

A Study of Rivers as Natural Resources for Adventure Tourism in Mongolia

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Abstract– In recent years, among the types of tourism, special interest tourism, which is a journey that is attracted by people's interests, aspirations, and innovation has developed rapidly. There is no limit to the special interest tourism products and services, and many new forms continue to thrive. Among them, adventure tourism has taken a significant place. This is a type of tourism that takes place in an environment that has an emotional element enriched by natural resources such as land, water, and atmospheric resources. Our research aims to identify water resources specifically river resources in Mongolia where adventure tourism can be organized. To assess natural resources document content analysis, expert evaluation, reliability analysis, factor analysis, and geographical research method (graphical method) were used in the study. As a result, 33 rivers were identified as a base of river-adventure tourism in Mongolia. The length, flow, river width, fall, water depth, and velocity were considered to be indicators of the assessment.

Keywords– Excitement, water resources, river length, flow, river width, river rapids, water depth, and velocity.

I. INTRODUCTION

According to the development of the tourism industry, some general interest tourism destinations have originated markets that became stable over time, whereas other types of special interest tourism have boomed. Nowadays, special interest tourism is developing as an industry that includes a wide variety of travel activities that are of great interest to tourists on the international market [1]. This category of tourism meets the needs of a specific market by involving a variety of experiences and activities outside the scope of general interest tourism [2]. These days special interest tourism developing rapidly as a relatively independent service with its markets, specific requirements, and regulations [1]. Moreover, a variety of types include adventure tourism, rural tourism, cultural tourism, religious tourism, ecotourism, culinary tourism, wildlife tourism, heritage tourism, and medical tourism. In recent years, adventure tourism has taken a large place in the global tourism market.

Adventure tourism is a type of tour that includes elements of nature, vigorous activities, and culture, and is aimed at providing travelers with a multifaceted experience. Travelers

seek novelty, unusual sensations, change, challenges, and well-being [6, 20]. According to Steven J. Hollenhorst, "Adventure tourism is a recreational activity involving real or perceived danger based on the environment, the outcome of which is often uncertain and based on the will and motivation of the participant" [4]. Alan W. Evert defined the adventure tourism as "a variety of independent activities that interact with the environment, containing elements of real and apparent danger, and are influenced by participants and circumstances, although the outcome is uncertain" [3].

Grounded on the above-mentioned it is safe to express that natural resources are the basic resources that form the main basis for the development of adventure tourism. From this perspective, the natural resources are divided into 3 main groups: land resources (mountains, rocks, ice, dunes, steppes, forests), water resources (rivers, lakes, and others), and atmospheric resources. These 3 groups of 8 types of resources have different characteristics and parameters. In this article, we will discuss only river resources.

Rivers as the main freshwater resource are a complex system of flowing water that flows over a specific land surface, termed a river basin or watershed. Water that flows in one direction under the influence of altitude and has an average velocity of more than 0.1-1 m³/second is called a river [21].

Rivers as resources to become a base for adventure tourism have never been assessed in Mongolia. Defining the river resource potential will be vital to the development of adventure tourism in the country. Our research aims to assess the rivers of Mongolia, categorize them based on selected indicators, and try to outline types of river-based adventure tourism. Specifically, we believe that the outcomes of our research may help develop policies and strategies related to the tourism sector of the country.

River-based adventure tours such as Jet skiing, Sailboarding, River surfing, Riverboarding, Paddleboard stepper, Stand Up Paddle, Black water rafting, Canoeing, Kayaking, Rafting, Glass-bottom boating, Pedal boating, Dragon boat racing, Dragon boat racing, Geckoing, Catamaran trip, Air boating, Houseboat stays, and Ice fishing are intensely

developing depending on the river characteristics [5, 6, 7, 8, 20, 22]. In our research, we used river flow, river rapid, and river velocity as a part of indicators in determining the capacity of rivers to organize adventure tours. River flow is defined as the amount of water flowing through a given cross-section of a river during a certain period. River flow is measured by *meter cube* and defined by $V=Q*T$ m³. River rapid is the height difference between the source of the river and the place where it flows. The river rapid is calculated as the height between the two points when a certain part of the river falls by equation $H=H1-H2$. River Velocity is the time it takes for a river to flow through a specific area.

