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INVESTIGATION OF URBAN BIODIVERSITY AND FACTORS INFLUENCING IT BASED ON MODERN TECHNOLOGIES

Shahnaz S. AMANOVA[1]✉, Gulnar N. HAJİYEVA[2], Jabbar S. NAJAFOV[3], Leyla P. IBRAHIMOVA[3]

[1]*Khazar University, Baku, Azerbaijan*
[2]*Institute of Geography named after acad. H. A. Aliyev, Baku, Azerbaijan*
[3]*Nakhchivan State University, Nakhchivan, Azerbaijan*

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Abstract. In the article, the development of the cities of the Shirvan plain, located in the central part of the Republic of Azerbaijan, and the impact of this development on the loss of biodiversity of the cities were analyzed. Currently, cities, where more than 50% of the world's population live, are the main reasons for the change of natural landscapes. The development of cities and the intensity of urbanization accelerate these changes. Therefore, our research is dedicated to the current issue. During the research, preference was given to modern methods. Landsat 5, 8 and 9 satellite images of 6 cities located on the Shirvan plain were obtained. As a result of the processing and analysis of these satellite images, the development of the territory and population of the cities was studied, and their effects on the natural landscape, its components, vegetation and water bodies were analyzed. The boundaries of cities in 1975 and 2023 were determined and compared. As a result of the conducted studies, it was determined by the processing of the 1975 topo plans and the 2023 satellite images that the area of the cities has increased by at least 2 times. The high average annual growth of the population has led to the transformation of cities from small towns to medium and large cities in a short period of time. This causes the loss of biodiversity as soon as possible and accelerates this process.

Keywords: urban landscapes, biodiversity, Landsat 5, 8 and 9, NDVI, NDWI, landfill.

✉Corresponding author. E-mail: ***shahnaz.amanova@gmail.com***

1. Introduction

Urbanization is one of the most important global phenomena of the modern world, involving all peoples and countries. Urbanization is the process of population concentration in cities, increase in the number and size of cities, increase in technical equipment, number of floors and building density, creation of comfortable living conditions (Remme et al., 2021).

Modern urbanization as a global process has three general features that are characteristic of most countries (Smith et al., 2018):

- rapid growth of urban population;
- the continuation of the concentration of urban population primarily in big cities;
- expansion of the territories of cities.

The consequences of changes in air flow around a high-rise building are mostly negative. First, it is the creation of an additional wind load on the facade area of the building, which can lead to partial destruction of the facade itself, as well as deterioration of the thermal performance of the high-rise building, thereby causing additional operating costs.

Harmonious development of man is impossible without constant interaction with nature, therefore its protection and enrichment is the most important task of rational territorial organization of society. Population development, efficient use of natural resources and efficiency of environmental protection are important issues. The growth of the economy, technology and the number of people on our planet actively affects natural landscapes (Keeler et al., 2019).

Pollution of air and water basins, soil erosion, damage to flora and fauna during the development of a number of areas, insufficiently economical use of land, oil, gas and coal resources, metal ores and other minerals are of great concern. With the expansion of needs, the industry's demand for various types of raw materials increases. At the same time, although many natural resources are large, they are by no means unlimited. The state of health of the population, working conditions and life depend more on the effective use of natural resources and solving the problems of environmental protection (Haque et al., 2018).

The historical process of world industrialization and urbanization has an increasing influence on the ecological situation, which reflects the nature of the human relationship with the environment in a certain period of time (Dinerstein et al., 2017).

The problem of the ratio of natural resources and population is, of course, related not only to the growth of production, but also to the growth of the population. The bulk of this growth comes from developing countries, which are experiencing acute shortages of food, production facilities and financial resources. The ratio of population growth dynamics and economic resources is related to the solution of socio-economic problems (Girault, 2017).

The greatest destruction of high-biodiversity habitats is occurring in coastal China, Brazil, and Nigeria. The expansion of urban areas causes a large loss of biodiversity, as the number of species in urban areas is on average 50% lower than in undisturbed natural habitats (Chan et al., 2018).

According to scientists, the indirect effects of urban growth on biodiversity will be much greater than the direct effects, as they include the effects on biodiversity of the resources consumed in the city and the effects of pollution caused by cities. According to scientists, the area required for the production of food for urban residents alone is 36 times larger than the area of the cities themselves.

The city consumes a large amount of natural resources from natural landscapes and returns to it the waste of its life accumulated in the biosphere (Czembrowski & Kronenberg, 2016).

