TASHKENT INSTITUTE OF IRRIGATION AND AGRICULTURAL MECHANIZATION ENGINEERS

REPORT

On study visit to Austria University of Salzburg in the frame of the Erasmus+ DSinGIS project (online)

(February 01– March 30, 2021)

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TASHKENT, 2021

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Introduction

Nowadays, changes in land use are associated with changes in land cover. The increase in population is explained by the increase in demand for food, the increase in demand for housing. Constant monitoring of changes in land cover is very important in the proper distribution of land resources and their effective management [1,2]

Today, importance of Geographic Information System (GIS) and Remote Sensing (RS) technologies in society are improving day by day. GIS and RS technologies are being looked as an important tool for key spheres and directions of Uzbekistan: water and land resources management, agriculture, cartography, geology, ecology and in other sciences, essential in decision making for sustainable development.

Land use and land cover changes, especially in and around the city, are a rapid process, and it is important to study changes in their proper distribution and management [3,4]. The main reason for this is that they have an annual database and provide opportunities to study long-term changes [5].

In this case, support of highly ranked foreign Higher Educational Institutions and qualification of their well-qualified teachers play crucial role. Erasmus+ "DSinGIS –Doctoral study in Geoinformatics" project has been giving good opportunity for doctoral students and young researchers of Uzbekistan in case of organizing 2 months scientific and practical training courses to improve their knowledge and skills in Geoinformatics [6].

So far, several researchers and doctoral students from partner HEIs of Uzbekistan have been improved their skills and qualification in their research topic and field of studies at European partner universities. I was scheduled for July-August 2020. But it was postponed indefinitely due to a pandemic caused by the spread of Covid-19 disease observed worldwide. Was created online in 2021 (February 1 to March 31) due to unsettled pandemic conditions. We work to online with Skype and mail.

Study Plan

We work online (Skype, mail) with Sabine Henning Salzburg University from Austria

1. Introducing IMRAD structure.

2. Taking tasks and assignments from Sabine Henning Host Institute Supervisor;
3. Reviewing the scientific papers and articles, which are related to:
   a. Application of Remote Sensing and GIS in land use and land cover;
   b. GIS methods for land use and land cover change remote sensing.
4. Learning new applied remote sensing methods and GIS programs.
5. Going to library and learning new scientific books which are regarding to my field of study;
6. Learning how to write scientific papers in my research;
7. Participating to International scientific conferences or Workshops (if applicable)

Time table of all activities

№	Task name	Start	finish	Duration	Percent Complete
1	Study IMRAD structure for propore the article.	1.02.2021	3.02.2021	2	100%
2	Remote sensing data gathering how to collect relevant date: satilate image (free downoloaded data)USGS plotform.	4.02.2021	8.02.2021	4	100%
3	Data classification: software some indexes to identifiy land fund categories (NDBI, BUI.UI, BAEI)	9.02.2021	25.02.2021	16	100%
4	Exploring the object of research through statistical analysis to analyze the current situation.	26.02.2021	1.03.2021	4	100%
5	Study the principles of working with vector data. (Intersect, Union, Merge, Dissolve through the Geoprocessing tool)	2.03.2021	23.03.2021	21	100%
6	Working with attribute data to reflect them effectively.	24.03.2021	31.03.2021	8	100%

Activities and Outputs of the stay

During the two months study online with Sabine Henning online, I have strengthened my scientific and practical knowledge on Remote Sensing and GIS. Firstly, basic concept of remote sensing, pixel and segment based classification, basic algorithms of image processing were taught by Dr Sabine Henning. She sent me some links to study IMRAD structure (Figure1).

