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THE STUDY OF THE CURRENT STATE OF THE SOIL COVER OF THE AKSHAT RURAL COUNTY OF WEST KAZAKHSTAN REGION ON THE BASIS OF GIS TECHNOLOGIES

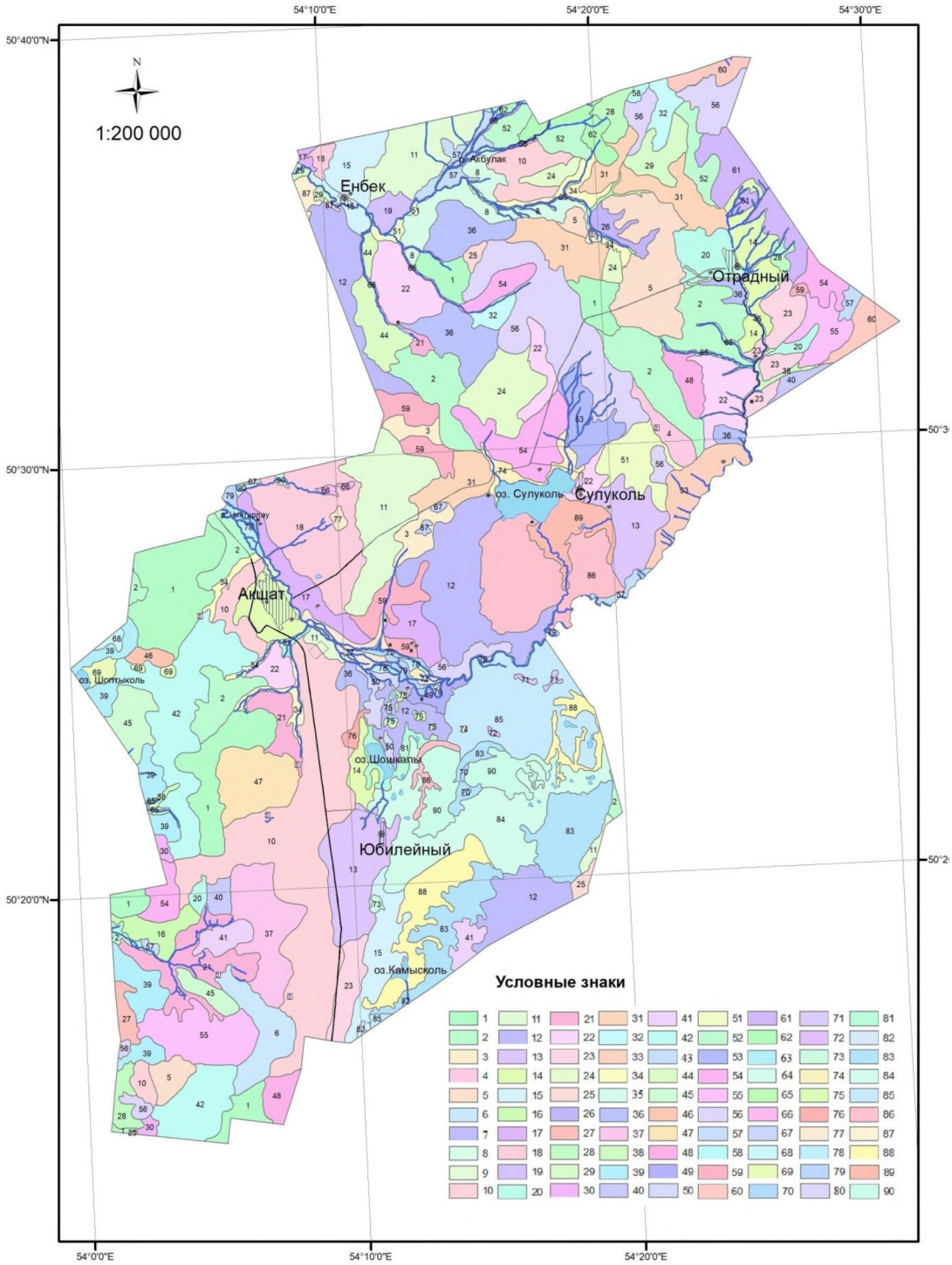
Abstract. The rational use and protection of soils in market conditions requires adequate application of new scientific and methodological approaches. One of such systematic-analytical methods of soil cadastre organizations is a combination of traditional terrestrial methods with technologies of geoinformation systems (GIS) based on extensive use of satellite images in different resolutions. The aggregate of information necessary for mapping soil cover patterns and their quantification has been described in GIS databases. Data integration has been realized through the spatial and attributive component in the form of: the results of topographic and thematic maps. At the same time, the creation of attributive GIS databases involves the digitization of thematic maps tied into a single cartographic projection (as a topographic map with a scale of 1: 50 000). As a result of the study, thematic maps and attributive databases of GIS of soils were formed. As a result of research, based on GIS technology, a digital soil map of the Akshat rural county of the Chingirlau district of the West Kazakhstan region has been developed using the ArcGIS software product.