It is necessary to mention several problems of pollution of natural landscapes by the products of urban life: water pollution, solid household waste, urban air pollution, noise pollution. Water pollution. The used city water contains heavy metals, residues of petroleum products, phenols, etc. saturated with Water bodies below the discharge of waste water are classified as "very polluted" and "extremely polluted". The problem of solid urban household and industrial waste recycling has not yet been fully resolved. The conventional method of collecting household waste in landfills is not the solution to the problem, because more and more waste is produced and there are less places to store it.

Motor vehicles occupy one of the leading places in urban air pollution. In many cities, car exhaust accounts for 30% of air pollution, and in some, 50%.

Noise pollution. The city is a source not only of harmful and toxic substances, but also of physical pollutants, including noise. Noise pollution increases the nervous and mental tension of the city dweller.

In solving the ecological situation of the atmosphere of cities and the organization of environmental protection, a special place is given to the importance of nature protection measures. These measures include conducting ecological expertise of the placement schemes of production facilities and measures on the protection of natural components – water, air, soil, vegetation and animal world, based on the proposal of the functional planning organization. It also includes functional zoning, preparation of area engineers, reclamation, greening, irrigation, etc. nature conservation measures.

In some countries, the process of urbanization can be called spontaneous. So, under the influence of socio-economic factors, today 90% of the population in Germany, 83% in Argentina and Sweden, 82% in Uruguay, 80% in the USA, 76% in Japan, 75% in Australia lives in cities. The largest urban agglomerations are Tokyo-Yokohama, Delhi, Shanghai, New York, Moscow.

The urban environment is significantly different from the natural environment. These differences include:

- the natural landscape has been modified and adapted to human needs;
- a large number of people are concentrated in a limited area;
- production facilities and various communication systems are located on its territory.

Over time, cities grow, an artificial environment is formed in their territory. People who follow comfort are moving away from nature. But gradually, everything they create for their own benefit, they create a block of environmental problems typical of large cities located anywhere in the world.

Active human activity gradually becomes an unbearable burden for the environment. Self-cleaning processes occurring in nature do not match the speed of pollution and cause large-scale environmental problems with a lack of funds for the implementation of environmental measures. They are especially in developing countries, where there is a very high level of harmful substances in the atmosphere, poor water quality, increased noise level, etc. creates problems.

The use of water resources for the needs of the urban population also has a negative impact on nature, water quality deteriorates. More specifically, the use of water for industrial purposes and to meet the needs of residents leads to a decrease in the quality of groundwater. Also, industrial wastes cause pollution of water bodies and eventually become unfit for human consumption.

2. Research method

In order to obtain more accurate results during the research, satellite images of cities and topo maps were used. Topo maps from 1975 and modern satellite images were deciphered and the impact of land development on biodiversity and its loss was studied.

3. Result

Our study area covers the cities of Zardab, Agdash, Kurdamir, Hajigabul, Ujar and Shirvan located on the Shirvan Plain (Figure 1).

As of 01.07.2011, the population of the city of Shirvan, located on the eastern bank of the Kura River, is 83.5 thousand people, and the population density is 1138 people

Figure 1. Study area

per 1 km^2. 48.9% of the total population are men, 51.1% are women. 99.6% of the population are Azerbaijanis, 0.4% are representatives of other nations.

The road and railway connecting the southern, south-western and northern regions of the republic, and the waterway through the Kura River pass through the city of Shirvan. The city borders Sabirabad, Salyan, Hajigabul regions. It is rich in mineral oil and gas deposits. In the semi-desert plains, mainly wormwood, sycamore and other trees grow (Amanova, 2022).

The territory of the city of Hajigabul is mainly plain, but some hills of the Greater Caucasus Mountains are clearly visible on the territory of the region. The soil is saline and the vegetation is poor. Tugai forests stretch along the banks of the Kura River. Venomous snakes such as jackals, wolves, foxes, wild cats, badgers, hedgehogs, rabbits and vipers live in the forests.

Agriculture, farming, fishing, animal husbandry and horticulture are widespread.

Although the soil is saline, it is possible to obtain abundant crops, especially in the fertile soils on the banks of the Kura River. Bark trees growing in Tugai forests are collected as firewood.

Our other city, Agdash, was called Uchgovag, later "Aghdash", a small village in the Agdash district of the Sheki Khanate at the beginning of the 19th century. At the end of the 19th century, Agdash became the center of cotton production, processing and sale in the entire Caucasus. For this reason, in 1904, the First Congress of Caucasian Cotton Growers was held in Agdash. In 1900, Agdash village was granted city status.

Kurdamir city, the administrative center of Kurdamir region, was founded in 1930. In 1938, the district announced the status of a subordinate city. The average annual air temperature in Kurdamir city is 15 °C, the annual rainfall is 250–300 mm, the wind speed is 2–3 m/sec, and it is typical of a dry subtropical climate.

