HYDROMODULE OF IRRIGATED LAND OF THE SOUTHERN DISTRICTS OF THE REPUBLIC OF KARAKALPAKSTAN USING THE GEOGRAPHICAL INFORMATION SYSTEM CREATION OF REGIONAL MAPS

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Abstract: ***The problem of global climate change is relevant to the human agenda, not only because of the average annual temperature rise on the planet, but also because of changes in the entire geosystem, rising global oceans, melting ice and permanent glaciers, increasing uneven rainfall, changing river flow regimes and climate instability. other changes involved.The article presents the results of scientific research on hydromodular zoning of irrigated lands of Khorezm oasis and scientifically based irrigation regimes for cotton in the main hydromodular regions of Khorezm oasis and study of soil and hydrogeological conditions of the oasis, new hydromod Inclusion of observation wells for monitoring of groundwater level and mineralization dynamics in ArcGIS program, interpolation of groundwater surface, creation of electronic digital map of soil mechanical composition, hydromodule using raster calculation panel based on groundwater level and soil mechanical composition information on the formation of the zoning layer.***

Keywords: Hydromodule zoning, cotton, irrigation schedule, irrigated lands, irrigation period, groundwater, soil mechanical composition, ArcGIS software, GAT, electronic digital map.

Introduction. Many researchers: V.P.Kippen, R.Tsimmerman, L.A. Molchanov, RI Abolin, GT Smolyanikov were engaged in climatic zoning of Central Asia and some of its regions for the purpose of agricultural planning. The issue of zoning was discussed by prof.N.A. Yanishevsky, then V.M.Legostaev, S.P. Suchkov, S.N.Ryjov and B.F.Fedorov performed

These researchers divided the southern regions of Central Asia and the Republic of Kazakhstan into three: northern, central and southern climatic zones.

The northern climate zone is characterized by the following indicators: average annual air temperature 12.5; vegetation period is 200 days, in July the temperature does not exceed 25-26; From April 1 to October 1, the sum of temperatures does not exceed 3800-3900; evaporation does not exceed 1500 mm throughout the year

Due to the short growing season, early ripening cotton and other agricultural crops are grown in this zone. This zone includes the northern regions of the Republic of Uzbekistan and the southern regions of the Republic of Kazakhstan (Aris river basin, Syrdarya and Karatov foothills).

The central climate zone is characterized by the following indicators: vegetation period 200-215 days; temperature sum 4000-4200 from April 1 to October 1; average annual air temperature 12.5-13.5; year-round evaporation 1500-1600mm; The average temperature in July is 26-28.

This zone is the main cotton growing zone.

This zone includes Chirchik, Akhangaron, Keles river basins, Mirzachul, Chordara, Dalverzin deserts, Fergana valley, upper part of Kashkadarya basin (except for 1000 m above sea level) and other regions, the lower reaches of the Amu Darya - from Darganota to Nukus. The Central Climate Zone also includes the regions of Tajikistan and the southern part of the Republic of Turkmenistan at an altitude of 1000 m above sea level.

The southern climate zone is characterized by the following indicators: growing season 230-240 days; temperature sum 4100-4200 from April 1 to October 1; average annual air temperature 14.5 and above; in the hottest July, the average air temperature reaches 31.3-32.4 (Termez, Sherabad); Evaporation in this zone is particularly strong, at 1750-2000 mm per year. This indicates that the air temperature is high enough at other times of the growing season. This zone includes the plain part of Bukhara and Surkhandarya regions (mostly southern districts), the basin of the Kofirnikhan River, the Gissar valley, the basins of the Murgab and Tajen rivers, and the basin of small rivers from Kopetdag.

S.N.Ryjov [6; 7] When zoning the Fergana valley, he divided a part of the territory into the fourth zone and named this zone as the cotton-free zone. Areas of this zone are located in the upper part of the valley, where temperatures are low and precipitation is low.

The three zones and the fourth non-cotton zone are divided into 10 hydromodule zones, taking into account climatic conditions, mechanical composition and water-physical properties of soils, productivity, depth of groundwater, etc. For each hydromodule region, depending on the type of crop, irrigation scheme, seasonal irrigation rate, irrigation norms and irrigation periods are determined.

Hydromodular region is a part of the soil-ameliorative area, the proximity of soil thickness, mechanical composition, their location in the aeration zone, water-physical properties, groundwater level, the order of irrigation of agricultural crops in general and the ordinate of hydromodule. characterized by proximity.

Depending on the lithological composition of the soil-forming rock and the hydromorphology associated with the depth of groundwater, soils are grouped into 9 hydromodule regions, the description of which (S.N.Ryjov and N.F.Bespalov [6; 7]) is given in Table 1.

