USING REMOTE SENSING AND GIS TECHNOLOGIES TO SEASONAL MONITOR AGRICULTURAL LAND (URTA CHIRCHIK DISTRICT, UZBEKISTAN)

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Abstract

Currently, one of the most important aspects of agricultural activity in the whole world is the rapid development of remote sensing technologies provided with information, the creation of modern electronic cards and real-time monitoring systems is one of the urgent issues today. The desire to use remote sensing tools, information from anywhere in the world, constantly updating capabilities and geographic information systems and databases based on them is increasing. Agriculture of the Tashkent region makes up a large part of the region's economy and is the leader in our republic in this regard. It is important to develop new technologies in agriculture.

Keywords: monitoring, agriculture, remote sensing, NDVI, mapping, land-cover change

Introduction. It is one of the main resources in agriculture in the study region. All activities on Earth have a spatial nature and are directly related to geography[1]. Therefore, GIS has become an indispensable platform for combining and analyzing large amounts of data of various types and formats, integrating and interacting with many enterprise-level systems[1,4]. The ability to quickly analyze this flow of data and visualize it in a cartographic image creates many new projects and opportunities for users in agriculture and related fields [5,7].

In general, remote sensing data and geographic information system (GIS) help to manage resources, coordinate actions and development strategies, register and inventory agriculture, create property and land cadasters and registers, and create geodatabases. will give[8–10]. Ultimately, at the producer level, it can increase productivity, reduce costs, provide detailed performance analysis and forecasting, help generalize knowledge to improve business and agricultural practices, and improve the accessibility and effectiveness of GIS data in many other areas. will give[9,11].

For this reason, it is necessary to create a model for forecasting the yield of agricultural crops using remote sensing data and GIS technologies[12,13]. This gives us the opportunity to place crops correctly, apply fertilizers at the right time, use chemical means to prevent crop failure, and predict crop yields in advance.

Study area, Data collection and Methods. ***Study area.*** The study area is located in Tashkent valley and Mid part of Chirchik river. The total land area of Urta Chirchik district of Tashkent region is 0.51 thousand km2. Most of its territory is located between the Chirchik river and the Tashkent canal, at coordinates 41°2'34.4''N 69°21'26.6E (Figure 1). The district, which was established on September 29, 1926, borders with Upper Chirchik in the northeast, Ohangaron district in the east, Tashkent city, Zangiota district in the north, Lower Chirchik in the west, Akkurgan and Piskent districts in the south, and the center of the district is the city of Nurafshon. The region of Middle Chirchik District is located on the plain on the left bank of the Chirchik River. The climate is continental, the average annual rainfall is 450-460 mm, and the vegetation period is 300 days. Tashkent named after Polvonov, Karasuv canals, and Chirchik river flow from the north-west of the district. In the south is the Tuyabogiz reservoir ("Tashkent Sea"). The main part of the soil is gray soil. The main part of the agriculture of the Middle Chirchik district is cotton and grain growing. Cotton is planted on 28,600 hectares of irrigated land, grain on 11,500 hectares, as well as potatoes, vegetables and rice, fodder crops, alfalfa and secondary crops are planted in the district.

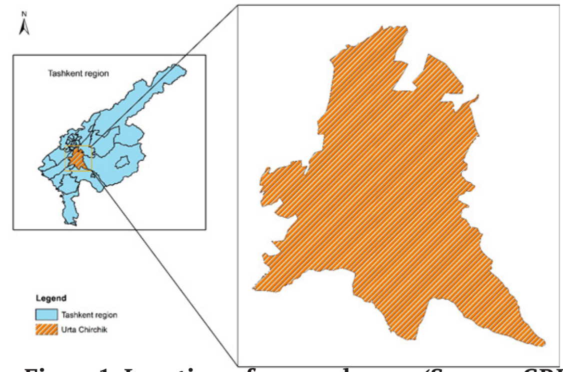

Figure1. Location of research area (Source: GRID-Arendal).

