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ИЗВЕСТИЯ

НАЦИОНАЛЬНОЙ АКАДЕМИИ НАУК
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Қазақстан Республикасы Ұлттық ғылым академиясы "ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы" ғылыми журналының Web of Science-тің жаңаланған нұсқасы Emerging Sources Citation Index-те индекстелуге қабылданғанын хабарлайды. Бұл индекстелу барысында Clarivate Analytics компаниясы журналды одан әрі the Science Citation Index Expanded, the Social Sciences Citation Index және the Arts & Humanities Citation Index-ке қабылдау мәселесін қарастыруда. Webof Science зерттеушілер, авторлар, баспашылар мен мекемелерге контент тереңдігі мен сапасын ұсынады. ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы Emerging Sources Citation Index-ке енуі біздің қоғамдастық үшін ең өзекті және беделді геология және техникалық ғылымдар бойынша контентке адалдығымызды білдіреді.

НАН РК сообщает, что научный журнал «Известия НАН РК. Серия геологии и технических наук» был принят для индексирования в Emerging Sources Citation Index, обновленной версии Web of Science. Содержание в этом индексировании находится в стадии рассмотрения компанией Clarivate Analytics для дальнейшего принятия журнала в the Science Citation Index Expanded, the Social Sciences Citation Index и the Arts & Humanities Citation Index. Web of Science предлагает качество и глубину контента для исследователей, авторов, издателей и учреждений. Включение Известия НАН РК. Серия геологии и технических наук в Emerging Sources Citation Index демонстрирует нашу приверженность к наиболее актуальному и влиятельному контенту по геологии и техническим наукам для нашего сообщества.

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SOCIO-ECONOMIC ASPECTS OF NATURE MANAGEMENT IN THE KAZAKHSTAN'S CASPIAN SEA REGION BASED ON FUNCTIONAL ZONING OF THE TERRITORY

Abstract. The article considers the socio-economic conditions of the Atyrau and Mangystau regions with the areas of the adjacent Caspian Sea shelf with an emphasis on the natural-resource potential, the ecological state and the peculiarities of economic use. Based on the assessment of the mapping of the types of economic use of lands, the functional zoning of the region under study was fulfilled and recommendations for sustainable nature management were given. The main target functions of the sectors of economic activity that determine the need for the use of territories and water areas were clarified to fulfill the functional zoning. Particular attention was paid to the industrial and transport use of territories and water areas with the detailed study of the current state of the most important regional industries: petrochemical and fisheries sector. Also, an assessment was given to the residential, agricultural and nature protection types of use of the territories of the regions and the adjacent water area of the Caspian Sea. On the basis of the results of the researches, a map of functional zoning was compiled, on which special zones of the main sectors of activity (industrial, transport, agricultural, nature protection, tourist-recreational, etc.) were allocated. A complex of possible interventions in existing nature management was defined for each of the functional zones in order to reduce or prevent the formation of conflict zones in nature management and to stimulate the most profitable industries from the socio-economic and environmental points of view.

Key words: functional zoning, socio-economic conditions, resources, economic use, nature management, land use, GIS-mapping.

Introduction. At the present stage of development of Kazakhstan, state policy is becoming polycentric and much attention is paid to the regions: mechanisms are being introduced for stimulating competitive industries and economic development of promising districts to form a common economic space that is harmoniously integrated into the global economic system.

The Atyrau and Mangystau regions of Kazakhstan, with a total area of 284,2 thousand square meters and a population of 1312 thousand people, are transboundary relative to the Caspian Sea for 4 states of the area. Over the period of independence, the share of these regions in the total GRP of the country has increased almost 13 times – from 3,4% (1993) to 18,8% (2019) [1]. Currently in the Caspian Sea region of Kazakhstan, about 70 hydrocarbon deposits are being developed, 65,3 million tons of oil and 26,7 billion cubic meters of gas are being produced [1].

