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LAND ACCOUNTING IN SETTLEMENTS USING REMOTE SENSING AND GIS TECHNOLOGIES

Gulmurodov F.E.
Samarkand State University of Architecture and Construction named after Mirzo Ulugbek,
Department of Geomatic Engineering,
Doctoral student (DSc)
Umarov N.Sh.
Samarkand State University of Architecture and Construction named after Mirzo Ulugbek,
Department of Geomatic Engineering,
Doctoral student (DSc)
Kalandarov M.M.
Samarkand State University of Architecture and Construction named after Mirzo Ulugbek,
Department of Geomatic Engineering,
Researcher

Abstract: This article focuses on improving methods for accounting of land resources in settlements using remote sensing and GIS technologies, conducting state cadastre work, and organizing these processes based on GIS technologies.

Keywords: satellite, geographic information technology, settlements, remote sensing, cadastral maps, and modern geographic information systems.

Currently, the technology for creating high-precision electronic digital maps using extensive space and aerial imagery in the development of geographic information systems across various sectors of our republic's economy has been established. Digital maps with scales ranging from 1:200 to 1:25000 are being created. Additionally, digital maps originally created in various formats are being converted to ArcGIS program formats.

The creation of digital maps in the ArcGIS program, compiled for land management and state land cadastre purposes, as well as for other purposes, occupies a central role.

The advantages of data automation in the land and building cadastre system are as follows:

– development of high-precision maps and plans for land and building

cadastre purposes;

– rapid provision of digital maps of various scales to landowners, land users, and tenants;

– faster map creation process compared to other programs;

– availability of data comparison capabilities;

– creation of centralized geoinformation databases;

– remote editing of digital maps (via internet);

– possibility of direct transfer of maps to GPS devices and electronic tacheometers;

– provision of interactive geoinformation services;

– economic advantages and time savings.

Electronic digital maps of districts in our republic are available in ArcGIS, OAZIS, and PANORAMA programs.

The distribution of the unified state land fund of the Republic of Uzbekistan by land categories is presented in Table 1.

Table 1

Distribution of the land fund by categories

(As of January 1, 2025)

No.	Land fund categories	Total area, thousand ha		Including irrigated lands	
		total	As a percentage	total	As a percentage
1	Agricultural lands	22264.6	50.13	4213.8	9.49
2	Lands of settlements	235.4	0.53	49.7	0.11
3	Lands intended for industry, transport, communications, defense and other purposes	1968.0	4.43	11.7	0.03
4	Lands for environmental protection, health improvement, and	75.5	0.17	0.6	0.001

	recreational purposes				
5	Lands of historical and cultural significance	0.4	0.001	0	0
6	Forest fund lands	8661.2	19.50	29.4	0.07
7	Water fund lands	815.8	1.84	4.5	0.01
8	Reserve lands	10389.4	23.40	1.9	0.004
	Total land:	44410.3	100	4311.6	9.71

According to the data from the "Cadastre Agency" of the Republic of Uzbekistan, as of January 1, 2025, the total land area of settlements in the republic is 235.4 thousand hectares, which constitutes 0.53 percent of the total land area of the republic. The area of irrigated land belonging to settlements in the republic is 49.7 thousand hectares, which is 0.11 percent. Of the total area of cities and villages, 68.6% is arable land, 12.4% is orchards and fruit plantations, and 19.0% is land occupied by buildings.

Currently, there are 3,214 households in the M. Sultanov massif of the Kattaming rural citizens' assembly in the Kattakurgan district of the Samarkand region, and the area of household plots is 653 hectares. Information about the area of household plots belonging to citizens living in the Kipchak village of the Kumak mahalla in the massif is provided.

According to the data in the table cited in the Rural Citizens' Assembly (RCA) land plot book, the land area used by citizens should have been 15.9 hectares. However, as a result of the conducted measurements, the area of land used by rural residents amounted to 23.81 hectares. That is, it was established that the excess land area used by rural residents is 8.12 hectares. Currently, there is a list of 133 citizens who have household plots according to the RCA book. If we conduct a brief analysis of this list, we can observe the following. Citizen Kalaev Suvon is listed as number one in the RCA book. The area of land used by him is indicated as 0.15 hectares. However, the actual land area he is using was found to

be 0.22 hectares. That is, it was determined that this citizen currently has an excess land area of 0.07 hectares.

