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REMOTE SENSING METHODS FOR ASSESSMENT OF TOURIST RESOURCES (CASE STUDY: R. GANGA - UTRAKAND)

МЕТОДЫ ДИСТАНЦИОННОГО ЗОНДИРОВАНИЯ ДЛЯ ОЦЕНКИ ТУРИСТИЧЕСКИХ РЕСУРСОВ (НА ПРИМЕРЕ: р. ГАНГА - УТРАКАНД)

Утраканд рекреациялык зонасынын табигый шарттары изилденген. Эң көп колдонулган аймактар жана объекттер аныкталган. Ички жана чет элдик туристтердин агымы талданган. Туризмдин инфраструктурасынын жана материалдык базасынын функционалдык өзгөчөлүктөрү аралыктан зондирлөө жана ГМСтин жардамы менен аныкталат. Анализдин негизинде изилденүүчү аймакта эс алууну өнүктүрүү үчүн эң оптималдуу варианты аныкталды. Туристтик продукцияны керектөөчүлөрдүн негизги контингенти аныкталды.
Өзөк сөздөр: *туристтик ишмердүүлүк, инфраструктура, материалдык база, туристтердин контингенти, аралыктан зондирлөө, ГМС, туристтик агым, талаа иштери, атактуу жерлер, объекттердин топтому.*

Изучены природные условия рекреационной зоны Утраканд. Выявлены наиболее часто посещаемые территории и объекты. Проанализирован поток внутренних и иностранных туристов. Определены функциональные особенности инфраструктуры и материальной базы туризма с помощью дистанционного зондирования и ГИС. На основе анализа выявлены наиболее оптимальные вариант развития рекреации на изучаемой территории. Определен основной контингент потребителей в турпродуктах.
Ключевые слова: *туристическая деятельность, инфраструктура, материальная база, контингент отдыхающих, дистанционное зондирование, ГИС, туристический поток, полевые работы, постполевые работы, известные места, концентрация объектов.*

Have been studied the Natural Conditions of the Utrakand recreational zone. Have been identified the most frequently visited territories and objects. Analyzed is the flow of domestic and foreign tourists. The functional features of the infrastructure and material base of tourism are

determined using remote sensing and GIS. Based on the analysis, has been identified the most optimal option for the development of recreation in the study area. Has been determined the main contingent of consumers in tourism products.

Key words: *tourism activities, Infrastructure, Material resources, contingent of Tourists, Remote Sensing, GIS, Tourist Flow, Field Work, Post-field work, Famous places, Concentration of objects.*

Introduction. For the urban population, water bodies are one of the prized recreational places that allow you to get away from the bustle of the city [1,2].

Prior to the study, a list of key players in the development process was prepared. The original list was amended during fieldwork. In most cases, a discussion was held with a recreational subject, including a high-ranking official or administrator.

Based on primary and secondary data collected on the required area for various infrastructures, and taking into account some minimum value for some infrastructures, logical statistical relationships between infrastructure and population have been developed.

This study is based on the study of a geospatial database created using remote sensing and GIS for geospatial analysis, including environmental expertise from the existing tourism infrastructure and the material base of tourism [3,4,5].

The aim of this work is:

1. Analyze the requirements of tourism activities.
2. To study the infrastructure and material and technical base of tourism.
3. Determine the main counterpart using this offer.

Study area: Rishikesh, Uttarakhand, India.

Rishikesh is located at 30.103368 ° N 78.294754 ° E, has an average elevation of 372 meters (1745 ft), where the Tehri dam is located just 80 km up the road to Gangotri and is the starting point for travel to the Char Dham pilgrimage sites - Badrinath, Kedarnath, Gangotri, Yamunotri.

It is best to get around this area on foot, as the city is hilly and consists of narrow lanes. To cross the river, you need to take a motor ferry from the iron suspension bridge known as Ram Jula, which is located near Svargashram, or go through Ram Jhula or Lakshman Jhula 2 km upstream. Experienced drivers drive two-wheeled vehicles on them, disrupting a calm walk. Noisy tempos (called Vikrams or phatpatis) are affordable devices with amiable owners who have “agreements” so that those visiting the area are best off getting out of the car and heading back on, depending on the driver's destination and the number of passengers remaining.

Materials used: software - Erdas Imagine 2014, ArcGIS 10, Bhuvan and Google Earth. Tools - GPS, mobile display unit and cameras.