II. RESEARCH METHODOLOGY

River flow varies depending on climatic conditions, catchment areas, flow channel features, and geological formations, and most rivers change their course over time. In general, the flow varies depending on the prevailing flow in rivers, tributaries, springs, and rivers [21].

There are quite a few studies by international researchers that identify rivers as adventure tourism resources. For example, M. Hafizudin et al. defined and measured rivers by parameters such as river height, water width, water depth, flow rate, and water quality [9]; likewise, D. Rankin et al. utilized river water velocity, flow drop, waves, eddies [10]; B. Prideaux and M. Cooper, length and width of the river [18]; and S. Ligare used parameters such as flow speed, flow slope, and fall [11].

As proposed by Hafizudin et al. and D. Rankin the degree of difficulty of boat travel is determined based on the speed of the river flow and the level of the fall [9, 10]. Based on this, the ranking of each river will be defined.

An international whitewater difficulty scale provides a categorization of rivers based on the degree of challenge or difficulty of the whitewater kayaking opportunity [12].

TABLE 1. The international scale of whitewater difficulty

Grade I	Moving water with a few riffles and small waves. Few or no obstructions.
Grade II	Easy rapids with waves up to one meter. Clear channels are obvious without scouting. The ability to move a craft across the current is not necessary.
Grade III	Rapids with high, irregular waves and narrow passages. The ability to spin and maneuver is necessary.
Grade IV	Difficult rapids require a series of controlled moves, cross-current, and spinning in confused water. Scouting is often necessary and a reliable roll is mandatory.
Grade V	Very difficult, long, and violent rapids. Nearly always must be scouted. Definite risks in the event of a mishap. Requires a series of controlled, precise, 'must make' moves to navigate successfully.
Grade VI	Extreme, very dangerous, and only for experts. Close inspection is mandatory and all possible safety precautions should be taken.

Source: Kay Booth, Andy England, Doug Rankin et al., 2010

As part of our research, we attempted to identify river resources for the development of adventure tourism in Mongolia. For this purpose, we utilized an expert research method to confirm indicators for assessing rivers for adventure tourism. In addition, the levels of each indicator were thoroughly reviewed and consolidated. The expert team is

composed of professionals, who specialized in adventure travel, have extensive experience or master's qualification in sports, and have experience in conducting research and analysis on types of tourism. To assess the inter-rater reliability of experts' opinions we applied multiple measures including the Intraclass correlation coefficient (ICC), Kendall's concordance coefficient, Fleiss's kappa, and Cronbach's alpha [12, 13, 14, 15, 16]. Calculations have been performed on SPSS 26.0 software.

TABLE 2. Reliability test results of expert research

№	Coefficients		Results
1	The intraclass correlation coefficient -ICC	Value	0.687
		Sig.	0.000
2	Kendall's concordance coefficient -W	Value	0.192
		Sig.	0.001
3	Fleiss's kappa -K	Value	0.189
		Sig.	0.000
4	Cronbach's alpha		0.939

River-based adventure tourism is characterized by a high level of risk, high demand for knowledge, skills, and experience from participants, as well as it requires a tour of a certain distance as a prerequisite. Hence, in this study, we have classified travelers as experts, experienced tourists, and the public.

Table 3 summarizes indicators for defining river characteristics for adventure tourism, their weight of importance, and corresponding levels.

TABLE 3. Indicators for identifying and evaluating rivers with potential for adventure tourism

№	Indicators	Weight of importance	Level		
			Areas for experts/professionals	Areas for experienced tourists	Areas for the public/Public tourist area
1.	Velocity (km/h)	16.35	12.6-14.4 km/h	5.4-12.6 km/h	2.88-5.4 km/h
2.	River wave height (meter)	15.78	0.25-3 m	0.2-0.3 m	>0.15 m
3.	River rapids (per 1 km)	15.18	>3.5 m	2-3.5 m	<2 m
4.	River discharge (cube meter per sec)	14.94	100 m ³ /sec	50-100 m ³ /sec	30-50 m ³ /sec
5.	Distance to the site	13.50	>50 km	<100 km	<50 km
6.	River water depth	12.34	0.5-5 m	0.5-3m	0.5-1 m
7.	The width of the river	11.91	3-10 m	3-10 m	10-20 m

Source: Developed by the authors

Henceforth, the following rankings with their respective level of difficulty can be defined based on the combined study of the International scale of whitewater difficulty and specific area assessment (Table 4).

