National University of Uzbekistan

REPORT

on online study in the frame of the Erasmus+ DSinGIS project

(February 10– April 10, 2021)

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Content

Introduction

Now level and amount of available information in the cadastre are so large that they are not possible to processing, analysis and understanding without modern hardware and software. Application of computers and information technologies allows the full, speedy and with high quality data to provide geographic information on land resources to the task of accounting, planning and management of resources. Therefore, it becomes very necessary application of GIS and Remote Sensing in cadastre as a unified complex to obtain complete information about the land, the availability of resources, opportunities, and the consequences, those our activities having on the world.

With the coordination of the Obuda University, the project "DSinGIS: Doctorate in Geoinformation Sciences" is being implemented within the framework of the Erasmus + CBHE program. The main aim of this project is to support Uzbekistan in sustainable development by GISc. The project offered scholarships to researchers and PhD candidates for partner HEI of Uzbekistan. These scholarships provide the opportunity for the candidates to embark on a two-month stay at one of the three European partner institutions where they further their research project under supervision of and in close collaboration with the selected mentors from the European institution.

I was awarded one of these scholarships to do research under supervision of Dr. Andrea Podor at the Obuda University for the period February 1st to March 31st, 2020.

Unfortunately, due to COVID-19, I was unable to trip to the Hungary. We just had to wait, because our trip was depend on how the situation with COVID-19 will change. However, the situation had not improved, and project was coming to an end. Based on the situation, the PAB suggested conducting the study online and this was accepted as a decision.

From the beginning of this decision, I discussed my mobility plan with Dr. Andrea Podor, and we agreed to prepare a scientific article on the topic of “Application of GIS technologies in the study of soil salinity”, as well as take part in the GISCA 2021 conference (https://www.aca-giscience.org/pages/gisca-2021-agenda).

The objective of this study is to monitor of soil salinity in irrigated lands and mapping temporal and spatial distribution of salt affected soils for the Arnasay district of Jizzakh province in Uzbekistan to support land management.

In recent years, economic reforms have been carried out in the country, which is one of the important directions in ensuring the sustainable development of agriculture. Irrigated agriculture is important for life in Uzbekistan. Irrigation is therefore the basis of food security, rural well-being, increasing land fertility and productivity, as well as a rapidly developing agro-industrial complex. In this regard, special attention is paid to the rational and efficient use of land resources in agriculture. The correct and efficient use of land as a means of production depends in many respects on the comprehensive study of its most important properties. For this purpose, land cadastre works are carried out in our republic and the information is periodically updated.

According to the statistics of 2020, the total area of the Uzbekistan are 44892.4 thousand hectares, and 20761.6 thousand hectares, i.e. 46.25% of the total area is used in agriculture. The irrigated land area in the country is 4329 thousand hectares, which is 9.6% of the total area. 95% of all agricultural products are produced in Irrigated area. (National report, 2020)

Natural soil salinity comes through rising ground water levels and high evaporation of moisture. Secondary salinization means soil salinization due to human activities in irrigated agriculture. Soil salinization has a negative impact on land use, as soil quality degradation, and untimely study of the causes of salinization and its elimination can jeopardize the integrity of the soil's self-management capacity and lead to negative consequences. It is impossible to quickly eliminate soil salinity, but the use of modern technologies in the field of assessment and monitoring will allow observing and better understanding how salinity develops and developing measures to eliminate it. All work related to land relations in the territory of the Republic of Uzbekistan is carried out on the basis of large scale maps. In particular, large-scale maps are used as the main source in the state land cadastre for land valuation, for land accounting for each land user, monitoring and other various design and survey activities.

Geographic information systems and remote sensing methods are important in creating these maps. The using of these technologies allows to provide complete, efficient and high-quality geospatial data on land resources in solving the problems of accounting, planning and management of land resources.

Study Plan

Here, below study plan is given:

Planned research activities and work plan

№	RESEARCH GOALS	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8
1.	Acquaintance with the works in the field of Soil mapping								
2.	Conducting research in the field "Soil salinity maps "and construct regression models in order to determine the primary and secondary factors of soil salinity.								
3.	Generalization of results and prepare presentation at the host institution								

The study area and methods

As a research area was chosen irrigated land of Arnasay district (Figure 1.) which is located in the north of the Jizzakh Region of Uzbekistan at latitude of 40°25'N- 40°45'N , longitude of 67°42'E - 67°57'E, absolute height 256 m above sea level. Its borders were formed in 1975 and have not changed until now. The total area of Arnasay district is 492.73 km2, wherein the 481.67 km2 used in agriculture. The relief of the region consists mainly of plains. The surface gradually rises from north and northwest to the south and southeast. The study area has a extreme continental climate, with four seasons. The average temperature in January is from -1-5 degrees and up to 30 degrees in July. The average annual rainfall is 150-300 mm. Lake Aydar is located in the northern part of the Arnasay region. The soil is mostly gray-brown, with partial salinity in the northeastern part.

