Prospects for the rational use of water bodies of the Northwestern Federal District of Russia in the tourism sector

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Abstract. The purpose of the article is to show that it is economically viable and environmentally sound to use the water resources of the Northwestern Federal District (NWFD) of Russia as a matrix for the development of tourism and recreational facilities in the region. Such specialization corresponds to the peculiarities of a very vulnerable northern nature and modern conditions when the sphere of recreational nature management and the market for services are actively developing all over the world. A large number of water bodies, unique monuments of natural and cultural heritage are located on the territory of the NWFD, which determines the possibilities of combining these resources in projects of recreational nature management. According to the authors of the article, the most promising resources are prehistoric monuments, including stone sculptures, structures and revered stones of different genesis and age. However, these objects are the least studied and protected. There are several problematic issues, which are related to the study, conservation and rational use of megalithic objects located on the region’s water and water routes. We consider the possibilities of researching such objects as the simplest astronomical tools of the Stone Age, list the main directions and research methods, and give some specific examples.

1. Introduction
NWFD is the most saturated area in terms of rivers and lakes in the European territory of Russia, promising for the development of water tourism. The rivers of the region are very diverse in their features: most of the rivers have a calm course, but the rivers of Karelia are similar in their complexity to the mountain rivers, being swift and rapid. Unlike mountain rivers, the rivers of Karelia are full-flowing throughout the year since runoff is regulated by a large number of lakes as natural reservoirs of water. However, the choice of the region for boating is connected not only with the level of complexity and the length of water routes, which provide optimal physical activity and the possibility of development of new sports achievements. A significant role in the choice of the region is its saturation with natural and historical and cultural heritage. The conservation of unique natural phenomena and cultural objects created by human in different eras of the development of the territory (figure 1) in the north and northwest of the Russian Plain was facilitated by a low level of plowing and industrial development as well as a low population density.

The development of ecological as well as historical and cultural water tourism can seriously compete with the construction of landfills for the disposal of garbage from large cities of the Center of Russia. Poorly developed and poorly substantiated projects for converting the historical territories of the Russian North into...
garbage dumps violate some laws of the Russian Federation that prohibit the placement of landfills at the river sources, on waterlogged soils and within the buffer zones of protected areas. The already begun construction of landfills does not enjoy the support of the local population since they do not contribute to the economic development of the region and carry environmental risks to public health and unstable northern ecosystems. Unfortunately, the economic authorities, who are the decision-makers, ignore this opinion.

The authors of the article discuss the issue of the rational use of the richest recreational resources of the NWFD and the project “Water Communications of the North: Traveling in Time”, which develops the traditions of water tourism in Russia, Europe and across the world. The development of this project will allow mobilizing and preserving the resources of the cultural and natural heritage, preserving the purity of water objects and revealing to the contemporaries the depth of the cultural tradition and the wide connections of the region based on a dense network of water-land ways.

2. Objects, data and methods
The project is based on the scientific provisions of V.I. Paranin on the decisive influence of transcontinental communications in the organization of the structure of territorial systems that were developed on the basis of historical geography, archeology, anthropology, ethnography and toponymy [1, 2]. By the prevalence of geographical names on a macro-regional scale based on observation of the position of the Sun in the daily and annual cycles, the leading role of solar navigation (navigation – movement and orientation) in the development and marking of the territory was determined. The results of astro-archaeological findings of the most recent astronomical tools and calendars in all regions of the world are consistent with these provisions.

For the territory of the NWFD, similar results were obtained by the authors of the article exploring objects of the Stone and Bronze Ages: northern labyrinths and petroglyphs, menhirs and revered stones, zoomorphic and anthropomorphic stone sculptures. Key objects are located in Murmansk, Arkhangelsk, Vologda, Leningrad, Pskov, Novgorod regions, and on the territory of the Republic of Karelia. The study was carried out jointly with the Department of Archeology of Eastern Europe and Siberia of the State Hermitage Museum, Central Astronomical Observatory of RAS (Pulkovo) and the Department of Country Studies and International Tourism of St. Petersburg University [3, 4]. We have revealed that most of the prehistoric navigational tools are located on waterways. As a rule, stone objects stand out clearly in the landscape and have their legend, some are still included in the living tradition of indigenous peoples (figure 2).

Many of these objects continue to perform primary information functions: they help locals and tourists to
navigate on the road, which is especially important in extreme situations, if it is impossible to use modern
technology, such as a compass or GPS.

In the research process, standard field and office methods of geography, astronomy and archeology were
used, as well as original methodological techniques developed to optimize statistical and metrological
analysis of factual material, cartographic and mathematical modeling (figure 3).

