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Land pollution by illegal dumps in the Tashkent region

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Abstract. The problem of the emergence of illegal dumps in rural areas is considered in the article on the example of the Tashkent region of the Republic of Uzbekistan. It was revealed that the sizes of illegal disposal fields vary from 1.0 to 18,895 m², there are dumps for building materials from construction sites, agricultural, household waste, as well as mixed landfills. The continuity of the layer of illegal dumps ranges from 60 to 100%. The roadsides also present long stretched illegal dumps with a continuity of the waste layer from 10 to 42%. For a full-scale assessment of the location, size and composition of illegal dumps, it is recommended to develop a GIS monitoring system.

1. Introduction

The problem of illegal dumps is relevant in many countries worldwide. In developing countries and countries with economies in the transitional stage, there are problems in waste collecting in rural areas [1]. Open landfills pose a serious environmental threat.

The amount of waste generated in rural areas increases with population growth and the expansion of consumption and services. For example, in rural areas of India, 15...18 million cubic meters of wastewater and 0.3...0.4 million tons of solid waste are generated daily [2]. In Romania, there is a lack of functioning of waste management systems in rural areas, resulting in illegal dumping of waste in forest areas [3].

Illegal dumping of waste is observed even in European countries with a developed waste management system, such as Spain or Italy [1], the same problem arises in the USA [4]. In developed countries, governments spend huge amounts of money to combat illegal dumping. Only the state of Kentucky (USA) spends about 4.4 million dollars a year to eliminate illegal open dumps, however, once liquidated landfills regularly reappear [4].

The problem of handling solid household waste in the Republic of Uzbekistan is quite acute. According to the State Committee of the Republic of Uzbekistan on Ecology and Environmental Protection in the field of municipal solid waste (MSW), the coverage of the population with sanitary cleaning services in 2021 increased from 60 to 73%. The bulk of solid waste in the Republic of Uzbekistan is stored in landfills. As of January 1, 2019, there are 221 solid waste landfills in the republic, run by organizations of various forms of ownership. Currently, the activities of 5 waste landfills that do not meet sanitary and environmental requirements have been suspended, and reclamation work has been performed on 1.5 thousand hectares of 138 landfills.



It must be noted that despite the positive dynamics, these values are far behind the targets set in the Strategy of the Republic of Uzbekistan for the management of municipal solid waste for 2019-2028 (Table 1).

Table 1. Some target indices of the strategy for the management of municipal solid waste for 2019-2028 [5].

	2021	2025	2028
Coverage of the population with services for the collection and removal of waste	85	100	
MSW recycling	25	45	60
Putting the state of waste disposal facilities in line with legal requirements	25	65	100
Reclamation of liquidated waste disposal sites	20	65	100
Monitoring the state of waste disposal facilities	20	75	100

Information on the ratio of the number of large official and illegal landfills is given in Table 2 (available data refer to 2017).

Table 2. The number of solid waste landfills by regions of the Republic of Uzbekistan (data for 2017) [6].

	Official landfills	Illegal dumps
Republic of Karakalpakstan	17	12
Andijan	15	29
Bukhara	15	26
Jizzakh	10	250
Kashkadarya	16	141
Navoi	9	10
Namangan	12	96
Samarkand	15	86
Surkhandarya	18	12
Syrdarya	12	83
Tashkent	23	96
Fergana	15	15
Khorezm	9	75
Total	186	931

It can be seen that the number of illegal dumps is 5 times higher than the number of official landfills. Moreover, only large objects are included in the official statistics. According to expert data, in 2021, all large illegal dumps were assigned to various legal entities and, thus, were transferred to the category of official landfills.

At the same time, there are many small illegal dumps near settlements, which, due to their small size, are not taken into account when monitoring, but their total area can reach significant figures. One of the sources of illegal waste disposal is holiday villages. According to the Tashkent Regional Department of the State Committee for Ecology and Environmental Protection, more than 50 unregistered small dumps were found near holiday villages near the city of Chirchik, including in the water protection zone of the Chirchik River [7].