Figure 1. Location map of the study area.

In the study area, soil samples were taken for the April, October 2017 and April, October 2018 from depths: 0-30, 30-70, 70-100 cm with the envelope method. In addition, groundwater samples were taken from these locations to determine the level and salinity of groundwater, in order to study their effect on soil salinity. The coordinates of the field survey points were recorded using a Trimble Juno 3B GPS navigator. Subsequently, soil samples at a depth of 0–30 cm were analyzed in the laboratory to obtain data on salinity.

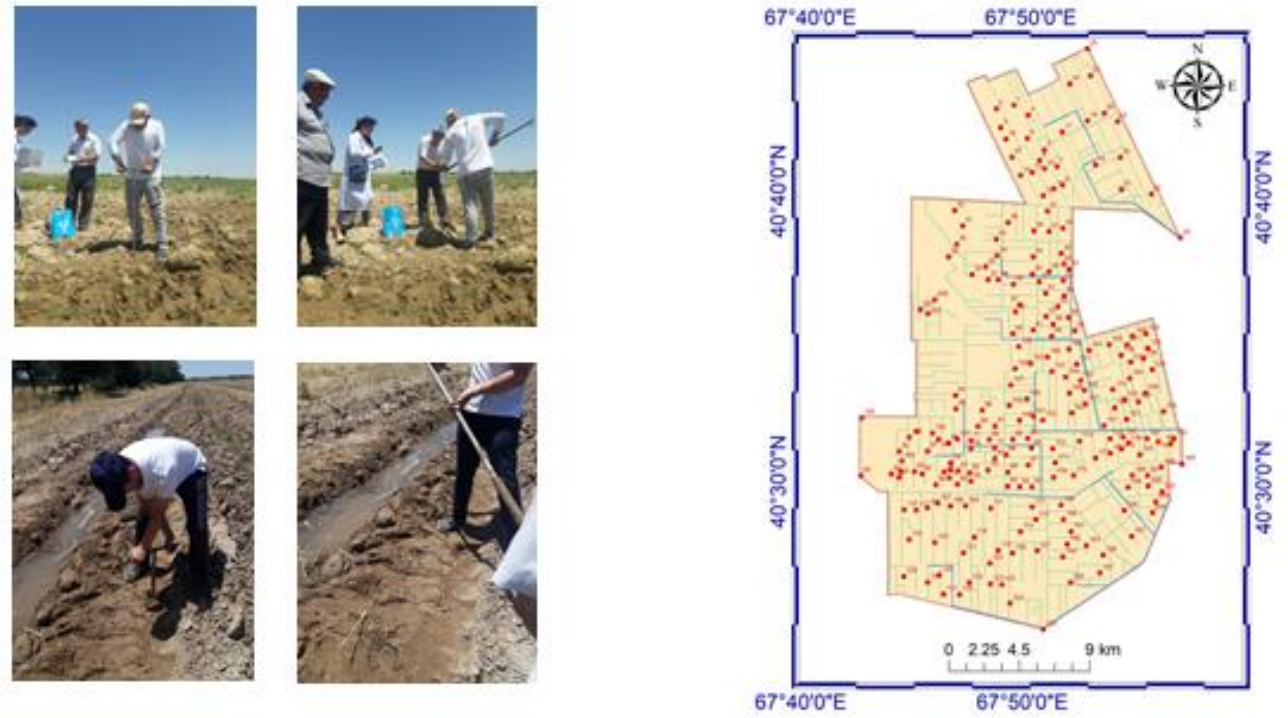

Figure 2. Field works and Soil samples.

Methods

In the last decade, there has been an intensive introduction of Geoinformation technologies for soil mapping. As a rule, this is due to their great opportunities for visualization, analysis and modeling of geographic objects and phenomena in comparison with traditional methods.

To achieve the goal, we used ESRI's ArcGIS 10.8 to diagnose and monitor soil salinity. At the first stage of the work, the main GIS layers of the study area were created, including the border of the study area and water bodies. In this study, to observe salinity distributions on the basis of the chemical analysis results, was applied an Inverse Distance Weighting (IDW) method and interpolation analysis was performed.