Grounded on the above indicators we attempted to define ranks and outline the rivers that may become a basis for the development of river-based adventure tourism in Mongolia.

TABLE 4. International rankings of rivers and the corresponding level of difficulty

Rank	Difficulty level	Description	Tourist area
I	Difficulty level low	Small, but long waves, the wave height is less than 0.2 meters, the velocity is 2.8-5.4 km/h, and the river rapid is 0.6-1 meters per 1 km.	Public area
II	Difficulty level medium	With standing waves, eddies, and bends. The wave height is less than 0.3 meters. The river velocity is 5.4-7 km/h, and the river rapid is 1-2.5 meters per 1 km.	Public area, area of the experienced
III	Difficulty level medium to high	Large fixed high waves require a high level of paddler skill. Wave height 0.3 meters. The river velocity is 5.4-12.6 km/h, the rapid is 2-3.5 meters, and the width is up to 10 meters.	Area for experienced professionals
IV	Difficulty level high	Very strong currents, large high waves, and obstacles in the river. Advanced skill is required from the rower. Wave height 0.3-0.7 meters. The river velocity is 9-12.6 km/h, the rapid is 3.5-7 meters per 1 km, and the width is up to 10 meters.	Area for the professionals
V	The difficulty level is too high	Very rough currents and very heavy and repetitive high waves in short distances. Wave height 0.5-1.2 meters. The river velocity is 12.6-14.4 km/h, the river rapid is 7-12 meters, and the width is up to 10 meters.	Area for the professionals
VI	Dangerous	Very dangerous, with a very high risk of death. The wave height is more than 1.5 meters, the velocity is more than 14.4 km/h, the river rapid is more than 15 meters, and the width is 3 meters.	Very risky for professional tourists to travel

Source: Developed by the authors

III. RESEARCH RESULTS

The total surface water resource of Mongolia is 599 km³/year, most of which is contained in lakes (500 km³/year), glaciers, and glaciers (62.9 km³/year). River flow is only 5.8% of the total surface water resources or 34.6 km³/year [1]. There are a total of 4113 rivers and streams in Mongolia. Their total length is 67,000 km, and the density of the river network is 0.05 km/km². The rivers originate from the highlands of Central Asia and flow into the Arctic Ocean, the Pacific Ocean, and the Central Asian basin (Fig. 1). In other words, 60 percent of the country's rivers will flow through the territory of the Russian Federation and China, and the remaining 40 percent will flow into the lakes of Gobi and fill underground water resources [2].

208 rivers and streams mentioned in previous studies, encyclopedias, maps, and publications in geographical disciplines were selected and assessed according to general criteria, compulsory for adventure tourism. The criteria include the average depth of the river is more than 0.5 meters, the water volume being more than 5 m³/sec, and the difficulty rank being IV or higher. As a result, 33 rivers were filtered out as potential candidates for adventure tourism (Table 5). To develop a comprehensive inference we have considered the economic regions of Mongolia (Western, Khangai, Eastern, and Central regions and, Ulaanbaatar city area) in the assessment. The results from the analysis provide several interesting insights.

18.18% of the total rivers are in the Western region, 45.45% in the Khangai region, 12.12% in the Central region, and 24.24% in the Eastern region (Fig. 1).