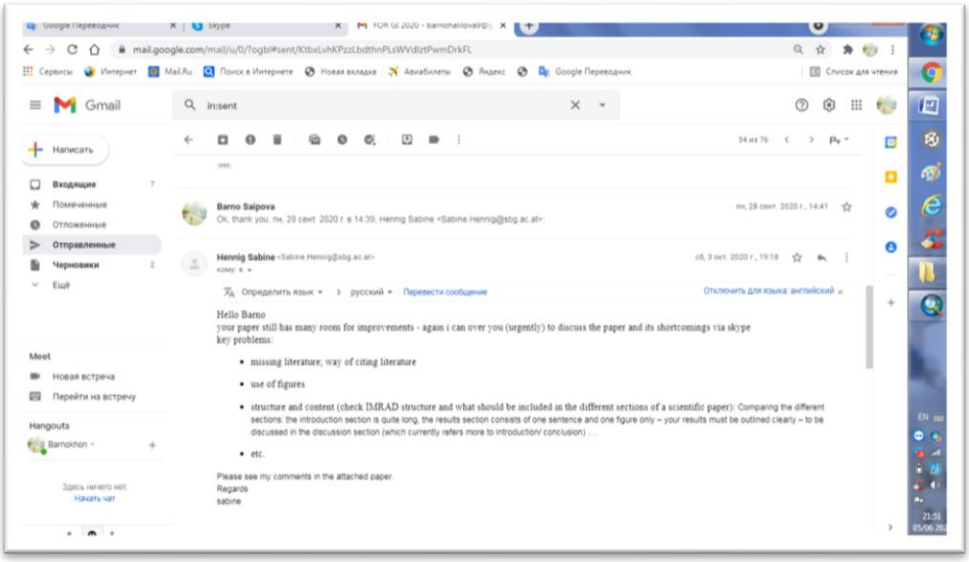


Figure1. Information about the IMRAD structure was sent Sabine Henning by mail.

Moreover, under supervision of Dr. Sabine Henning important Remote sensing methods and tasks such as: image geometric correlation, atmospheric correlation, assessing quality of the satellite images, classifying land fund categories and land cover changes by using supervised and unsupervised methods by using Landsat 4-5 and Landsat 8 satellite images (Figure 2).

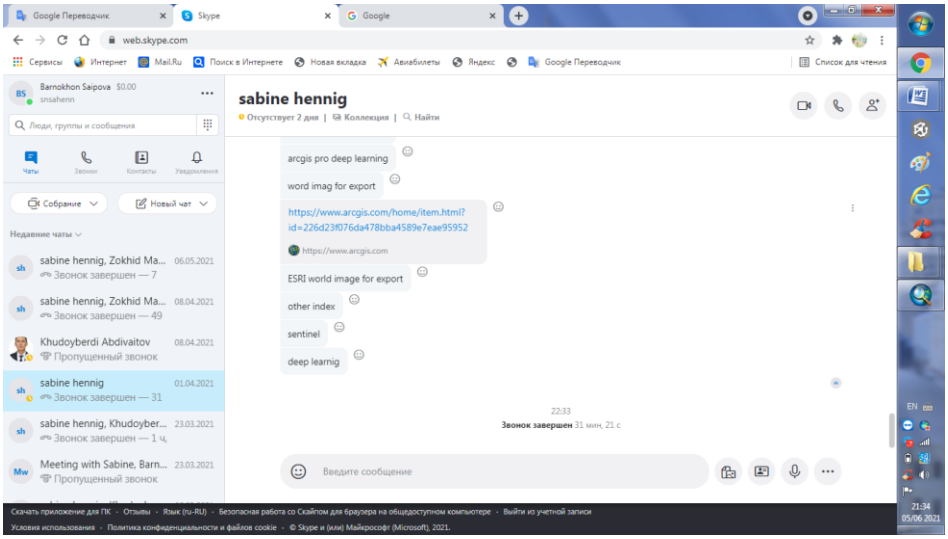


Fig. 2.Given tasks from Sabine Henning by skype.

In addition, remote sensing tasks as Arc GIS 10.6 (Figure 2) software's opportunities have been learned and have done some analyses with them on classifying land fund categories (Figure 3). Before classifying for land fund categories and identifying land cover changes.

With the increase in satellite capabilities in remote sensing, area monitoring and urban planning are more effective [8,9].

