

## RESEARCH ARTICLE



# White-water Rafting Tourism Potential at Bukit Baka Bukit Raya National Park Based on The Tourism Suitability Index

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**Abstract**

Bukit Baka Bukit Raya National Park (BBBRNP) is a national park that functions as a conservation area for flora and fauna of mountainous tropical rain forests as well as a water catchment area for two large rivers, namely the Melawi River (West Kalimantan) and the Katingan River (Central Kalimantan). This natural condition produces potential for BBBRNP as a tourism area, especially for white water rafting. One of the BBBRNP resorts that have the potential to become a tourism area is Belaban Resort, a white-water rafting spot. However, the existing possibility of white-water rafting has not been analyzed measurably. This research aims to determine the Tourism Sustainability Index (TSI) of white-water Rafting at Belaban Resort, BBBRNP. The study was conducted in March 2022. The method for determining the observation location used a purposive sampling technique. Data was analyzed using the Tourism Suitability Index (TSI) analysis. This research consists of ten observation points. The research results show that the suitability index for rafting tourism is included in the very suitable (S1) with a suitability index value of 88.56%.

Keyword: Belaban Resort, Bukit Baka Bukit Raya National Park, White-water Rafting, Tourism Suitability Index

**1. Introduction**

Bukit Baka Bukit Raya National Park (BBBRNP) is the National Park in West Kalimantan and Central Kalimantan, with offices in Sintang, West Kalimantan. BBBRNP is the national park representing the mountainous tropical rainforest type and the habitat of protected and unprotected flora and fauna [1]. Apart from this function, BBBRNP is also a water catchment area for two large rivers, namely the Melawi River (West Kalimantan) and the Katingan River (Central Kalimantan). This condition also causes BBBRNP to have a potential tourism function. BBBRNP has several National Park Management Sections (SPTN) as a unit to make it easier to secure the BBBRNP area. One of them is SPTN Region I Nanga Pinoh BBBRNP. SPTN Region 1 has a resort as a tourism area that has the potential to be developed, namely Belaban Resort.

The potential for natural tourism at Belaban Resort includes waterfalls, cultural sites, diversity of flora and fauna, and white-water rafting. Belaban Resorts is located on the Ella River. Belaban resort has a potential route for white water rafting activities along 7.78 km. Along the white-water rafting route, visitors can enjoy natural views naturally.

White-water rafting is one of the potential activities to be developed in the BBBRNP area. White-water rafting is rafting the river channel with a cascade using rubber boats, kayaks, canoes, and paddles. The purpose of rafting can be seen from the side of sports, recreation, and expeditions [2]. However, the potential of white-water rafting in Belaban Resort needs to be studied further in a measurable manner.

The Tourism Suitability Index (TSI) is an index for determining an area considered suitable or not used as a tourist area by looking at the parameters that exist in an area compared to the parameter values according to the tourist area [3]. Each tourism activity has resource and environmental requirements for developing the tourist attraction area. Each type of tourism activity has different suitability parameters between one tourism activity and another [4]. The location and potential available in the white-rafting area will also be part of the final tourism decision [5].

Measurement of TSI can provide an assessment of tourism potential in areas that have a specific purpose, one of which is through the determination of values (classes) in areas with land use patterns associated with land potential so that more targeted utilization can be sought in one of its sustainability efforts [6]. This research aims to calculate the suitability of white-water rafting at Belaban Resort for tourism purposes using TSI.

## 2. Materials and Methods

### 2.1. Materials and methods

This research was conducted at the Rafting Tour in the Belaban SPTN Wilayah I Nanga Pinoh, Bukit Baka Bukit Raya National Park, with a research time of around 10 days. The observation spots in this study consisted of ten observation points that could represent the general state of the research location and were determined using the purposive sampling method. The tools used are GPS, rubber boat, roll meter, Distance meter, Prediction ball, Secchi meter, whistle, Stopwatch, Amtast EC900 (pH meter, dissolved oxygen (DO) meter, Thermometer), and a questionnaire. The object studied in this research is the Ella River in SPTN Wilayah I Nanga Pinoh, Bukit Baka Bukit Raya National Park to 35-39 km for white-water rafting tourism.

