Monitoring of green areas in Mirzachul district and its geoecological aspects

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Abstract. The article is devoted to the relationship between public health and the natural environment in densely populated cities. The "Green Space" project enters all areas in the republic. In particular, it is of urgent importance in the mapping of health care and related industries, as well as in geoecological monitoring. The article is dedicated to monitoring the condition of green areas in Gulistan city with the help of remote sensing materials, as well as the analysis and mapping of related geoecological conditions. Medical-geographic mapping is carried out under the influence of natural and social, and technical factors.
The fact that the Syrdarya region and the city of Gulistan are becoming the "hub of innovative medicine" of our country in Central Asia increases the practical importance of this work.

1 Introduction

You know that President Sh. Mirziyoyev visited the Sirdarya region on April 13, 2023. During this visit, the president emphasized the following words: "Syr Darya region will be transformed into a large logistics hub connecting our country with Kazakhstan, Tajikistan, China, and Afghanistan, Gulistan city will be transformed into an "innovative medicine hub" of our country. It is worth noting that research on this topic is of great practical importance in such large-scale projects.

Several factors determine human health. Among them, it depends on geoecology, proper nutrition, playing sports, working in the field you love and know well, being in the circle of family and close people, and many other causal factors.

The field of technology directly deals with the issue of image-model representation, i.e., mapping the parameters determining human health. A medical-geographical map is a pictorial-model form of natural-territorial complexes showing the location, state, and relations of various natural and socio-economic factors and events in the "Human health and environment" system and their condition over time and in a certain place. The purpose of medical-geographical maps is to monitor and describe the quality of the environment, which is manifested in the negative impact on public health; the existence of (natural, social, and indus-

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trial) conditions for human diseases; consists of describing natural healing resources and the possibilities of their rational use.

Human health is one of the urgent issues for every period of society's development. Consequently, the degree of development of any country is determined by the level of health and literacy of the population of this country [4].

In the republic, extensive work is being carried out on implementing complex measures in geodesy and cartography, including modern interactive methods in creating thematic maps. In particular, it is important to reveal the monitoring of green areas and their geoecological aspects with the help of GIS (geographical information systems) programs.

Trees. They absorb harmful carbon dioxide from the air, produce oxygen instead, and help people breathe. They provide coolness in the heat and protect the environment from noise. According to data, there are currently around 3 trillion trees worldwide. However, every minute a part of them equal to 27 football fields is cut. Planting and maintaining trees in residential areas is a continuous process. It is worth remembering that during the campaign "One million trees" held in 2019-2020, a total of 3,800,000 fruit and ornamental tree seedlings were planted in all regions of Uzbekistan [1, 10]. But it is a pity that the sprouting of ornamental trees, which has been carried out at the cost of a large amount of money, has also been controlled. The fact that green areas are shrinking in Gulistan is confirmed by satellite images. This situation will undoubtedly cause an increase in various diseases.

In the Atlas of nature protection based on ecological indicators (2008), a map of diseases among the general population of Uzbekistan (per thousand people, by the number of people registered in hospitals) is presented. As a result of the map analysis, the number of sick people in the Syrdarya and Jizzakh regions is 214-275 people per 1,000 inhabitants. Although it is relatively satisfactory, it is high in some types of diseases, including microbiological indicators, sanitary chemical composition [8].

From the scientific works carried out in the CIS (Commonwealth of Independent States), in "Medical-demographic atlas of Moscow region" (2007) published under the editorship of S. Malkhazova: General medical-demographic situation of Moscow region: Population and social conditions; Environmental conditions; Includes issues of public health and health care. In addition, the disease of the elderly population; Children diseases, including issues of population health assessment [9].

From work carried out in Uzbekistan in recent years, it is possible to show "Noise cards", according to Sh. Tokhtamyshev, the question of studying, analyzing, and carrying out cartographic studies of the increase of noise migration in big cities and its effects on the dynamics of growth is one factor that determines the population's health. During the creation of maps describing noise in the world, the development and improvement of geoinformation methods, a database related to noise was created, and research was conducted on the modeling of noise spatial distribution processes. A method of describing the spatial distribution of noise using special conditional symbols has been developed [7].

Population morbidity is related to geoecological conditions and was also considered in the work of Sh. Dusanova. According to the World Health Organization, 25% of the world's diseases and 23% of deaths are caused by the deterioration of the environment. 40,000 of the chemicals used by mankind are harmful to humans. In 2021, 7,790 tons and 5,850 tons of various gases and dust were released in 2021. If current water-inefficient agricultural practices continue or are negligibly modified, climate change will inevitably lead to significant water shortages and, as a result, various disasters. At the same time, the importance of trees and greenery in ensuring the cleanliness of the city air is incomparable [3].

