Гидрометеорология и экология

Scientific article

SPATIAL STRUCTURE OF CONFLICTS OF RECREATIONAL NATURE MANAGEMENT IN EAST KAZAKHSTAN

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KEY WORDS

recreation
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ABSTRACT

The mapping of conflicts of recreational nature use of selected model recreational systems within East Kazakhstan was carried out. It has been identified that the most intense conflicts occur along the shores of lake Alakol, within the Katon-Karagay National Nature Park, and in the Semey ormany region. These conflicts in the field of natural resource use are driven, on one side, by the high conservation and recreational value of natural landscapes, and on the other, by the increasing intensity of economic activities, particularly in the sectors of transportation and recreation. The obtained results can be utilized to enhance functional zoning, plan measures for nature conservation, and organize ecological monitoring of recreational areas..

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1. INTRODUCTION

In contemporary conditions, recreational natural resource use in various countries and regions is attaining importance comparable to that of agriculture, both in terms of economic benefits and environmental impact. The development of recreation as a form of spatial utilization is accompanied by a significant increase in recreational flows, the expansion of recreationally developed areas, a diversification of recreational activities, and, consequently, an increased burden on natural systems. Addressing the spatial distribution of various types of recreational systems and their interaction with other forms of natural resource use has become one of the key challenges for modern society.

Modern recreational natural resource use in East Kazakhstan is characterized by multifunctionality, leading to disruptions in the optimal territorial structure and intensifying environmental conflicts. In this context, it becomes essential to map the structure of natural resource use conflicts in recreational complexes to prevent and resolve them while preserving both unique landscapes and the territorial specialization of regions.

A natural resource use conflict represents a contradiction between territorial priorities for nature conservation and economic development within a specific natural resource use regime. This results in actual or potential degradation of natural systems or their key components, a decline in biodiversity, productivity, and landscape value, as well as a reduction in the overall efficiency of territorial functions [1].

Theoretical and methodological foundations for studying, classifying, and mapping the structure of natural resource use conflicts are discussed in the scientific literature [2...4]. In international research, the concept of natural resource use closely aligns with the notion of spatial planning of territories [5...6]. The primary aim of most such studies is to develop scientifically grounded schemes for spatial planning, including solutions for natural resource use conflicts in the context of multiple stakeholders [7...12].

The objective of this study is to identify and map the spatial structure of recreational natural resource use conflicts in model sites of East Kazakhstan.

2. MATERIALS AND METHODS

The rapid growth of recreational complexes inevitably leads to conflicts between recreational and other types of natural resource use. A distinctive feature of conflict situations caused by recreational natural resource use is that, when interacting with other forms of natural resource use, recreation often undermines the very factors and conditions necessary for its own development.

Such conflict situations include [13]:

competitive relations with traditional nature management, depriving recreation of the basic prerequisites for the development of ethnic and rural tourism;

the change in the space of recreational agricultural activity, leading to the destruction of the traditional landscape, which is the most important recreational resource;

A conflict between recreational activities and conservation efforts, leading to environmental issues that result in the degradation of natural landscapes and, consequently, hinder the recreational development of the region.

Functions that cannot share the same territory are considered antagonistic. This occurs when a territory is used for activities that are mutually incompatible. In such cases, these functions are spatially separated by a sufficient distance to minimize their negative impacts on one another. Functional antagonism not only complicates their interaction but also contributes to destruction and degradation. Consequently, challenges arise, such as accommodating the interests of antagonistic functions. These issues can be addressed through the creation of buffer zones that mitigate their mutual influence.

Such pairs within the study region include [14]:

residential – environmental;

recreational – transport;

environmental – transport.

For mapping recreational natural resource use conflicts in the selected model recreational systems, Sentinel-2 satellite imagery, data obtained through territory survey methods and image processing, information from the Google Earth geoportal, and field research materials with GPS referencing conducted during the summer of 2022 were utilized. All data were integrated into a unified cartographic projection and coordinate system.

The main stages of determining the spatial structure of the conflicts of recreational nature use in East Kazakhstan:

Collection of data on the components of the natural environment of model recreational systems with the compilation of cartographic material of the object of study;

Compilation of maps-hypotheses of nature management of selected recreational systems based on satellite images;

Conducting field research on model sites with the preparation of the final map of the nature use of recreational systems;

Identification of conflicts of nature use of model recreational systems and mapping;

Analysis of the obtained data and the search for optimal solutions to resolve the identified conflicts. Determination of the most efficient land-use strategy, with the identification of areas requiring changes in the nature of their utilization.