Figure 3. Labyrinth on Bolshoy Zayatsky Island, White Sea. Photo by A.N. Paranina, 2010.

The algorithm of system-information analysis includes the following steps: 1. object research by
standard methods (measurement, description and comparison); 2. specification of the host landscape (taking
into account the evolution of the natural and climatic situation in the Holocene and geological and
gemorphological features, including the dominant systems in the fracturing of rocks and in the extension of
lineaments, i.e. linear tectonic structures that are expressed in the landscape); 3. astronomical and
paleoastronomical calculations of the calendar azimuths of the sunrise / sunset of the Sun and the Moon, the
height of the gnomon of the sundial calendar and the position of the midday shadow by season (for the
geographical coordinates of the object, taking into account the differences in physical and astronomical
horizons); 4. establishing correlations of the spatial characteristics of the studied object, the surrounding
landscape and astronomical indicators recorded at this point; 5. comparison of the instrumental capabilities
of the object with local and regional life support tasks in different historical eras (including analysis of the
location of the object in the system of transport communications); 6. analysis of traditions, myths and
legends associated with the studied objects; 7. problems of protection and the possibility of rational use in
tourism; 8. system-based conceptual modeling.

3. Results and discussion

The mobilization of recreational resources of the territory and the communicative function of river systems
can be effectively carried out based on the development of integrated business projects that unite the efforts
of specialists in various fields, theorists and practitioners. The aim of the project “Water Communications of
the North: Traveling in Time” is to replenish tourism resources in the NWFD with prehistoric objects of
cultural heritage located on the ancient water-land ways of the North. The main scientific task is to identify
new and present correctly the already known objects that are necessary for their protection and rational use.
3.1. Natural and cultural heritage of the Northwestern Federal District

The natural heritage of the NWFD are the famous attractions of the region. Water bodies are well studied and presented in different scale cartographic models. Rivers, waterfalls and lakes are popular among tourists, including the largest in Europe Ladoga and Onega. Specific relief forms usually associated with glaciation but possibly of marine and tectonic genesis (sheepback rocks, eskers), rocky shores, skerries, picturesque islands and lakes, outcrops of noteworthy rocks, including amethysts, shungites, etc., are very attractive. Some can be seen in the protected areas that are available for visiting.

The cultural heritage of the NWFD is no less interesting and diverse. There are stone objects of natural and man-made origin in the territory of the Baltic Shield and the so-called cover areas of Quaternary glaciation: Karelia, the Kola Peninsula and the North of the Russian Plain. These are, for example, anthropo- and zoomorphic remnants and rocks (Dva Brata (Two Brothers) on the Sredny Peninsula, Crow Stone in Murmansk, Manpupuner idols), menhirs and seids (Murmansk, Mount Vottovaara, and the Kuzov archipelago), revered stones (Tiunovsky sanctuary in Tarnogsky district of the Vologda region) (figure 4).

Among the artificial objects of cultural heritage, petroglyphs and labyrinths created in the Stone and Bronze Ages are of undoubted interest. Petroglyphs are concentrated on the rocks of the east coast of Lake Onega, on the White Sea coast and Kanozero in the Kola Peninsula. The main distribution area of the labyrinths is the islands and the coast of the White Sea (the territory of the Republic of Karelia, the Murmansk and Arkhangelsk regions) (figure 3). The primary instrumental purpose of labyrinths and petroglyphs has so far been well studied by the authors of the article based on observations and calculations of the shadow path of the gnomon of a sundial. Together with the plots of cave paintings, this creates an idea of a deep tradition of navigation by the Sun, which in polar days and nights is the main reference point for navigation in the Arctic [5]. These data are consistent with the results of archaeological research [6].

3.2. Problems of studying the prehistoric heritage of the Northwestern Federal District

The ancient and most ancient stone objects of the region are still not fully explored. All megalithic monuments remain poorly studied: menhirs, seids, cromlechs, stone stairs and chairs, geometric formations
(parallelepipeds, balls, pyramids), stone anthropomorphic and zoomorphic sculptures (sculptures and bas-reliefs). The most uncertain and debatable are the interpretations of their purpose, genesis and age. The reason for the rejuvenation of ancient stone objects is often the presence of medieval objects in the lifting material of archaeological excavations and the time frame put forward by supporters of the continental glaciation hypothesis.

The same hypothesis is used to explain stone objects, including seids, which are found in other regions far beyond the supposed boundaries of the ice sheets. For example, there are tens of thousands of seids concentrated in South Korea, which are similar to those located in the NWFD, and they have long been recognized as anthropogenic in origin. About 100 pyramids in China are recognized as man-made, and analogues of such forms in our region are considered as natural (on the Kola Peninsula and Spitsbergen Island). At the same time, it is recognized that there are no geomorphological formations of this form in nature since not a single relief factor is capable of creating them. In Europe, almost all menhirs are considered man-made, and some even have names, and in Russia, very few of them are recognized as man-made.