Data collection. The series of images from the Landsat 8 OLI on NASA's Terra satellite (retrieved from https://earthobservatory.nasa.gov/) documents the changes for analyzing of shrinking lake. At the start of the series in 2022 for spring, summer and autumn seasons. As the Urta Chirchik district is split into three satellite data for analysis data undertaken with the application of the Normalized Difference Vegetation Index (NDVI), as a remote sensing tool, Landsat 8 OLI images were used.

Methods. The NDVI is one of the most widely used vegetation indices and its utility in satellite assessment and monitoring of vegetation cover has been well demonstrated over the past two decades.

$$NDVI=(NIR-VIS)/(NIR+VIS)$$

Where, NIR - Near Infrared band of the satellite image (Band 4), and VIS (Band 5) of the satellite image.

NIR and VIS represent surface reflectance averaged over visible (λ~0.6 μm) and near infrared (NIR) (λ~0.8 μm) regions of the spectrum, respectively. The NDVI is correlated with certain biophysical properties of the vegetation canopy, such as the Leaf Area Index (LAI), fractional vegetation cover, vegetation condition, and biomass. NDVI increases near-linearly with increasing LAI, and then enters an asymptotic phase in which NDVI increases slight slowly as increasing LAI (Platonov et al. 2015).

Results and discussion. Monitoring of agriculture based on modern GIS technologies and remote sensing data is now becoming important. In this small study. If we look at the studied district, we can see the analysis of seasonal agricultural land changes. In this case, we can say that the change of agricultural crops is one of the main factors in crop rotation.

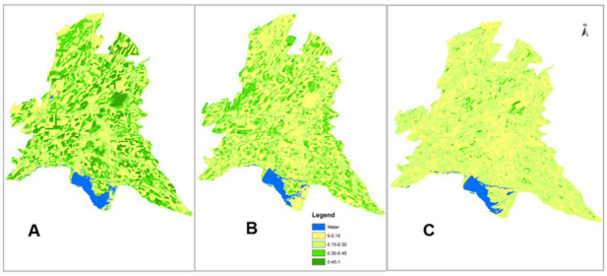

Figure 2. Seasonal changes in agricultural land areas.

From our analysis, we can see that the greenness index is high in the spring season, which means that wheat is the main agricultural crop in agricultural areas. Coming to the summer season, it can be seen that in the agricultural fields there are fields empty of wheat crops, and in the fallow fields we can see cotton as the main type of crop. It is possible to see that the arable land index showed a small index in the spring season, but the index is large in the summer.

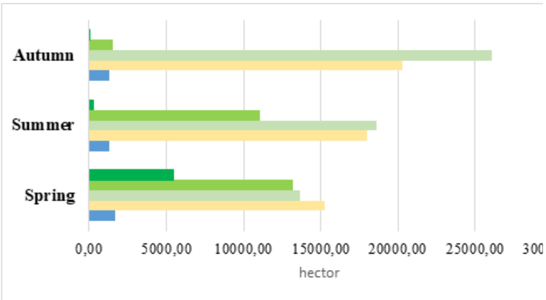

Figure 4. Actual area of each index class of seasons.

By the autumn season, the main indicators are changing again in terms of cultivated areas, and the main index is given by newly grown wheat areas. Continuous observation and monitoring of cultivated areas using GIS technology facilitates the analysis of seasonal crop changes and allows to determine the accounting book of areas.

Conclusion. In conclusion, cropland monitoring with modern technologies and remote sensing data will involve high cost-effectiveness and rapid analysis. However, one of the shortcomings of the technology is that it is necessary to carry out field practice in the area under study to monitor crop types and their differences from weeds. Correlation of several indexes in currently used data analysis can increase the accuracy of the analysis. Therefore, I am currently conducting research on these issues in my scientific work, and I have published the first research results in this direction in this small article.

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