TABLE 5. Rivers with potential for adventure tourism development

№	River	Length* (km)	Flow discharge (m ³ /sec.)	Width (m)			Rank	Average rapids per km (meter)	Depth (m)		River velocity (km/h)		
				Max. width	Average	The most narrow			Great depth	Average	Beginning	Middle	At the end
Western Region													
1.	Khovd	596	58.4-90	130	80	80	VI	2	3	1.5	10.8	7.2	3.6-7.2
2.	Zavkhan	776	15.8	100-350	30-60	30	VI	1.4	2	0.6-1.5	3.6-5.4	3.6	2.5-4.3
3.	Tesiyn	568	13.6-60	200	40-120	15-60	V	1.7	2.5	0.3-2.5	2.5	2.5-5	5.4
4.	Bulgan	295	4.5-5	60	20	10	V	0.2	4-5	0.5-1.5	9	7.2	2.52
5.	Buyant	170	5.67	40	8-13	8	IV	4.4	2	0.4-0.8	9	7.2-9	4.32
6.	Harhiraа	126	5.13	30	10-20	10	IV	13.5	1.5	0.3-0.5	7.2	7.2-9	4.32
Khangai Region													
7.	Selenge	593	111.3-339.2	100-250	80-150	60-70	IX	1.0	2.5-5	0.5-1.5	7.2-9.0	3.6-6	3.6-4
8.	Delger moron	440	37	50-100	25-40	25	VI	4.9	2.5	0.5	7.2	6	0.36
9.	Ider	466	33.4-54.1	80-100	40-60	15	VII	1.7	3-3.5	0.7-2	7.2-10.8	5.4-7.2	2.0-2.5
10.	Chuluut	415	25.1	70-80	20-60	20-30	VI	5	2.5	0.5-2.5	7.0	3.6-7.2	3.6-7.2
11.	Suman	60	11.3	40	30-40	30	IV	0.7	1.5	0.5-10	3.6	3.6	3.6
12.	Hanuy	400	4.8-9.3	50-80	20-30	20	V	2.2	2.5	0.5-1	7.2	4.32	4.32
13.	Egiyn	510	23.8-99.2	50-150	20-70	20	VII	2	3.0-3.5	0.3-1.0	14.4	7.2-4.3	2.1
14.	Uur	331	47.0	140	50-90	30	V	2.47	3.0	0.5-1.0	8	7.2-5.0	7.2
15.	Shishid	298	16.8-67.3	100	40-60	35	VII	2	2.5	0.7-1.3	7.2	9	7.2
16.	Bugsei	142	1.7-17.1	40	20	13	V	4.7	2.5	0.5	2.16	10.8	7.2
17.	Tamir	180	10	70	40-70	8	VI	1.8	3	0.6-2.5	7.2	3.6	3
18.	Orkon	1124	45.1-106	120-150	20-60	10-60	VIII	1.6-4.3	2.5-4.0	0.5-1.5	9	7.2	6-7.2
19.	Baydrag	295	9.7	40	20-40	20	VI	1.1	1.5	0.3-1.5	5.4	3.6-5.4	3.6
20.	Tuyn	243	2.95	80	25-45	12	V	5.3	2.5-3	0.5-1.5	7.9	7.9	7.2
21.	Ongiyn	401	4.32	30	15-30	10-20	V	0.3	1.7	0.4	6.2	4.3	2
Central Region													
22.	Tuul	871	19.9-22.6	75	35-75	35	VI	1.32	3.5	0.8-	14.4	5.4	1.8
23.	Haraа	291	8.3-11.4	30-45	15-20	15	V	1.49	2	0.5-0.8	2.16	2.42	2
24.	Yeruu	323	26-59.6	100-150	22-51	22	VII	1.7	3	0.5-2.5	9	7.2	7.2
25.	Zheltur	229	14.1	50	20	15	VI	3.2	2.7	0.5-1	7.2	3.6	4
Eastern Region													
26.	Herlen	1090	14.2-24.7	150-200	30-50	30	VI	1.2	3	0.8-1.5	7.2	3.6	3.6

27.	Onon	445	32.9-101	3000	80-150	25	VI	1.6	3.0	0.5-1.5	7.2	3.6	3.6
28.	Baldzha	200	63.9	65	20-40	20	V	1.9	3.5	1.7	3.6	3.6	3.6
29.	Uldza	420	24.7	32-16	8-10	8	V	1.2	1.9	0.5-1	6	5	4.68
30.	Halhiin	264	34.	80	50-60	20	VI	0.85	2.5-4.5	0.5-0.7	7.2	4.68	3.6
31.	Numrog	218	8	20	10-20	10	IV	1	3	0.8-1.2	7.2	2.16	1.44
32.	Egiyn	90	3.8-4	40	10-25	10	IV	8	1.2	0.5-1.2	7.2	4.3	4.3
33.	Menza	165	62.8	70	30-50	30	VI	1.5	3	0.7-1	6	3.6	3.6