Research methods. Functional zoning is the most important component of sustainable regulation of the use of the territory, which determines those types of environmental management that can prevent or reduce the level of conflicts, promote the industry most beneficial from the socio-economic and environmental point of view for each of the zones on the basis of modern socio-economic development of the natural environment and the ecological state of resources.

First of all, functional zoning involves conducting an analysis of environmental management and includes component-based characteristics of the natural environment, analysis of the socio-economic and environmental situation of the territory. The types of environmental management are studied and mapped, and a classification is created from the point of view of impact on the natural environment [2,3].

The main stages of functional zoning are:

– collection and assessment of data on the components of the natural environment of the research area with the compilation of a set of thematic maps;

– assessment of the ecological state of the components of the natural environment;

– assessment of the socio-economic development of the territory and types of land use;

– assessment and mapping of land use types;

– analysis of land use, identification of ecological conflicts, analysis of causes, search for acceptable solutions;

– determination of the optimal option for the use of the territory by sectors of activity with the identification of zones requiring changes in the nature of use.

Almost all lands are used in natural or economic terms, a change in environmental management leads to the redistribution of lands between sectors. For example, territories allocated for residential or industrial facilities are withdrawn from agricultural land use, reserve lands or other categories of lands. Over time, due to their degradation, they will no longer have the natural value that they had before the redistribution. On the maps of actual environmental management, the territories used by the main types of land use are distinguished.

Analysis and results. Functional types of use of the territory are formed on the basis of revealing the mutual influence of existing natural conditions and the nature of the population's activity, including the analysis of natural, socio-economic, eco-economic and regulatory factors. The result of the study is displayed in a cartographic manner with the revealed actual data of the current land use. It is known that the lands used by man for industrial, agricultural and residential functions, which in the region under study occupy an area of 10710,3 thousand ha or 37,8%, are exposed to main anthropogenic impact.

Residential type of land use. Historically, the settlements of the Caspian Sea region are distributed extremely unevenly [4]. Narrow stripes on the coasts of the delta channels of the Volga, along the banks of the Zhaiyk (Ural), ZhEM (Emba), Oil (Uil), Sagiza rivers, lakes, northern and eastern coasts of the Caspian Sea, along highways, near sand massifs of peninsulas are most densely populated.

There were changes in the location of settlements with the development of industry and transport, they began to develop near deposits and transport hubs, and in recent decades, urbanization processes have intensified. The necessary condition for the emergence and sustainable development of residential territories is the availability of resources in quantity, quality and diversity sufficient to meet the basic vital requirements of the population, at least to maintain a minimum acceptable standard of living [5,6]. So, as a result of industrial expansion, development of the richest reserves of natural resources, new settlements in the Caspian Sea region - Tengiz, Prorva, Ozen, Zhetybai, Tenge, Munaishy and others, on the new railway lines - Akkol, Akkystau, Borankul, Beineu, Mangyshlak, Sayotes, as well as new administrative and industrial centers of Aktau, Zhanaozen, Kulsary and others appeared.

Industrial and transport type of land use. The Caspian Sea region is one of the largest industrial centers of the country. The basis of the economic growth of the Caspian Sea region is the mining industry, namely the extraction of hydrocarbons and its partial processing [7]. Thus, out of 90 million tons of crude oil produced in the country in 2018, 72% fall on the Atyrau (47 million tons) and Mangystau (18 million tons) regions [1].

Over twelve years, industrial lands increased by 84,5 thousand ha in the Atyrau region alone, and by almost 100 thousand ha in the Mangystau region. Almost 50% of the country's oil is being currently produced on 6% of the coastal zone. In general, the lands of industry, transport, communications, defense and other non-agricultural purposes occupy 3,4% of the region's territory.

Agricultural type of land use. Against the background of the active development of the oil and gas industry, agriculture of the region, especially the agricultural industry, is experiencing one of the most difficult periods.

The location of the Caspian Sea region in the depths of the continent of Eurasia determined the continentality of its climate. In addition, it is located in semi-desert and desert zones. This was the basis for the formation of an extremely arid climate, low fertility and salinity of desert soils and a lack of fresh water. Moreover, severe natural and climatic conditions are becoming more complicated against the background of worsening of ecological state. Processes of desertification are actively developing in the region.