3. RESULTS AND DISCUSSION

And in the process of reconnaissance, model recreational systems were determined taking into account the types of nature management and using Sentinel-2 high spatial resolution satellite imagery for 2022, the images were selected for the summer season, with the lowest possible cloud cover. As a result, the coast of Lake Alakol, the territory of the Republican State Institution "Katon-Karagai State National Natural Park", and the territory of the State Forest Natural Reserve "Semey Ormany" were chosen as model recreational systems (Figure 1).

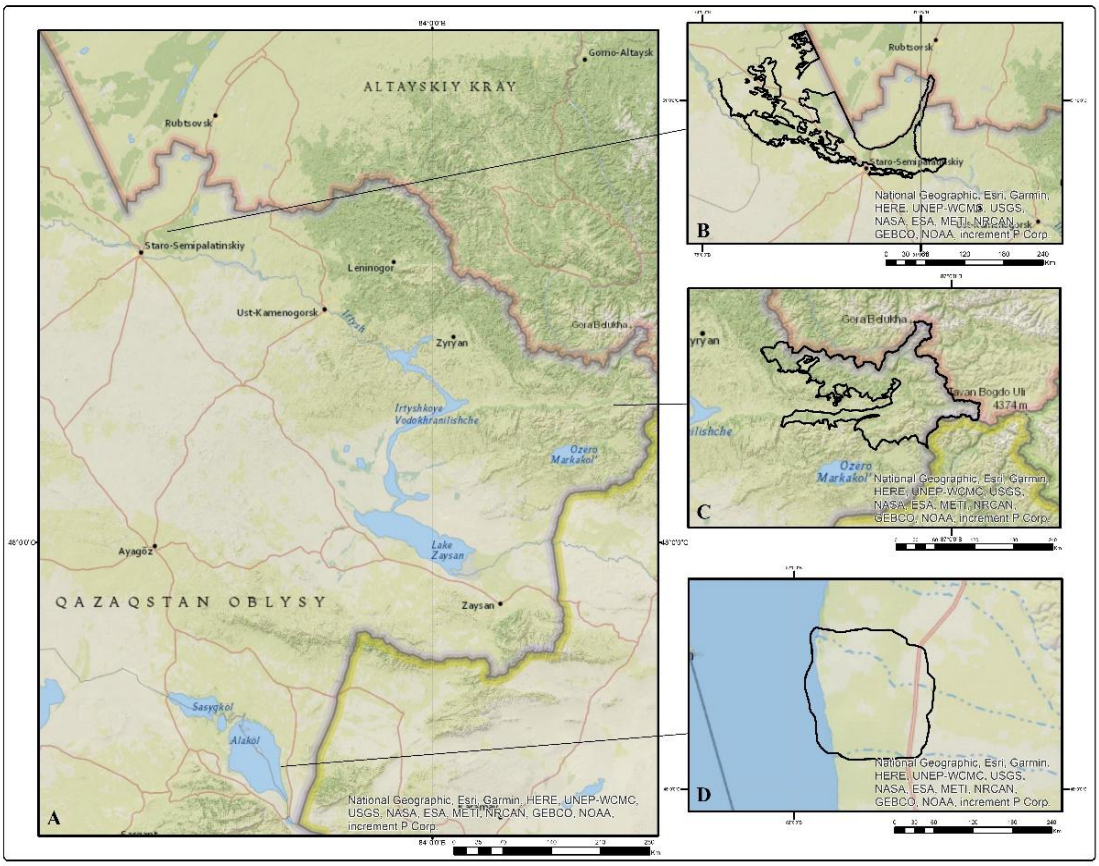

Figure 1. *Selected model recreational systems within East Kazakhstan (Source: Author, created in the program ArcGIS.10.4 using the "National Geographic World Map") A) East Kazakhstan; B) State Forest Nature Reserve "Semey-Ormany"; C) "Katon-Karagai State National Nature Park"; D) East coast of Lake Alakol.*

The main purpose of the formation of the "Semey Ormany" Reserve is to protect and carry out environmental measures to restore the ribbon forests of the Irtysh region, which perform irreplaceable protection functions and have important geoecological, scientific, environmental, and recreational significance. In this region, there are various types of vegetation: steppe, forest, desert, shrubs, and meadows. The protected area in the study area is 251 km^2.