Key words: geoinformation systems, soil cover, soil map, dark chestnut soils, rural county.

Introduction. Soils are an important component of the natural and biological resources of any country and they determine the socio-economic wealth of the country and greatly affect on the political relations. Thus, soil is considered as the most important part of the natural environment, characterized by certain natural (space, vegetation, etc.), socio-economic (means of production, value, etc.), production (subject, tool and means of production,) characteristics. Complete and reliable information on soils, including their quantitative and qualitative characteristics, should provide an opportunity for the executive authorities to make informed decisions on the development of specific territories and the country as a whole. Therefore, the need for objective and systematized information about the country's soil resources is constantly growing. The latter necessitates the need to create a fundamentally different system of accounting, assessment and monitoring of soil resources, different from the management of other types of material resources.

Rational use and protection of soils in market conditions requires adequate application of new scientific and methodological approaches. One of such systematic-analytical methods of soil cadastre organizations is a combination of traditional terrestrial methods with technologies of geoinformation systems (GIS) based on extensive use of satellite images in different resolutions. This approach underlies the agrarian geo-information systems of the developed countries of the world [1-3], where soils are the main subsystem of this information product. The development of scientific research in this area corresponds to the requirements of the State Program on Forced Industrial and Innovative Development of the Republic of Kazakhstan and the Program for the Development of Space Activities in the Republic of Kazakhstan.

Experimental. The aim of research is to study the soil cover and develop a soil map of the Akshat (Lubenka) rural county of the Chingirlau district of the West Kazakhstan region on the basis of applying GIS technologies for solving long-term problems of monitoring land resources and developing the agro-bioindustry.



Soil map of Akshat rural district in West Kazakhstan region

Materials and methods. In order to conduct large-scale soil research, it has been adhered to the relevant guidelines [4,5]. Physico-chemical parameters of soils were studied by conventional methods

[6-10]. For topographical and geodetic work, paper soil maps of different scale have been applied, ranging from 1-100 000 to 1:50 000 (for searching and selecting reference areas). The development of a large-scale soil map using GIS-technologies was carried out on the basis of the ArcGIS software product using scanned paper maps and aerial photographs.

Results and discussion. In the study area, we carried out soil cover studies based on the geosystemic approach and new information technologies (figure). In this systematic description, the soil subdivisions that we encountered in the territory of the Akshat rural county of the Chingirlau district of the West Kazakhstan region were identified.

Detailed diagnostic indicators have been given for the most common soil varieties within the study area. Specific morphological genetic features of the soil cover are indicated, based on the available data of field research and cameral processing. In the study area, dark chestnut soils are formed in the soil cover in combination with various soil combinations. They are formed in the conditions of the dry steppe zone, with the non-wash type of water regime, under the haymooth, meadow-grass, herbaceous-fat-grass, black-wormwood-meadow and meadow-white-wormwood-kokpekovic plant communities, on loesslike loams.