When using remote sensing information, determining the DEM data of a tourist place, high-resolution satellite imagery - Liss-IV, Cartosat - 1;

- GIS used for collecting, storing, and processing, analyzing, managing and presenting tourism objects with a geographic location.
- Data of the travel agency Uttrepredesh (Dehradun, Poury, Minikireti).

Analysis of the geographic conditions of the studied area, suitable for tourism, determine the comfortable state for recreation, study the socio-economic state of potential users of natural resources [5].

Materials and research methods: include pre-field work, field work, post-field work.

Pre-field work included data collection - a map at a scale of 1: 15000 and a topographic map at a scale of 1; 50,000, satellite data, DEM, information on tourism infrastructure and facilities used.

Fig. 1. Important tourist sites in Rishikesh

- Field work - inspection and verification of the tourist facility (facilities, infrastructure), collection of secondary data and maps and relevant information from various tourist departments;
- Reporting - includes data analysis, balance assessment of potential, analysis of the tourist network, development of a new generation of maps, reporting and submission to the appropriate authorities [6,7].

The climatic characteristic is pleasant during many months of the year. Since the location is in a hilly area, it never becomes an extreme type. Thus, Rishikesh is one such tourist destination that can be visiting at any time of the year.

The maximum temperature recorded so far is 31.7 ° C, while the minimum temperature in Rishikesh is 14.6 ° C. In the summer months, temperatures range from 35 ° C to 45 ° C. In winter, the temperature ranges from 10 - 30 ° C, and the average annual precipitation is about 2136.7 mm.

The analyzed city is sacred and located on the banks of the Ganges River. The Himalayan mountain peaks surround the area. One of the disadvantages is monsoon rains.