2 Study area

Syrdarya is a province of Uzbekistan that was founded on February 16, 1963. It is bordered by the eastern Tashkent region, the western Jizzakh region, the Republic of Kazakhstan to the north and Tajikistan to the south. The region has 900,000 individuals and covers an area of approximately 4.28 thousand square kilometers. Syrdarya's climate is characterized by changeable and arid circumstances, with an annual temperature of 14°C. Temperatures in January normally average around -6°C in the north and -2°C in the south. Winter temperatures drop rapidly, with occasional drops as low as -30°C (-35°C in Gulistan).

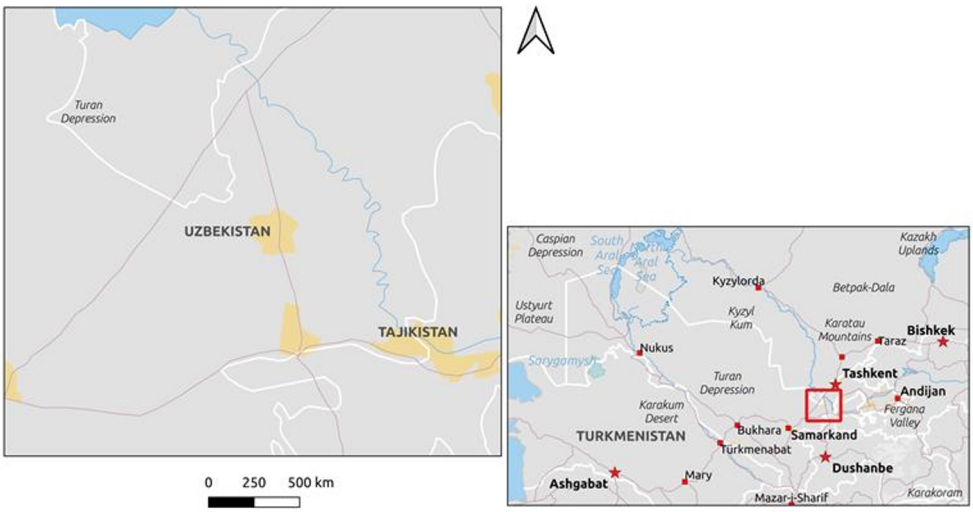


Fig. 1. Study area (Source:www.openstreetmap.org adapted by QGIS)

Due to excessive evaporation during the summer season, the surface regions of Sharof Rashidov, Aqoltin, and Gulistan districts in Syrdarya experience soil salinity. From November to March, the "Bekabad Wind" blows at 20-25 m/sec speeds, with gusts exceeding 40 m/sec in the Boyovut district. During the spring season, this wind can be harmful to blossoming plants. To address these issues, Syrdarya has built isolated plantings. The region is dominated by light-colored weak gray soils with low to medium salinity, which are mechanically composed of sandy and silty soils. The region also has saline and saltwater-like soils.

3 Methods

Monitoring of green areas in ArcGIS software based on remote sensing data (NDVI - remote assessment of plant vegetation) analysis and public health relevance was considered. Medical, geographic mapping in Uzbekistan is one of the new and rapidly developing fields in the world, and several maps related to the field have been compiled in Medical Geographical Atlases, Ecology and Geoecology Atlases, and the National Atlas of Uzbekistan (2020). It can be seen that the content of the conducted scientific research has been improved year by year based on demand and supply.

The object of research is water bodies (hydrographic systems) and rivers - indicators that show the geoecological conditions in this area. Lack of clean water is the main cause of many diseases; 80% of the world's diseases are related to water. 25,000 people, mostly children, die every day in the world due to the consumption of poor-quality water. The need

for irrigation and drinking water in the Syrdarya region is mainly fulfilled by the Syrdarya River and the North and South Mirzachol canals flowing from it. Based on the data of the Hydrometeorological Service of the water of the Syrdarya River, the chemical composition of the water flowing from the water measuring stations in 2000, 2010, and 2019 was analyzed.

4 Results

According to the results of the analysis, according to the chemical analysis of the waters of the South Mirzachol canal flowing from the city of Yangier in 2000, the amount of Ca was 106 to 140 mg/l, which was less than the fixed rate (permissible norm) (180 mg/l for FIXED RATE - Ca element). Aslanov I. et al., in their scientific works (2020), the importance of green areas in the large urban ecosystem in Tashkent city is mentioned. Currently, population growth and human activity are increasing the demand for cities. Urban area change research using GAT is important in determining the current state and conservation of the natural environment and environmental issues. GIS using remote sensing data is one of the most widely used tools for urban land use classification. These are fast and automatic tools and allow for simultaneous statistical analysis. To analyze land area change, based on the analysis of Landsat space satellite data, the normalized vegetation index (NDVI) algorithms are used to separate green and vacant land and residential and infrastructure areas in the study area [3]. Automatic mapping tools are used based on the arithmetic calculation of Landsat space images. Land monitoring mapping uses remotely sensed images (Figures 1 and 2 and Tables 1 and 2).