Agricultural lands (99,3%) are used mainly as pastures. And these pastures are more attractive for grazing small cattle.

Environmental land use. In the territories of the Atyrau and Mangystau regions there are a number of specially protected natural areas (SPNAs).

On the lands of SPNAs, areas of non-coincidence of interests of nature users appear. One of the main conflict areas exists on the territory of the conservation zone of the Northern Caspian region, where, despite the special status of the object, decisions were made on the development of hydrocarbon deposits. On the lands of the Karakiya-Karakol Nature Sanctuary, a part of the uranium quarry enters, which is currently on standby, but nevertheless continues to have a negative impact on the environment. Almost all the SPNAs of the region are negatively affected due to overgrazing of livestock.

The lands of the *forest fund* include land areas covered by forest, as well as not covered by forest, but provided for the needs of forestry [8]. It is important to note that over a decade and a half the land area of the forest fund in the region has been almost unchanged. Forest areas are distributed extremely unevenly, especially in the Mangystau region, 93% of these lands are located in the Beineu district.

The *water fund* in the context of areas and districts of the Atyrau and Mangystau regions, taking into account water conservation zones, is only 1,8 thousand hectares, but it is of great importance both for the population and its household needs, and for the stable functioning of natural systems.

The *reserve lands* include all lands not provided for ownership or land use, which are under the jurisdiction of the district executive bodies.

Low-productive pastures located in the desert and semi-desert zones, as well as other lands, were transferred to the reserve lands. In recent years, there has been a tendency towards the development of reserve lands for agricultural and other purposes.

Functional zoning. Based on the assessment and mapping of the socio-economic development of the territory and the types of existing environmental management, functional zoning was performed within the Kazakhstan's Caspian Sea region (figure 1). The conducted analysis of the socio-economic situation of the territory made it possible to assess the current situation and identify opportunities for development. The results of the research reflecting the geographical characteristics of the district, the socio-demographic situation and the economic condition of the territory are interpreted to represent them in the GIS in the form of integrated assessments reflecting the state and tendency of the studied component to change.