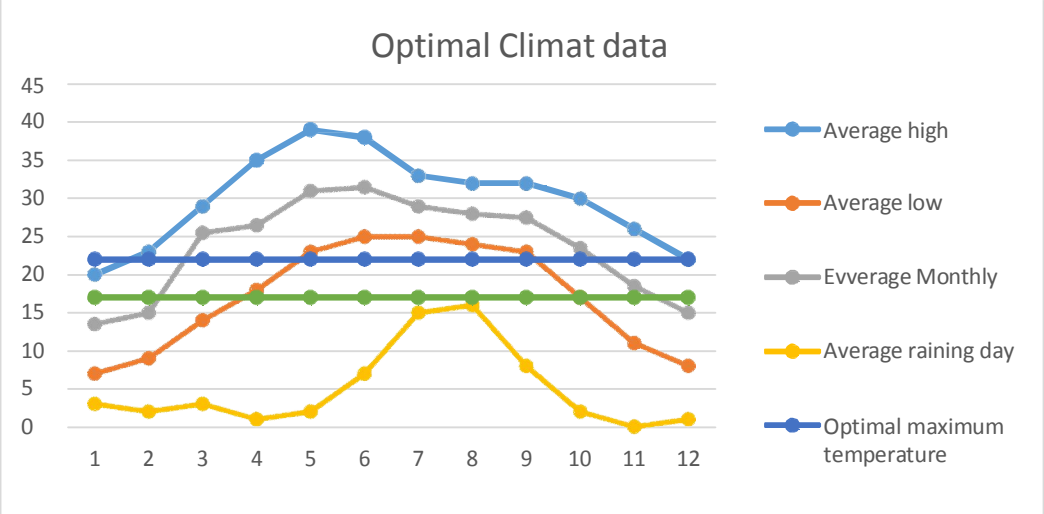

Fig. 2. Optimal climate data

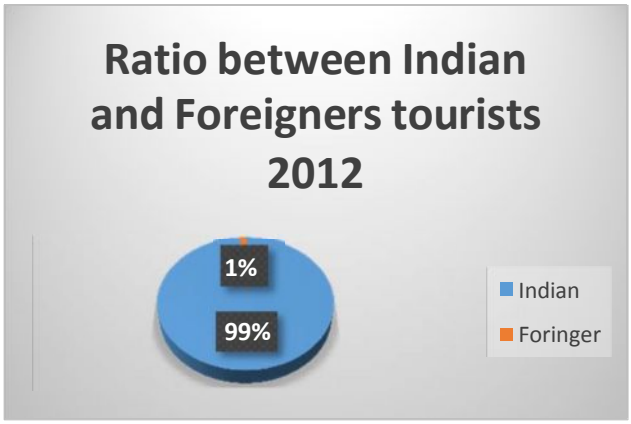

Fig. 3. The ratio between Indian and foreign tourists in Munikoti

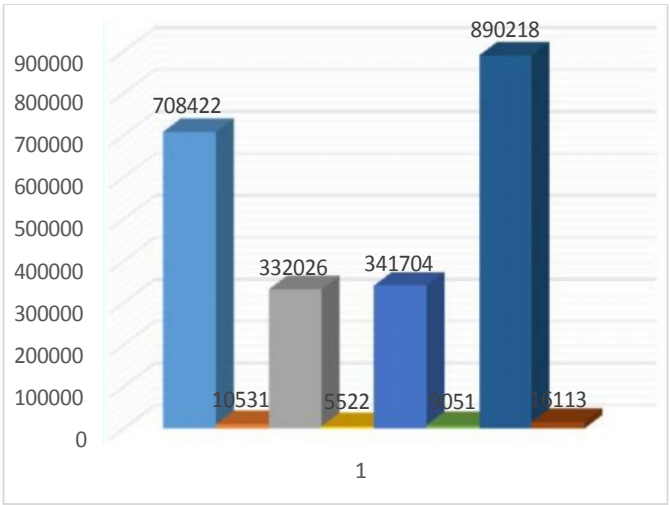

Fig. 4. Cumulative ratio between indicators of Indian and foreign advertisers (2012-2015) in Munikireti

Table 1 - Tourist flow in Rishikesh

N	2009		2010		2011		2012		2013		2014		2015	
	Indian	Foreigner	Indian	Foreigner	Indian	Foreigner	Indian	Foreigner	Indian	Foreigner	Indian	Foreigner	Indian	Foreigner
Jan	16632	338	18254	644	18639	547	21670	452	18023	441	12953	449	20135	450
Feb	18885	475	19854	539	18089	419	20197	423	18241	446	13447	469	17856	371
Mar	15966	298	23779	636	22792	346	22533	682	21937	354	19486	302	18975	812
Apr	16754	232	35842	662	30047	372	39978	411	25105	501	19610	278	27001	132
May	52542	304	5895	445	88974	366	70476	187	74476	351	26039	149	44964	953
June	143789	402	308406	305	558149	262	262416	345	132847	161	37839	44	55785	97
July	106968	299	260732	431	148317	391	167842	319	13624	165	29965	178	44060	89
Aug	8083	551	166145	661	198066	627	68243	589	13470	349	31482	287	43470	346
Sep	71098	450	145942	306	28233	473	67224	519	12401	198	71259	421	78516	104
Okt	20980	451	22304	340	28641	482	24673	411	12310	243	23399	542	35186	56
Nov	19732	355	14590	275	20562	255	17931	402	12495	324	23066	313	21643	147
Dec	17440	395	18641	304	21026	454	21435	412	15287	660	20391	620	26442	166
Total	508869	4550	1040384	5548	1181535	4994	804618	5152	370216	4193	328936	4052	434033	3723

SOURCE: DISTRICT TOURISM OFFICE

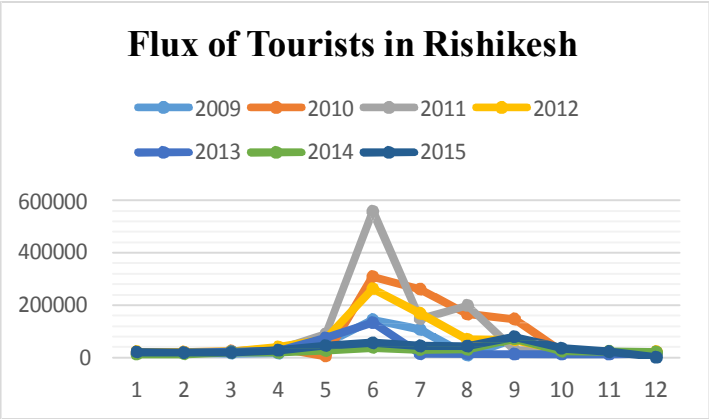

Figure 5. The total number of tourists in Rishikesh 2009-2015.

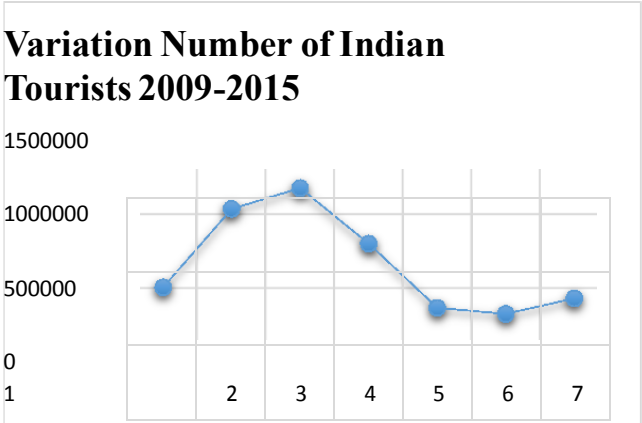

Figure 6. Dynamics of the flow of tourists in Rishikesh in 2009-2015.