The Katon-Karagay State National Nature Park is one of the largest national parks in Kazakhstan. Its primary mission is the preservation and restoration of the natural landscapes of Southern Altai, which hold significant conservation, scientific, and recreational value. The park's main objectives include: protecting the state natural reserve fund, biodiversity, and unique natural and historical-cultural complexes and sites of particular recreational, ecological, and scientific importance; studying natural processes in their undisturbed state and conducting ecological monitoring; purposeful and rational use of the park's territory to advance science, culture, and education; restoring degraded natural and historical-cultural sites based on recommendations from scientific organizations. The total area of the park is 6,435 km².

On the territory of the eastern coast of Lake Alakol, the following conditions contribute to the development of the tourist and recreational sphere: microclimatic conditions and the chemical composition of the water attract recreants to improve health, as well as to create a beach area; certain groups of recreants create an opportunity to develop water sports and recreation and ecological tourism on the lake shore; attractiveness for tourists due to the location of the region under study in the vicinity of a large transport highway, which is of international importance.

Residential – environmental conflict. In the modern world, the relationship between natural and man-made landscapes is a form of the increasing pressure of the anthropogenic factor on the natural system. Under the influence of recreational and economic transformations, nature protection

zones are experiencing significant changes. At the same time, the natural environment transformed under the influence of economic, industrial, and recreational needs is subject to a violation of the ecological balance, which results in an increase in air and water pollution, changes in climatic indicators, degradation of soil cover, destruction and change of vegetation species.

The residential–environmental conflict of nature management is a consequence of the antagonistic contradictions between the residential and environmental types of nature management. This type of conflict of nature management arises as a result of the construction of residential facilities in protected areas or the neighborhood of residential construction with environmental protection in the area's territorial aspect. Residential objects include anthropogenic impact in the form of a residential factor that negatively affects specially protected natural areas. It should be noted that long-term residential influence leads to a decrease in the quality of the state of the natural environment in the nature protection zone.

Conflicts of nature management in certain areas of the Katon-Karagai National Park and the "Semey Ormany" Forest Reserve were formed as a result of the simultaneous manifestation of residential and environmental antagonistic functions.

On the territory of the Katon-Karagai National Park, a multifunctional residential-environmental conflict forms the village of Arshaty (Katon-Karagai district), located in the central part of the nature protection zone, with an area of 0, 91 km^2. The main type of nature use of the village of Arshaty with a population of more than a thousand people is agriculture and animal husbandry (Figure 2).

