DEVELOPMENT OF GEOGRAPHIC INFORMATION SYSTEM (GIS) TO CHANGE THE LEVEL AND LEVEL OF SOIL SALINITY IN JIZZAX REGION

I.M.Ruziev- PhD, D.G.Yulchiyev – senior lecturer at "TIIAME" National Research University

Abstract

In the Republic, especially in the Jizzax region, the reclamation state of irrigated lands and soil salinization is inextricably linked with the level of groundwater, their salinity and movement. The level of groundwater and its salinity depends largely on the technical condition of the drainage networks and the amount of atmospheric precipitation, the supply of fresh water during the vegetation period, and the movement of groundwater from outside. . Discussed future of using GIS in different sphere. GIS gives possibilities to collect the data, renewing it or use new information in analysis. It requires quick change of GIS information about Earth because procedures in the Earth are dynamically changeable. Periodically changing information in GIS gives us possibility to get new information and analyze it. GIS technologies and techniques started using widely in all sphere of humanity. It is important to know its properties.

Key words: *GIS, water management, Irrigation, Integrated Water Resource Management (IWRM), Uzbekistan, River basin, Agriculture.*

Introduction. Development of Geographic Information System (GIS), occurrence of salinization and water logging, crop extinction, etc. in the agricultural field.For a stable and high yield from agricultural crops, there must be an optimal combination of all the factors that are essential to the life of the plant. For the process of photosynthesis: the necessary moisture and nutrients in the soil; thermal energy of the atmosphere in the upper soil layer; water exchange should be provided to the surface.

The vast majority of irrigated agriculture in Uzbekistan are desert areas, where the lands have a certain amount of natural primary salinity, high mineralization and close to the surface. Irrigated agriculture in these regions can only give us the expected results if it is done with scientifically sound reclamation measures.

The main and effective method of land reclamation is the construction of collector-drainage systems and the maintenance of groundwater level, preventing secondary salinization of land by irrigation and drainage water.

There are many models created in GIS which are successfully used in water management of different countries of the world. Liu (2007) inserted EPIC model, which was suggested by FAO, into GIS and created GEPIC model (J. Liu, 2007; J. Liu, 2009). Stockholm Environmental Institute created WEAP (water evaluation and planning) model by GIS modeling (Assaf and Saadeh, 2008). Fortes et. al. (2005) inserted the existing irrigation scheduling simulation model ISAREG (this model, also, calculates the waste water amount of the area by inserting natural and climatic factors) into GIS, and created a GISAREG model based on the above-mentioned GIS. By this model, they predicted the quality of utilizing the Syr Darya basin water in different climatic scenarios. Creating this model in GIS eases the labour (Fortes, Platonov, and Pereira, 2005). From these models SEBAL is the most widely spread model. Over 30 countries are implementing this model for water resource control.

A number of works are carried out to determine the ameliorative condition of the irrigated lands: - study the movement of groundwater and their impact on natural irrigation factors, determine their impact on natural irrigation factors, soil salinity and other important environmental and saline measures. Development, monitoring of technical condition of collector-drainage networks, repair of collector-drainage networks that require repair z timely repair of Nexis, produced counsel, farms and exploitation activities and controlled by the management of the district reclamation fulfillment.

The GIS (geographic information system) technology is being developed to improve GIS-based data analysis based on field experiments when assessing factors affecting land reclamation. [1]

GIS is currently widely used and implemented in agriculture and water management and land reclamation monitoring not only in Uzbekistan, but also all over the world. Data analysis and transmission and storage within the GIS are addressed in GIS.

Materials and Methods. Therefore, the task of GIS is to receive, collect, analyze, store and transmit data in any format. Being able to access any of these data formats and accessing the program will further enhance GIS capabilities. The ability of GIS to conduct various statistical analyzes, mapping and creation of various databases ensures that it is more relevant and popularized in the area of land and water conservation (Tsihrintzis et al., 1996, Lyon 2003). Therefore, the task of GIS is to receive, collect, analyze, store and transmit data in any format. Being able to access any of these data formats and accessing a meal program will further enhance GIS capabilities. The ability of GIS to conduct various statistical analyzes, mapping and creation of various databases ensures that it is more relevant and popularized in the area of land and water conservation (Tsihrintzis et al., 1996, Lyon 2003).

Using GIS in water management of Central Asia started to develop after 2000, after the implementation of water management in this region. To supply the integrated and regular water management, to create irrigation sets and objects, water users, vegetation type and area database and maps for regional and global scale, and analyze it rapidly was the main problem of water managers. During its long time experiments water management found an answer to this problem. It was using new computer technologies and scientific achievements to water management. This component was added to Central Asian water management plan. As a result the scope of work in this field expands.

GIS Digital Database Analysis and Database Creation Since the 1920s. Improvement of GIS and installation of personal computers started in the 1970s. Since the 1980s, scientists have begun to use GIS in natural and technical sciences. With each passing year, GIS began to improve and become more widely used in various industries, and the capabilities and content of the community began to grow. Upgrading capabilities and the program has increased its use in various areas. As can be seen from the above, the use of GIS in solving various problems increased 2.5 times from 2000 to 2015 (Tsihrintzis et al., 1996).