A soil map has been created on the basis of a fragment of a substrate of a soil map and a photographic plan and has been produced using ArcGIS. While creating the soil map for mapping the soil layer, attribute tables are used. While creating the same neighboring soil areas and generally with the further process of creating a soil map, it is needed to use the auto-polygon tool.

Figure illustrates the soil map of the Akshat rural county of the Chingirlau district of the West Kazakhstan region, which has been created using the above-described technique based on scanned soil maps.

The aggregate of information necessary for mapping soil cover patterns and their quantification has been described in GIS databases. Data integration has been realized through the spatial and attributive component in the form of: the results of topographic and thematic maps. At the same time, the creation of attributive GIS databases involves the digitization of thematic maps tied into a single cartographic projection (as a topographic map of scale 1: 25000). As a result of the study, thematic maps and attributive databases of GIS of soils were formed.

Legend to the soil map of the Akshat rural county

Soil No	Mechanical composition (soil texture)	Soil name
1	2	3
1	medium loamy	dark castanosems medium power
2	light loamy	dark castanosems medium power
3	sandy	dark castanosems medium power
4	heavy loamy	dark castanosems medium power with dark castanosems medium hardy saline low thin 10-30%
5	heavy loamy	dark castanosems medium power with meadow-castanosems medium heavy 10-30%
6	medium loamy	dark castanosems medium power with solonetz castanosems small 10-30%
7	sandy loam	dark castanosems medium power with solonetz castanosems small 10-30%
8	heavy loamy	dark castanosems medium power with solonetz castanosems small 30-50%
9	sandy loam	dark castanosems medium power with solonetz castanosems small 30-50%
10	light loamy	dark castanosems thin
11	sandy loam	dark castanosems thin
12	sandy	dark castanosems thin
13	light loam	dark castanosems thin with dark castanosems weakly-deflated 10-30%
14	sandy loam	dark castanosems thin with dark castanosems weakly-deflated 10-30%
15	sandy	dark castanosems thin with dark castanosems weakly-deflated 10-30%
16	light loamy	dark castanosems thin weakly chasteed with dark castanosems carbonate weakly washed away weakly debilitated 10-30%
17	sandy	dark castanosems thin with dark castanosems under-developed 10-30%