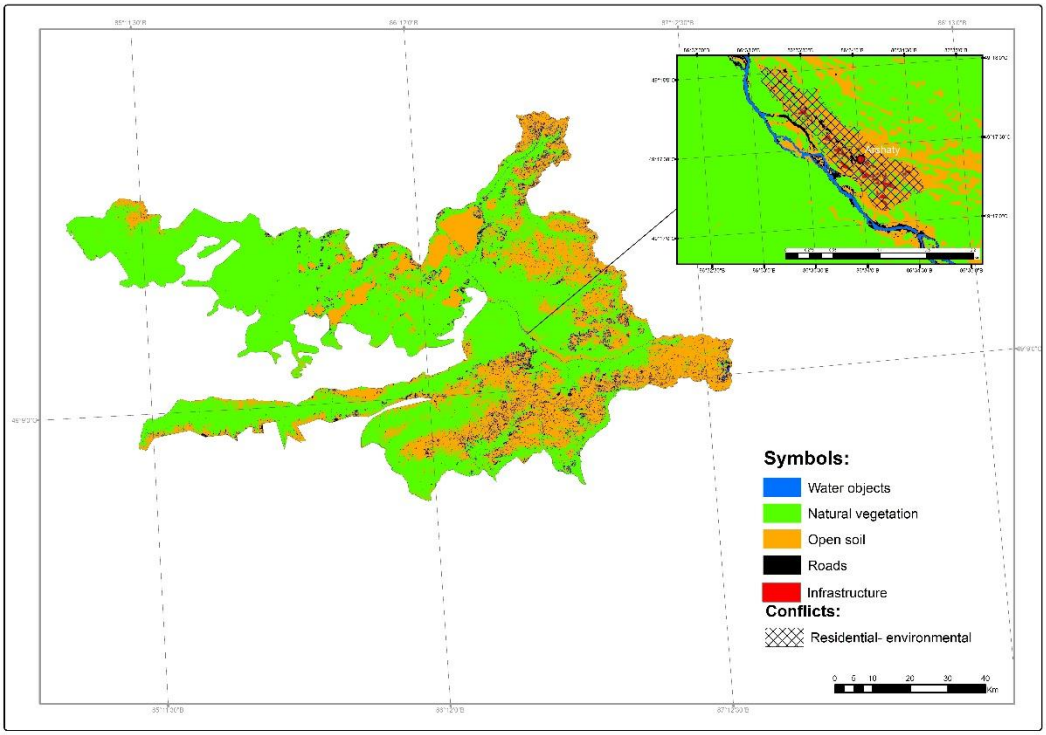

Figure 2. *Map of conflicts of nature management "Katon-Karagai State National Natural Park" (Source: Author, created in the program ArcGIS.10.4)*

Residential – environmental conflict a type of conflict, as in the Katon-Karagai National Park, was formed in the forest reserve of the “Semey Ormany” between the residential function, which is represented by the village of Gunboat, and environmental protection. The village of Kanonerka with an area of 2, 169 km^2 in the Beskaragai district of the East Kazakhstan region. The main type of nature use of the village of Kanonerka with a population of 1892 people is agriculture and animal husbandry.

Further expansion of residential nature management on the territory of specially protected areas will lead to a noticeable violation of the ecological condition of sites subject to a multifunctional conflict of nature management. In particular, this is related to the development of

settlements, residential and industrial facilities in areas of specially protected natural zones, or the placement of residential structures near (less than 1 km from) protected natural areas.

The residential factor hurts nature conservation areas. Long-term anthropogenic impact, in this case residential, leads to a gradual deterioration of the state of the natural environment of the nature protection zone.

Recreational – transport. A conflict zone has emerged between recreational and transportation types of natural resource use in the recreational area of the village of Kabanbay, located on the eastern shore of lake Alakol. This type of conflict of nature management combines the clash of antagonistic recreational and transport functions.

As already noted, one of the indicators of the attractiveness of the eastern shore of Lake Alakol is its proximity to a major transport highway of international importance. It should be noted that the radius of the zone of influence for objects of the transport function is, in our case, a distance of one-kilometer-long, which is characteristic of the zone of the maximum negative influence of the transport and industrial enterprises by the current sanitary and hygienic standards of environmental safety of the Republic of Kazakhstan.

In the zones of mass organized and unorganized recreation of the recreational zone of the Kabanbai village, this type of conflict of nature management is acutely felt. The uncontrolled development of organized and unorganized recreation of tourists and recreants in the studied region leads to a violation of the ecological balance of the natural system. And not everywhere, but only around recreational centers, such as recreation centers, health centers, sanatoriums, suburban areas, as well as along highways. Especially the increase in recreational impact is noted in the areas of Kabanbai village most visited by recreants and tourists, such as the recreation area "Orange", the family recreation center "Alakol East Kazakhstan region", "Inzhu Alkol", the family recreation center "Dawn", etc. The low level of the landscaping of these territories, the absence of a road and path network in some areas of the studied territory, and the location of recreation areas in remote areas significantly limit the free movement of recreants and residents over long distances. Transformation, burning, and trampling of vegetation cover, compaction of soil cover, unauthorized felling of trees, and contamination of the territory with solid household waste occur in such territories (Figure 3).

