwing garbage in the river (56%) Not throwing industrial waste in the river (70%) Responded by male (60.89%) & female (39.11%)	Throwing garbage in the river (77%) Not throwing industrial waste in the river (55%) Responded by male (51.85%) & female (48.15%)	Throwing garbage in the river (77%) Not throwing industrial waste in the river (52%) Responded by male (48.87% & female (51.13%)
Community Involvement in River Conservation	The community does not involve (64%) consisting of a male (60.77%) & female (39.23%)	The community does not involve (77%) consisting of a male (51.85%) & female (48.15%)	The community does not involve (64%) Consisting of male (48.87%) & female (51.13%)
Community Participation in River Community Forum	The community does not involve (97%) consisting of a male (60.81%) & female (39.19%)	The community does not involve (100%) consisting of a male (51.85%) & female (48.15%)	The community does not involve (99%) Consisting of male (48.87%) & female (51.13%)
Approval of the River Improvement Plan	Very agree (39%) Agree (61%) consisting of male (60.51%) & female (39.49%)	Very agree (56%) Agree (41%) Doubtful (3%) consisting of male (51.99%) & female (48.01%)	Very agree (11%) Agree (87%) Doubtful (2%) consisting of male (48.99%) & female (51.01%)
Attitudes Towards River Restoration Regarding Community Land	Asking for compensation (86%) consisting of male (61.40%) & female (38.60%)	Asking for compensation (78%) consisting of male (51.36%) & female (48.64%)	Asking for compensation (85%) consisting of male (47.72%) & female (52.28%)

3.5. Level of Community Participation in River Conservation

The assessment of the level of community participation in river conservation was analyzed using a Likert Scale. The parameters used to determine community participation are knowledge, perceptions, and community attitudes towards river conservation. There are 12 indicators used in the assessment, and they are distinguished between the upstream, middle, and downstream areas of the Babon River. Based on Table 4, it can be seen that the overall level of community participation in river conservation was in the moderate category. Likewise, the assessment of each upstream, middle, and downstream area was included in the moderate category. This fact shows that the community still needs information and invitations to understand the importance of the river and its conservation.

Knowledge parameters consisting of indicators of understanding river conditions, river benefits, river border ownership, and sources of information in river conservation showed different results. The community understands the benefits, conditions, and ownership of borders, namely medium-high. Meanwhile, the understanding related to the source of information on river improvement plans is in the low-medium category. This means that local governments need to increase the dissemination of information to reach the community.

The parameter of community perception was assessed from their perception of changes in land use from border areas to settlements and perceptions of the river improvement plan. Communities around the Babon River, in the upstream, middle, and downstream areas, have a high category of perception. This means that most of the community does not use the border as residential land and agrees with the river improvement plan. This high perception is influenced by a quite high community knowledge regarding ownership of river borders and river improvement.

The attitude parameter used six indicators: throwing garbage, throwing waste, community involvement in conservation activities, river community forums, river restoration, and community attitudes towards residents' land. Table 4 showed that the community's attitude in the context of river conservation was in the low-medium category, except for attitudes towards the river restoration plan. Communities in the upstream, middle, and downstream areas had an attitude included in low categories: still throwing garbage and waste in the river, not being involved in river conservation activities, and not being involved in river community forums. This showed that the community did not yet have the awareness to protect the river environment. Based on this assessment, the government needs to carry out socialization to increase public awareness around the Babon River. According to [19], the combined management model, namely the top-down and bottom-up methods, is suitable for community participation-based management, especially in urban areas.

Table 4 Assessment of the level of community participation in river conservation activities (Own study, 2021)

Parameters	Indicators	Total Score of Watershed	Watershed Category	Total Score of the Upstream Area	Upstream Category	Total Score of the Middle Area	Middle Area Category	Total Score of the Downstream Area	Downstream Category
Knowledge	River benefits	3011	High	1074	High	913	Moderate	1027	High
	Kondisi	2988	High	929	High	1121	High	941	High
	River border ownership	2903	High	909	Moderate	1019	High	977	High
	The information source of river improvement	2142	Moderate	922	Moderate	492	Low	731	Moderate
Perception	River borders used for settlements	3519	High	1158	High	1175	High	1189	High
	River improvement plan	2925	High	1120	High	851	Moderate	957	High
Attitude	Throwing garbage	1913	Low	740	Moderate	593	Low	581	Low
	Throwing waste	2604	Moderate	945	High	849	Moderate	811	Moderate
	Involvement	1939	Low	670	Moderate	589	Low	681	Moderate
	River Community Forum	1226	Low	415	Low	407	Low	405	Low
	River Restoration	3552	High	1169	High	1202	High	1181	High
	Restoration of the residents' land	2561	Moderate	851	Moderate	852	Moderate	860	Moderate
Total		Moderate		Moderate		Moderate		Moderate	

Based on the analysis on the perception and assessment of community participation in river conservation, several indicators can be used for further studies on river performance index assessment, namely community activities, profile or socio-economic conditions of the community, and community participation. It is hoped that the assessment of the river performance index that will be studied can obtain good results according to the socio-economic conditions around the Babon River.