Note: * - The total length of the river in the territory of Mongolia

Source: Developed by authors

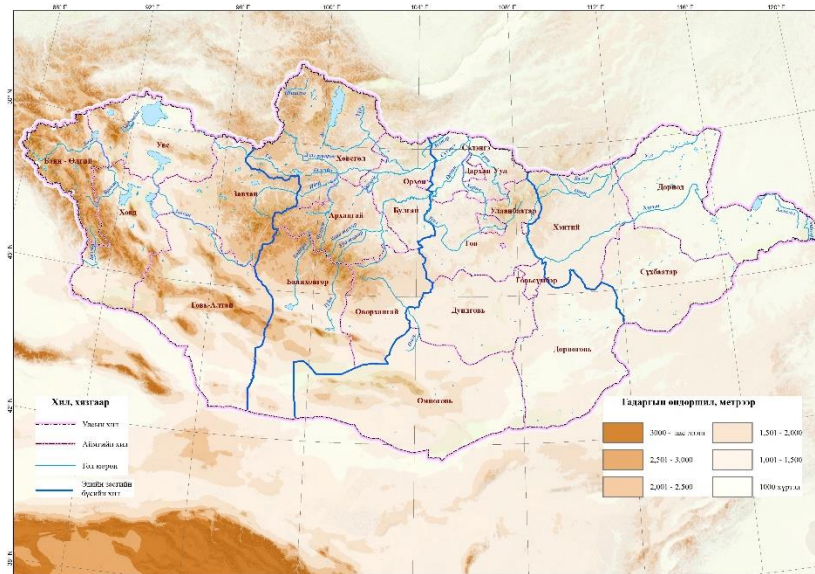


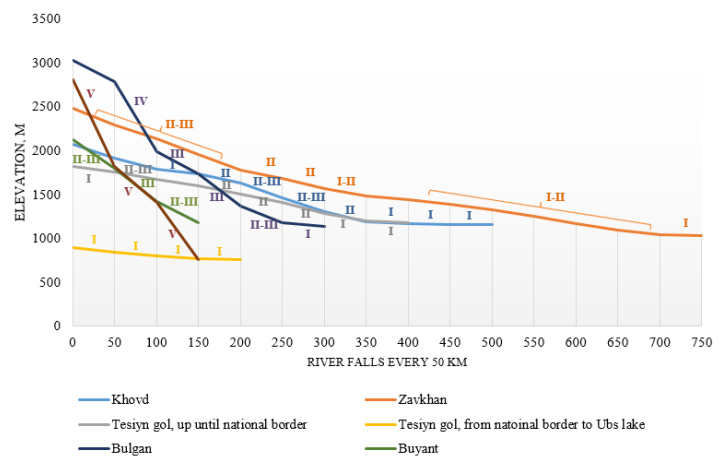
Fig. 1. Map of the distribution of rivers in the regions of Mongolia

To define types of adventure tourism, selected 33 rivers were assessed by their length, height above the sea level per 50 km, and level of difficulty. The results are demonstrated in the following figures.

Western region rivers

The rivers of Central Asia in the western region without outflow have high rapids and velocity at the beginning, but the flow rate is relatively small. In the middle part, the velocity drops due to the increase of streams of many rivers, but rapids and flow rates increase. It slows down at the end when drains to lakes and rapids become almost unnoticeable due to many forks, mud, and marshlands.

Khovd, Harhiraа, Bulgan, and Buyant rivers are rivers with permanent snow and ice sources, so the river discharge increases in the afternoon. The discharge of the Zavkhan and Tes rivers, originating from the mountains of the Khangai Range, is constant but depends on the amount of rainfall of the year. The difficulty level of the rivers in the basin is IV-V at the beginning. The level declines to II-III from around 100 km of the length of the river, which is suitable for the development of adventure tourism. Based on the indicators it is safe to conclude that the above rivers are suitable for experienced and professional tourists. Tes river originates from the Bulnai mountain range, crosses the national border, flows through the territory of the Russian Federation, and then enters the border of Mongolia, so it is divided into two parts: up until the national border and from the national border (Fig. 2).