GIS has been used for many years in agriculture and water management. Awulachew et al. (2012) note that the use of GIS in these areas enhances the accuracy of data and also provides access to information about difficult-to-reach areas. Another advantage of meliorative hydrogeological monitoring of irrigated lands based on GIS technologies is the achievement of automation and centralization of management, remote data acquisition and management of facilities. Automatic data transmission is achieved. Creating a unified system of water and land surveillance and establishment of a centralized system is currently the main task of the GIS sector.

We have the following advantages when monitoring the reclamation of irrigated lands on the basis of GIS technologies: [1]

Creation of the analysis database to the user in the format he wants (Tsihrintzis et al., 1996);

Creation and use of agricultural and hydrological models (Hu et al., 2001);

Creating Surface Water Models (Bastiaanssen et al., 2005);

Creating models of groundwater and surface water and their delivery systems (Zhang, 2005);

Land use and classification models and maps (Bhaduri et al., 2014);

Formation of water supply system plans (Ames et al., 2009);

Groundwater management modeling;

Water quality monitoring (Banerjee et al., 2013);

Hazardous Material Mapping and Modeling, Natural Hazards or Groundwater Management (Tsang, 2005);

The depth of groundwater level and salinity of groundwater shows that the land reclamation condition worsened compared to 2013. At the beginning of the growing season (1 April), the area less than 2 meters was 168.38 thousand hectares or 59%. During the same period, groundwater salinity was 93.78 thousand hectares, or 32%, in the dense residue up to 3g / l (low salinity). At 118,11 thousand ha or 41% of the irrigated land, the depth of groundwater was at a critical point of more than 2 meters, of which 6.43 thousand or 2% of the irrigated land was up to 1 meter deep. Groundwater salinity was more than 3 g / l (weak, medium and highly saline) at 192,71 thousand, or 67%. The groundwater depth of fewer than 2 meters was reduced to 20.84 thousand hectares, and salinity increased (by more than 3 g / liter) to 18.51 thousand.

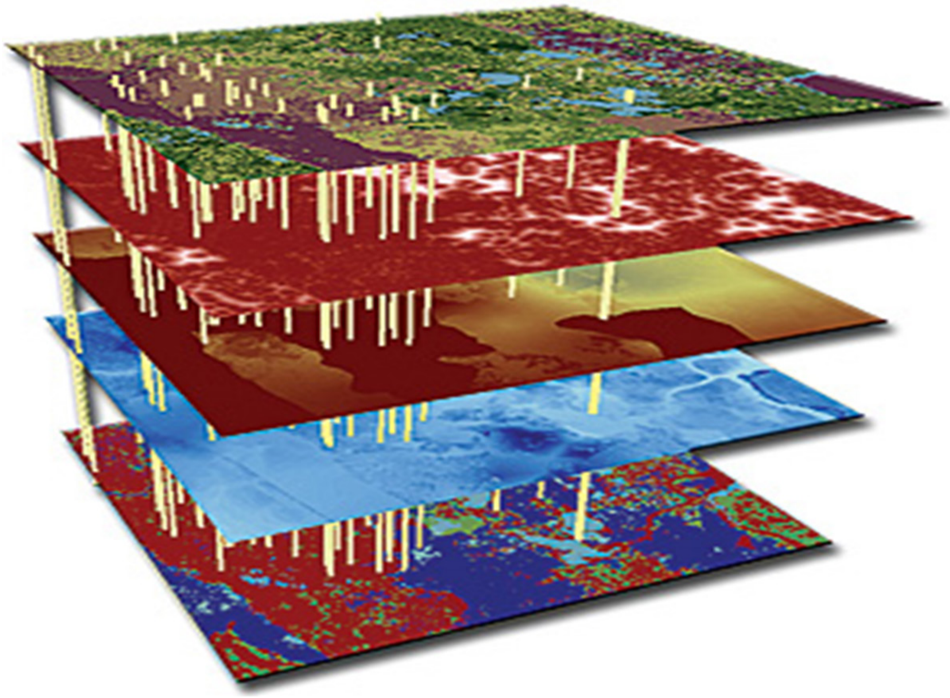

Figure 1. This conceptual model shows the three main components of an aquifer vulnerability assessment: the upper four layers represent soil conductivity; density of sinkhole features, material overlying the aquifer, and estimated aquifer recharge; yellow extruded lines are training points (monitor wells); and the lower layer is the model output, or aquifer vulnerability map.

At the end of the growing season (October 1) the depth of groundwater less than 2 meters increased the area by 15.78 thousand hectares, with salinity (up to 3 g / liter) reduced by 7.0 thousand hectares.

The dynamics of groundwater salinity continued to change throughout the year. In addition, the above salts also dissolve as a result of precipitation. When the surface water drops, some of the salts pass into the soil and the groundwater is depleted.