Hydromodule zoning table

Hydromodule district number	Soil condition	Groundwater level, m
	Automorphic soils	
I	Low-lying sand and thick-layered sand on top of sand-gravel.	>3,0
II	Medium-layered sand and thick sand and light sand,	-»-
III	located on the sand-gravel	-»-
	Thick medium and heavy sand and muddy	
IV	Semi-automorphic soils.	
	Sand, medium and low thickness layered sand and	2-3
V	clay.	-»-
	Light and medium sand, a layer of heavy sand that	
VI	lightens down.	-»-
	Heavy sand, clayey, layered with the same layer and	
VII	different mechanical composition.	1-2
	Hydromorphic soils.	
VIII	Sandy and sandy, low and medium thickness layered sand and clay.	-»-
IX	Light and medium sand, single-layer, heavy sand that loosens down.	-»-
	Heavy sand and clay, layered with the same layer, different mechanical composition.	

Scientific research. Hydromodular zoning of irrigated lands of southern districts of the Republic of Karakalpakstan, irrigation procedures for basic agricultural crops were developed in 1982 by NF Bespalov and others (former UzPITI). [8] used to determine water consumption and develop water use plans.

During the years of independence, the water use system in our country has changed radically. Previously, in the Khorezm oasis, water intake from rivers was stopped in September, and canals and ditches were inspected and repaired before the start of saline washing. Currently, as a result of the use of cotton-autumn wheat rotation system, irrigation networks are working continuously throughout the year. The load on the collector-drainage networks has greatly increased. These, in turn, affect the process of soil formation in the Khorezm oasis, where there is an increase in the area of hydromorphic soils. Therefore, the research work developed in the 80s to address changes in the hydromodular zoning of irrigated lands of the Khorezm oasis, the distribution of irrigated lands by hydromodule regions and the definition of scientifically based irrigation regimes for cotton in each hydromodule region is climate change. is relevant in the context of increasing water scarcity.

Today, there are no maps that clearly show the boundaries of hydromodular areas. [3] Within the framework of this project, using modern GAT technology, maps of hydromodular areas of Khorezm oasis districts will be created, operative changes will be made to these maps based on the groundwater level data received by reclamation expeditions every 10 days, and irrigation procedures will be clarified.

Irrigated lands of southern districts of the Republic of Karakalpakstan were analyzed according to the data of regional (Republican) reclamation expeditions under the Lower Amudarya and Chapkirgak Amudarya Basin Departments. [14; 15] It used a map of the administrative territories of the region and districts (scale 1: 50000) and observation wells of the expedition included in it. Data from soil-lithological sections from the "passport" of observation wells and average perennial indicators of groundwater level during the growing season for each observation well of reclamation expeditions were entered into the software as a vector to create a hydromodule zoning map in ArcGIS software (Figure 1).