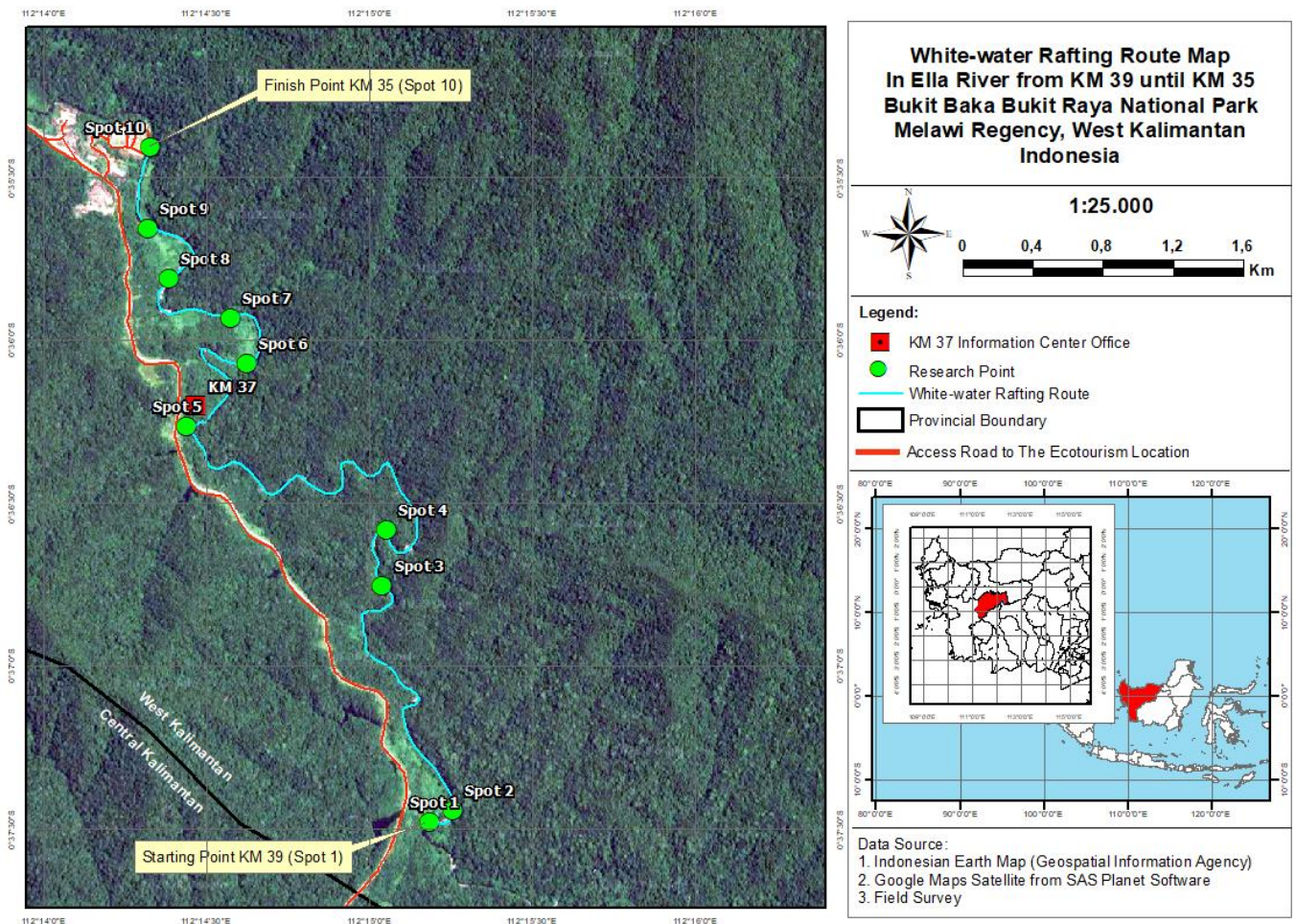


Figure 1. Map of the white-water rafting Trail on the Ella River

Determining the weight and score for each parameter is based on the importance of a parameter in planning tourist areas [7]. The weights for each parameter for planning a given

tourist area are 4 (four), 3 (three), and 2 (two). The criteria for each parameter weight are as follows [8]:

- The weight of 4 for essential parameter elements or key parameters.
- The weight of 3 for slightly needed or essential parameter elements.
- The weight of 2 for the parameter element in the assessment element is unnecessary but must always be present, or this parameter is unimportant.