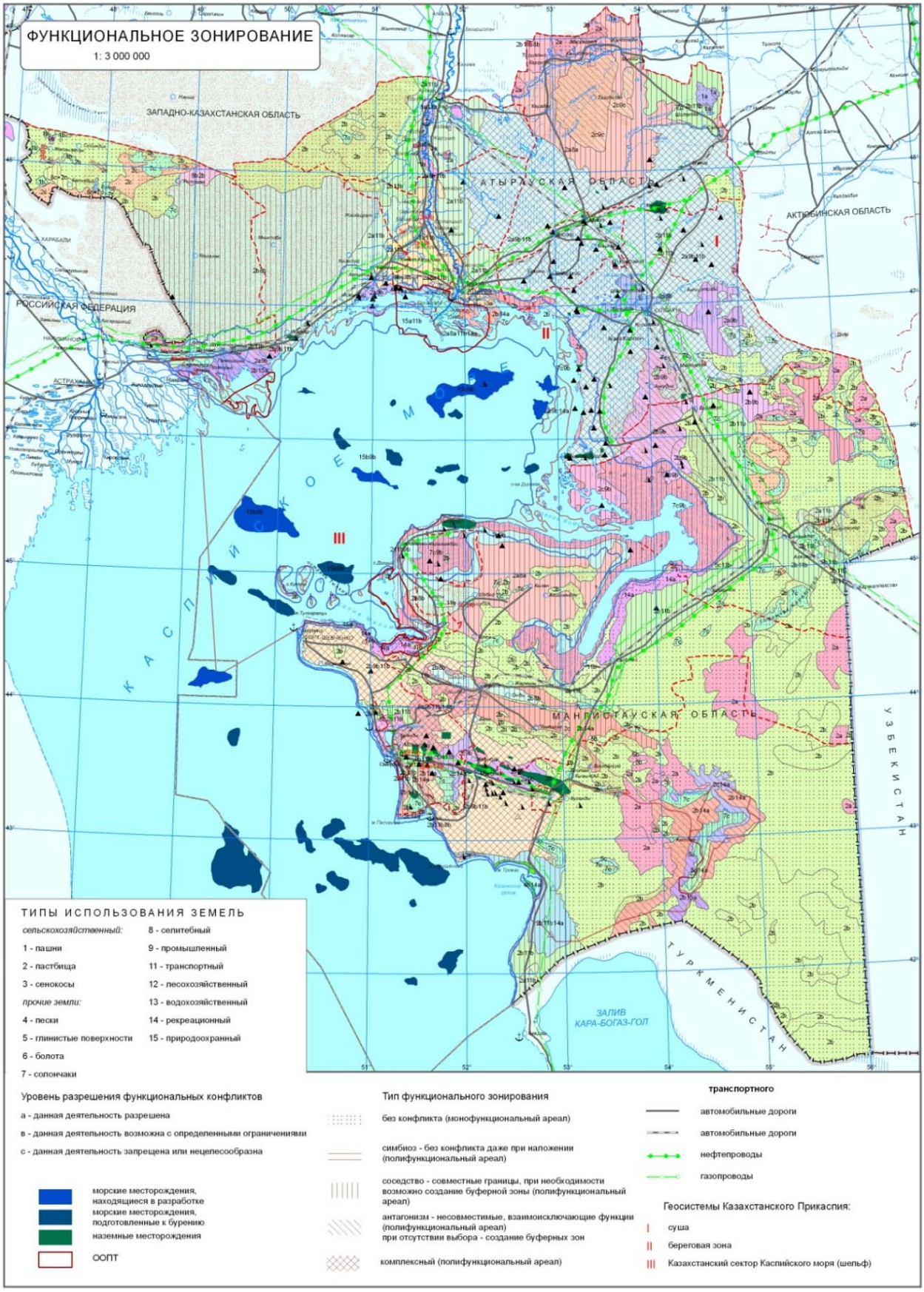
The implementation of functional zoning is necessary for the purposes of regulation and territorial organization of areas, identification of special zones of the main sectors of activity (agriculture, industry, transport, tourism, recreation, etc.). In addition, functional zoning serves for environmental purposes in SPNAs - in order to differentiate them into exclusive zones (for walking, diving, fishing, water sports, etc.). Moreover, the functional zoning establishes a set of possible interventions in the existing environmental management for each of the zones in order to prevent or reduce the level of conflicts, as well as stimulate the industries that are most beneficial from the socio-economic and environmental point of view.

Certain types of use are allowed in the designated areas, the rest are either prohibited or allowed under the agreed conditions.

Some of the limitations are set due to their impact on natural resources. These factors are taken into account when planning the multi-purpose economic development of the Kazakhstan's Caspian Sea region. The areas, where it is necessary to carry out measures on restoring natural resources, are identified in order to restore and conserve natural resources. These are lands subject to reclamation, reforestation, as well as wetlands, etc. A cartographic analysis of the types of land use shows that most of the study area occupied by the accumulative and denudation plains is monofunctional and is used for pasture. The degree of anthropogenic degradation of these lands is associated with an increase in pasture loads near settlements, and there is a threat of withdrawal of these lands from economic circulation due to the created conflict situation. Local areas of land suitable for pastures are occupied by industrial and transport facilities, i.e. conflict areas are formed due to the simultaneous use of lands for these two functions. Multifunctional (occupying about 18% of the territory) conflict areas on these lands are associated with negative changes in environmental quality in the area of higher-intensity functions of facilities of oil and gas sector, which limits the possibility of using the territory as a pasture or for other function.

The determination of the spatial combination of functions in this conflict situation is possible only according to antagonistic form with the creation of buffer zones around the deposits.