Results

Using IDW spatial analysis tools, thematic digital maps were created which indicate spatial distribution of soil salinity in the territory of the Arnasay district (Figure 3. and Figure 4.).

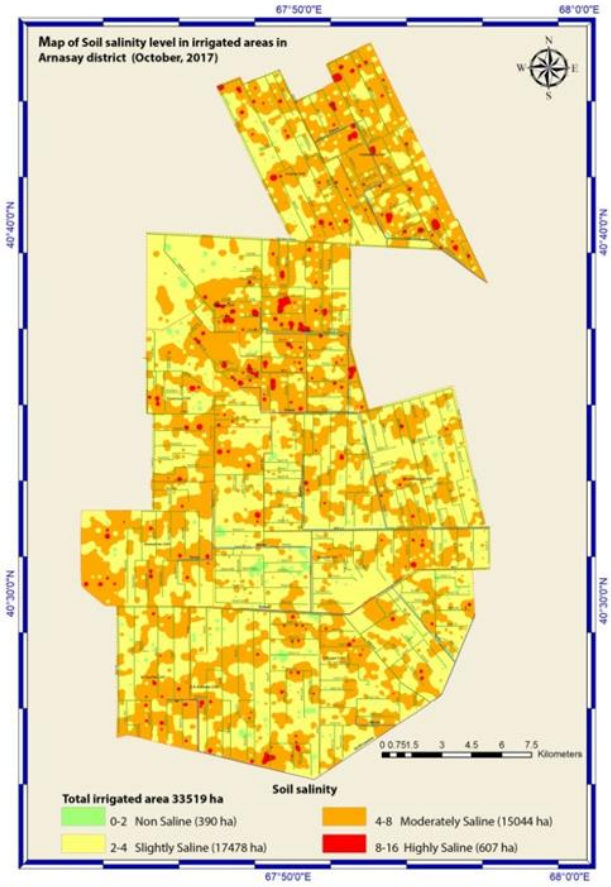

Figure 3. Map of Soil salinity level (2017).

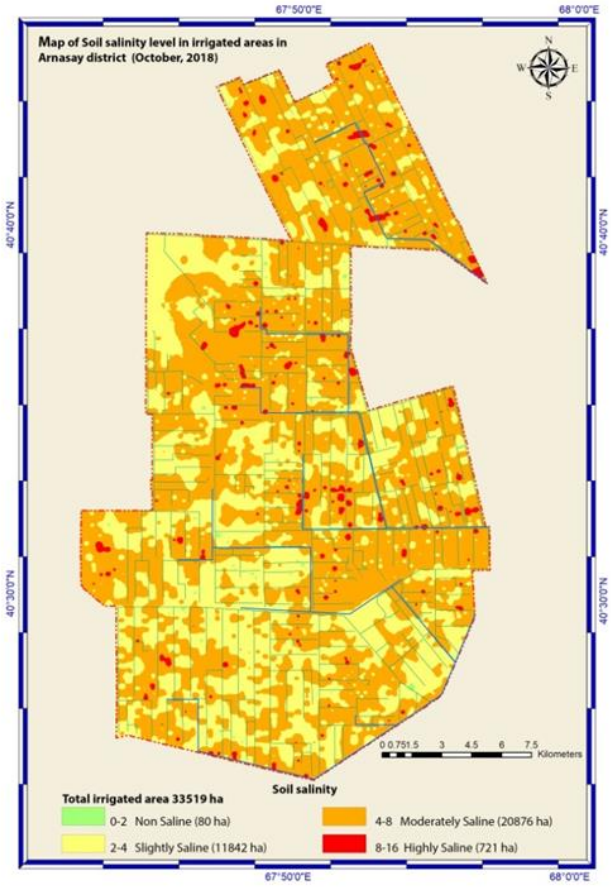

Figure 4. Map of Soil salinity level (2018).

Conclusions

Erasmus+ “DSinGIS –Doctoral study in Geoinformatics” project has been giving good opportunity for researchers of Uzbekistan in case of organizing 2 months scientific and practical training courses to improve their knowledge and skills in Geoinformatics and remote sensing.

I had achieved crucial knowledge and skills during two months. In the future, I will more develop my knowledge on application of Remote Sensing and GIS.

Acknowledgements

I gratefully acknowledge for support Dr. Andrea Podor in conducting this research.