For some megalithic formations in the region, there are signs of technogenic processing: the presence of artificially cut edges and faces at the stone of St. Paraskeva (Friday) in the Leningrad region on the shore of Lake Vrevo, stone coasters at some seids and grinding at the stone ball on Mount Vottovara in Karelia. A separate scientific problem is the age and genesis of anthropo- and zoomorphic stone formations, which is considered in detail in the author’s monograph [7]. Here, we briefly review several main criteria of artificiality. One of the signs of the anthropogenic genesis of stone sculptures, a statistically significant amount of easily recognizable elements of the figure of the depicted creature (outlines of the body, two eyes, forehead, mouth, and nose), that this is beyond the power of any natural factor of relief formation. A reliable criterion for the artificiality of the stone sculptures of the region is the presence of their analogues in other parts of the planet, regardless of the landscape evolution and the modern natural environment. The aforesaid applies both to anthropomorphic sculptures and a number of the most common zoomorphic stone sculptures (turtles, bears, camels, elephants, seals, walruses, and dragons). These analogies do not have an explanation, if not taking into account the active role of human and the development of inter-regional communications associated with the use of simple and universal navigation technologies. An essential sign of the man-made genesis of the considered stone formations is their orientation in the countries of the world and the directions of significant days of the astronomical calendar. For this purpose, they were created at locations convenient for observation, such as elevated places, river lobe turns and islands (for example, a stone sculpture of a turtle in the Skalnoye area in Murmansk is oriented to the east). A significant argument in favor that ancient stone structures and statues are man-made is the location of most of them on the shores of seas, lakes and rivers, which served as ancient waterways, including those on the coasts of the Barents, Baltic and White seas, Ladoga and Onega lakes, on the banks of the large rivers Northern Dvina, Kola, Pechora, Volkhov, and on the interfluves.

3.3. Landscape-geographical and paleoastronomical research methods

An example of identifying new objects of prehistoric heritage that replenished the resources of recreational nature management is our astronomical observations and paleoastronomic calculations on the complex of the revered stone of St. Paraskeva (Friday). Previously, the attention of archaeologists and local historians was attracted only by the main stone, as a pagan object consecrated by the Christian church in the Middle Ages (figure 5).

Interdisciplinary studies have shown that large boulders installed at a distance of 100 to 500 m from the revered stone allow us to fix the azimuths of sunrise / sunset on the horizon line on the days of solstices and equinoxes [8]. An important astronomical direction coincides with the line of the high shore terrace of Lake Verkhnnee Vrevo (sunrise at the winter solstice / sunset at the summer solstice), which could be the first
landscape tool. A triangle cut out on its surface of the main stone can serve to check the “adjustment” of the tool since one side is directed along the geographic meridian. The other two sides can serve as lines of sight, which field observations on solstice days confirmed (figure 6).

![Figure 5. The revered St. Paraskeva (Friday) stone on the coast of Lake Vrevo in the Leningrad region. Photo by A.N. Paranina, 2011.](image1)

![Figure 6. Field observations on 22.06.2019, the azimuth of the sunrise coincides with notches on the surface of the of St. Paraskeva (Friday) stone. Photo by A.N. Paranina.](image2)

3.4. Conservation status

Conservation status is attributed to many natural objects (landscape complexes, forests, and geological monuments) as well as cultural and historical objects of medieval time. The least protected are the prehistoric stone objects of natural, man-made and artificial genesis. In conditions of an increase in anthropogenic loads, their number is rapidly declining. This increases the relevance of their comprehensive research, the need to create a geographic database of such objects and develop sound recommendations for their rational use [9].

As an example of a rational attitude to heritage sites, we recall the experience of a small country, the Netherlands, where similar natural and man-made formations (in the amount of only approximately 50) are well known, protected and the objects of tourism. Unfortunately, in our country, most of these formations are considered bizarre forms of nature, a kind of “lusus naturae”, and those who have no experience in researching objects using natural science methods play the role of “experts”.

It is not very important what processes and technologies created the benchmarks of space and time that a person could use as information resources necessary for life safety, the successful development of the territory and the economic development. Debatable objects can be even more interesting, for they retain their first-issued appearance and attract tourists. In our opinion, such objects can replenish not only the resources of the recreational facilities of the NWFD and other territories of Russia but also the list of World Cultural Heritage.