Table continuation

1	2	3
18	sandy	dark castanosems thin with meadow-castanosems medium power 10-30%
19	sandy loam	dark castanosems thin with with solonetza castanosems small 10-30%
20	light loam	dark castanosems weakly washed away
21	medium loamy	dark castanosems weakly washed away with meadow-castanosems medium duty 10-30%
22	light loamy	dark castanosems weakly washed away with meadow-castanosems medium power 10-30%
23	sandy loam	dark castanosems backlash
24	heavy loamy	dark castanosems carbonate medium power
25	medium loamy	dark castanosems carbonate medium power
26	light loamy	dark castanosems carbonate medium power weakly debilitated with dark castanosems weakly washed away 10-30%
27	medium loamy	dark castanosems carbonate medium power weakly debilitated with meadow-castanosems medium power 10-30%
28	medium loamy	dark castanosems carbonate thin
29	light loamy	dark castanosems carbonate thin weakly debilitated with dark castanosems carbonate weakly washed away weakly debilitated 10-30%
30	heavy loamy	dark castanosems carbonate thin weakly debilitated with dark castanosems undeveloped medium protective 10-30%
31	medium loamy	dark castanosems carbonate weakly washed away
32	heavy loamy	dark castanosems carbonate weakly washed away with dark castanosems undeveloped weakly debilitated 10-30%
33	sandy loam	dark castanosems carbonate weakly washed away with dark castanosems medium washed 10-30%
34	medium loamy	dark castanosems carbonate weakly washed away with dark castanosems medium washed 10-30% and meadow-castanosems medium washed 10-30%
35	heavy loamy	dark castanosems carbonate weakly washed away with meadow-castanosems medium washed 10-30%
36	light loamy	dark castanosems carbonate weakly washed away with solonetz castanosems small 10-30% and meadow-castanosems medium power to 10%
37	sandy loam	dark castanosems carbonate weakly-deflated with dark castanosems weakly-deflated 10-30%
38	medium loamy	dark castanosems carbonate-solonchak weakly washed away with dark castanosems medium washed
39	medium loamy	dark castanosems slightly salted medium power
40	light loamy	dark castanosems slightly salted medium power
41	sandy loam	dark castanosems slightly salted medium power
42	medium loamy	dark castanosems slightly salted medium power with dark castanosems solonchak medium power 10-30%
43	medium loamy	dark castanosems slightly salted medium power with solonetz castanosems small 10-30%
44	sandy loam	dark castanosems slightly salted thin with dark castanosems weakly-deflated10-30%
45	medium loamy	dark castanosems slightly salted medium power with solonetz castanosems small 10-30%
46	heavy loamy	dark castanosems solonchak medium power
47	medium loamy	dark castanosems solonchak medium power
48	light loamy	dark castanosems solonchak medium power
49	sandy loam	dark castanosems solonchak thin with meadow castanosems solonchak 10-30%
50	sandy loam	dark castanosems solonchak thin with typical solonchak 10-30%
51	heavy loamy	dark castanosems incompletely developed medium protective
52	light loamy	dark castanosems incompletely developed weakly debilitated
53	light loamy	dark castanosems incompletely developed medium protective with dark castanosems underdeveloped medium protective 10-30%
54	heavy loamy	dark castanosems incompletely developed medium protective with dark castanosems underdeveloped medium protective 30-50%
55	light loamy	dark castanosems incompletely developed weakly debilitated with dark castanosems underdeveloped medium protective

End of table

1	2	3
56	light loamy	dark castanosems underdeveloped medium protective
57	heavy loamy	dark castanosems underdeveloped medium protective
58	medium loamy	dark castanosems underdeveloped medium protective
59	sandy loam	dark castanosems underdeveloped
60	heavy loamy	dark castanosems underdeveloped medium protective with dark castanosems incompletely developed 10-30%
61	medium loamy	dark castanosems underdeveloped medium protective with dark castanosems incompletely developed 10-30%
62	heavy loamy	dark castanosems underdeveloped medium protective with exits solid rocks 10-30%
63	medium loamy	castanosems medium power with solonetz castanosems small to 10%
64	medium loamy	castanosems medium power with solonetz castanosems small 30-50%
65	heavy loamy	meadow-castanosems medium power
66	medium loamy	meadow-castanosems medium power
67	sandy	meadow-castanosems medium power
68	medium loamy	meadow-castanosems mid-solonetz-solonchak
69	light loamy	meadow castanosems
70	sandy loam	meadow castanosems
71	sandy	meadow castanosems
72	sandy loam	meadow-castanosems weakly solonetz
73	light loamy	meadow-castanosems mid-solonetz-solonchak
74	light loamy	meadow-castanosems solonchak
75	heavy loamy	meadow-castanosems solonchak
76	medium loamy	meadow-castanosems solonchak
77	light loamy	meadow-castanosems solonchak
78	light loamy	floodplain meadow castanosems solonchak
79	heavy loamy	floodplain meadow castanosems solonchak
80	heavy loamy	solonetz castanosems small with meadow-castanosems medium power 10-30%
81	sandy loam	typical solonchak (salt flats)
82	sandy loam	sor solonchaks
83	sandy	flat sands fixed with sands ridge-hilly fixed 10-30%
84	sandy	flat sands fixed with sands ridge-hilly semi-fixed 10-30% and meadow castanosems solanchak to 10%
85	sandy	flat sands fixed with sands ridge-hilly semi-fixed 10-30% and meadow castanosems to 10%
86	sandy	flat sands fixed with sands ridge-hilly fixed 10-30% and sands ridge-hilly semi-fixed to 10%
87	sandy	sands ridge-hilly fixed
88	sandy	sands ridge-hilly fixed with sands ridge-hilly semi-fixed 10-30% пески грядово-бугристые закрепленные с песками грядово-бугристыми полузакрепленными до 10-30%
89	sandy	sands ridge-hilly semi-fixed with sands ridge-hilly fixed 30-50%
90	sandy	sands ridge-hilly semi-fixed with sands ridge-hilly fixed 10-30% and meadow castanosems strongly solonetz-solonchak (salted-saline) to 10%