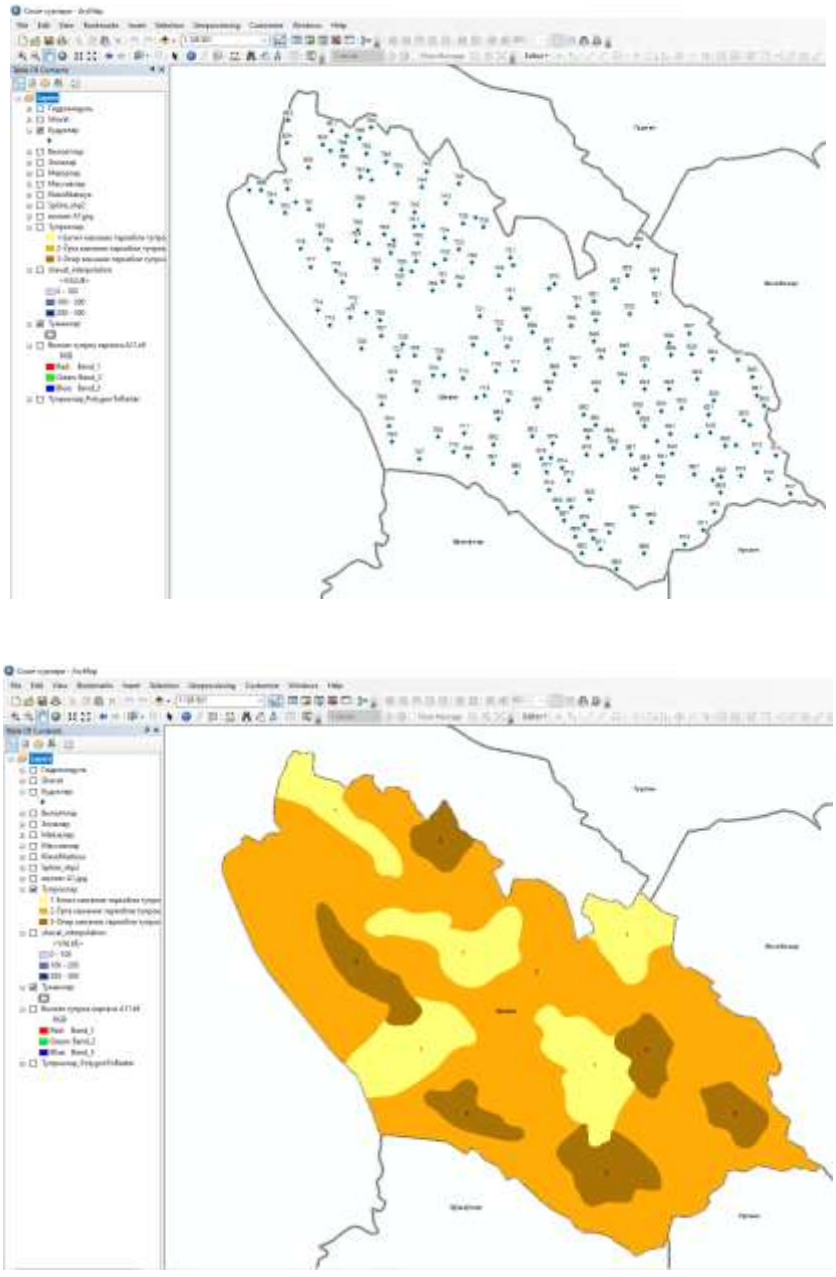

Figure 1. Working with vector layers in ArcGIS.
a) thematic layer of wells monitoring groundwater
b) thematic layer of mechanical composition of soils

Based on the groundwater level detected in the observation wells, IDW analysis was performed by interpolation using the software's ArcToolbox panel. [3] In the IDW analysis,

the groundwater level and interval height determined in the observation wells were determined. As a result, the location of groundwater on demand is visualized (Figure 2).

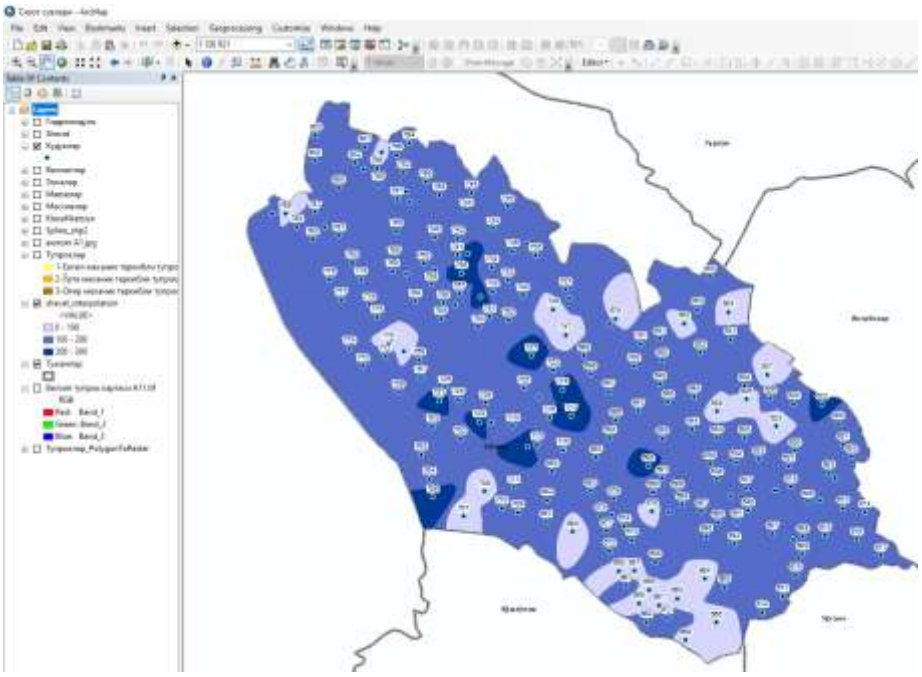

Figure 2. IDW analysis of groundwater

Thematic layers with a vector appearance called the mechanical composition of the soils are required to be rasterized in order to carry out the analysis. This was done using the command to convert (export) vector layers with a field view in the ArcToolbox panel to a raster format unit (Figure 3). [3]