However, at the same time, it was found that there are citizens who have land plots smaller than those recorded in the RCA book. For example, although the land area belonging to Muhammadiyev Uktam, assigned serial number 5, was 0.15 hectares, it actually amounted to 0.10 hectares. That is, a deficit of 0.05 hectares was observed. The land area belonging to Ortikov Uchkun, listed under serial number 8, was indicated as 0.2 hectares, but in reality, it was 0.17 hectares, that is, 0.03 hectares less.

The same situation can be seen with Buriyev Tolib, cited under number 63, Buriyev Erkin, also cited under number 63, and others.

It was confirmed that the land area of 11 citizens listed with the corresponding number in the QFY matches the information provided in the book.

Figure 1 shows a digital map of household plots of the residents of the "Kipchak" mahalla in the M. Sultanov massif of the Kattaming rural community, Kattakurgan district, Samarkand region, developed using GIS programs. This map displays the boundaries of settlements, the serial number of each household, border descriptions, roads, and irrigation ditches.

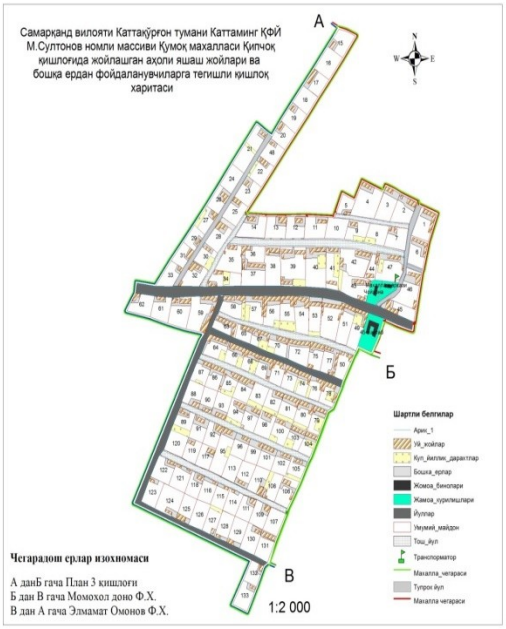

Figure 1. Cadastral map of residential areas

Table 2.

Types of land users in the Kipchak village of the Kumak mahalla, M.

Sultanov massif, Kattaming rural community, Kattakurgan district, Samarkand region

No	Type of land users	Number of land users	Total land area determined by measurement (ha)
1	Families	123	22.15
4	School	1	0.6
3	Teahouse	1	0.1
4	Community center	1	0.09
2	Land plots not used for housing	10	1.66
6	Streets and roads		4.9
7	Irrigation ditches and canals		0.6
	Total		30.1

Table 2 shows the types of land users in the Kipchak village. According to the table data, the village currently has 1 school, 1 teahouse, a mahalla center, land plots not used for housing, streets and roads, irrigation ditches and canals, and a total of 30.1 hectares of land for 123 families.

Table 3

Information on the household plot areas belonging to citizens residing in the Kipchak village of the Kumak mahalla, M. Sultanov massif, Kattaming rural community, Kattakurgan district, Samarkand region.

Description	Cultivated land area determined by measurement (ha)	Residential area determined by measurement (ha)	Perennial trees identified as a result of measurements, ha	Other lands identified as a result of measurements, ha	Total land area identified as a result of measurements, ha	Land area used by citizens, ha	Difference, +-
Total land area of household plots, ha	17.45	2.77	1.22	2.37	23.81	15.69	8.12