Source: Developed by authors

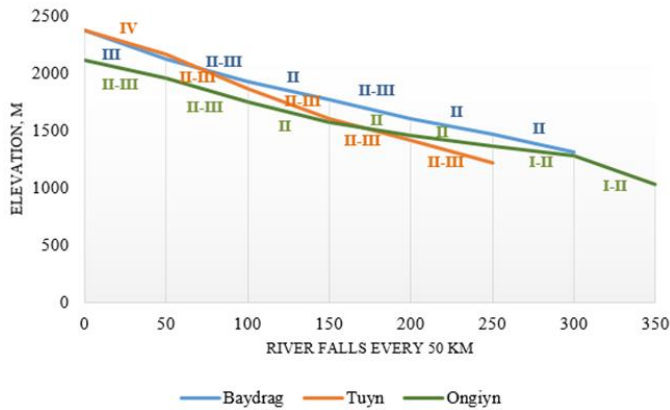
Fig. 2. The river rapids (rivers in the western region)

Rivers of the Khangai region

15 rivers have been identified in the Khangai region and divided into 4 groups. They are divided into rivers of Central Asia without outflow in the Khangai region, tributaries of the Selenge River in the north of the Khangai region, tributaries of the Selenge River in the south of the Khangai region, tributaries of the Orkhon River in the Khangai region and the source of the Yenisei River (Fig. 3-6).

The rivers of Central Asia in the Khangai region without outflow, are considered suitable for adventure tourism, but the following points should be taken into account. Ongi river has

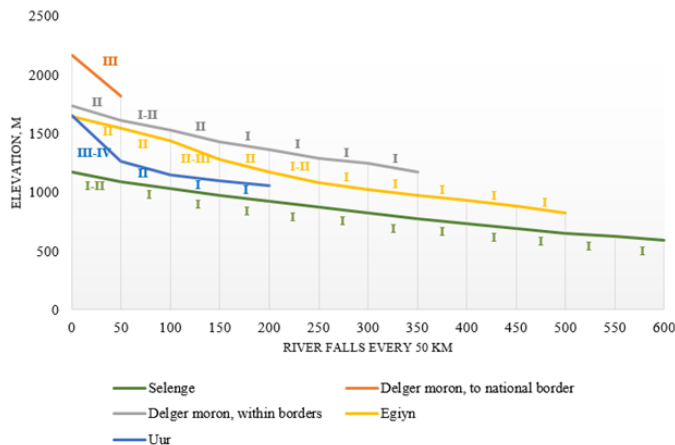
very little water and seeps into the soil in the last 150 km, so it might not be suitable for its floodplain. Baidrag and Tuin rivers, the water flow is low in the first and last 50 km, and in the end, rivers flow through the valley and create many branches that may not be suitable for boat trips (Fig. 3).



Source: Developed by authors

Fig. 3. The river rapids (rivers of the Central Asian basin with no outflow in the Khangai region)

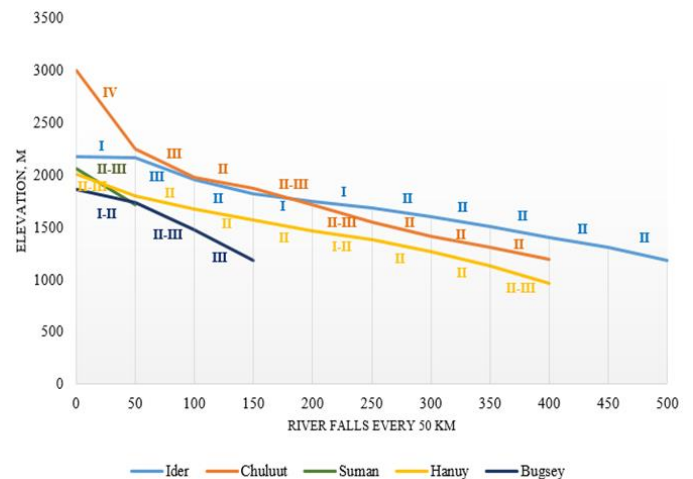
Tributaries of the Selenge River in the north of the Khangai region originate from the Khuvs gul mountains, which have abundant rainfall. It affects the water discharge, rapids, and velocity of the rivers in the basin. The rivers of the basin reach the level of I-IV, and if the degree of difficulty is high at the beginning of the river, it drops when merge. The merge creates large tributaries with high discharges, but low rapids and stable velocity. The northern tributaries of the Selenge River are suitable for experienced and mass tourism (Fig. 4).