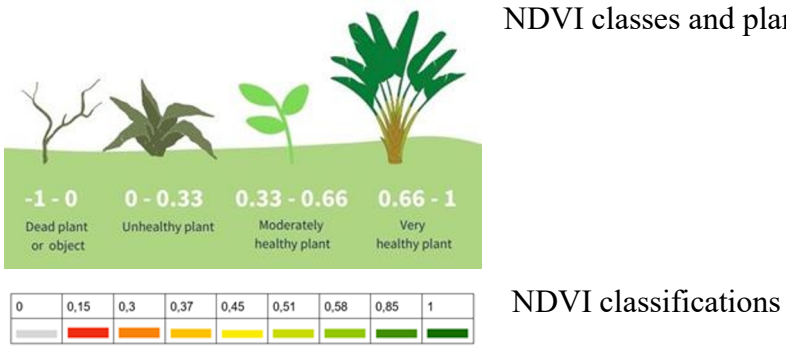
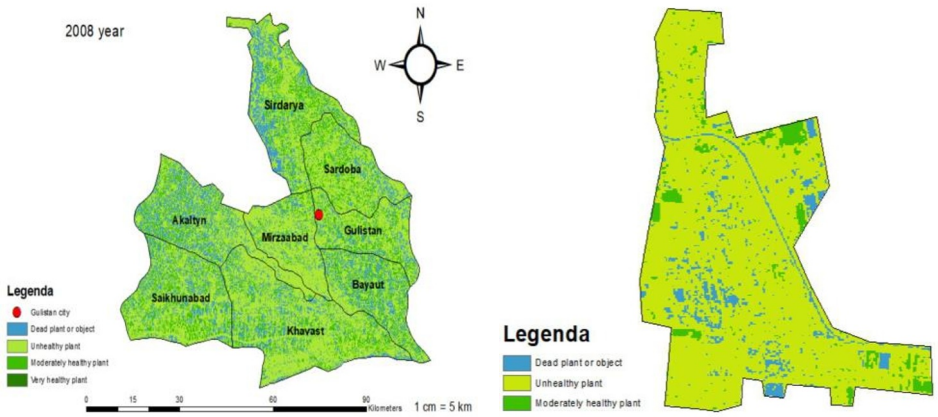
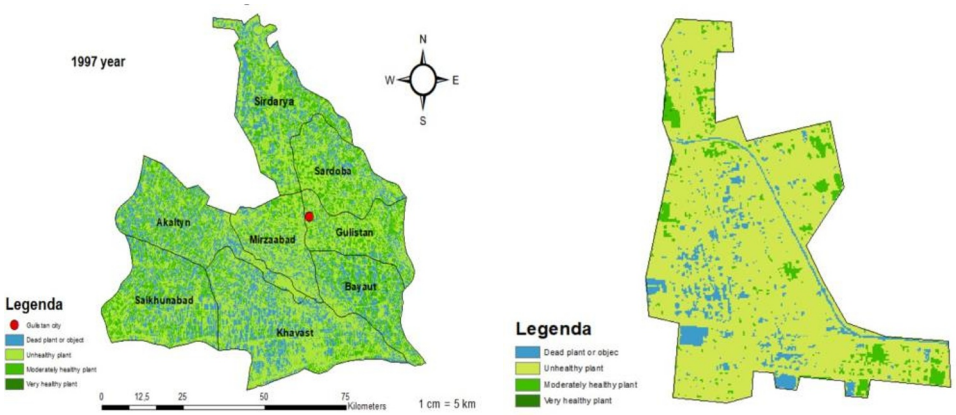