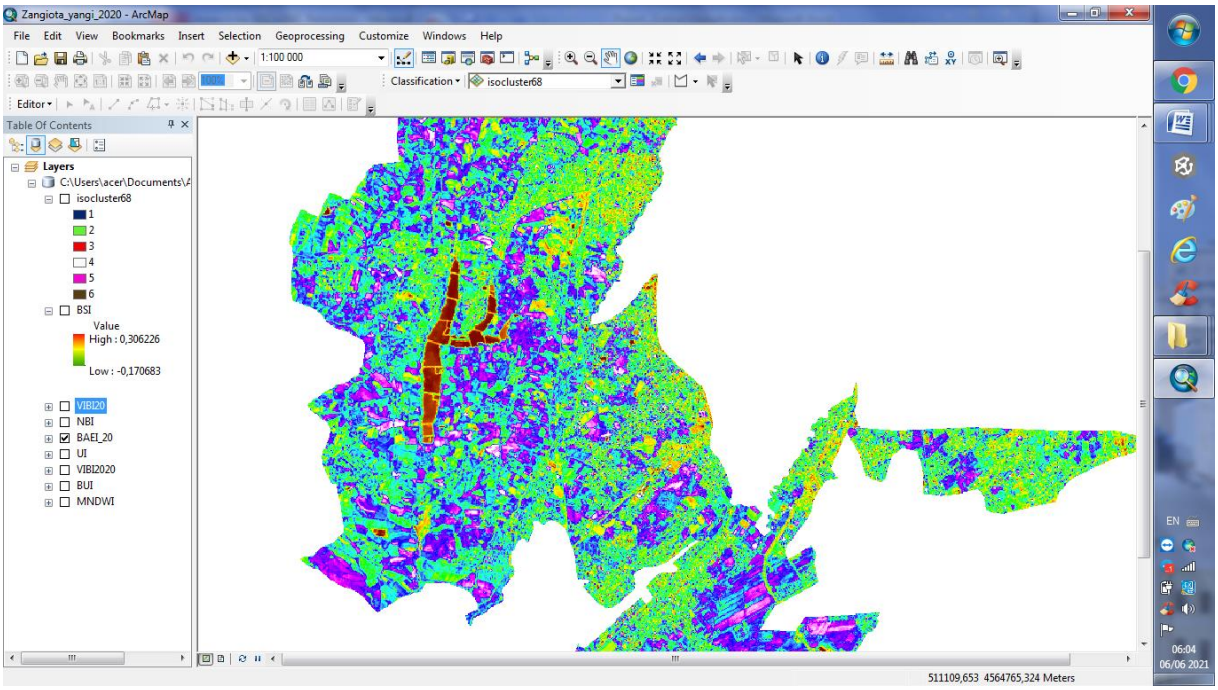


Fig. 3. NBI,UI, BAEI true color, and false color analyses with Arc GIS10.6

Land use is characterized by the arrangements, activities and inputs people undertake in a certain land cover type to produce, change or maintain it. Definition of land use in this way establishes a direct link between land cover and the actions of people in their environment.