Rishikesh is becoming a popular destination for rafting enthusiasts from both India and abroad as the Ganges offers medium to rugged class 3 and 4 rapids. The rafting season starts in March and ends in September [8].

It is a center for hiking, mountaineering, rock climbing, mountaineering and kayaking. In previous years, bungee jumping introduced in Rishikesh. Mountain biking is possible in Mohanchatti, which is located near a popular place called Lakshman Jula in Rishikesh.

As tourists from all over the world are attracted to Rishikesh for yoga, rafting and travel, Rishikesh has become an international tourist attraction. Rafting in Rishikesh is a popular sport in the summer, but due to violations of the rules, most of the rafting camps in Rishikesh pollute the river. [8]

- Chugtayani Malii;
- Rafting on the Bast river;
- Rajaji National Park;
- Place for jumping;
- Rafting camp.

Rishikesh, located at the confluence of the Chandrabhaga and Ganges rivers, is known for its Ashrams, Dharshala is often called the "world capital of yoga", has a significant floating population, as millions of tourists / pilgrims annually flock from India and from abroad for spiritual reasons and adventure tourism. According to statistics published by the Department of Tourism of Uttarakhand, the estimated average tourist stay in Rishikesh is about 6.3 days, compared with the average in Uttarakhand of 3.95 days [8].

The area is home to Guru Sri Ram Sukh Daastji, popular with the Hindu community. Twice a year people gather in this ashram to read the Ramayana together.

The study area is distinguished by the concentration of ashrams and temples. It is this place that is the gathering center of famous yogis. An hour's drive from Rishikesh up the river is Vasishthi Gufa, where the famous saint Vasishtha practiced meditation on the banks of the Ganges. It is a very calm area and is an ideal place for meditation [8].

The analysis showed that the territory under consideration has abundant tourist facilities (see Fig. 7) and the corresponding infrastructure, and our task is to determine the contingent - which is to a greater extent the consumer of these objects.