The main activity here is to develop crop and animal husbandry, and recently, in accordance with the conditions of the market economy, small business activities in trade, service and other fields have been given ample space.

The development of cities takes place on the basis of both population growth and territory growth (Figure 2).

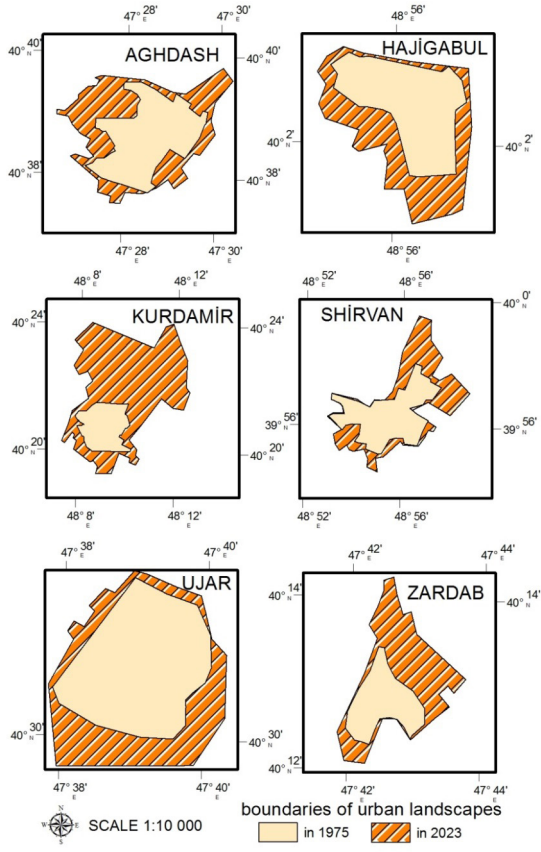

Figure 2. Boundaries of cities during 1975 and 2023

For this purpose, we have analyzed the development dynamics of both the population and the territory of the cities located on the Shirvan Plain. The areas of the cities located in the study area were studied in 1975 and 2023, 1:10,000 scale topo plans were used to determine the boundaries of the cities in 1975, and satellite images were used to study the dynamics in 2023 (Table 1). It was determined that Kurdamir, Zardab, Aghdash and Shirvan cities are the rapidly expanding cities, and Hajigabul and Ujar are the cities that are developing at a relatively low speed. Thus, the territory of Kurdamir city has increased more than 5 times in 48 years. The main reason for this is closely related to the location of the urban area on TRACECA. It also depends on the availability of surrounding areas for urban expansion.

Table 1. Dynamics of areas of urban landscapes

Urban landscapes	Area (ha)		Dynamics of area	
	in 1975	in 2023	ha	%
Aghdash	627	1238	611	1.98
Hajigabul	601	1125	524	1.87
Kurdamir	702	3831	3129	5.46
Shirvan	1475	2821	1346	1.91
Ujar	651	1065	414	1.64
Zardab	177	467	290	2.64

The population of the cities located on the Shirvan Plain has grown rapidly, as has the area. This was due to their proximity to transport routes and their location on the banks of the Kura River (Figure 2). In order to monitor the dynamics of population growth, the population in 2013 and 2022 was analyzed and it was determined that the first city in terms of population is Shirvan, and the city with the least population is Zardab (Figure 3).

The highest average annual growth rate of the population is observed in the cities of Shirvan and Agdash, which once again proves the expansion of the territory (Figure 4). After 2013, the average annual population growth in Shirvan city was 6.7%, in Agdash city 2.9%, in Hajigabul city 1.7%, in Ujar city 1.2%, in Kurdamir 1%, and in Zardab city 0.4%.

The highest average annual growth rate of the population is observed in the cities of Shirvan and Agdash, which once again proves the expansion of the territory (Figure 5). After 2013, the average annual population growth in Shirvan city was 6.7%, in Agdash city 2.9%, in Hajigabul city 1.7%, in Ujar city 1.2%, in Kurdamir 1%, and in Zardab city 0.4%.

Satellite images obtained in July 2022 show poor plant growth and even drought in large areas. For 9 years, the indicators of the NDV index decreased in the cities of Kurdamir and Hajigabul, and the area of the low-index areas expanded. If we take into account that low-index areas correspond to areas with residential houses, we can