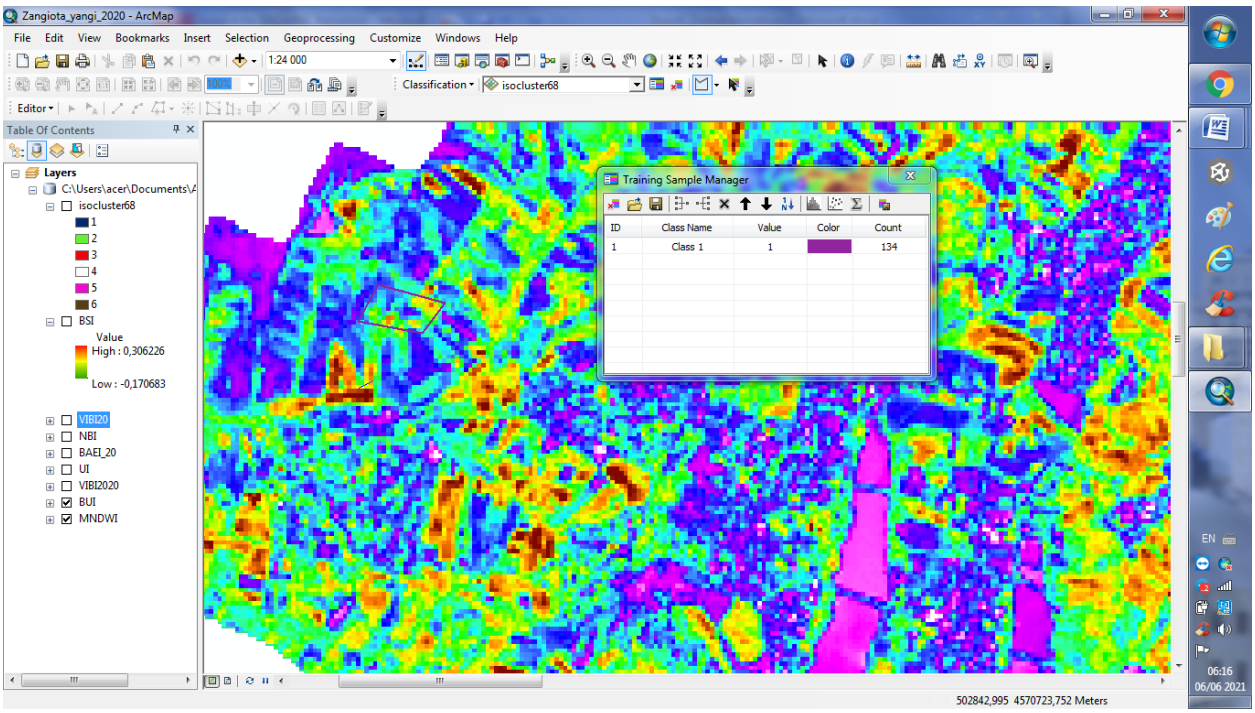


Fig.4. Creating land cover classification of small subset area of Zangiota district of Tashkent region in Uzbekistan using by Arc GIS 10.6

A classification describes the systematic framework with the names of the classes and the criteria used to distinguish them, and the relationship between classes. Classification thus requires the definition of class boundaries, which should be clear, precise, possibly quantitative, and based upon objective criteria [10]. Land use/land cover (LULC) classification is one of the most important applications in remote sensing, but is a complex procedure, because different factors, such as the spatial resolution of the remotely sensed data, availability of different data sources (e.g., field survey data, digital elevation model data), a suitable LULC classification system, availability of classification software, and the analyst's experience may affect the classification results [11].

There are two major categories of image classification techniques include unsupervised (calculated by software) and supervised (human-guided) classification [10].

Unsupervised classification is where the outcomes (groupings of pixels with common characteristics) are based on the software analysis of an image without the user providing sample classes. The computer uses techniques to determine which pixels are related and groups them into classes (Figure 5) [11].

Mostly for unsupervised classification Minimum distance, Maximum Likelihoods and Iso Cluster methods were used.

Supervised classification is based on the idea that a user can select sample pixels in an image that are representative of specific classes and then direct the image processing software to use these training sites as references for the classification of all other pixels in the image. Training sites (also known as testing sets or input classes) are selected based on the knowledge of the user. The user also sets the bounds for how similar other pixels must be to group them together.