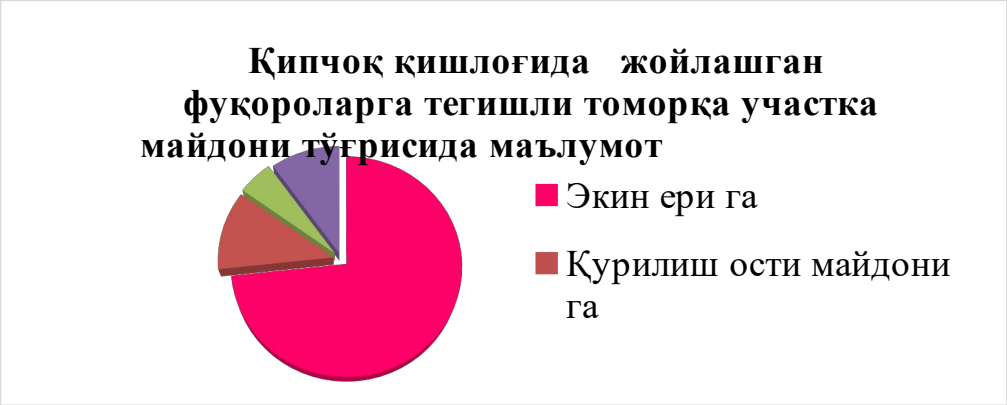

Figure 2. Household plot area of Kipchak village

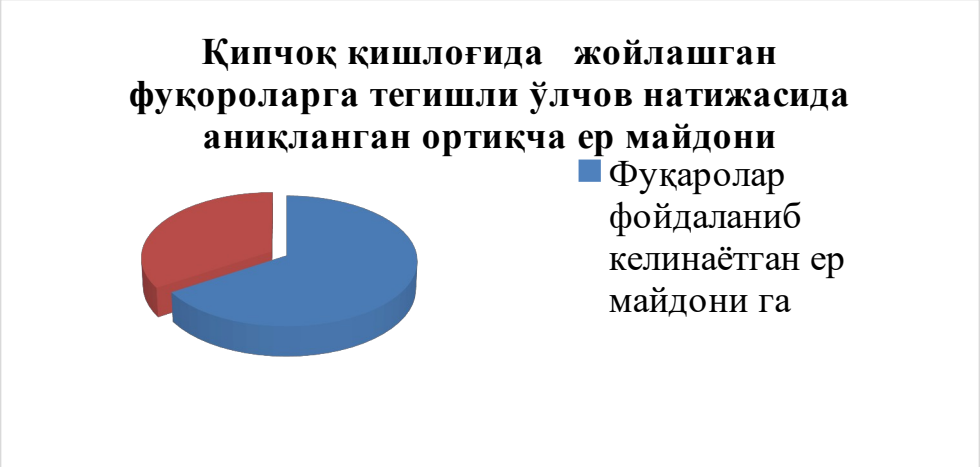

Figure 3. Excess land area identified as a result of measuring the household plot area in Kipchak village

Table 2 and Figures 2-3 provide information on the area of household plots belonging to citizens located in Kipchak village of Kumak mahalla, M. Sultanov massif, Kattaming rural community, Kattakurgan district, Samarkand region.

Cultivated land identified as a result of measurements: 17.45 ha (73%)

Houses identified as a result of measurements: 2.72 ha (12%) Appendix 2

Trees identified as a result of measurements: 1.22 ha (5%) Appendix 3

Other lands identified as a result of measurements: 2.32 ha (10%) Appendix 4

Total land area identified as a result of measurements: 23.81 ha (100%)

Land area used by citizens: 15.69 ha (66%)

Difference: +- 8.12 ha (34%)

Table 4

Information on the area of household plots belonging to citizens not used as housing in Kipchak village

Serial number	Last name and first name	Serial number in QFY book	Cultivated land identified as a result of measurements, ha	Houses identified as a result of measurements, ha	Perennial trees identified as a result of measurements, ha	Other lands identified as a result of measurements, ha	Total land area identified as a result of measurements, ha
1	Ortikov Uchkun	1814	0.14		0.03		0.17
2	Toshpulatov Jurabek	1815	0.18				0.18
3	Ubaydov Feruzjon		0.20				0.2
4	Ruzibaev Asad	1825a	0.16				0.16
5	Buriev Jonibek	1910a	0.15				0.15
6	Daminov Shakhzod	1931	0.12		0.03		0.15
7	Mukhammadiev Bakhtiyor	1831	0.16				0.16
8	Shodiev Khasan	1945	0.15				0.15
9	Omonov Zohid	1948	0.17				0.17
10	Turdiev Shukhrat		0.17				0.17
Total land area of household plots in hectares			1.60	0.00	0.06	0.00	1.66