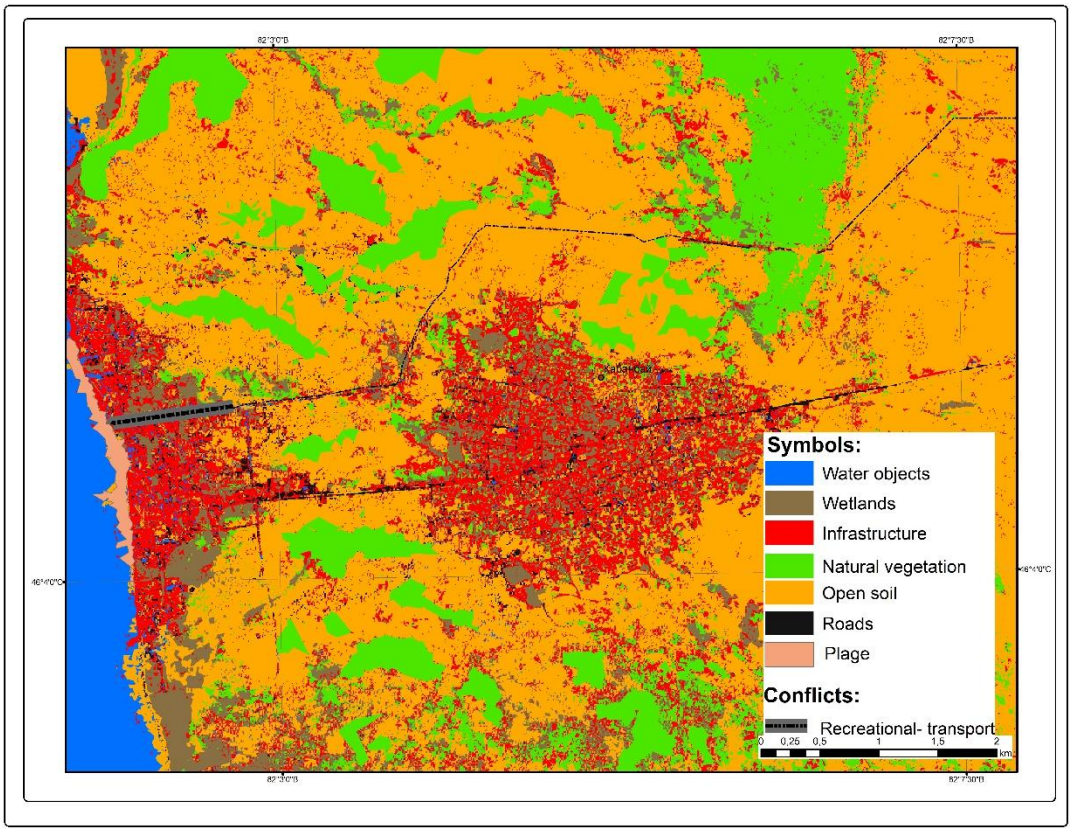

Figure 3. *Map of environmental management conflicts on the eastern shore of Lake Alakol (Source: Author, created in the program ArcGIS.10.4)*

The objects of transport infrastructure harm the state of the coast of Lake Alakol, creating a transport load. The result of the transport impact on recreational areas is the development of road digression of soils (destruction, compaction of soils, etc.), which leads to the development of processes of water and wind erosion of the soil cover and vegetation transformation. Road transport along the busy main line pollutes the air and soil with lead and other chemical compounds.

Environmental – transport. Conflicts of nature management have formed on the territory of the "Semey Ormany" Forest Reserve in the form of an antagonistic form of relations between environmental and transport nature management. Transport facilities, as noted above, exhibit a negative anthropogenic impact, being located within a radius of less than 1 km to nature-protected areas, according to sanitary and epidemiological requirements for sanitary protection zones of objects of the Republic of Kazakhstan (Figure 4).

