UDC 910

Monitoring of spontaneous waste tips and soils on the basis of air photography

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The purpose. To use innovative approach on the basis of air photography with the help of drone for assessment of areas of soils under spontaneous waste tips; to analyze state and content of spontaneous waste tips, to lead systematization of the gained information. Object of researches — lands of Derhachev region (Kharkiv oblast) under spontaneous waste tips. **Methods.** Researches were spent by means of drone with camera (Pentax W60) with the following settings: 1/2,3 CCD-matrix, shutter at shooting 1/5-1/320, ISO 50-1600 in regimen Digital SR (5 Mp), regimen of serial shooting. Flight of drone covered subject of inquiry. The flying height was 80 – 100 m, shooting was made at different conditions of illumination and air cover. For 1 tour of shooting drone took more than 120 – 200 pictures of one field. **Results.** They got orthophotoplans of surface of land, in particular under spontaneous waste tips. That made it possible to determine, present and systematize in the form of database spontaneous waste tips of Derhachev region. By results of systematization they calculate of areas of lands (soils) under spontaneous waste tips for determination of areas of alienation of land under them. **Conclusions.** In territory of Derhachov administrative region 2,5% of lands are under spontaneous waste tips. Practically all of them are in limits of 1 km from edge of human settlement. For spontaneous waste tips use, as a rule, forest belts, pits, gullens or headland

Key words: *area of soils, databases, methodology of searching, telechiric aircraft (drone).*

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Introduction. In Ukraine, waste disposal in the form of natural landfills has been steadily increasing over the last decades. The alienation of land under natural landfills is spontaneous and uncontrolled. This is a concern of the community and self-government bodies and the relevant Ministry of Ecology and Environmental Protection, which has launched an appropriate disaster monitoring service.

Plastic was the dominant part of the waste. Unfortunately, the waste situation today is complicated and is gaining momentum.

Research into the environmental impact of landfills through the analysis of storage and disposal sites for production and consumption waste is being actively pursued worldwide [1-4].

For example, Vladimirov SA, Karchevsky AA (2010) used the survey method of searching for natural landfills, in which the main role of the search is assigned to man. All other work focuses primarily on monitoring and developing measures to reduce and prevent the negative effects of landfills on the atmosphere, surface and groundwater, soil, flora, fauna and, as a consequence, human health.

Purpose To use an innovative approach based on aerial photography from a drone to estimate soil areas under natural landfills. To analyze the condition and composition of natural landfills, to systematize the information received.

Research Methods. The studies were conducted using a drone with a camera installed (Pentax W60 model) with the following settings of a 1 / 2.3 "CCD, shutter when shooting 1 / 5-1 / 320. ISO 50-1600 in Digital SR mode (5 megapixels), Unmanned flight was conducted with the coverage of the object of study by aerial photographs by flying throughout the study area. The height of the drone's flight over the test sites (objects) was in the range of 80 m to 100 m, shooting was carried out under different lighting and cloud conditions. To solve the problems of soil soil determination tours under natural dumps, the drone routes were visually "snail-like" when using a camera (sensor) with GPS, or the like, the route looked like parallel routes along the overlapping object. If a quick shooting result was required, then the route was used in the form of several series of spirals, first from the bottom up, then from top to bottom over the test fields, which eliminates errors in the definition of contours, different angles of the sun and significantly reduce the time of shooting (up to 10 min. per 100 ha). During one round of shooting, DCLA took more than 120-200 shots of one field.

After the shooting, aerial photographs were taken to obtain an orthophoto plan, which reflects a real picture of the vegetation (including agricultural) condition on the field (s) and the location of the soil contours. The images were processed in Agisoft Photoscan software using the following algorithm:

1. Selection of aerial photographs (AZ) to create an orthophoto plan by the basic criterion ¬– Photo axis. If the axis had an angle greater than 100 then (AZ) in the processing process is rejected, because the Brown model incorrectly reproduces similar AZs in the orthophoto plan. When creating an orthophoto plan to address issues of nitrogen fertilization on the field (s), aerial photography was different from another shooting by moving the sensor (aerial camera) over the field area. To get snapshots (the axis of the camera ranges from 0 to 2) across the entire field of the field, the sensor (camera) moved like a spiral in the center of the field, gradually rising and then decreasing to landing.

2. Selected aerial photographs were formed into a block (a series of images). If the images were more than 300 units, then the processing was performed sequentially block by block, without overloading the PC. After selecting and organizing, they carried out the "photo alignment" directly. The need for alignment arises from the need to remove the aberration of the lens of the aerial camera itself. In the case where the shooting was carried out under conditions of continuous or partial cloud, the contrast was enhanced with the help of ErdasImage software. After alignment, received the original scheme, taking into account the directions of shooting the aerial camera. It is important that the resulting images intersect, that is, have common points (pixels) in the two adjacent images

After the model was built, the Processing sequence was selected from the menu. "Texture construction" under the following conditions: parameterization mode: adaptive orthophoto, blending mode selected: mosaic, width and height of atlas: 2048 (pixels). The result was an orthophoto plan of the study object (see Fig. 1)

Research results. The methodological approach that was used to detect and map the natural landfills on an electronic map was implemented on the basis of orthophoto planes obtained from the unmanned aerial vehicle in the Dergachiv district.

