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SPACE MONITORING OF LAND USE IN KARGALY DISTRICT OF AKTOBE REGION

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Every year, the relevance of space monitoring is increasing. There will be a need for reliable information on the state and use of land.

Land monitoring is a system of monitoring the state of land resources in order to timely detect all kinds of changes, forecast and evaluate these changes, as well as prevent and eliminate negative consequences [1].

The purpose of this research is to conduct space monitoring using ArcGIS software, by studying the principle of processing the received data from the MODIS system [2]. The object of research is agricultural land of the Kargaly district of Aktobe region.

The objective of this research is to analyze the use of land by applying the method of processing space data, using field data as reference values.

The processing program involved the MODIS space data chain, consisting of 10 images from May to September 2018. To process satellite images from the MODIS system, ArcGIS software was used. ArcGIS is a system for collecting, managing, analyzing, and distributing geographic information. Different data sets are provided for data processing.

Before processing optical images from the MODIS system, registration on the website www.eos.com is required [3]. Further in the data set, you should enter the position / coordinates / ID scene of the required territory. In our case, the Kargaly district, Aktobe Region, Kazakhstan. In the metadata filter, we indicate a certain period, cloudiness, necessary at the discretion of the user, as well as the sensor - MODIS. On the right side of the screen you should select the option “scene download”, as well as resolution-XL, format-GEOTIFF, and load. It is necessary to download satellite images in 2018, 3 images a month, in the period May-September, on two channels b1 and b2.

The Vegetation Index (VI) is an indicator calculated as a result of operations with different spectral ranges (channels) of an RS, and related to the vegetation parameters in a given pixel of the image. The effectiveness of VI is determined by the characteristics of reflection; these indices are derived mainly empirically [4].

Basic tools for image processing and SAVI output.

Mask extraction - extracts raster cells corresponding to the area bounded by the mask.

- In the input raster, select pictures with channels B1 and B2 one by one.

- In the input vector or raster data of the mask, select the extraction area (the boundaries of the Kargaly region).
- In the output raster, select the place where you want to save the new extracted data from the input raster.

Raster calculator.

You must enter the formula:

$$SAVI = ((NIR - Red) / (NIR + Red + L)) * (1 + L);$$

$$L = 0.5;$$

$$M = ((b2 - b1) / (b2 + b1 + 0.5)) * (1 + 0.5).$$

ArcToolBox - Spatial Analyst Tools - Zone - Zone statistics in a table.

- In the input raster or vector data of zones, select Arable land - the area from which information is to be extracted.
- In the zone field, select a field that contains non-floating values, in this case Id.
- In the input value raster, select SAVI - a raster containing values based on which statistics will be calculated.
- In the output table, select the place where you want to save the new extracted data from the input raster.
- In the statistics type, select MEAN_STD.

The next step is to find the largest number of pixels in one of the raster layers. This requires images for 6 years (2013-2018), one image for one July date, on 7 channels b1-b7.

First you need to carry out the extraction procedure by mask with all space images.

Raster to polygon (A geoprocessing tool that converts a raster dataset into polygon features).

- In the input raster, select pictures with channels b1-b7 in turn.
- In the field, select - Count.
- In the output polygon features, select the place where you want to save the new extracted data from the input raster.

Editing a pixel layer. In order to start adjusting and cleaning the pixel layer, you need to start editing. Select the necessary area for editing, and using the "cut polygon" tool, divide the polygon into several cells.

After adjusting the vector (pixel) layers, you need to select the largest pixel layer and use it as a reference for further data processing. On the raster layer with the largest number of pixels, it is necessary to impose a layer of arable land to perform selection by location.

- In the target layers, select the "All Pixels" layer.
- In the source layer, select the plow layer.

In the spatial sampling method for the target feature classes, select "is completely inside the features of the source layer."

Next, to create a layer from the selected objects (pixels), you need to export data (save the layer data as a shape file). After creating the reference pixel layer,

you need to overlay the processed tiff format images - SAVI images. Then conduct zone statistics in a table to display the SAVI index for each pixel.

Analysis of the data.

It is necessary to carry out the transfer of the obtained data of zone statistics to the Excel table, distribution by thresholds, and also the issuance of final results. Having moved the data of zone statistics to Excel, you need to put down the thresholds needed to further determine the use of land. Data for 2018 is shown in figure 1.

Fig. 1 - Data for 2018

- Column A below cell N shows the number of pixels.
- Column B below the pole contains pixel numbers.
- Values of vegetation indices are given in columns C to L under cells from 1 to 10.
- Columns from M to V below cells from 1 to 10 give thresholds from 0 to 1.

Through field trips, the reference values shown in figure 2 were obtained.

| 2018 | | | |
|------|------|----------|----------------|
| N | pole | Культуры | Дополн |
| 3 | 180 | 4263 | залежь |
| 4 | 273 | 4987 | залежь |
| 5 | 319 | 5339 | яровая пшеница |
| 6 | 432 | 5934 | залежь |
| 7 | 441 | 5992 | яровая пшеница |
| 8 | 453 | 6066 | житняк |
| 9 | 466 | 6146 | яровая пшеница |
| 10 | 472 | 6159 | яровая пшеница |
| 11 | 621 | 6811 | ячмень |
| 12 | 633 | 6842 | яровая пшеница |
| 13 | 638 | 6881 | яровая пшеница |
| 14 | 678 | 7093 | ячмень |
| 15 | 691 | 7124 | ячмень |
| 16 | 701 | 7179 | залежь |
| 17 | 705 | 7186 | залежь |
| 18 | 713 | 7235 | яровая пшеница |
| 19 | 716 | 7245 | яровая пшеница |
| 20 | 717 | 7248 | яровая пшеница |
| 21 | 801 | 7641 | яровая пшеница |
| 22 | 824 | 7735 | ячмень |

Fig. 2 - Reference values obtained through field visits

Below are charts that show the value of SAVI indices for 2018 in the period - beginning of May - end of June.

- The value of the indices on the land on which wheat grows will range from 0.25 to 0.44 in mid-May. A sharp increase will be observed during the beginning of June. The maximum indicator may be an index equal to 1.13 (it will be a peak).

- The value of the indices on the land on which wheat grows will range from 0.24 to 0.44 in mid-May. In early July, the index may reach a maximum value of 1.03.

- The value of the indices of the land, which is a deposit, will range from 0.55 to 0.66 at the beginning of May. The maximum indicator may be an index equal to 0.75 (it will be a peak).

Percentage of results obtained in the Kargaly district of Aktobe region:

- Land used (for 2018) - 81.75%.

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