4. Conclusion

Community perception of the condition of the Babon River is categorized in moderate to damaged conditions. The community understands the benefits of the river but still pollutes rivers in the upstream, middle, and downstream areas, which will be conducted in further studies on the river performance assessment index. Forms of community participation in river conservation include a high attitude for river restoration, with one condition that if it is about residents' land, the community asks for compensation. About >60% of the community around the Babon River have not been involved in river conservation activities, and >90% of the community have not joined the river community forum. The level of community participation is included in the medium category, the level of knowledge and perception is in the medium-high category, but the community's attitude is classified in the low-medium category. Therefore, integrated river conservation by involving the surrounding community needs to be improved.

References

[1] SEYHAN, E. *Dasar-Dasar hidrologi (Basic of hydrology)*. Yogyakarta: Gadjah Mada University Press, 1977.

[2] JUWONO, P.T., LIMANTARA, L.M., and AMRIE, S. The effect of land-use change to the depth area and inundation in the Bang sub-watershed Malang-Indonesia. *International Journal of Geomate*, 2018, 16(53): 240-246.

[3] ADHIKARI, B.R. Flooding and inundation in Nepal Terai: Issues and Concerns. *Hydro Nepal*, 2013, 12: 59-65
[4] JUWONO, P.T., LIMANTAR, L.M., and ROSIADI, F. Optimization of irrigation cropping pattern using linear programming: A case study on irrigation area of Parsanga, Madura Island, Indonesia. *Journal of Water and Land Development*, 2018, 39: 51–60.
[5] WAHYUDI, A.H., SOBRIYAH, and YUNANTO, I. Desain kriteria penilaian kinerja sungai berdasarkan aspek fungsi bangunan (Assessment criteria design of river performance based on the structure function aspect) (Studi kasus Sungai Pepe Baru Surakarta). *e-Jurnal Matriks Teknik Sipil*, Desember 2016, 1112.
[6] ZEMP, D.C., WENG, W., COSTA, L., and LUDEKE, M.K.B. Aerial river management by Smart Cross-Border Reforestation. *Land Use Policy*, 2019, 84: 105-113.
[7] MATSUSHIMA, K., OGI, K., ARI, and ISMURINI, D. Community participation on water management; Case Singosari District, Malang Regency, Indonesia. *Procedia Environmental Sciences*, 2013, 17: 805-813.
[8] JUWONO, P.T., and SUBAGITO, A. *Integrasi pengelolaan Daerah Aliran Sungai dengan wilayah pesisir (The integration of watershed management with coast region)*. Malang: UB Press, 2019.
[9] SUGIYONO. *Metode penelitian kombinasi (Mixed resear4ch methods)*. Bandung: CV Alfabeta, 2018.
[10] SUPARJO, M.N. Kondisi pencemaran perairan Sungai Babon Semarang (Watering polution condition in the Sungai Babon-Semarang). *Saintek Perikanan: Indonesian Journal of Fisheries Science and Technology*, 2011, 4(2): 38–45.
[11] CAHYANINGTYAS, I., HUTABARAT, S., and SOEDARSONO, P. Studi analisa plankton untuk menentukan tingkat pencemaran di muara Sungai Babon Semarang (Stusy of plankton analysis dor determining the polution level in the estuary of Sungai Babon-Semarang). *Management of Aquatic Resources Journal (MAQUARES)*, 2013, 2(3): 74–84.
[12] THOHA, M. *Perilaku organisasi konsep dasar dan aplikasinya (Organization behaviour base concept and application)*. Jakarta: PT Raja Grafindo Persada, 2005.
[13] MARYONO, A. *Eko-hidraulik pengelolaan sungai ramah lingkungan (Echo-hydraulicsmanagement of environment friendly river)*. Yogyakarta: Gadjah Mada University Press, 2017.
[14] SOEMARWOTO, O. *Ekologi, lingkungan hidup dan pembangunan (Ecology, life environment, and development)*. Jakarta: Djambatan, 2008.
[15] MANIK, K.E.S. *Pengelolaan lingkungan hidup (Management of life environment)*. Jakarta: Djambatan, 2007.
[16] MARYONO, A. *Reformasi pengelolaan sumberdaya air (Reformation of water resources management)*. Yogyakarta: Gadjah Mada University Press, 2017.
[17] CABALLERO-SERRANO, V., ALDAY, J.G., AMIGO, J., CABALLERO, D., CARRASO, J.C., MCLAREN, B., and ONAINDI, M. Social perceptions of biodiversity and ecosystem services in the Ecuadorian Amazon. *Human Ecology*, 2017, 45: 475-486.
[18] ANGRIANI, P., SUMARMI, RUJA, I.N., and BACHRI, S. River management: The importance of the roles of the public sector and community in river preservation in Banjarmasin (A case study of the Kuin River, Banjarmasin, South Kalimantan – Indonesia). *Sustainable Cities and Society*, 2018, 43: 11-20.
[19] LI, X., ZHANG, F., HUI, E.C., and LANG, W. Collaborative workshop, and community participation: A new approach to urban regeneration in China. *Cities*, 2020, 102.
[20] MINISTER OF PUBLIC WORKS AND HOUSING. *Regulation No. 28/PRT/M/2015 on Stipulation of River Border Line and Border Line Lake*, 2015, Indonesia.