The impact of landfills on the environment is known:

- the decomposition of waste in a dump leads to the formation of leachate and gases (mainly methane and carbon dioxide - greenhouse gases). Landfills account for 20% of global anthropogenic methane emissions [8];
- leachate can seep into groundwater and surface water, poisoning aquifers;
- the landscape is changing, its aesthetic indices are deteriorating;
- the reproduction of harmful insects and rodents is increasing, the dumps also attract birds, stray animals - dogs, cats, and in the conditions of Central Asia - wild foxes and jackals. Since the edible part of waste in landfills is usually in a state of decomposition and mixed with toxic substances, animals can get seriously poisoned;
- the socio-economic impact of landfills is expressed in risks to public health due to pollution of watercourses, the spread of flies, bad odors, and smoke [3, 8].

Another serious problem is the spread of garbage from illegal dumps to nearby agricultural land, which leads to a deterioration in the quality of land resources.

For an ecological and economic assessment of the impact of illegal dumps on the environment and agricultural land, it is necessary to study the number, composition and size of illegal dumps. The purpose of this article is to assess the approximate scale of the emergence of illegal dumps in rural areas of the Republic of Uzbekistan.

2. Materials and methods

2.1. Study territory

The studies were conducted on the territory of the Tashkent region of the Republic of Uzbekistan (Figure 1).



Figure 1. Map of the study territory (Tashkent region of the Republic of Uzbekistan).

Tashkent region is located in the northeast of Uzbekistan between the western part of the Tien Shan Mountains and the Syrdarya River; it has a total area of 15,300 km² and a population of 2,907,000 people. The region is subdivided into 15 districts, 241 settlements are located there, including 16 cities and 18 urban-type settlements. According to the regional khokimiyat, there are 56,000 holiday villages in the Tashkent region. The length of motor roads is 3771 km.

2.2. Research methods

We conducted a sample survey of some districts of the Tashkent region (Kibray, Tashkent, and Yangiyul districts).

The survey was conducted by direct observations and measurements, all detected illegal dumps were photographed, and their GPS coordinates were recorded using a smartphone. The component composition of waste at illegal dumps was determined by the method described in [9]. The area of dumps and the continuity of the layer of garbage was determined by the A. Savich method [10].

3. Results and discussion

Illegal dumps were found near settlements, separately located farms, and near highways. In addition to separately located illegal dumps, it was found that the roadside strip along some roads to a width of 1.5-5 m is covered with garbage (mainly plastic bags and PET bottles, wheel rims, aluminum cans from drinks, glass bottles, rags, and occasionally construction debris). The continuity of surface coverage with garbage in the roadsides is small and ranges from 10 to 42%, in some places to 70-80%. Thus, the roadside was turned into an illegal dump. Plastic bags from the roadside are carried by the wind to nearby fields, littering the soil, or linger on tree branches, worsening the aesthetic characteristics of the landscape and endangering birds. Such a state of the roadside was observed on the roads when passing through many small settlements (for example, the Tashkent-Maysk-Chirchik road). The roadside lanes of motor roads, passing through agricultural land, away from settlements, are less littered. The share of the littered part of the roadside of motor roads is on average 27.6% along the length of the roads. Given that the length of all roads in the Tashkent region is 3,771 km, it can be assumed that the total length of littered roadside lanes in the region is 1,041 km.

Illegal dumps found in rural areas have a different area, thickness and continuity of the layer, as well as the waste composition. In general, the sizes of illegal dumps found by the authors range from 1.0 to 18,895 m².

The dumps ranking by size categories is shown in Figure 2, and by the waste type - in Figure 3.