Result. Many scientists have created SEBAL models to control the irrigation in the Khorezm region and Fergana valley in central Asia. Here SEBAL models are used with MODIS images (Chemin et al., 2004; Bohovic, 2009; Awan et al., 2011; Bohovic et al, 2012; Awan, 2015). Especially, scientific research of Conrad is very important in this field. He created the SEBAL model using images of RS, MODIS,

Table 1

About categories of soil salinization in Jizzax region farms As of 2019-2020 Information						
The name of the farm`s	Years	Total irrigated - area, ha	Categories of soil salinization %			
			not salinization area ha	less salinization area ha	on average salinization area ha	strong salinization area, ha
1	2	3	4	5	6	7
Arnasoy	2019	33,5	1,4	20,7	10,1	1,3
	2020	33,5	1,4	20,5	10,4	1,2
Baxmal	2019	12,4	12,4			
	2020	12,4	12,4			
Gallaorol	2019	12,0	11,5	0,5		
	2020	12,0	11,5	0,5		
Sh.Rashidov	2019	34,7	6,8	23,1	4,6	0,1
	2020	34,7	7,8	23,0	3,8	0,1
Do`stlik	2019	35,2	5,6	24,3	4,8	0,5
	2020	35,2	3,8	26,0	4,6	0,8
Zomin	2019	20,9	12,9	5,8	2,1	0,1
	2020	20,9	12,8	6,6	1,4	0,1
Zarbdor	2019	53,1	8,6	35,7	7,7	1,0
	2020	53,1	7,0	38,3	6,9	0,9
Zafarobod	2019	28,2	3,9	18,2	5,3	0,8
	2020	28,2	4,0	19,9	3,6	0,7
Mirzacho`l	2019	32,9	2,0	26,5	4,3	0,1
	2020	32,9	1,0	26,2	5,6	0,2
Paxtakor	2019	28,8	3,1	20,5	4,9	0,4
	2020	28,8	3,6	20,3	4,5	0,4
Forish	2019	2,0		1,8	0,2	1,3
	2020	2,0	0,1	1,7	0,2	1,2
Yangiobod	2019	5,5	5,5			
	2020	5,5	5,4	0,1		
Arnasoy	2019	33,5	1,4	20,7	10,1	
	2020	33,5	1,4	20,5	10,4	
By area:	**2019**	**299,2**	**73,8**	**177,1**	**44,1**	**4,27**
	2020	**299,2**	**70,7**	**183,3**	**40,9**	**4,31**

ASTER, SPOT-5 and other satellites for the Amudarya basin and calculated the fertility of utilizing water. Besides, he created several hydrologic models for the very area by using GIS (Christopher Conrad, 2006; Christopher Conrad et al., 2007; Christopher Conrad et al., 2010; C. Conrad et al., 2013).

The use of GIS in agriculture, irrigation networks, and meliorative hydro geological monitoring of irrigated land has a high potential for monitoring the use of irrigation networks and agricultural land (Tsihrintzis et al., 1996). The following features and equipment make GIS the most important program in agriculture (Zhang, 2005)

- Spatial analysis;
- 3D operations
- Network layers;
- Short way to summarize;
- Simple data reception;
- Accessibility options;
- Duration of the process;
- Determining closer distances;
- Visualization.

Conclusion. Introduction of GIS in some arid regions and improve water resource management by this system can be an innovation for some regions. But, GIS is just software and for processing and obtaining solutions one needs to collect data and enter results of analysis, then this program becomes a useful data source for us. Data collection and entering it into GIS are also highly diversified and based on many selections. There are many ways and methods to collect data. Consequently, the types of data are numerous. Filling GIS with unnecessary information causes the user to be lost in a huge information mess. Therefore, it is very essential in research to get only necessary data and choose proper analysis software for it.

There are 286,500 hectares of irrigated land in the region controlled by the Jizzax Amelioration Expedition. Thus, as of October 1, 2017, the soil samples were analyzed by the Dynamic Chemical Experts at a constant dynamic point, and the amount of chlorine ion was determined by the amount of silver nitrate and by the X-express and conductor apparatus. Soil samples were taken from layers 0-0.3 m, 0.3-0.7 m, 0.7-1.0 m. [3]

According to the results, as of October 1, 2017, the area of 7059 saline areas, 223727 low salinity, 50222 moderately saline, and 5486 strong saline areas were identified. The area under saline decreased by 616 hectares compared to 2013, the area of low salinity decreased by 1,036 hectares, the average saline area increased by 211 hectares, and the saline area increased by 1,441 hectares.

The geographical information system (GIS) has been developed with detailed data on these indicators and maps of soil salinity categories by region, region.

Strongly saline areas have been increased in Sardoba, Havas and Mirzaabad districts. These areas are the areas prone to salinity. The recent establishment of fish farms in Mirzaabad, Havas and Sardoba districts, inadequate water supply during the irrigation season, pumping water from the drainage networks, resulting in increased saline areas. [4]

Current leaching measures for the 2017 crop are set at the low-salinity area of 56,430 ha, moderately saline at 1,095 ha, and heavily saline area at 1,675 ha, and the full-scale leaching has been performed in the designated areas.

An analysis of the autumn 2013 and the spring 2017 shows that the average salinity area in all areas of the region increased due to the decrease in the area of saline and saline areas.

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