参考文:

[1] SEYHAN, E. 水文學基礎。日惹：加札馬達大學出版社，1977。
[2] JUWONO, P.T.、LIMANTARA, L.M., 和 AMRIE, S. 土地利用變化對 砰子流域 瑪瑯-印度尼西亞的深度區域和淹沒的影響。國際地質學雜誌, 2018, 16(53): 240-246。
[3] ADHIKARI, B.R. 尼泊爾特萊的洪水和淹沒：問題和關注。尼泊爾水電，2013，12:59-65
[4] JUWONO, P.T., LIMANTAR, L.M., 和 ROSIADI, F. 使用線性規劃優化灌溉種植模式：印度尼西亞馬杜拉島 帕桑加灌溉區的案例研究。水土發展雜誌，2018，39：51-60。
[5] WAHYUDI, A.H., SOBRIYAH, 和 YUNANTO, I. 基於建築功能方面的河流性能評估設計標準（基於結構功能方面的河流性能評估標准設計）（雙溪佩佩巴魯甦拉卡塔的案例研究）。土木工程矩陣電子期刊，2016 12 月，1112。
[6] ZEMP, D.C.、WENG, W.、COSTA, L., 和 LUDEKE, M.K.B. 通過智能跨境再造林進行空中河流管理。土地使用政策，2019，84：105-113。
[7] MATSUSHIMA, K.、OGI, K.、ARI, 和 ISMURINI, D. 社區參與水資源管理； 案例新加坡區，瑪瑯攝政，印度尼西亞。 繼續環境科學，2013，17：805-813。
[8] JUWONO, P.T., 和 SUBAGITO, A. 流域管理與海岸地區的整合。瑪瑯：出版社，2019。
[9] SUGIYONO。組合研究方法（混合研究方法）。萬隆： 阿爾法貝塔，2018。
[10] SUPARJO, M.N. 尼蘇達州巴本河三寶壟的水污染狀況（狒狒河-三寶壟的水污染狀況）。漁業科學：印度尼西亞漁業科學與技術雜誌，2011，4(2)：38–45。
[11] CAHYANINGTYAS, I. 、 HUTABARAT, S., 和 SOEDARSONO, P. 斯圖西浮游生物分析確定 狒狒三寶壟河口污染水平。水產資源管理雜誌 (馬誇雷斯), 2013, 2(3): 74–84。
[12] THOHA, M. 組織行為基礎概念與應用。雅加達：格拉芬多·佩薩達國王，2005。
[13] MARYONO, A. 環保河流的生態液壓管理。日惹：加札馬達大學出版社，2017。

[14] SOMARWOTO, O. 生態、環境與發展（生態、生活環境和發展）。雅加達：賈巴坦，2008。

[15] MANIK，K.E.S. 生活環境管理（生活環境管理）。雅加達：賈巴坦，2007。

[16] MARYONO, A. 水資源管理改革。日惹：加札馬達大學出版社，2017。

[17] CABALLERO-SERRANO, V., ALDAY, J.G., AMIGO, J., CABALLERO, D., CARRASO, J.C., MCLAREN, B., 和 ONAINDI, M. 厄瓜多爾亞馬遜地區生物多樣性和生態系統服務的社會認知。人類生態學，2017，45：475-486。

[18] ANGRIANI, P., SUMARMI, RUJA, I.N., 和 BACHRI, S. 河流管理：公共部門和社區在 班賈爾馬辛河流保護中的作用的重要性（比河的案例研究，班賈爾馬辛，南加里曼丹 - 印度尼西亞）。可持續城市與社會，2018，43:11-20。

[19] LI, X., ZHANG, F., HUI, E.C., 和 LANG, W. 合作研討會和社區參與：中國城市更新的新方法。城市，2020，102。

[20] 公共工程和住房部长。关于河流边界线和边界线湖的规定的第 28/PRT/米/2015 号条例，2015，印度尼西亚。