Source: Developed by authors

Fig. 4. The river rapids (tributaries of the north side of the Selenge River in the Khangai region)

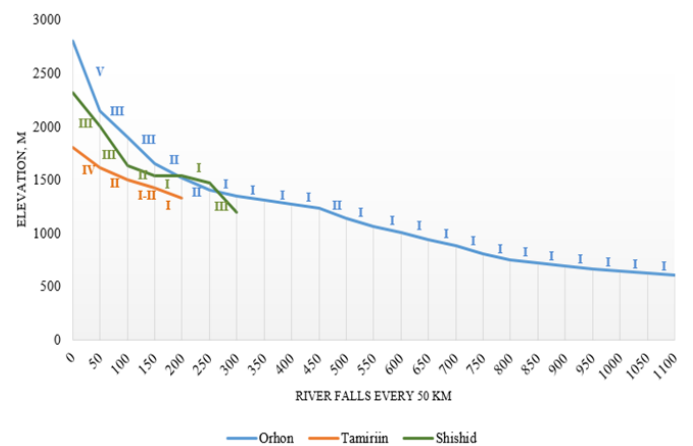
Since the southern tributaries of the Selenge River in the Khangai region are irrigated from the main ridge of the Khangai, constant flow prevails, although it depends on the rainfall of the year. The constant flow of water is suitable for developing adventure tourism in any area. The rivers of the basin are mainly of II-III level, suitable for expert and experienced tourists (Fig. 5).



Source: Developed by authors

Fig. 5. The river rapids/ River fall (southern tributaries of the Selenge River in the Khangai region)

The tributaries of the Orhon River and spring rivers of the Yenisei River in the Khangai region have a high level of difficulty (grade III-V) at the beginning, so specialized and experienced tours are suitable. The difficulty level decreases to I-II from the middle of the river, becoming suitable for experienced and mass tours (Fig. 6).

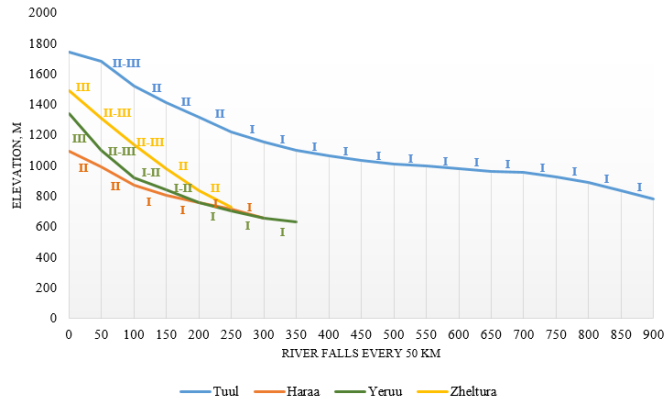


Source: Developed by authors

Fig. 6. The river rapids (tributaries of the Orkhon River in the Khangai region and the source of the Yenisei River)

Rivers of the Central region

As for the rivers of the central region, Tuul, Haara, and Yeru rivers originate from the Khan Khentii mountain range which has a large amount of rainfall, and the Zheltura river originates from the Buteel mountain range. The rivers of the region are dominated by difficulty levels from II to III, with relatively high rapids at the beginning and low from the middle, and the velocity decreases making the difficulty level drop down to level I. As for the Tuul River, it is hard to organize an adventure tour on the river from Altanbulag Sum in the Central Province to the tributary of the Khar Bukh. Because the river passes through heavily populated urban areas, suffering pollution and degradation.



Source: Developed by authors

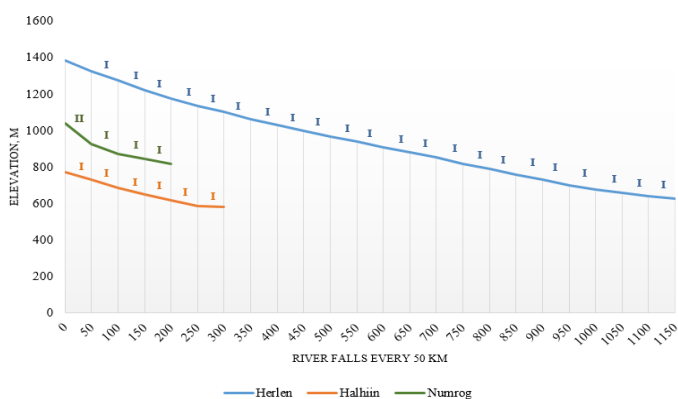
Fig. 7. River decline (Central region rivers)

Rivers of the Eastern Region

The rivers of the eastern region were mapped into two parts: the rivers of China's Great Lake basin and the rivers crossing the border with the Russian Federation.