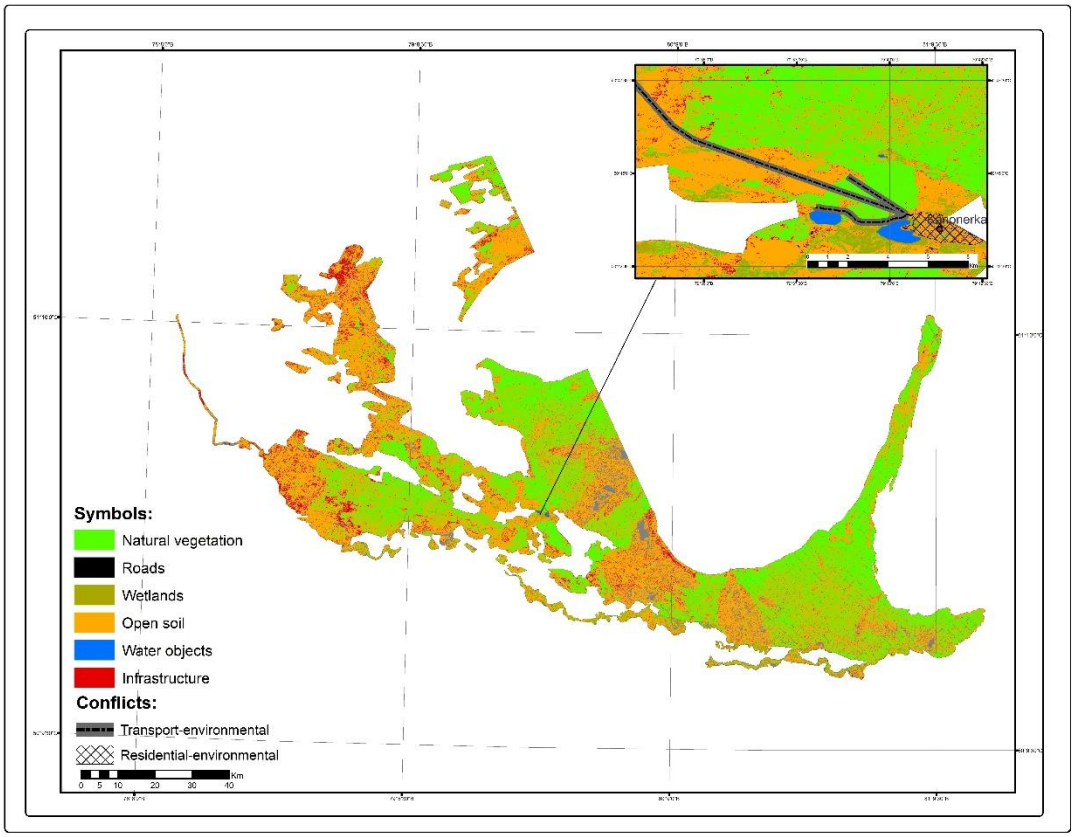

Figure 4. *Map of conflicts of nature use of the state forest nature Reserve "Semey-Ormany" (Source: Author, created in the program ArcGIS.10.4)*

In this territory, any economic, industrial, and recreational activities are prohibited, except environmental and scientific activities. The territory of the protected regime is represented by the least ecologically disturbed part of the studied region with a protected conservation regime, the purpose of which is to preserve landscape and biological diversity. The buffer zone is 284 km^2. A buffer zone is formed around the protected regime, which has a custom-made protection regime. This zone is aimed at reducing the impact of the recreational and economic functions of nature management in the protected area.

There is also a zone for the restoration of disturbed natural systems and a zone of sustainable development in the study area. The zone of restoration of disturbed natural systems is represented by heavily destroyed areas with reduced natural restorative properties and is intended for the implementation of measures to restore landscape and biological diversity, as well as the restoration of their economic significance.

The Sustainable Development Zone does not have a special nature conservation regime. However, all types of economic activities are prohibited in this territory, as a result of which adverse changes in the natural environment may occur in the zone of the protected regime and the buffer zone of the "Semey Ormany" Reserve [15].

In the studied region, the area of the conflict of nature management has developed in the north-western part of the territory, where the highway of the international transport corridor "Omsk-Pavlodar-Semey-Maykapchagai" passes. The development of transport routes in the studied region gradually leads to the degradation and destruction of the upper horizon of the soil cover and a decrease in the productive properties of meadows and pastures. The transport factor often causes dust and pollution of vegetation with chemical elements. Road embankments, in turn, often become the causes of waterlogging of areas of a certain territory. As a result of the transport impact in the studied region, partial destruction of herbaceous vegetation cover is observed in places areas located near (less than 1 km) with transport routes.

The result of road digression is the developing processes of water and wind erosion of soils and the modification of vegetation, in the direction of increasing the area of weeds. Grader and asphalt roads are often the causes of increased road digression with a significant deterioration of the natural environment in the studied region.

Thus, the impact of the transportation factor on conservation areas leads to the deterioration of the geoecological condition of the environmental components in the natural resource use conflict zone. This is manifested in the gradual degradation of vegetation and soil cover (destruction and transformation of certain plant species due to the "concentration" of roadways and the destruction of the topsoil), as well as the pollution of natural components in general.

4. CONCLUSION

1. Theoretical and methodological approaches and methods of identifying and analyzing conflicts of recreational nature management are investigated and analyzed.