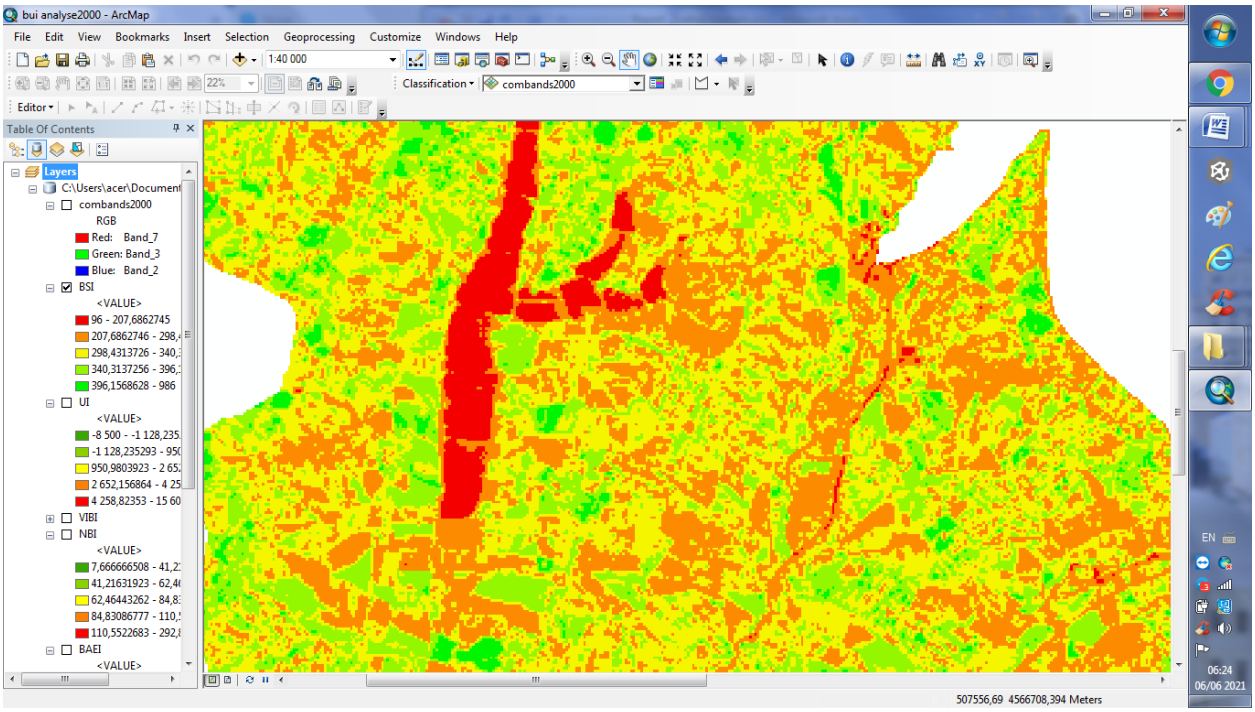


Fig. 5. Unsupervised classification of subset area with Arc Gis10.6

Determining the habitats of the population using the above formulas can give good results. But the following formulas are also effective for distinguishing vacant land areas and lands in common use by the population and can give us a clear result. Then NR used as a data for unsupervised classification by ISO clustering tool of ArcGIS. By converting the result into a vector format, we can analyze 20-year changes by doing Intersect, Union, Merge, Dissolve through the Geoprocessing tool. After completing the above steps, a surface cover map of the area will be prepared. As a result, the changes observed in the surface cover for the period from 2000 to 2020 were analyzed. The reasons for these changes were explored. As a result of the research, the data obtained from land management organizations and the results obtained by processing remote sensing data were compared (Figure6).

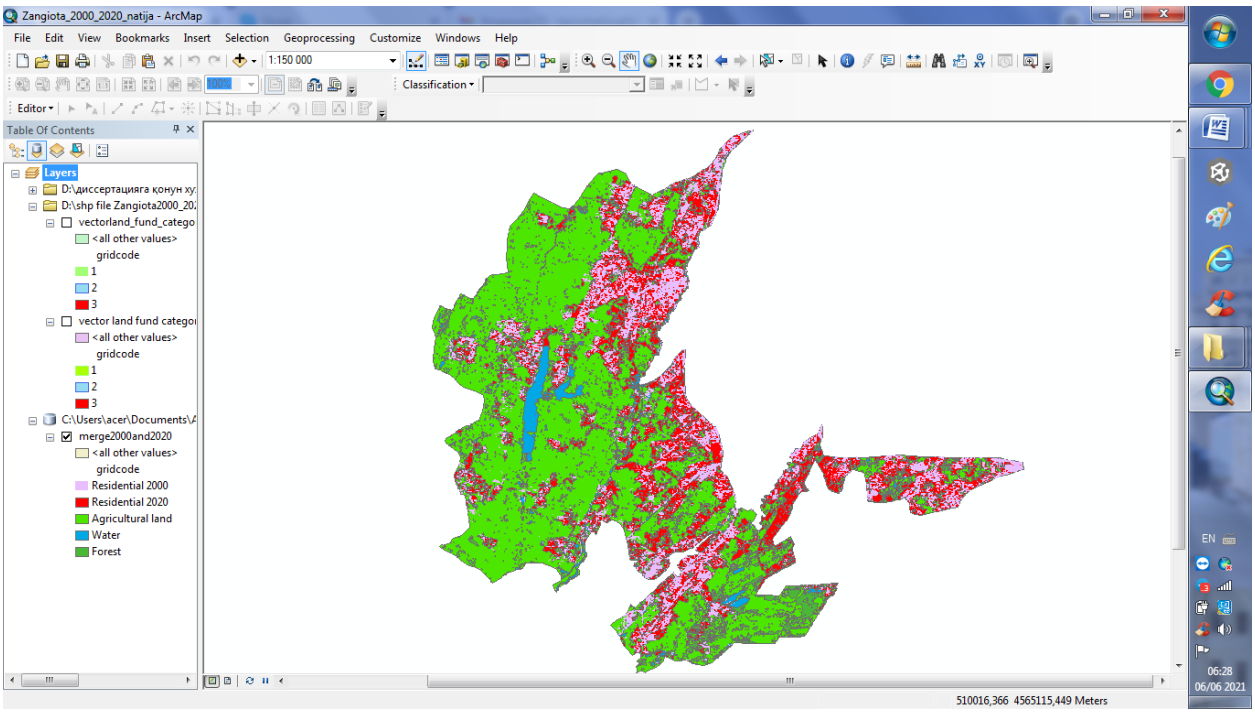


Fig. 6. Created change analyze from 2000 to2020 of subset area with Arc Gis10.6

I uploaded my package to Arc GIS online and discus it with Sabine Henning. She recommended how to improve the map. (figure 7).