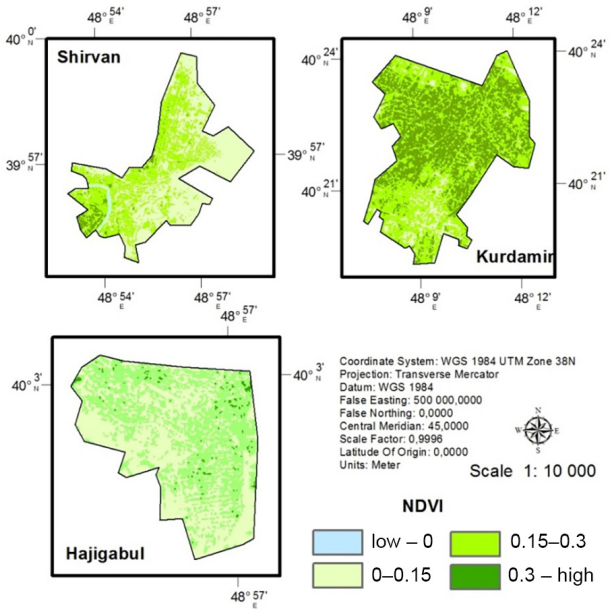

Figure 5. NDV index in urban landscapes (in 2013)

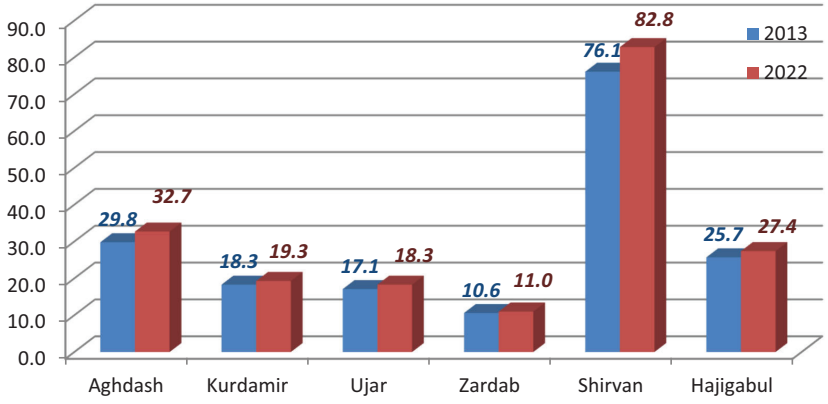

Figure 3. Population dynamics of urban landscapes

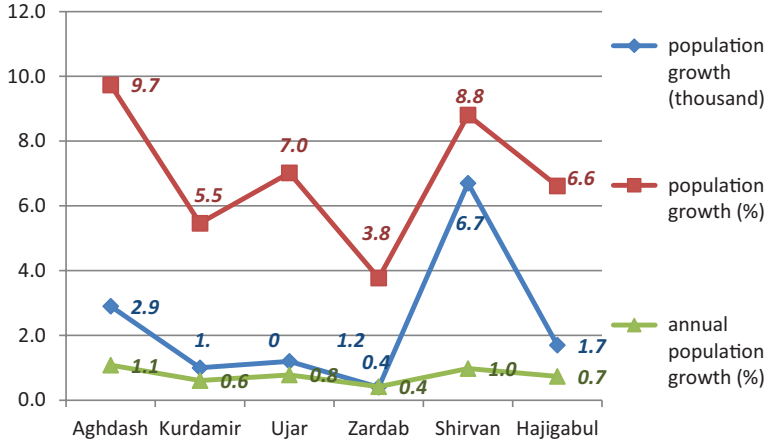

Figure 4. Population growth of urban landscapes

say that the area of houses in these cities has expanded, and as a result, the area of greenery, trees and bushes, as well as agricultural fields and pastures has decreased. This shows that urbanization is going on intensively (Figure 6).

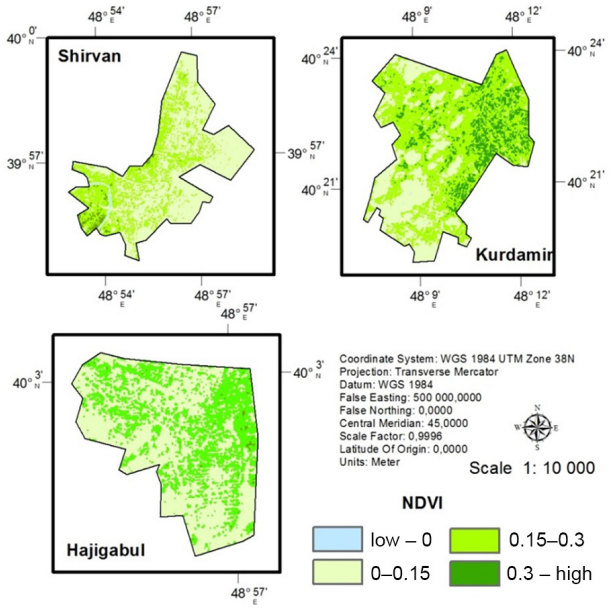

Figure 6. NDV index in urban landscapes (in 2022)

The development of cities can create various environmental problems not only within their borders but also in the surrounding landscapes. As an example of this, we can show the Hajigabul lake, located between the cities of Shirvan and Hajigabu. Based on our previous studies, we can note that the analyzes of NDW and MNDW indices show that the water is drying up in the area of the lake and instead the wetlands are expanding. Based on the analysis of Google Earth images from 2000, 2005, 2010, 2015 and 2020, it was determined that the area of the lake was 844.6 ha in 2000, 746.2 ha in 2010, and 667.3 ha in 2020.