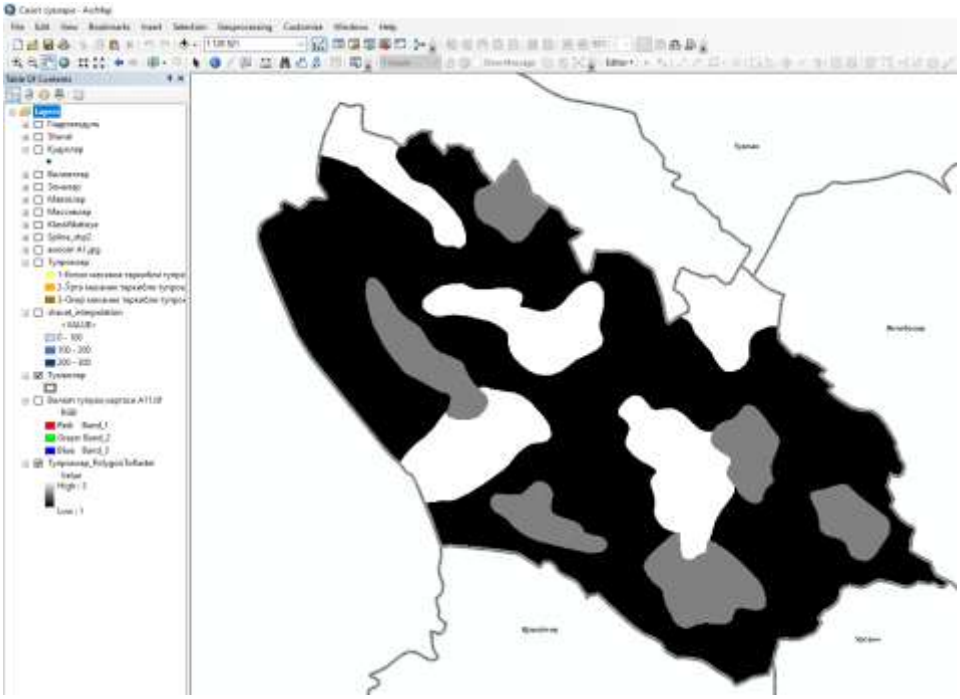

Figure 3. Mechanical composition of soils in raster form

Once the above steps are completed, it will be possible to create a hydromodule zoning map. To do this, using a raster calculator, a classification based on the location of

groundwater according to the mechanical composition of the soils is developed, as in Table 1, and the processes are algorithmized (Table 2).

Existing hydromodule regions in Khorezm oasis classification and algorithm

Quality classification	Soil condition	Ground water
IV	sand, medium to fine bedded sand and clay	2-3 meters
V	light to medium sand, a layer of heavy sand that brightens	2-3 meters
VI	heavy sand, clayey, homogeneous layered sand of mechanical composition	2-3 meters
VII	sandy-loamy, slightly bedded and medium sandy-clayey	1-2 метра
VIII	light to medium sand, a layer of heavy sand that loosens	1-2 метра
IX	heavy sand and clay, homogeneous layer, layered with different texture	1-2 метра

The algorithm uses the formula "*Con ((((" shavat_interpolation "> = 200) & (" shavat_interpolation "<= 300) & (" Soils_PolygonToRaster "== 1)), 1,0)".* In this formula, the groundwater level and the mechanical composition of the soils vary according to the conditions of the soil class analysis. (Figure 4)