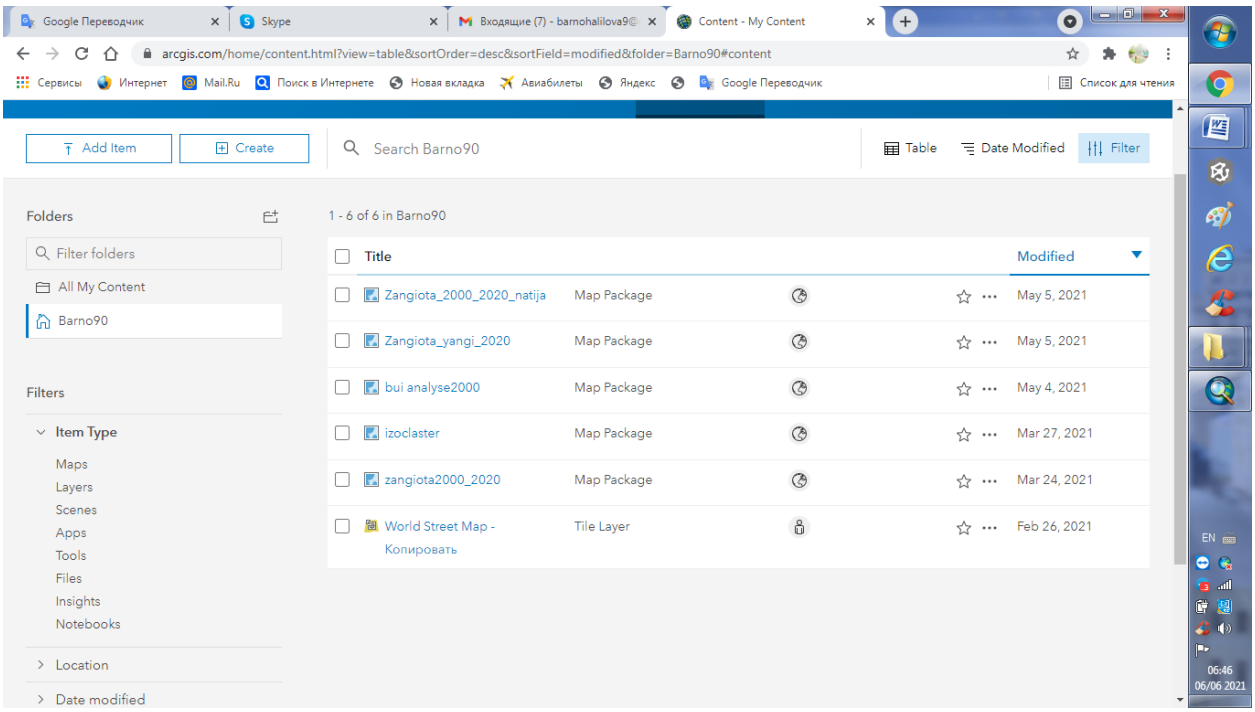


Fig. 7. Arc Gis online platform in www.esri.com

At the end of the research, for evaluating supervised classification results Accuracy Assessment analyse had done. It was found that there was a large discrepancy when the result obtained from the processing of remote sensing data was compared with statistical analyzes (Table1,2).