During the analysis of the Normalized Difference Index (NDWI) of Water in Hajigabul Lake and surrounding areas, based on the analysis of 2010, while the NDW index in Hajigabul Lake is higher than 0, in 2019, this indicator is expressed in negative values in the lake and surrounding areas. This is caused by factors such as the surrounding urban landscapes and climate warming. As can be seen from the map reflecting the dynamics of 2010–2019, the maximum change is observed in the lake area.

As a result of the analysis of satellite images, it was determined that during 9 years, the minimum indicator of the surface temperature in the Hajigabul lake area increased from 21.5 °C to 28 °C, while the maximum indicator was 43 °C in August 2010, in 2019 it was higher than 43° C. Following the dynamics, it is known that the maximum temperature increase (18–21 °C) is observed in the central part of the lake. During 2010–2019, the temperature in the area of Hajigabul settlement north of the lake increased to 6–12 °C, and in the area of Shirvan city to 0–9 °C.

During the improvement of the Normalized Difference Water Index (NDWI), the Modified Normalized Difference Index (MNDWI) was proposed as a modification due to deficiencies in the NDWI. The near-infrared band has been replaced by a mid-infrared band that provides improved results such as higher values for water bodies, but unlike NDWI, MNDWI does not allow distinguishing between construction and under-construction areas. Significant dynamics are reflected in the MNDW index as well as in the NDW index in Hajigabul Lake and surrounding areas. In 2010, the index was expressed with positive indicators around the lake, but in 2019, this indicator varies between –0.2–0.

If we pay attention to the environmental changes in natural landscapes due to urban development, we will see that the situation in waste landfills is tense. For this purpose, we have investigated the existing situation in waste landfills in the cities located in the research area (Figure 7).

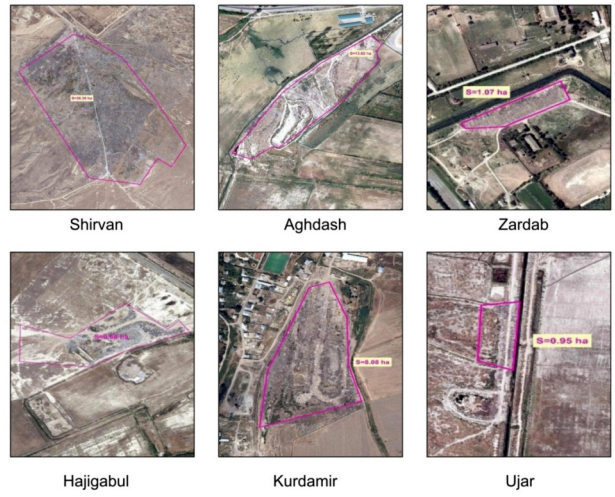

Figure 7. Lanfill in urban landscapes

It was determined that the area in the waste landfill in Shirvan is in an unsanitary condition, waste is placed without a system, cases of burning and scattering of piled waste are observed. The main component of piled waste is industrial waste. At the landfill, the gate has not been closed, the warning board has not been installed, and access and exit are not controlled. Outsiders and vehicles enter the landfill without hindrance, large and small cattle can be found.

The area of the existing waste landfill here is 30.36 ha, and the volume of waste delivered during the day is 144.2 m^3.

The area of the landfill in Hajigabul is 9.68 ha. The volume of waste brought here during the day is 144.2 m^3. In the area, waste is not sorted, it is placed without a system, it is not buried, it is piled up. In the landfill, the gate has not been buried, the fence has not been erected, the warning board has not been installed, and there is no access control. Outsiders and vehicles enter the landfill without hindrance, large and small cattle can be found. The smoke and smell produced by the burning of waste at the landfill are strongly felt in the residential area close to the site.

The area of the landfill in Agdash is 13.62 ha. The volume of waste brought here during the day is 80 m^3. The landfill is located 550 m from the village of Tatlar and 850 m from the village of Mursel. The area is not fenced, the gate is not buried, warning signs are not installed, access and exit are not controlled, waste is collected without a system, it is not sorted, residual waste is not buried and burned. Animal carcasses were observed in the landfill. Wastewater formed in the area flows into the canal bordering the landfill. It was observed that the smoke generated as a result of the burning of waste was spreading around. Strangers and vehicles enter the landfill without hindrance, stray dogs, large and small cattle can be found in the area.