Figure 4. The area of household plots belonging to citizens not used as housing in the village of Kipchak

Table 4 and Figure 4 provide information on the area of household plots belonging to citizens not used as housing in the village of Kipchak. In the village of Kipchak, 10 owners of household plots are not using the land allocated for

individual construction as housing; their total land area is 1.66 ha (7%).

Table 5 Information on the area of household plots belonging to citizens not included in the citizens' assembly list in the village of Kipchak

Serial number	Last name and first name	Cultivated land, determined by measurement, ha	Houses identified as a result of measurements, ha	Perennial trees, identified as a result of measurements, ha	Other lands identified as a result of measurements, ha	Total land area determined as a result of measurements, ha
1	Buriev Jakhongir	0.15	0.01		0.02	0.18
2	Ubaidov Feruzjon	0.20				0.2
3	Kalaev Bekmurod	0.14	0.01		0.02	0.17
4	Kalaev Buyod	0.13	0.01		0.01	0.15
5	Buriev Elyor	0.23	0.01	0.02	0.02	0.28
6	Salimov Sherali	0.15	0.01		0.01	0.17
7	Toshpulatov Orif	0.23	0.01		0.02	0.26
8	Soliev Shukhrat	0.12	0.02		0.01	0.15
9	Turdiev Shukhrat	0.17				0.17
10	Normurodov Alibek	0.11	0.01	0.02	0.01	0.15
11	Islomov Nodir	0.14	0.01		0.01	0.16
12	Toshtemirov Mirjalol	0.16	0.01		0.01	0.18
13	Bobokulov Islom	0.14	0.03		0.01	0.18
14	Usmonov Sarvar	0.11	0.01		0.01	0.13
15	Muhammadiev Egamberdi	0.15	0.01		0.01	0.17
Total land area of household plots (ha)		2.33	0.16	0.04	0.17	2.7

Figure 5. The area of household plots belonging to citizens not included in the Citizens' Assembly list in the village of Qipchaq

Table 5 and Figure 5 provide information on the area of household plots belonging to citizens not included in the Citizens' Assembly list in the village of Qipchaq. Based on this, it was established that in Qipchaq village, land plots belonging to 15 citizens are not listed at all, and these citizens have not been paying land and property taxes. It was determined that the total land area used by these citizens is 2.7 ha, which is 11.3% of the total.

Thus, according to the records of the Qipchaq Rural Citizens' Assembly of Kattaqo'rg'on district, the land area of residential settlements is indicated as 15.69 hectares, while our research revealed it to be 23.81 hectares. The difference is 8.12 hectares. Taking Kattaqo'rg'on district as an example, when we calculated the residential land area in the records of the village citizens' assemblies and mahalla citizens' assemblies, it amounted to 5760 hectares. If we conduct inspections of residential land plots in Kattaqo'rg'on district, it was found that an additional 2,980.96 hectares of land could potentially be discovered.

In conclusion, the results obtained during the study reveal that, due to the boundaries between residential properties in the Kipchak village not being clearly marked on the map, the actual dimensions of residential yards differ on average by 6 sotix from the data entered in the cadastral book for each household. As a result, while the cadastral data of Kipchak village reflected the area of residential buildings as 15.69 hectares in reports, in reality, the area of residential buildings

was found to be 23.81 hectares. Consequently, every year the state tax authorities have been deprived of the opportunity to collect taxes on 8.12 hectares of land from houses in the village area. Of course, my goal was not to verify the correct collection of land tax. Primarily, this pilot experiment was intended to test the possibility of accurately defining residential area boundaries, which could be applied for remote landscaping of the village territory, laying electricity lines, and organizing work based on public-private partnerships. This would allow for correct determination of the work area for each household and help prevent potential disputes over residential property boundaries. The results revealed that this could bring even greater economic benefits for society than I had anticipated.

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