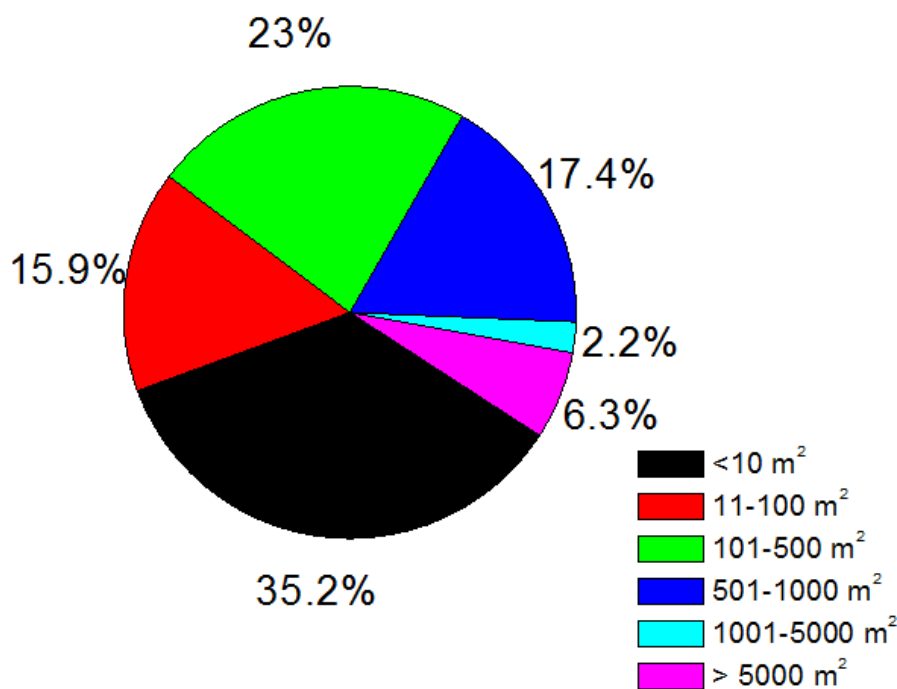


Figure 2. Ranking of illegal dumps by the area.

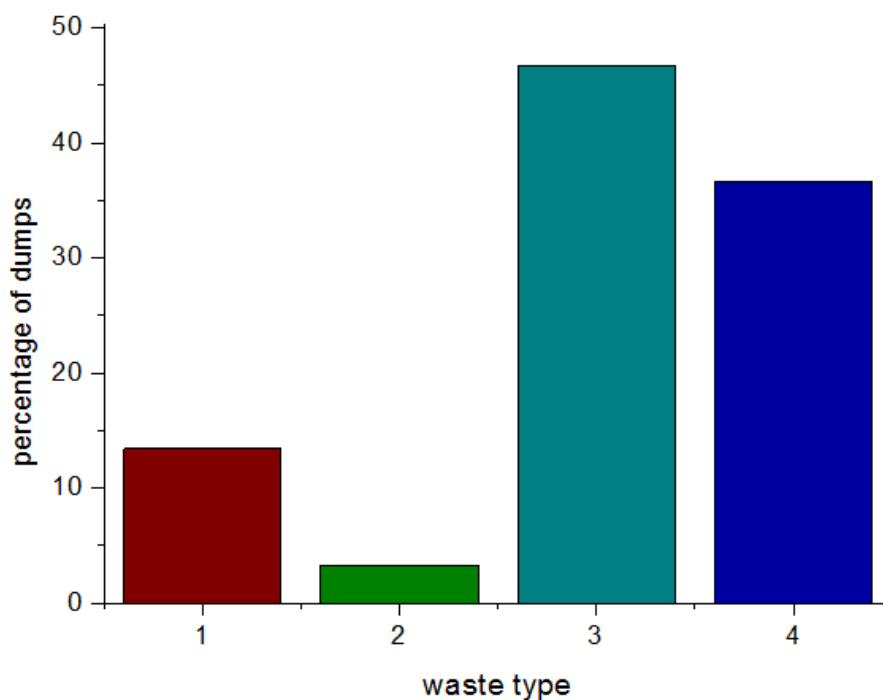


Figure 3. Distribution of illegal dumps by types of waste.

1 - construction debris; 2 - agricultural waste; 3 - mixed waste; 4 - household waste

Figures 2 and 3 show that in rural areas the main type of illegal dumps are small garbage accumulations of a small area, and dumps of household waste and mixed waste predominate in composition. The continuity of the layer of garbage accumulations is from 60 to 100%. All these indices determine the degree of negative impact on the environment.

Figure 4 shows photos of some dumps.

The danger of small illegal dumps is the creation of centers of chemical and biological (due to the reproduction of insects and rodents) pollution of soil, water and atmospheric air. Local residents periodically set fire to landfills to reduce their size (traces of burning are visible in Figure 4, a, b, c), which also leads to the release of pollutants into the atmosphere. It is not possible to fully estimate the amount of emissions into the atmosphere from such fire settings due to their irregularity, although it is known that the combustion of 1 ton of municipal solid waste results in an average emission of 1.25 kg of solid particles, 3 kg of sulfur dioxide, 5 kg of oxides nitrogen, 25 kg of carbon monoxide and 0.625 kg of soot [11].