The area of the landfill in Ujar is 1.0 ha. The volume of waste brought here during the day is 130 m^3. The area reserved for the landfill is located 5.1 km from the center of Ujar city, 1.8 km from Gulaband village, bordering the Garabörk forest. The landfill is bordered by the Garabörk forest area and the drainage channel, the formed fecal waters flow into the channel. Waste generated in nearby villages is brought to the landfill. The area is not fenced, the gate is not buried, warning signs are not installed, access and exit are not controlled, waste is collected without a system, not sorted, not buried, piled up and burned. Strangers and vehicles enter the landfill without hindrance, large and small cattle, and stray dogs are found.

The area of the landfill in Zardab is 1.07 ha. The volume of waste brought here during the day is 50 m^3. The municipal solid waste landfill is located 220 m from the Ujar-Zardab highway, bordering the Main Shirvan Collectorate (BSC). The area is not fenced, the gate is not buried, warning signs are not installed, access and exit are not controlled, waste is collected without a system, partially sorted, residual waste is buried. Solid domestic waste generated in the villages of the region is dumped into wells dug in backyards or directly into the terrain. Medical waste is collected and neutralized by Komkhoz-polygon organization. In the landfill, paper, metal, glass and plastic waste is selected and handed over to "Azersun", "Azerkagyz" and cardboard production combine.

The area of the landfill in Kurdamir is 8.08 ha. The volume of waste brought here during the day is 153 m^3. The landfill is located on the central street of the city, bordering the residential area. The main composition of the waste is construction-demolition, inert and solid waste. The gate is buried in the area, the fence is not built, the warning signs are not installed, the entry and exit control is formal in nature, the waste is collected without a system, is not sorted, buried, or burned. The environmental situation in the landfill is not satisfactory. Strangers and vehicles enter the landfill without obstacles, large and small cattle, and stray dogs are found.

If we pay attention to the composition of waste, the highest indicator belongs to food waste in all cities. Especially in the cities of Hajigabul, Agdash and Ujar, this indicator makes up more than half of the waste (Table 2).

Transport roads also play an important role in polluting the geocomplexes of the studied cities and in worsening the ecological situation and loss of biodiversity. Along with the great advantages of the daily increase in the density of this network, its constant and dynamic development leads to many negative consequences. According to the calculations of the World Health Organization, more than 70% of harmful substances released into the atmosphere are accounted for by motor vehicles. These harmful effects are manifested in our republic, where the rapid growth of cars has been registered in recent times, including in the mentioned cities.

The most important highways pass through the study area. 43 km of the Agsu-Kurdamir-Bahramtepe highway (III grade), 42 km of the Alat-Gazimammad-Kurdamir-Yevlakh road (II grade), and 44 km of the Baku-Tbilisi main railway pass through the territory of Kurdamir district.

A number of factors, including their technical condition, the quality of the fuel they use, the structure of highways, etc. affect. The level and smoothness of the highway alone leads to a 13% reduction in the amount of waste emitted by trucks into the environment, and by 9% in cars (Table 3).

Table 2. Composition of waste, in %

No.	Waste	Urban landscapes					
		Shirvan	Hajigabul	Aghdash	Ujar	Zardab	Kurdamir
1	Food waste	47%	52%	52%	51%	48%	40%
2	Other organic waste (greenery, livestock, etc.)	10.5%	11.5%	14%	16%	16%	16%
3	Metals	2.5%	2%	1.1%	1.2%	1.6%	1.3%
4	Plastic/polyethylene	3.5%	0.5%	1.5%	1.8%	2.6%	1.5%
5	Paper/cardboard	12%	10%	17%	15%	15%	19%
6	Construction-demolition Inert waste	13%	11%	4%	3%	3%	15%
7	Glass	1%	2%	0.9%	0.8%	0.7%	1%
8	Rubber, leather, textile, etc.	2%	1.5%	2.3%	2.1%	2.1%	3.6%
9	Electrical/electronic waste	2%	1%	1.4%	1.2%	1.4%	0.7%
10	Other	6.5%	8.5%	5.8%	7.9%	9.6%	1.9%