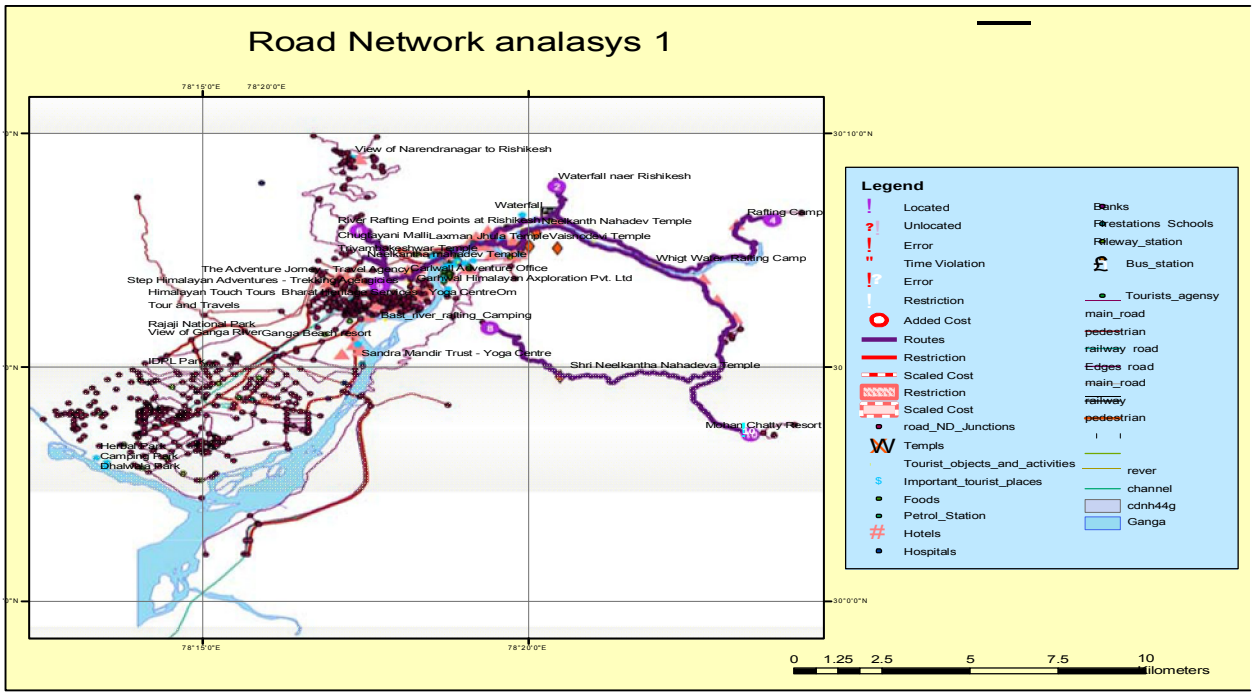

Fig. 7. Analysis of the road network

When analyzing the road network, we showed the shortest direction from the bus station to:

- Narendranagar;
- Waterfall;
- Sahndra Mandir Trust;

The figure shows a high potential area based on the needs of the tourist area. This whole area is located at a distance from the roads and is convenient for visiting all the sights, rivers, etc.

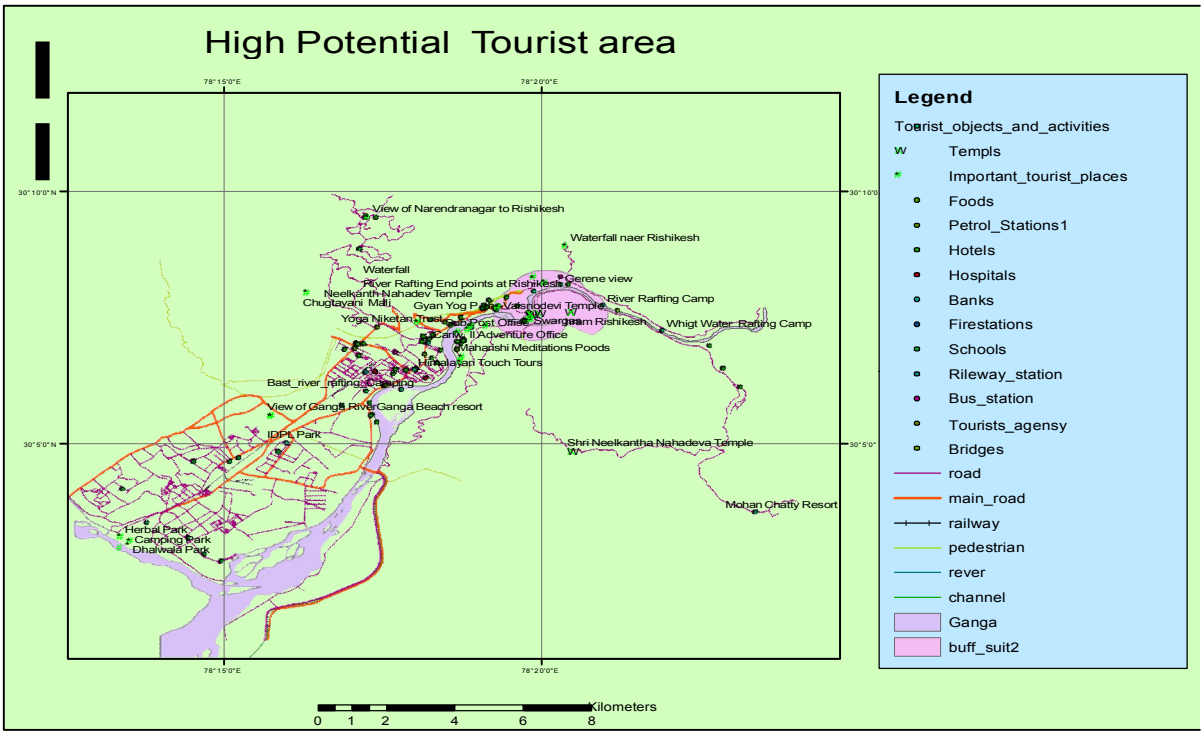

Fig. 8. Tourist area with high potential

Conclusions: In general, remote sensing and GIS facilitate the analysis of tourism resources. But without specifying the exact coordinates of individual objects, a complete analysis of the objects under consideration is impossible.

To process data about the flow of tourists and the objects used, additional software resources are required.

The results of the work carried out were presented in the form of a long-term plan for local travel agencies, which can be implemented for the development of tourism activities in the area under consideration.

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