Based on field observations with the BBBRNP team, nine parameters will be observed, which are by Yulanda (2007) [7] with modifications, such as river width, river depth, flow rate, river discharge, brightness of the water, river difficulty level, riverbed material, hazardous biota, water quality.

Data collection analysis is based on Yulianda (2019) [9] with modifications. Data collection in the field is based on observation spots determined on the research map (Figure 1). The depth of the river and the brightness of the river water are calculated using the Secchi disk. River width measurements use distance and roll meters stretched between the river shoulders. The calculation of river discharge uses the values of river flow rate, river depth, and river width, which are entered into the river discharge formula. The river difficulty level is determined from direct observation in the field with the help of experts from BBBRNP staff with terms from the safety code of American white-water regulations. Determination of the riverbed materials that make up rivers is observed in the field. Observations of hazardous biota were carried out twice along the rafting route. Water quality is carried out by smelling the water at each spot by BBBRNP staffs. The value of each parameter (weights and score) is used to determine the tourism suitability index (TSI) value.

**Table 1.** Parameters of suitability of rafting tourism resources

Parameter	Weights	Categories	Scores
Flow rate (m/s)	4	0 – 1 m/s	4
		>1- 1.5 m/s	3
		> 1.5-2 m/s	2
		>2 m/s	1
River discharge (m <sup>3</sup> /s)	4	0 – 25 m <sup>3</sup> /s	4
		>25 – 150 m <sup>3</sup> /s	3
		>150 – 300 m <sup>3</sup> /s	2
		>300 m <sup>3</sup> /s	1
River depth (m)	3	0–3 m	4
		>3 – 6 m	3
		>6 – 10 m	2
		>10 m	1
River difficulty level	3	grade IV	4
		grade III	3
		grade II	2
		grade I	1
Riverbed material	3	stone	4
		sandy stone	3
		mud sand	2
		mud	1
Brightness of the waters (m)	2	>10 m	4
		>5 – 10 m	3
		3–5 m	2
		<2m	1
River width (m)	2	>15 m	4
		10 – 15 m	3
		3 - <10 m	2
		<3m	1
Hazardous biota	3	none	4
		monitor lizard	3

Parameter	Weights	Categories	Scores
Water quality	2	snake	2
		monitor lizards, snakes	1
		odorless	4
		smell	3
		very smelly	2
		strong scent	1

Analysis of the tourism suitability index using the Yulianda [7] guidelines with modified parameters according to research needs (Equation 1).

$$TSI = \sum_{i=1}^n \left( \frac{N_i}{N_{max}} \right) \times 100\% \tag{1}$$

Where:

TSI =Tourism Suitability Index

N<sub>i</sub> =Parameter value i (weight x score)

N<sub>max</sub> =Maximum value of a tourism category

I =Suitability parameters

N =The number of parameter types

After calculations all parameters using the Tourism Suitability Index formula, the suitability category for white-water rafting tourism activities is carried out. The suitability category is divided into 4 (four) suitability, such as very suitable (S1), suitable (S2), conditionally suitable (S3) and not suitable (TS) (Table 2).

**Table 2.** Tourism Suitability Index based on Suitability Interval Value

Categories	Suitability Interval Value
S1 (very suitable)	83 – 100 %
S2 (suitable)	50 – < 83 %
S3 (conditionally suitable)	17 – < 50 %
NS (not suitable)	< 17 %

Source: [9]

### 3. Results and Discussion

The results of the analysis of the suitability of rafting tourism at the Belaban Resort, by considering all the parameters that influence it, have found that the Suitability Index of rafting tourism is 88.56%, so it can be said to be an area that is included in the very suitable category (S1).

Water quality analysis in the Ella River was carried out by measuring each suitability parameter in each spot. In each spot, the results of the suitability parameter research have varied values but do not show a significant difference between each spot. The measurement results to get the suitability category for white-water rafting on the Ella River based on the suitability matrix.

