Short Communication

Recognition of indicative landscape objects in protected areas by means of different remote sensing data

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Annotation

The article presents the results of the study of indicative landscape objects of protected areas through the example of the National Natural Park "Slobozhansky" in Kharkiv region, Ukraine. The authors justified the choice of various types of satellite images and optical scanning windows for getting relevant information. The authors also used the original landscape map with more than 200 elementary units (facies). It was compiled at the previous stage of work by means of automated processing of space information (with the training according to standards) and large-scale ground survey of test objects.

The method for identifying indicative objects and their characteristics by means of a large-scale landscape photography on the ground with the creation of the database of attributive information has been developed and applied. Indicative local objects were established being appropriate for various components of monitoring; landforms, boundaries of landscape facies; the state of the vegetation cover.

It is proposed to use the research results for the design of landscape restoration in the contours of previous years, to maintain the conditions of animal habitats (including 20 animal species from the Red Book of Ukraine). The results obtained are already a small contribution to the establishment and assessment of ambiguous manifestations at the local level of the global climate change.

Introduction

Protected areas need well-timed identification of landscape changes and their assessment. The use of the data of open orbital survey makes it possible to get the information about the state of natural objects in the study area relatively quickly, but requires specialization of information processing methods (GIS technologies). The proper choice of a data processing method, its algorithmic presentation and the formation of a database of attributive information create the basis for analyzing and predicting changes in order to improve the state of objects of interest. It is especially important that the ability to process Earth remote sensing data make it possible to reduce the volume of field surveys and get information about the state of indicative objects in hard-to-reach places and where access to human activities is prohibited (swamps, inland deserts, nature reserves and national parks).

Natural object of research

This is the territory of the National Natural Park (NAP) "Slobozhansky" of Kharkiv region in Ukraine. This is a small new park created in 2009. It is located in the forest-steppe zone but contains some features typical of the forest zone. The territory of the NPP has been little explored. The most significant feature of the park is the combination of zonal landscapes of mixed forest and steppe zones with intrazonal alluvial landscapes of the Merla River Valley on a compact territory, the presence of old channel lakes and downstream bogs.

Goal

To install landscape indicators suitable for monitoring natural objects of the NPP based on the data of special processing of significant volumes of primary satellite information from the

Sensinel-2 and Planet Scope scanning systems in combination with local ground-based observations. To explore how the global trend of climate change is transforming at the local level and how this data can be used in practice.

Factual information

Primary space information in 13 optical channels. An original large-scale landscape map of the entire territory up to the level of landscape facies (more than 200 units in total) and field survey documents of indicative landscape objects.

Method

It is defined by interpretation space images used for recognition of landscape units through the identification of plant groups (as the most informative component of the landscape) and the choice of spectral methods for tracking changes in their state overlay analysis used for spatial data combining to create landscape, modern field landscaping used for specification of landscape contours.

Research results

The primary space information was processed using ArcGIS methods. This made it possible to refine the contours, identify them on the ground and classify them with training. Various combinations of optical transmission windows of rays reflected by the landscape were used in the analysis. The best results have been obtained for wetland contours. The authors came to the conclusion that they should be the most sensitive and dynamic indicators of the responses of local landscapes to global climate changes. Based on the automatic comparison of space information got selectively during 2016-19, the trends of the most variable objects in the study area were traced. These materials were verified by ground-based observations of individual indicative objects.

The authors determined that the interpretation of space images used to recognize landscape units by identifying groups of plants (as the most visually capacious component of the landscape) is justified and profitable due to the possibility of algorithmic presentation and reduction of the time to obtain a result compared to traditional field observations. Contour change analysis based on multi-temporal contour overlay analysis provides an accurate assessment of dynamics. The choice of spectral ranges makes it possible to reliably track changes in the state of indicators. All this serves as the basis for the effective use of scientific results for the protection of landscapes on reservations and modern landscape design.

Conclusions

The choice of indicative landscape objects and methods of information processing depends on the tasks set. It has been established that objects are indicative if their individual changes affect the dynamics and organization of the entire landscape system. Therefore, it is they that require regular monitoring, analysis and forecasting of situations.

It has been experimentally established that various landscape objects can act as indicators of changes in the state of the environment: change in relief; contours of reservoirs; outlines of plant communities.

The possibility of using high-precision satellite geodata Sensinel-2 and Planet Scope in combination with selective ground surveys for space monitoring of changes in the landscape of the protected area has been established.

The existing variants of GIS-processing of information about the morphology of the relief, the contours of the landscape and the internal state of the indicative objects of monitoring were analyzed.

Data use

The ability to track changes in landscapes as a result of nature management, characteristic of the forest-steppe; restoration of plant communities along the contours of previous years; assessment of the impact of landscape communities on the living conditions of animals listed in the Red Book; assessment of the impact of global climate changes at the local level through landscape indicators.