3.5. The project “Water communications of the North: Traveling in Time”

The project “Water communications of the North: Traveling in Time” is based on rich historical information about the navigation traditions of the territory of the NWFD. In the region, there were several large water-land routes, actively functioning as far back as the Middle Ages. The most significant was the route from the Gulf of Finland through the Neva, Ladoga, Volkhov, and Ilmen, then, to the Dnieper and the Black Sea. Another route followed from Lake Onega through White Lake to the Volga and further to the Caspian...
Sea. Along Sukhon, further along the Pechora, its tributary passed the water-land ways in the Trans-Urals. Finally, from the Barents Sea, a water-land way was laid along the Kola River across the Kola Peninsula, and then, along the White Sea, rivers and lakes of Karelia to Lake Onega.

All mentioned routes are marked with ancient cities, and church buildings. At the same time, markers-indicators of their use in prehistoric times were preserved on these ways. These are not only archaeological sites but also megaliths, labyrinths and ancient toponyms. In the best way, ancient stone structures and statues have been preserved on the Kola Peninsula as well as on the islands and the coast of the White Sea. Single megaliths and their clusters are confined not only to large rivers but also to their small tributaries or reservoirs in transit, for example: on Vuoksa (Karelian Isthmus) and the Indiga River (Arkhangelsk region).

The implementation of the new project will be facilitated by contacts with the comprehensive international program “The New Hanseatic League” and existing tourist routes: the Blue Road, the Scandinavian Ring, the Royal Road, and the Silver and the Golden Ring, which allows using the accumulated experience and infrastructure elements [10-15]. In the future, the project can expand in different directions: eastward – beyond the Urals and the Bering Strait, westward – to the countries of Scandinavia and southward – to the central part of Russia.

4. Conclusion
The strategy for the development of environmental management of the NWFD may be based on recreational resources associated with water bodies. There are many interesting natural and cultural monuments on the sea coasts, lakes and waterways. Due to the good development of the territory in the past and the dispersal of the modern population, objects of different times have survived from the Stone Age to the present day. The most attractive for tourists are geological outcrops (for example, Cape Byk (Bull) in the Veliky Ustyug district of the Vologda region) and prehistoric monuments of cultural heritage (labyrinths, petroglyphs, menhirs, and revered stones).

Studies of the authors of the article have shown that on the waterways of the NWFD there are navigation objects of different ages and technological levels, which show the continuity of the cultural traditions of the inhabitants of the forest zone and tundra in the use of waterways as communication lines. A high level of astronomical knowledge and skills in solar navigation made it possible to go down the rivers to the Arctic Ocean, build ships for sea navigation and explore the islands of the Arctic during the polar days and white nights. Walking along the ancient waterways is not an easy task, which can create a sense of respect for the peoples who inhabited the harsh northern region in the distant past. The development of tourism projects, combining water bodies and monuments of ancient culture, focuses on the continuity of the traditions of astronomical navigation, testifies to the inheritance of the location of prehistoric monuments by medieval, and later – modern ones. On the stone of St. Paraskeva (Friday) on Lake Vrevo, for a long time there was a wooden Orthodox chapel. In Murmansk, near the stone turtle, a chapel and a church were built. And the huge modern megalith Alyosha (a sculpture created from concrete to the defenders of the Soviet Arctic during the Second World War) was built directly on the site of the accumulation of prehistoric stone objects.

The cultural and historical heritage located on the shores of water objects in the NWFD clearly shows that our distant ancestors mastered the vast territories of the Northwest based on advanced navigation technologies related to the navigation by the Sun in space and in time. At the same time, the development of landscapes took place primarily along large rivers, as well as their tributaries, which made it possible to penetrate the “remote” corners rich in necessary natural resources. Later, in the historical era, especially in the Middle Ages, the development of a huge territory continued along previously developed routes, i.e. along the same water bodies: rivers, lakes and seas. Many medieval objects or the territories surrounding them, in particular, religious buildings, inherit the locations of the Stone Age monuments (for example, the Solovetsky and Valaam Monasteries on the White Sea and Lake Ladoga, respectively and Kizhi Cathedral
on Lake Onega).

Today, water tourist routes along the islands of the White and Barents Sea are well developed. The routes along the Neva – Ladoga Lake and the Neva – Ladoga – Svir – Onega Lake systems, as well as through the system of rivers and lakes, the Neva-Volga, are widely known and popular. To expand the scope of recreational activities and the market of tourist services, the promising routes of small tourist groups along the water-land ways connecting small rivers and lakes are promising. In the future, due to the tourism development in the Arctic and global warming, the project can cover the entire coast of the Arctic Ocean and become circumpolar.

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