**Table 2.** Matrix analysis of rafting tourism suitability

Parameter	Score Average	Weights	N <sub>i</sub> (Weights x Score)
River Width (m)	3.9	2	8.0
River Depth (m)	3.8	3	11.4
Flow Rate (m/s)	3.7	4	14.8
River Discharge (m <sup>3</sup> /s)	4.0	4	16.0
Brightness of the Waters	4.0	2	8.0
River Difficulty Level	1.1	3	3.3
Riverbed Material	3.6	3	10.8
Hazardous Biota	4.0	3	12.0

Parameter	Score Average	Weights	N <sub>i</sub> (Weights x Score)
Water quality	4.0	2	8.0
Total N <sub>i</sub>			92.1
N <sub>max</sub>			104.0
TSI			88.56
Suitability level			S1

After analysis of TSI, the high quality of white-water rafting in Belaban resort is affected by high suitability value in almost all main parameters. Only one main parameter has a low score, namely the river difficulty level category. This shows that white-water rafting in Belaban Resort has tourism potential.

The varying width and depth of the river also affects the speed of the river flow. The width of the river that is not too narrow will facilitate the movement of the rubber boat maneuver without having to worry about limitations in boat movement. The depth of the river that is not too shallow will facilitate rafting activities because if the river is too shallow, it will hinder the movement of the boat. After all, the friction between the boats and the riverbed material consisting of rocks and sandy rocks will make it difficult for the boat to run smoothly. The formation of white-water rafting is influenced by main morphometric factors such as flow discharge, width, slope, and turbulence of the river [10].

One factor affecting the aquatic ecosystem and the level of water brightness is the type of riverbed material found in the river, in this case, the riverbed material from the Ella River. The brightness of the waters is a measure of transparency that can be determined visually. The value of the brightness of the waters in the Ella River is very high, even reaching 100% so that when the Secchi disk has reached the bottom of the river, it can still be seen. The indicators for observing dangerous biota are snakes, monitor lizards, scorpions, and centipedes. Snakes, which are the leading indicators of dangerous biota in this study, stated that no such biota was found, other than those other indicators were not found during observations.

The parameters of the suitability of rafting tourism resources consist of river width, river depth, river flow velocity, river water discharge, riverbed material, brightness of the waters, level of difficulty, and hazardous biota, and water quality. Ella River has a width range of 12.8 m to 30.09 m, with an average river width of 23.15 m from 10 observed spots. The width of the Ella River is categorized as very suitable for white water rafting activities. According to a feasibility study [11], white-water rafting activities have a minimum river width limit of 3.66 m.

The average depth of the Ella River from spots 1-10 is 1.8 m, with the most profound length being 3.5 m at Spot 1 and the shallowest being 0.73 m at Spot 7 [12]. They stated that relatively shallow waters are conditions that support tourism activities where visitors can play in the water or swim safely, provided that the most suitable river depth for tourism activities is 0-5 meters. The depth of river waters is crucial in determining a tourist area's safety, especially rafting tours. The average river depth of the Ella River shows that it is very suitable for rafting tours.

The average flow velocity of the Ella River is 0.75 m/s, with the highest flow velocity in Spot 10 with a speed of 1.48 m/s and the smallest flow velocity in Spot 6 with a flow velocity of 0.25 m/s classified the flow velocity speed into 4 categories, namely the category of slow flow velocity (flow velocity speed 0 – 0.25 m/s), medium flow velocity category (flow velocity speed 0.25 – 0.50 m/s), fast flow velocity category (speed flow velocity 0.5 – 1 m/s) and very fast flow velocity category (flow velocity speed > 1 m/s) [13]. The flow velocity of white-rafting from Ella River was higher than the Saba River, with 0,32 m/s in normal flow velocity [14]. Based on this category, the Ella River is categorized as a river with a fast flow velocity. A slow flow velocity will hinder rafting activities and vice versa. If the flow velocity is too fast, the rafting activity will be more challenging to control and endanger visitors' safety [15].

The Ella River has an average water discharge of 3.50 m<sup>3</sup>/s, with the highest discharge in Spot 1 at 7.10 m<sup>3</sup>/s and the smallest in Spot 6 with a discharge of 0, 85 m<sup>3</sup>/s. Several physical

factors and weather influence water discharge differences during data collection. Judging from the significant difference in water discharge, the range of water discharge in the Ella River is 6.25 m<sup>3</sup>/s, which is a relatively large number. The amount of river water discharge depends on the watershed itself. Differences in the river's speed, depth, and width are very influential. The best conditions for wading through the river are when the water discharge ranges from 25-300 m<sup>3</sup>/s. Rivers with a 25-300 m<sup>3</sup>/s discharge tend to pass quickly because the control through rapids and obstacles is relatively easy to master. On the other hand, large rivers with discharges above 25-300 m<sup>3</sup>/s are generally difficult to pass and avoid [16].