In addition, the occurrence of illegal dumps is often noted near watercourses of various capacities. About 14.5% of illegal dumps are located directly on the banks of ditches and canals, part of the garbage periodically enters the watercourses. For example, the landfill in photos 4, e, is located directly on the bank of the Chirchik River. This dump is located on the outskirts of the holiday village of "GlavTashkentSroy". It should be noted that holiday villages are a constant source of illegal dumps due to the complete lack of garbage collection systems. Legislative and regulatory documents on the coverage of the territory of holiday villages by waste management systems in Uzbekistan do not yet exist.

Our own observations and a survey of local residents show that the location of most illegal dumps is unchanged for many years, causing permanent damage to the environment.



Figure 4. Photos of rural illegal dumps.

The situation with the emergence of illegal dumps in the Tashkent region is observed in many countries, both developing and developed ones.

For example, roadside pollution of highways is a constant problem in the state of Kentucky (USA). Cleaning up roadside garbage costs about \$4 million a year, and cleaning up illegal off-highway open dumps costs \$2.9 million a year [4]. It should be noted that, unlike the United States, roadside lanes in the countryside of Uzbekistan are often used for grazing. That is, pollution of roadside lanes can be considered in some way as pollution of pastures.

The results obtained in terms of the volume of accumulation and the characteristic localization of illegal dumps in rural areas of the Tashkent region are similar to the situation in Russia, Romania and India [3, 8, 12, 13]. Similar to the data obtained by Russian researchers [14, 15], in Uzbekistan, near each rural settlement, there are dozens of illegal dumps of household and construction waste.

This situation in the Republic of Uzbekistan can be explained not only by the low level of environmental awareness of the population but also by the insufficient level of functioning or the absence of waste collection and disposal systems in rural areas. In addition, there is no system for regular monitoring of landfills. Since small illegal dumps are not only numerous but also extremely nonuniformly distributed in the area, ground monitoring of all available dumps is physically impossible. Huge expenditures of labor, time and money are required to conduct a complete ground control. To detect some dumps is almost impossible, as they are often located in natural depressions in the terrain.

The solution to the problem of detecting illegal dumps to take measures to eliminate them could be the use of remote monitoring. It can be conducted using aerial photography, video filming, optical, thermal, microwave or lidar (laser scanning) sensors. The introduction of all these methods requires significant financial investments [13, 15]. To develop a GIS monitoring system in Uzbekistan, one should take into account not only the results obtained by researchers in other countries, but also the climatic features of the republic. The most rational way seems to be the development of a GIS system for monitoring landfills.

4. Conclusions

It can be argued that currently in rural settlements, holiday villages and along the roads of the Tashkent region there are illegal dumps of various sizes, compositions and capacities, which have a negative impact on the environment. The roadside lanes have actually been turned into long stretched dumps, although with a low density of the garbage layer.

The solution to the problem of illegal dumping should be conducted in a comprehensive manner. The following steps can be recommended:

1. Placement of garbage collection containers not only in rural settlements but also on the road sections between settlements. As is known from [1, 12], the amount of illegal waste disposal decreases with an increase in the number of intermediate garbage collection points. At the same time, in order to locate collection points, it is probably necessary to choose the places of illegal dumps locations since they are already familiar to the local population.

2. Development of additional regulatory and legislative documents on the organization of waste management systems in rural areas, and separately - on the territory of holiday cooperatives.

3. Environmental education of the rural population. As noted in [3, 16], the development of environmental legislation requires not only the participation of public authorities but also the support of civil society.

4. To develop and implement measures to eliminate illegal dumps, first of all, it is necessary to identify their localization. The most economical method of remote monitoring of landfills is GIS technologies and remote sensing. Such experience is available in Russia, Italy, Malaysia, Serbia, Ukraine and a number of other countries [13, 15, 17-20]. However, this method is not currently used in Uzbekistan. The results obtained in this study can serve as the basis for creating such a system.

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