The symbiotic type of conflict-free or slightly conflict (occupy about 39% of the territory) situation includes local areas of joint use of pasture lands and water fund. The conflict-free situation in the study area is created by the imposition of lands of forest and water funds according to the type of neighbor



Map of functional zoning

functions (occupy about 35% of the territory). They have common boundaries and their mutual interaction is very insignificant, which makes it possible to preserve the parameters of development of both functions.

The greatest attention in the study area should be paid to territories with the simultaneous use of activities that are incompatible with each other (antagonistic type - occupy about 7% of the territory). Such antagonistic functions include residential – conservational (for example, the villages of Peshnoye, Damba, Taskala and others in the Atyrau region located in the SPNAs), residential - industrial (the villages of Sarykamys, Karaton and the Tengiz Gas Processing Plant), recreational - industrial (conservation zone in the northern part of the Caspian Sea and exploration and preparation for the development of oil and gas deposits of the shelf of the North Caspian region), conservational - transport and industrial (conservation zone in the northern part of the Caspian Sea - the development of marine corridors) and others. The interests of antagonistic functions can be taken into account by creating buffer zones that absorb the effects of antagonists on each other. The possibility of rational and sustainable nature management of the territory of the Kazakhstan's Caspian Sea region depends on the optimization of activities and the development of mechanisms for resolving conflicts that have arisen or possible in conflict areas.

Conclusion. Functional zoning is one of the advanced methods for the integrated assessment of the territory, which was first used for the Kazakhstan's Caspian Sea region in the framework of the scientific and applied project on "Ecological zoning of the Caspian Sea region of the Republic of Kazakhstan", implemented by the Institute of Geography of the Ministry of Education and Science of the Republic of Kazakhstan at the request of the Ministry of Environmental Protection of the Republic of Kazakhstan in 2008.

The methodological approaches used made it possible to identify conflict areas in territories with different types of functional use.

The socio-economic conditions of the Atyrau and Mangystau regions were studied with an emphasis on resources and features of economic land use. The analysis of economic activity contributed to the identification of environmental problems in the state of the lands:

– the main adverse and limiting factors in the areas of oil fields are chemical pollution of soils and groundwater with oil products, heavy metals, leakage of hydrogen sulfide from wells;

– human-induced disturbances are linear (alignments of field roads) or locally-pattern (construction and drilling sites, industrial waste landfills, oil wells, etc.);

– disturbances of the soil and vegetation cover in settlements and their surrounding zone within the range from 3-5 to 10 km are strong, often irreversible and are connected with construction, laying of communications and the road network around cities. Degradation of vegetation around the settlements is often caused by overgrazing and a network of roads diverging radially from the center in almost all directions. Landfills of household waste, construction waste, scrap metal are often connected with settlements;

– agricultural lands are almost completely used as pastures, which are unequal in quality, productivity and season of use. As a result of poorly regulated grazing, a transformation of vegetation took place in part of the territory.

The analysis of environmental problems and geo-information mapping of the functional use of lands made it possible to identify conflict areas and define functional zones:

– conflict-free (monofunctional area);

– symbiotic - without conflict even when superimposing functions (multifunctional area);

– neighborhood - joint borders, if necessary, the creation of a buffer zone is possible (multifunctional area);

– antagonism - incompatible, mutually exclusive functions (multifunctional area), complex (multifunctional area).

The conducted functional zoning of the economic systems of the Kazakhstan's Caspian Sea region made it possible to justify the system of measures for further sustainable social and economic development of the region, which is:

– restoration of degraded lands within the buffer zone of 3-5 km through the regulation of livestock grazing, the organization of seeded pastures, planting trees and shrubs. In the settlements – activities on planting trees and shrubs with the creation of park zones, protective forest strips, etc.;

– land reclamation through the creation of artificial plant groupings from phytomeliorant species of local flora in the areas of oil fields, where the main negative and limiting factor is the chemical pollution of soils and groundwater with oil products, heavy metals and leakage of hydrogen sulfide from wells;

– strict regulation of the recreational load in the desert zone;

– regulation of the use of wormwood pastures; it is important to preserve cereals (feather grass, wheatgrass) and spring ephemeroids in their composition, which can be used in the spring-summer-autumn period. Pastures with a predominance of perennial saltwort *(Anabasis salsa*, *Nanophyton erinaceum)* are less productive and can be used mainly in autumn;

– the introduction of pasture rotation, the establishment of a normal load on the pastures, compliance with the start and end dates of grazing, as well as conducting phytomelioration.