As for the rivers in the Great Lake basin of China, they are rivers with high water flow that flow through the vast plains of the eastern region of Mongolia with low rapids. Due to the low falls, the difficulty level of these rivers is almost entirely ranked as I.

Rivers crossing the border into the territory of the Russian Federation originate from the Khan Khentii mountain range, which has a large amount of precipitation, which has a major influence on the flow. The water discharge, river velocity, and rapids are high at the beginning of the stream, however, rapids drop down from the middle, and water discharge remains high. Rivers in the region are mostly ranked II-III at the beginning and rank I from the middle, hence, they are suitable for experienced and public tourism. The Uldza river flows through the steppe and bends a lot in the last 200 km, and the water level drops dramatically due to its sinking into the soil. It is characterized by withdrawal in some years.

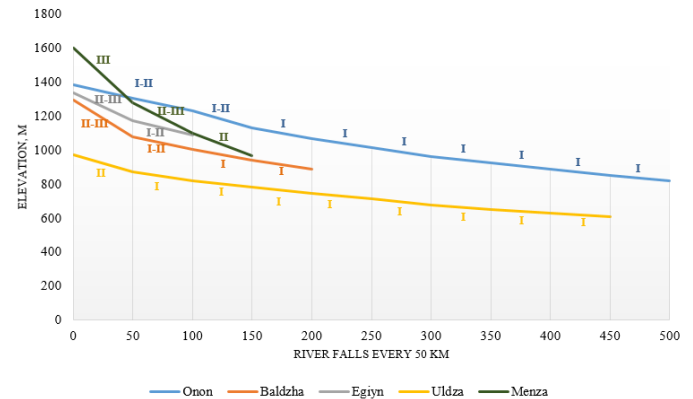


Source: Developed by authors

Fig. 8. The river rapids (rivers in the eastern region – rivers in the China Sea Lake Basin)

Based on the analyses we perceive the following river-based adventure tours likely to be suitable for these rivers. Perhaps, Rafting Float with an inflatable boat, Kayaking, Canoeing, Geckoing Float on a 1-person inflatable bike, Airboat travel,

Catamaran Sailing on a catamaran boat, and Houseboat stays may be arranged based on in-depth socio-economic studies.



Source: Developed by authors

Fig. 9. The river rapids (rivers of the eastern region - rivers crossing the border into the territory of the Russian Federation)

IV. CONCLUSION

Our research aimed at assessing the rivers of Mongolia as natural resources of river-based adventure tourism. As part of the objective, we studied and developed indicators of assessment. Correspondingly, we attempted to rank and characterize rivers following the requirements of adventure tours. The following conclusions are made within the scope of this research.

Natural resources as one of the main foundations of adventure tours ought to be thoroughly studied to identify capacity. Detailed information developed by a comprehensive study will be supportive in developing policies and strategies for the sector.

River-based adventure tourism natural resources can be determined by indicators such as river velocity (km/h), river wave height, river rapids (per 1 km), river discharge (m3/sec), travel distance, river water depth, and river width. In our study corresponding levels of indicators were defined based on the levels used in international studies.

As a result, 33 rivers that can be developed for adventure tourism in Mongolia were identified. 18.18% of all rivers are in the Western region, 45.45% in the Khangai region, 12.12% in the Central region, and 24.24% in the Eastern region. The rivers of the eastern region have low flow rates and high discharges when they meander through vast plains. Rivers in the central region generally have high velocity, rapids, and discharge, from the beginning down to the middle, and the flow rate drops downstream.

Most of the rivers in the early part are suitable for experienced and specialized tourists, and most eastern region rivers are suitable for planning trips for experienced tourists and the public. Also, the average water depth of these rivers is relatively shallow, making them unsuitable for motorboat travel. Therefore, it is suitable for the development of Kayaking, Rafting, Riverboarding, Geckoing, Catamaran trips, Air boating, and Houseboat stays.

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