The riverbed material of the Ella River waters is rock and sandy rock. Following the theory from Yulianda, [7] it can be concluded that the riverbed material in the Ella River is in the very suitable category. The riverbed material of the water is a determinant of the brightness of water [17]. The waters' riverbed material is one factor affecting the aquatic ecosystem and a supporting factor for the feasibility of marine tourism activities [18].

The water brightness level of the Ella River is 100% along the rafting path. The brightness value is closely related to sediment, organic, and inorganic materials in water. Other factors, such as weather conditions, measurement time, and the accuracy of researchers, can affect the brightness level of the waters in the river [19]. White-water rafting activities are influenced by the brightness of the waters so that visitors can see the diversity of aquatic biota on the Ella River, which is the rafting route.

The difficulty level of the Belaban Resort's white-water rafting cascade is mainly in the 1st Class category, with a difficulty level that tends to be stable. The grade method or class states whether a rapid is difficult. The river's difficulty level is often said. Changes in flow velocity due to differences in riverbed protrusion bends of river width, additions, and measurements of river discharge affect the character of the rapids [20].

After direct observations along the rafting path, especially in the 10 selected spots, and repeated three times, no dangerous biota was found on the Ella River rafting path. It shows that the suitability of hazardous biota in the Ella River is in the suitable category. Even so, according to the rafting guide at the Belaban Resort, they have been rafting, but these dangerous biotas tend to run away if they meet humans [21]. The dangerous biota often found along the rafting path are snakes, monitor lizards, scorpions, and centipedes, where snakes are the main parameter of dangerous biota. Observations of dangerous biota need to be conducted to determine whether there is dangerous biota that will disturb tourist visitors [22].

The waters of the Ella River, especially on the rafting route, have outstanding quality because, in all observation spots, there is no odor in the water. Based on several factors, such as the waters having a high level of water clarity and are supported by observations with parameters consisting of the degree of water acidity (pH), the amount of dissolved oxygen (DO), and the temperature and measured at ten observation spots.

The pH value in the Ella River has an average value of 6.97, with the lowest pH being in spot 1, with a value of 6.79, and the highest pH being in spot 9, with a pH of 7.14. The average pH value in all observation spots is still within the range of class I water quality standards according to Indonesia Government Regulation (PP) Number 82 of 2001 concerning water quality management and water pollution control.

DO values in Ella River waters ranged from 2.37 mg/l – 2.90 mg/l, with the lowest value at Spot 9 and the highest at Spot 4. The average DO value in Ella River was 2.69 mg/l. The results of these data show that the waters of the rafting route are in the range of class IV quality standards according to Government Regulation 82 of 2001. The low value of the water quality standard of the Ella River is allegedly due to illegal gold mining activities that occurred several months ago on the rafting route and upstream. Rivers, resulting in changes in river water quality. However, the area's manager, BBBRNP, has handled the mining activity.

The temperature value of the waters in the Ella River can have different results depending on the time and weather observations. The temperature in the waters of the Ella River has an average value of 25.10 °C, with the lowest temperature being in spot 7, which has a value of 24.77 °C, and the highest temperature was in spot 8, with a value of 25.63 °C.

#### 4. Conclusions

The tourism suitability index for Belaban Resort's white-water rafting facility is classified as 'Very Suitable' (S1) for tourists, with a total score of 88.56%. Promotion, infrastructure improvements and additional amenities are needed to serve visiting tourists. In the future, further research is recommended regarding the level of satisfaction of visitors to white-water rafting at the Belaban Resort.

#### Author Contributions

**SR:** Supervision, Methodology, Conceptualization, Writing - Review & Editing; **KAL:** Investigation, Formal Analysis, Writing – Original draft; **MF:** Supervision, Conceptualization, Writing - Review & Editing; **DMP:** Software, Resources, Project administration, and **MM:** Writing - Review & Editing, Data curation, Validation.

#### Conflicts of interest

There are no conflicts to declare.

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