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АУМАҚТЫ ФУНКЦИОНАЛДЫ ЗОНАЛАУ НЕГІЗІНДЕ ҚАЗАҚСТАНЫҢ КАСПИЙ МАҢЫ АЙМАҒЫНДАҒЫ ТАБИҒАТТЫ ПАЙДАЛАНУДЫҢ ӘЛЕУМЕТТІК-ЭКОНОМИКАЛЫҚ АСПЕКТІЛЕРІ

Аннотация. Мақалада табиғи-ресурстық әлеуеті, экологиялық жағдайы және шаруашылықтық пайдалану ерекшеліктеріне ерекше көңіл бөле отырып, Каспий теңізінің қайраңына жақын жатқан участкелермен бірге Атырау және Маңғыстау облыстарының әлеуметтік-экономикалық жағдайлары зерттелді. Жерлерді шаруашылықтық пайдалану типтерін бағалау мен картографиялау негізінде, зерттеліп отырған аймақты функционалдық зоналау жүргізілді және табиғатты тиімді пайдалануға ұсыныстар берілді. Функциналдық зоналауды жүргізу үшін, аумақты немесе су айдынын пайдалану қажеттілігін анықтайтын шаруашылықтық қызмет ету секторларының негізгі мақсаттық қызметтері анықталды. Аумақты және су айдынын өнеркәсіпке және көлікке пайдалануға ерекше көңіл бөле отырып, аймақтың өнеркәсіптік маңызды салаларының қазіргі жағдайына талдау жасалды. Сондай-ақ, Каспий теңізінің су айдынына жақын жатқан аумақтар мен облыс аумағын пайдаланудың селитебті, ауылшаруашылық және табиғатты қорғау типтері бойынша баға берілді. Зерттеу нәтижесі бойынша, қызметтің негізгі салаларының (өнеркәсіптік, көлік, ауылшаруашылық, табиғатты қорғау, туристтік-рекреациялық және т.б.) арнайы зоналары бөлінген, функционалдық зоналау картасы құрастырылды.

Жерді пайдаланудың типтеріне картографиялық талдау жасау зерттеу аумағының көп бөлігін аккумуляциялық және денудациялық жазықтар алып жатқандығын және оларды шаруашылықтың көптеген салаларында, оның ішінде жайылымдар ретінде пайдаланылатынын көрсетеді. Бұл жерлердің антропогендік дағдарысқа ұшырау дәрежесі елді мекендердің айналасындағы жайылымдық жүктеменің өсуімен байланысты, осы шиеленіс жағдайына байланысты бұл жерлер шаруашылықтық айналымнан шығып қалуы мүмкін. Осы жерлердегі көп салаларда пайдаланылатын (аумақтың 18 %-ын алып жатыр) шиеленісті ареалдар мұнай және газ секторы нысандарының өте қарқынды даму зонасындағы қоршаған орта сапасының кері өзгерістерімен байланысты, сондықтан бұл аумақтарды жайылым немесе басқа мақсатта пайдалану мүмкіндігі шектеледі. Осындай шиеленіс жағдайындағы жерді пайдалану мақсаттарының кеңістіктік үйлесімділігін анықтау тек кен орындарындарының айналасындағы буферлік зоналардың антагонизм түрі бойынша ғана анықталады. Шиеленіссіз немесе шиеленіс әлсіз (аумақтың 39 %-ын алып жатыр) жағдайлардың симбиоздық түрлеріне жайылымдық жерлер мен су қорын бірге қолданатын кішігірім ареалдар жатады. Зерттеу аумағының шиеленіссіз жағдайларын орман және су қорлары жерлерінің көршілес түр бойынша қабаттасуы құрайды (аумақтың 35 %-ын алып жатыр). Олардың шекаралары ортақ және бір-біріне әсері аз, сондықтан екеуінің де даму көрсеткіштері сақталады. Зерттеу аумағында баса назар аударатын нәрсе – ол бір уақытта бір-біріне сәйкес келмейтін шаруашылық іс-әрекеттерге пайдаланылатын жерлер (антагонизмдік түр – аумақтың 7 %-ын алып жатыр). Осындай антагонизмдік түрлерге селитебті-табиғатты қорғау (мысалыға ерекше қорғалатын табиғи аумақтарда орналасқан Пешное, Дамба, Тасқала және т.б. сияқты Атырау облысының ауылдары), селитебті-өнеркәсіптік (Сарықамыс және Қаратон ауылдары және Теңіз газ өңдеу зауыты), рекреациялық-өнеркәсіптік (Каспий теңізінің солтүстік бөлігіндегі қорықтық аймақ және Солтүстік Каспий шельфінде орналасқан мұнай және газ кен орындарын игеруге дайындық), табиғатты қорғау көліктік-өнеркәсіптік (Каспий теңізінің солтүстік бөлігіндегі қорықтық аймақ – теңізде көлік дәліздерін дамыту), және т.б. Антагонизмдік түрді дамытуды антагонитсердің бір-біріне деген әсерін азайтатын буферлік зоналарды құру арқылы жүргізу керек.