The orthophoto plan around each settlement with the help of GIS package (Mapinfo) built circles that had a radius not more than 1 km from the boundary of each settlement, where then again drone flights (UAV - unmanned aerial vehicle) at a lower altitude [5 - 9] (see Fig. 1).

With this apparatus, detailed (planned and perspective) aerial photographs of the landfill site were obtained (5 cm resolution). These snapshots were processed using the ErdasImage analysis suite and the data obtained were recorded in the database.

Fig. 1. UAV flight route (red line)

The database collected quantitative and qualitative characteristics of both the landfill itself and its area, location according to the relief and size, for the purpose of the subsequent calculation of the areas of land alienated under the landfills of this area (Table).

View of the database of natural landfills of Dergachiv district of Kharkiv region (fragment)

ID	Date	Relief	Latitude	Longitude	Size, $м^2$	Volume, $м^3$	Quality composition
84	10.09.2010	Field	50,04639	35,83285	500	50	5200.3
94	10.09.2010	slope	50,04196	35,85004	40	8	5200.3
97	10.09.2010	skirt	50,03787	35,86961	200	30	5200.3
96	10.09.2010	skirt	50,01408	35,84218	6000	20000	5200.3
98	10.09.2010	ravine	50,03139	35,87866	300	40	5200.3
93	10.09.2010	slope	50,0536	35,84845	6000	800	5200.3
91	10.09.2010	slope	50,0542	35,85294	80	20	5200.3
82	10.09.2010	skirt	50,06256	35,83304	2	1	5200.3
87	10.09.2010	slope	50,05349	35,86001	80	10	5200.3
74	09.07.2010	slope	50,07101	35,8717	4000	120	5200.3
75	09.07.2010	slope	50,07066	35,87192	2400	100	5200.3 1413.3
76	09.07.2010	slope	50,07009	35,8724	2500	40	5200.3
77	09.07.2010	slope	50,06965	35,87279	2500	50	5200.3
78	09.07.2010	slope	50,06922	35,87324	600	40	5200.3
79	09.07.2010	slope	50,07285	35,87066	200	10	5200.3
73	09.07.2010	slope	50,07253	35,86917	200	10	5200.3
81	10.09.2010	ravine	50,06651	35,86014	2000	60	5200.3
52	10.09.2010	slope	50,03981	35,94375	4000	20	5200.3
50	10.09.2010	plain	50,0448	35,96452	200	10	5200.3
45	10.09.2010	plain	50,04198	35,97386	60	4	2614;

							5200.3; 2910.1.0.25
17	10.09.2010	plain	50,00569	36,06098	5000	7500	2613.2.9.02; 2210
16	10.09.2010	plain	50,00459	36,06287	2000	2200	1710.2.9.31; 2416.3
22	10.09.2010	slope	50,02109	36,03766	400	40	2665.1.1.01
8	10.09.2010	plain	49,98796	36,08523	60	30	2640.3; 2940.1.1.09

Table 1 does not show several components of the database, namely: the presence of filtrate, landfill replenishment, radioactivity (starvation), organoleptic characteristics (odor,), distance to the settlement, photo fixation of the landfill. Component – The qualitative composition of the landfill was performed using the national waste classifier. Below are some of the original drone images that were used to create the database (a total of over 120,000 images were taken on the territory of Dergachiv district).

a ***b***

Fig. 2. Natural dump of Dergachiv district: a – geographical coordinates of the landfill: 49,985116; 36,100768; b – geographical coordinates of the landfill: 49,987925; 36,083640

After calculating the total area of natural landfills (more than 337 units), it is revealed that the total area under landfills reaches 2.5% of the area of the entire administrative district of Kharkiv region. Of these, clustered soils account for about 0.8%, that is, 0.8% are in landfills and could be used in the treatment of agricultural land of land.

Conclusions

Of the study and prospects for the following research in this area: There is a problem of soil contamination under natural landfills in the Dergachiv administrative district of Kharkiv region, 2.5% of the area is already under natural landfills that could be used as arable land. Almost all natural landfills are located no more than 1 km from the edge of the settlement. Under natural landfills, as a rule, a forest strip, a quarry, a ravine or the edge of a field are used. That is, each of the dumps can be reached by road. The landfills that are equipped do not get from 8-15% of the garbage due to payment for using the landfill services. Garbage is dumped around an official landfill (for example, around 10 landfills occurred around the territory of the Utility Utility Utility Company). According to our own observations, single emissions from natural landfills absorb them for several seasons, and in these cities there is an increased background of phosphorus and potassium in the soil for several years in a row.

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