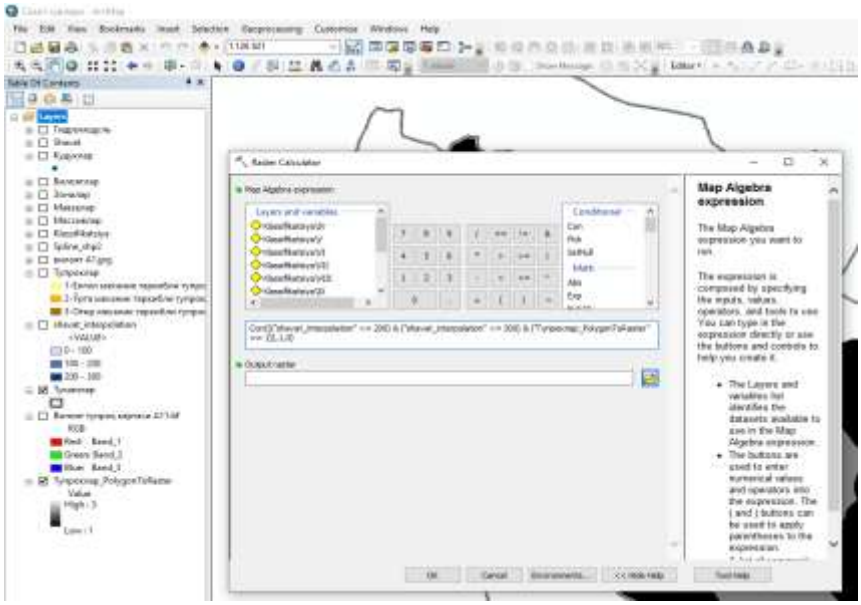

Figure 4. Raster calculation window

As a result of raster calculation, a new themed raster-shaped layer is formed. The raster

layer formed according to the requirements specified in the conditions is visualized by dividing it into hydromodular regions. (Figure 5)

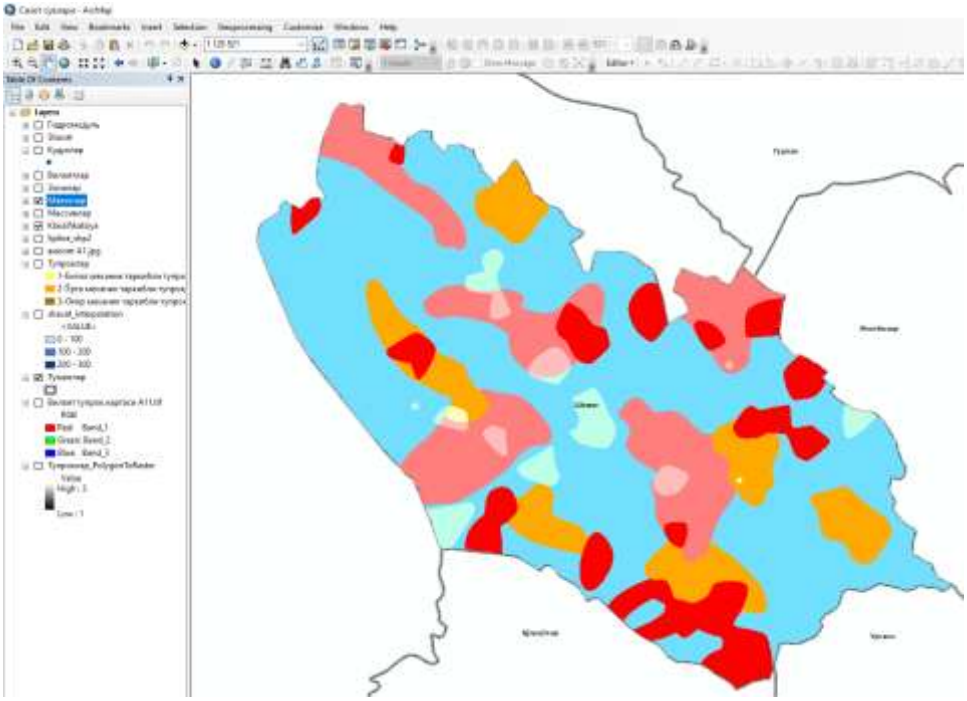

Figure 5. Raster-themed layers on the hydromodule zoning

The raster-shaped layers on the hydromodule zoning are vectorized using the ArcToolbox panel. The thematic layers, which are rendered in vector form, are given conditional marks and clearance work is carried out according to the state standard. [3] (Figure 6)

Figure 6. Hydromodule zoning map

Conclusion. Today, irrigated lands of Khorezm region and the southern districts of the Republic of Karakalpakstan can be divided into 6 hydromodule regions: IV, V, VI, VII, VIII

and IX, depending on the thickness of the aeration layer, mechanical composition, location and groundwater level. Groundwater at a depth of 2-3 meters makes up 4.68% (IV, V and VI) of the total area. The remaining 95.32% falls on VII, VIII and hydromodule regions, where groundwater is located at a depth of 1-2 meters.

2.78% of irrigated lands of Khorezm region - IV, 0.11% - V,? 1.32% - VI, 49.59% - VII, 9.88% - VIII and 36.32% - IX hydromodular regions, southern districts of the Republic of Karakalpakstan? 0.14% - I, 0.44% - II, 1.22% - III, 3.72% - IV, 0.05% - V, 5.72% - VI, 12.64% - VII, 0.68% - VIII and 75.39% - IX hydromodule regions.

The ArcGIS program provides the opportunity to create 1:10,000 digital digital irrigation maps of all regions of the country and periodically enter the results of field research in this electronic digital map, creating a hydromodular zoning map of the region based on the latest data.

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