Табиғатты пайдаланудағы шиеленіскен зоналардың қалыптасуын төмендету немесе алдын алу және өнеркәсіп салаларының әлеуметтік-экономикалық және экологиялық тұрғыдан алғанда айтарлықтай тиімділігін арттыру үшін, әрбір функционалдық зонаға қазіргі табиғатты пайдалануда болуы мүмкін әсер ету кешендері анықталды.

Түйін сөздер: функционалдық зоналау, әлеуметтік-экономикалық жағдайлар, ресурстар, шаруашылықта пайдалану, табиғатты пайдалану, жерді пайдалану, ГАЖ-картографиялау.

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СОЦИАЛЬНО-ЭКОНОМИЧЕСКИЕ АСПЕКТЫ ПРИРОДОПОЛЬЗОВАНИЯ В ПРИКАСПИЙСКОМ РЕГИОНЕ КАЗАХСТАНА НА ОСНОВЕ ФУНКЦИОНАЛЬНОГО ЗОНИРОВАНИЯ ТЕРРИТОРИИ

Аннотация. Изучены социально-экономические условия Атырауской и Мангистауской областей с участками прилегающего шельфа Каспийского моря с акцентом на природно-ресурсный потенциал, экологическое состояние и особенности хозяйственного использования. На основе оценки и картографирования типов хозяйственного использования земель выполнено функциональное зонирование исследуемого региона и даны рекомендации рационального природопользования. Для выполнения функционального зонирования уточнены основные целевые функции секторов хозяйственной деятельности, определяющие необходимость использования территорий и акваторий. Особое внимание уделено промышленному и транспортному использованию территорий и акваторий с детализацией современного состояния наиболее важных региональных отраслей промышленности: нефтехимической и рыбной. Также дана оценка селитебному, сельскохозяйственному и природоохранному типам использования территорий областей и прилегающей акватории Каспийского моря. По результатам исследований составлена карта функционального зонирования, на которой выделены специальные зоны основных секторов деятельности (промышленной, транспортной, сельскохозяйственной, природоохранной, туристско-рекреационной и др.). Для снижения либо предотвращения формирования конфликтных зон в природопользовании и стимулирования наиболее выгодных с социально-экономической и экологической точки зрения отраслей промышленности, для каждой из функциональных зон определен комплекс возможных вмешательств в существующее природопользование.

Ключевые слова: функциональное зонирование, социально-экономические условия, ресурсы, хозяйственное использование, природопользование, землепользование, ГИС-картографирование.

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