Table 1. Statistical data

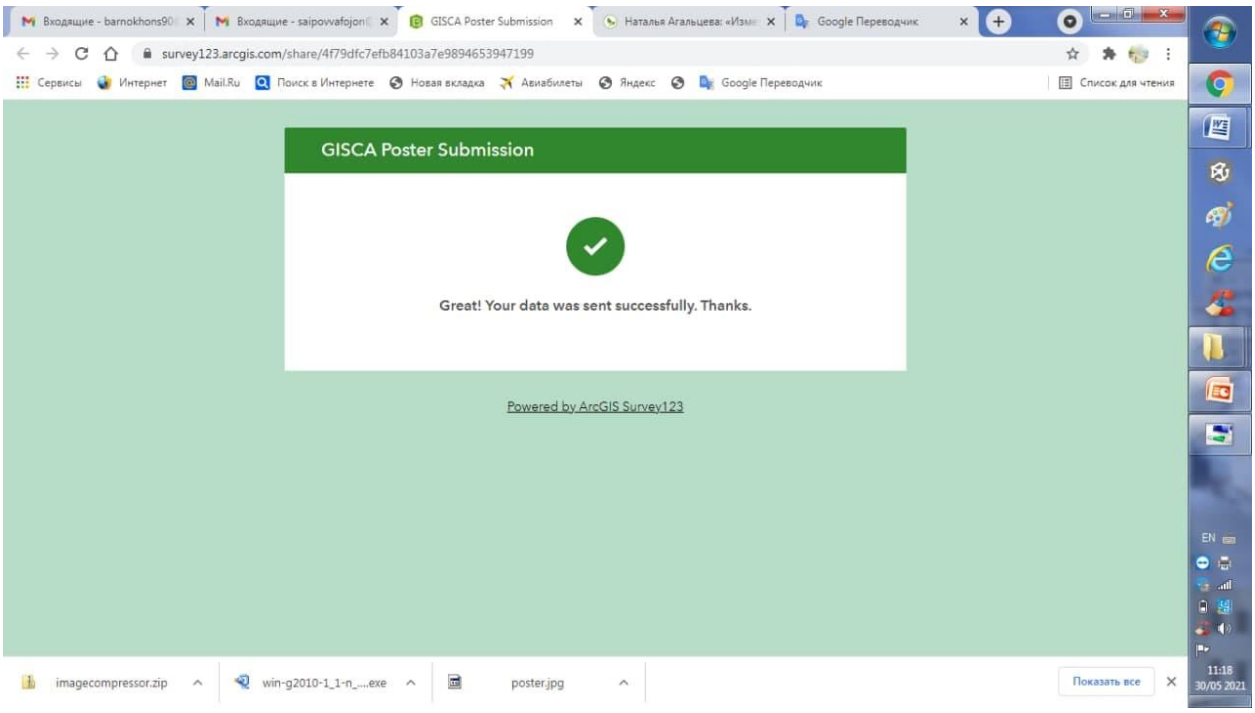
Land fund categories	**2000**	**2020**	**+-**
Agricultural land	19293	17008	-2285
Residential area	272	416	+144
industrial transport, defense, communications etc.	2645	3425	+780
Recreational purposes	-	-	-
Historical land	-	1	1
Forest land	10	6	-4
Water land	397	406	-9
Reserve land		8	+8
Total area	**22617**	**21270**	**1347***

Table 2. Results based on remote sensing data

Land fund categories	**2000**	**2020**	**+-**
Agricultural land	17436	13223	-4213
Reserve land			
Recreational purposes			
Residential area	3637	7039	+3402
industrial transport, defense, communications etc.			
Historical land			
Forest land	10	6	-4
Water land	376	412	-36
Total area	**21460**	**20680**	**780***

* Land transferred from Zangiota district to Sergeli district of Tashkent city and land transferred Tashkent district of Tashkent region

The article was prepared as a result of 2 months of research. And sent to the GISCA 21 conference (figure8).



Conclusions and future plans

Erasmus+ "DSinGIS –Doctoral study in Geoinformatics" project has been giving good opportunity for doctoral students and young 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.

So far, several young researchers and doctoral students from partner HEIs of Uzbekistan have been and improved their skills and qualification in their research topic and field of studies at European partner universities. But the pandemic Covid-19 observed around the world did not allow us to visit Austria and work face to face. But I think we worked online and partially achieved the desired result.

Acknowledgements

I gratefully acknowledge for great opportunity for Erasmus + "DSinGIS – Doctoral Studies in Geoinformatics" project, DSinGIS project coordinators Dr Lorant Foldvary and Ilhom Abdurahmanov, manager – Mamanbek Reimov, Supervisor from Obuda University - Dr. Sabine Henning as well as J.Strobl, and international relations department of TIIAME for moral and technical support before and during my study Austria (online).

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