Table 3. Statistics of transport in urban landscapes

Years	2015	2019	2021
Zardab			
Number of cars	2933	4230	4823
Trucks	362	424	455
Passenger buses	38	57	57
Passenger cars	2499	3697	4256
Ujar			
Number of cars	5702	7368	8209
Trucks	736	822	870
Passenger buses	62	60	63
Passenger cars	4871	6381	7224
Kurdamir			
Number of cars	6699	9776	11112
Trucks	850	1062	1166
Passenger buses	129	140	145
Passenger cars	5646	8494	9715
Aghdash			
Number of cars	8082	10138	11277
Trucks	900	1021	1110
Passenger buses	123	183	193
Passenger cars	7002	8858	9902
Hajıgabul			
Number of cars	5360	6967	7780
Trucks	848	1003	1003
Passenger buses	103	122	116
Passenger cars	4352	5751	6477
Shirvan			
Number of cars	7244	9348	10430
Trucks	910	1055	1142
Passenger buses	307	381	386
Passenger cars	5794	7654	8640

According to the data of 2021, the total number of vehicles in the city is 53631 units. 86.2% of these vehicles are passenger cars, 10.7% are trucks and 1.8% are buses. In general, the number of vehicles increased by 32.8% compared to 2015. This growth is mainly manifested in passenger cars. Thus, the number of passenger cars increased by 34.7%, trucks by 19.8%, and buses by 20.6% (Figure 8).

As can be seen from Figure 1, the number of vehicles is increasing in the last 6 years. Year by year increase of vehicles has increased the amount of waste they throw into the environment, especially into the atmosphere. This indicator received separate prices for each vehicle. The main reason for this is that each of them has a different fuel consumption and the fuel they use. There are cars running on gasoline, diesel and methane gas. In particular, we have investigated the environmental impact of gasoline-powered vehicles (Gadjieva, 2021). Thus, in 2015, the fuel consumption of trucks was 142.8 tons, buses 18.2 tons, and cars 482.6 tons. Compared to 2021, these indicators increased by 34.7% for cars, 19.8% for trucks, and 20.6% for buses. However, overall fuel consumption increased by 31.6% (Figure 9).

As can be seen from Figures 1 and 2, the increase in the number of vehicles in 6 years resulted in an increase in their fuel consumption. This process eventually led to an increase in the amount of waste thrown into the environment. As a result of our research, it was determined that in these cities during the years 2015–2021 carbon oxide 23.6%, nitrogen oxide 23.6%, sulfur gas 23.7%, hydrocarbons 23.7%, aldehydes, organic acids 0.9% %, and solid particles increased by 23.4% (Figures 10).

Carbon monoxide CO_2, carbon oxides CH_x, nitrogen oxides NO_x and sulfur oxides SO_x are more harmful than exhaust gases in cars. The amount of waste and their degree of harm depends on many factors: structural, technological, organizational-technical (urban construction, traffic organization, technical operation of motor vehicles, etc.) characters, as well as natural-climatic conditions and mode of operation of vehicles.

Emissions from vehicles have a negative impact on the environment as well as human health. The increase in the amount of nitrogen oxide in the atmosphere has caused lung diseases in the population living in the city. So, every 10 μg/m^3 increase in NO_2 results in 6.5% increase in