Conclusion. Therefore, as a result of conducted studies the mapping of the soil cover has been carried out using traditional terrestrial methods with geographic information system technologies (ArcGIS) based on extensive use of satellite images in different resolutions. This has allowed us to characterize the soil combinations by their belonging to a certain genetic-geometric form, the conditions of occurrence in the relief, and the quantitative indices.

In order to improve the quality of generalized maps (regional, provincial and other), it is necessary to create objective automated methods of generalizing maps in the digital environment.

As a result of our research, we have developed a simple and at the same time practically accessible to a wide audience of GIS users the methodology for compiling a digital soil map using the ArcGIS software product. To compile a map, it is possible to use any scanned cartographic basics, photographic plans, and if there are other raster materials. And as evidence of efficiency, with its help a large-scale soil map of Chingirlau region of the West Kazakhstan region was created.

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ГАЖ-ТЕХНОЛОГИЯСЫН ҚОЛДАНУ АРҚЫЛЫ БАТЫС ҚАЗАҚСТАН ОБЛЫСЫ ШЫҢҒЫРЛАУ АУДАНЫ АҚШАТ АУЫЛДЫҚ ОКРУГІ ТОПЫРАҚ ЖАМЫЛҒЫСЫНЫҢ ҚАЗІРГІ ЖАҒДАЙЫ

Аннотация. Жұмыс топырақ құнарлылығын сақтау мен жақсартуға арналған, өйткені оның жағдайы жер ресурстарын тиімді пайдалану, өнімділікті арттыру және ауылшаруашылығы ландшафтының топырақ экологиясын жақсарту жалпы мәселесінің негізгі бөлігі болып саналады. Топырақты заманауи бағалау мемлекет пен қоғамның дамуы үшін маңызды, өйткені географиялық таралуды есепке алу топырақ құндылығы, ұтымды пайдалану, сақтау және топырақты пайдалануды жоспарлау туралы ақпарат береді.

Нарық жағдайында топырақты тиімді пайдалану және қорғау жаңа ғылыми-әдістемелік тәсілдерді барабар қолдануды талап етеді. Топырақ кадастрын ұйымдастырудың осындай жүйелік-аналитикалық әдістерінің бірі түрлі рұқсаттағы аэроғарыш суреттерін кеңінен қолдануға негізделген дәстүрлі жердегі әдістерді геоақпараттық жүйе (ГАЖ) технологияларымен үйлестіру болып есептеледі.

Оқу аймағында геожүйелік көзқарас пен жаңа ақпараттық технология негізінде топырақ жамылғысын зерттеуді жүргіздік. Бұл жүйелі сипаттамада Батыс Қазақстан облысы Шыңғырлау ауданы Ақшат ауылдық округі аумағынан біз тапқан топырақ бөлімдері ерекшеленеді.

Топырақ жамылғысы құрылымдарын картаға түсіру мен сандық анықтауға қажетті ақпарат жиынтығы ГАЖ мәліметтер базасында сипатталған. Мәліметтерді интеграциялау кеңістіктік және атрибутивті компонент арқылы топографиялық және тақырыптық карта нәтижелері түрінде жүзеге асырылады. Сонымен бірге ГАЖ-ның атрибутивті мәліметтер базасын құру бір картографиялық проекциямен байланысқан тақырыптық карталарды цифрландыруға болжам жасайды (бұл масштабы 1: 50000 топографиялық карта болған).