2. Collection of data on model recreational systems with the compilation of cartographic material of research objects based on satellite images.

3. Compilation of maps-hypotheses of nature management of selected recreational systems based on satellite images. Based on Sentinel-2 satellite images and field research data, the mapping of conflicts of recreational nature management of selected model recreational systems within Eastern Kazakhstan was carried out. The following classes are allocated: water bodies, natural vegetation, open soil, roads, infrastructure, wetlands, beaches.

4. The identified natural resource use conflicts are driven, on one side, by the high conservation and recreational value of the natural landscapes, and on the other, by the increasing anthropogenic activity, particularly in the transportation and recreation sectors. Two types of conflicts were identified within the "Semey ormany" reserve.

A) Residential – environmental conflict: Katon-Karagai State National Nature Park, "Semey Ormany" State Forest Nature Reserve;

B) Recreational – transport: the coast of Lake Alakol;

C) Nature protection and transport: State Forest Nature Reserve "Semey Ormany".

The main modifications associated with modern conflicts of recreational nature management are analyzed.

5. The analysis of the obtained data and the search for optimal solutions to resolve the identified conflicts. Determination of the most effective land-use options, considering various types of activities and identifying areas that require changes in the nature of their utilization. The results of the study can be used to improve functional zoning, develop plans for conservation measures, and organize geoecological monitoring of recreational systems.

DATA AVAILABILITY

Sentinel-2 satellite imagery, data obtained through territory survey methods and image processing, information from the Google Earth geoportal, as well as field research materials with GPS referencing conducted in the summer of 2022.

AUTHORS' CONTRIBUTION

Conceptualization – ZhO, ZM; resources- AZ; formal analysis – SS; methodology - ZhO, ZM; software - MU.; supervision - ZM; visualization - MU; writing—original draft preparation – AZ, ZhO; writing—review and editing -SS, MU.

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ШЫҒЫС ҚАЗАҚСТАНДАҒЫ РЕКРЕАЦИЯЛЫҚ ТАБИҒАТ ПАЙДАЛАНУДЫҢ ҚАҚТЫҒЫСТАРЫНЫҢ КЕҢІСТІКТІК ҚҰРЫЛЫМЫ

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ТҮЙІН СӨЗДЕР

рекреация
туризм
табиғат пайдаланудағы қақтығыс
ГАЖ
қашықтықтан зондтау

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АБСТРАКТ

Шығыс Қазақстандағы таңдап алынған модельдік рекреациялық жүйелерде рекреациялық табиғат пайдаланудың қақтығыстарын картографиялау жүргізілді. Ең өткір қақтығыстар Алакөл жағалауында, Катонқарағай ұлттық паркінде және Семей орманында қалыптасқаны анықталды. Табиғат пайдаланудағы анықталған қақтығыстар бір жағынан табиғи ландшафттардың жоғары экологиялық және рекреациялық құндылығымен, екінші жағынан экономикалық белсенділіктің, әсіресе көлік пен демалыс саласының артуымен байланысты. Жүргізілген жұмыстың нәтижелері функционалдық аймақтарды жетілдіруде, қоршаған ортаны қорғау шараларын жоспарлауда, рекреациялық жүйелердің геоэкологиялық мониторингін ұйымдастыруда қолданылуы мүмкін.

ПРОСТРАНСТВЕННАЯ СТРУКТУРА КОНФЛИКТОВ РЕКРЕАЦИОННОГО ПРИРОДОПОЛЬЗОВАНИЯ ВОСТОЧНОГО КАЗАХСТАНА

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КЛЮЧЕВЫЕ СЛОВА

рекреация
туризм
конфликт природопользования
ГИС
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ABSTRACT

Проведено картографирование конфликтов рекреационного природопользования выбранных модельных рекреационных систем в пределах Восточного Казахстана. Установлено, что наиболее острый конфликт сложился на побережье озера Алаколь, Катон-Карагайского национального природного парка и Семей Орманы. Выявленные конфликты природопользования обусловлены с одной стороны, высокой природоохранной и рекреационной ценностью естественных ландшафтов, с другой – возрастающей хозяйственной деятельностью, особенно транспортной и рекреационной. Результаты выполненной работы могут быть применены для совершенствования функционального зонирования, планирования природоохранных мероприятий, организации геоэкологического мониторинга рекреационных систем.