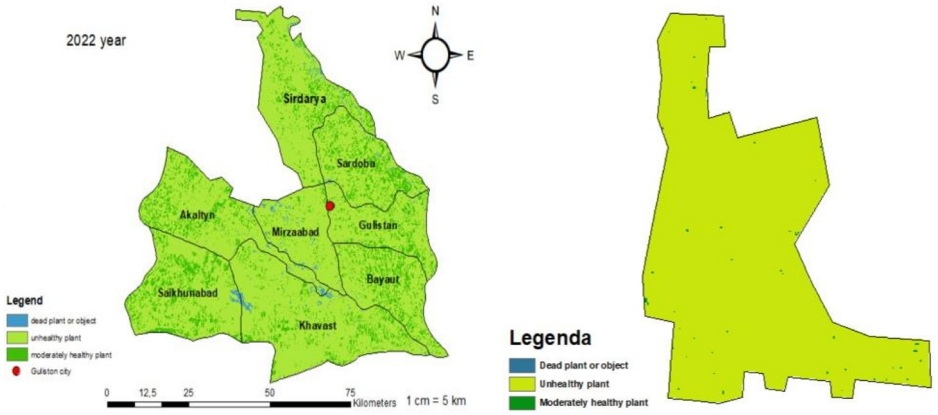
Fig. 2. Normalized Difference Vegetation Index (NDVI) quantifies vegetation by measuring. (Source:www.gisgeography.com)



Situation between April 15-20, 2008 (A)



Situation between April 15-20, 1997 (B)



Situation between April 15-20, 2020 (V)

Fig. 3. Reduction of green space in Gulistan city (between 1997-2022). (A, B, V)

An analysis of Landsat-8 satellite images shows that the green space in Gulistan has been shrinking over the years. This condition significantly affects the health of the population (Figure 2 and Tables 1-2).

The population's health and the crops' vegetation also depend on the chemical composition of the water entering the area. According to the chemical analysis of the water in 2010, it was within the normal range from 98.2 mg/l to 108 mg/l. In 2019, we can see that this element has increased from 104.2 to 136.3 mg/l compared to previous years (Uzgidromet fund data). In 2000, Mg element 52.42; 64.59; 70.67; It was 65.81 and 80.43 mg/l. 48.77 in 2010; 60.93; 52.42; 43.90; It was 44.77 mg/l.

Table 1. NDVI indicators for Syrdarya region

№	Classes	Values	Number of pixels			Estimated land area (in hectares)		
			1997	2008	2022	1997	2008	1997
1	Water, snow and ice, clouds	-1-0	1310909	1089865	60848	117981.8	98087.85	5476.32
2	Open soil (unhealthy plant)	0-0.33	2998536	3409748	4540952	269868.3	306877.3	408685.7
3	Moderately healthy plants (sparsely located)	0.33-0.66	1115725	935773	835226	100415.3	84219.57	75170.34
4	Healthy plants (densely located)	0.66-1	11856	1640	0	1067.04	147.6	0

Table 2. NDVI indicators for the city of Gulistan

№	*Classes*	*Values*	*Number of pixels*			*Estimated land area (in hectares)*		
			1997	2008	2022	1997	2008	2022
1	Water, snow and ice, clouds	-1-0	2630	2288	3	236.7	205.92	0.27
2	Open soil (unhealthy plant)	0-0.33	24351	25058	28902	2191.59	2255.22	2601.18
3	Moderately healthy plants (sparsely located)	0.33-0.66	1990	1637	78	179.1	147.33	7.02
4	Healthy plants (densely located)	0.66-1	12	0	0	1.08	0	0

In 2019, 55.94; 58.39; 60.83; It was 87.54 mg/l. It is almost 2 times more than fixed rate (fixed rate - Mg element is 40 mg/l for 1-2). According to data obtained from water monitoring points on SO4 element, 2000: 451; 499; 518; 621; It was 665 mg/l. In 2010, was 498, 428, 513, 399 and 335 mg/l. By 2019, it is 426, 436, 535, and 692 mg/l, and it is 100 mg/l according to the fixed rate, which is 4, 5, 6 times more than the norm. According to the research, the changes in the chemical composition of the water of the hydrographic objects that supply water to the Syrdarya region: the Syrdarya and Chirchik rivers, the North and South Mirzachol canals also lead to an increase in the number of diseases in the population living in this area. In particular, it can be seen that the types of kidney diseases and gastrointestinal diseases have increased.

5 Conclusions

As highlighted by scientific studies, continuous monitoring of green spaces is crucial for public health. Monitoring seedlings' growth, funded through the "Green Space" program, is particularly important. Utilizing satellite images within programs for observation proves to be convenient and effective. The analysis of these images using NDVI (Normalized Difference Vegetation Index) provides clear and detailed results. Satellite images have been instrumental in determining the decrease in green areas within the Syrdarya region and Gulistan city. The article emphasizes the impact of water composition on the population's health in these areas, calling for comprehensive large-scale studies. These situations underscore the importance of monitoring green areas and analyzing their geoecological aspects in the Syrdarya region and Gulistan (major cities). Satellite image monitoring proves effective as it captures changes over time. A robust approach to geoecological research is vital for identifying green areas and developing appropriate recommendations.

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