Осылайша жүргізілген зерттеу нәтижесінде түрлі қабаттағы аэроғарыштық суреттерді кеңінен қолдануға негізделген географиялық ақпараттық жүйе (ArcGIS) технологияларымен дәстүрлі жер әдістерін қолдану арқылы топырақ жамылғысының картасы жасалды. Бұл топырақ комбинацияларын белгілі бір генетикалық-геометриялық пішінге, рельефте пайда болу шартына және сандық көрсеткіштерге жатқызылу жағдайына қарай сипаттауға мүмкіндік берді.

Жұмыс нәтижесінде тақырыптық карталар және ГАЖ – топырақтың атрибутивті мәліметтер базасы құрылды. ГАЖ технологиялары негізінде жүргізілген зерттеулер нәтижесінде ArcGIS бағдарламалық өнім арқылы Батыс Қазақстан облысы Шыңғырлау ауданы Ақшат ауылдық округінің цифрлық топырақ картасы жасалды.

Түйін сөздер: географиялық ақпараттық жүйелер, топырақ жамылғысы, топырақ картасы, қара қоңыр топырақ, ауылдық округ.

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СОВРЕМЕННОЕ СОСТОЯНИЕ ПОЧВЕННОГО ПОКРОВА АКШАТСКОГО СЕЛЬСКОГО ОКРУГА ЗАПАДНО-КАЗАХСТАНСКОЙ ОБЛАСТИ НА ОСНОВЕ ПРИМЕНЕНИЯ ГИС-ТЕХНОЛОГИЙ

Аннотация. Данная работа посвящена сохранению и повышению плодородия почв, т.к. ее состояние является основной частью общей проблемы рационального использования земельных ресурсов, увеличения продуктивности и улучшения почвенной экологии агроландшафтов. Современная оценка почв является актуальной для развития государства и общества т.к. обеспечивает информацией об учете географического распределения, о стоимости почв, о рациональном использовании, об охране и планировании использования почв.

Рациональное использование и охрана почв в рыночных условиях требует адекватного применения новых научно-методических подходов. Одним из таких системно-аналитических способов организации почвенного кадастра является сочетание традиционных наземных методов с технологиями геоинформационных систем (ГИС) на базе широкого использования аэрокосмических изображений разного разрешения.

На исследуемой территории нами проведены исследования почвенного покрова на основе геосистемного подхода и новых информационных технологий. В настоящем систематическом описании выделены почвенные подразделения, которые были встречены нами на территории Акшатского сельского округа Чингирлауского района Западно-Казахстанской области.

Совокупность информации, необходимой для картографирования структур почвенного покрова и их количественной оценки, описывается в базах данных ГИС. Интеграция данных реализуется через пространственную и атрибутивную составляющую в виде результатов топографической и тематических карт. При этом создание атрибутивных баз данных ГИС предполагает оцифровку тематических карт, привязанных в единой картографической проекции (в качестве которой служила топографическая карта масштаба 1:50000).

Таким образом, в результате проведенных исследований выполнено картографирование почвенного покрова с привлечением традиционных наземных методов с технологиями геоинформационных систем (ArcGIS) на базе широкого использования аэрокосмических изображений разного разрешения. Это позволило охарактеризовать почвенные комбинации по их принадлежности к определенной генетико-геометрической форме, условиям залегания в рельефе, количественным показателям.

В результате работы сформированы тематические карты и атрибутивные базы данных ГИС – почв. В результате исследований на основе ГИС-технологий разработана цифровая почвенная карта Акшатского сельского округа Чингирлауского района Западно-Казахстанской области с помощью программного продукта ArcGIS.

Ключевые слова: геоинформационные системы, почвенный покров, почвенная карта, темно-каштановые почвы, сельский округ.

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