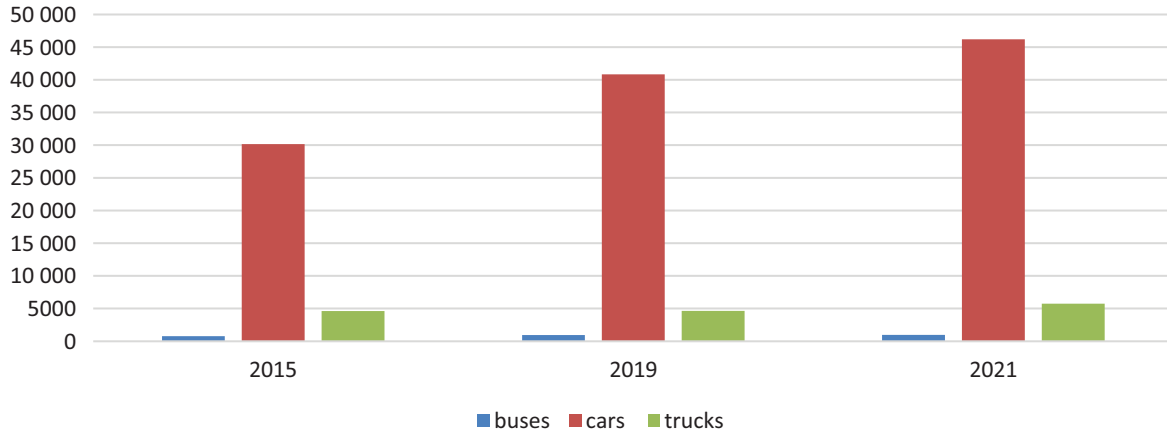

Figure 8. Growth dynamics of vehicles in the mentioned cities

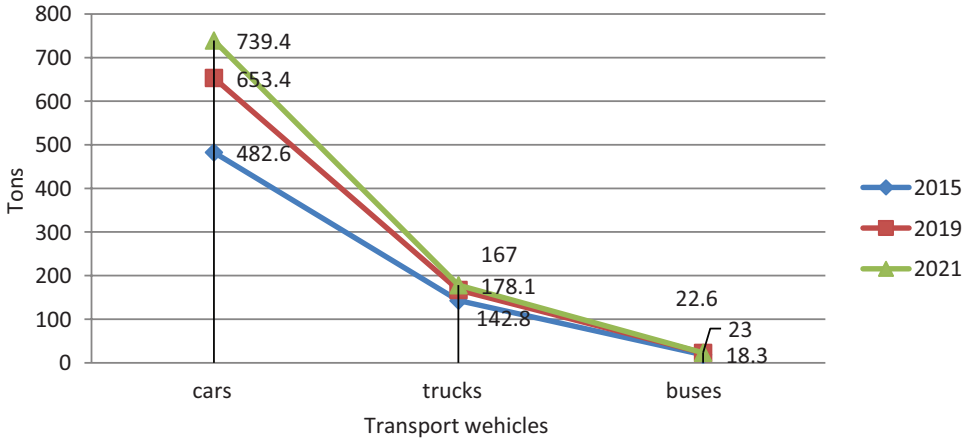

Figure 9. Amount of fuel used by vehicles in the cities in 2015–2021 (thousand tons)

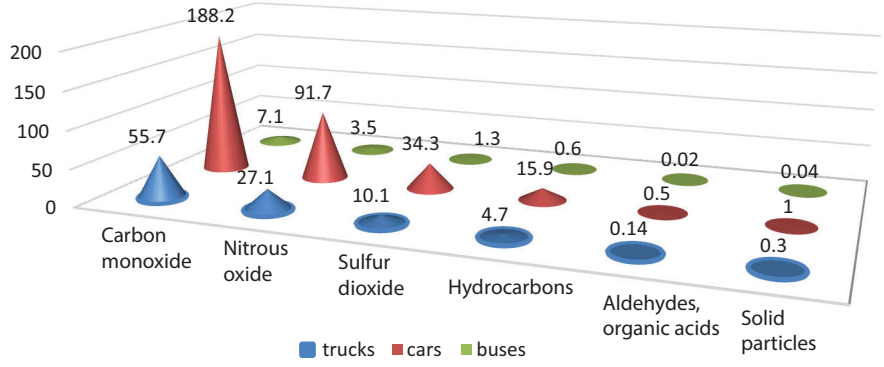

Figure 10. Waste emitted by vehicles in these cities in 2015 (thousand tons)

bronchial asthma, 6.6% increase in lower respiratory tract disease, and 3.8% increase in upper respiratory tract disease. If the indicator is 380–560 μg/m^3, serious changes are already observed in the lungs.

When we talk about the impact on human health, it is necessary to emphasize sulfur dioxide. This gas, which has a sharp unpleasant smell, damages the central nervous system. It causes cardiovascular and respiratory diseases.

Carbon dioxide ranks 3rd in terms of the impact of waste on human health. This gas quickly passes into the blood in a person, causing an increase in the amount of carboxyhemoglobin and a change in mental movement reaction in children. Chemical elements such as Sr (strontium), Zr (synconium), Y (yttium), Rb (rubidium), Fe (iron), Ag (silver) and Sb (Stibium-antimony) were determined based on the results of the analysis of soil samples taken in the research area. Contamination of different layers of the soil by these elements to different degrees disrupts the biological activity of the soil. As a result, due to the violation of soil self-cleaning processes, the accumulation of toxicants in the soil in proportion to the duration of pollution and thus the risk of their impact on population health through alimentary means increases, and the destruction of soil saprophytes increases the epidemiological danger of the soil for the population.

Reducing the harmfulness of waste. Harmful waste from vehicles is reduced in four ways:

- changing the construction, working process, production technology and special regulation of the combustion process system;
- using other types of fuel or changing the physical and chemical composition of the fuel;
- regulation of harmful components in waste with special devices;
- reducing the amount of waste.

4. Conclusions

Urban deveopment has caused deforestation. About 50 years ago there were Tugay forests along Kura river. But development of riverine cities and overpopulation caused deforestation.

As a result of the conducted research, we can say that the number of vehicles has increased year by year due to the increase in the population living in these cities and the development of the urbanization process. Thus, their number increased by 32.8% in 2015–2021. This was directly caused by the increase in the amount of waste thrown into the environment. The continuous development of this process has resulted in the deterioration of the city's

environmental condition. In order to prevent negative processes, first of all, it is necessary to control the release of cars that meet Euro-2 standards, and ban the use of technically unfit cars.

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