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River basin soil-vegetation condition assessment applying mathematic simulation methods

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Meticulous attention paid nowadays to the problem of vegetation cover productivity changes is connected also to climate global transformation. At the same time ecosystems anthropogenic transformation, basically connected to the changes of land use structure and human impact on soil fertility, is developing to a great extent independently from climatic processes and can seriously influence vegetation cover productivity not only at the local and regional levels but also globally.

Analysis results of land use structure and soil cover condition influence on river basin ecosystems productive potential is presented in the research. The analysis is carried out applying integrated characteristics of ecosystems functioning, space images processing results and mathematic simulation methods. The possibility of making permanent functional simulator defining connection between macroparameters of "phytocenosis-soil" system condition on the basis of basin approach is shown.

Ecosystems of river catchment basins of various degrees located in European part of Russia were chosen as research objects.

For the integrated assessment of ecosystems soil and vegetation conditions the following characteristics have been applied:

1. Soil-productional potential, characterizing the ability of natural and natural-anthropogenic ecosystem in certain soil-bioclimatic conditions for long term reproduction. This indicator allows for specific phytomass characteristics and ecosystem produce, humus content in soil and bioclimatic parameters.
2. Normalized difference vegetation index (NDVI) has been applied as an efficient, remotely defined, monitoring indicator characterizing spatio-temporal unsteadiness of soil-productional potential.

To design mathematic simulator functional simulation methods and principles on the basis of regression, correlation and factor analysis have been applied in the research.

Coefficients values defining in the designed static model of phytoproductivity distribution has been executed applying non-linear approximation by the smallest squares method with the help of software in Mathcad environment.

Mathematic simulation resulted in defining possible permanent conditions of "phytocenosis-soil" system in coordinates of phytomass, phytoproductivity, humus percentage in soil.

It has been demonstrated that phytocenosis productivity is determined not only by vegetation photosynthetic activity but by forest and meadow phytocenosis area ratio as well. Local maximums attached to certain phytomass areas and humus content in soil have been determined at basin phytoproductivity distribution diagram. One of such areas lies within specific phytomass values of B = 133,56 t/hectare and humus content of 2,29 % and the most stable "phytocenosis - soil" system condition corresponds to it.

Efficient correlation of natural forest and meadow phytocenosis for the Klyazma river has been defined, at which the most stable permanent condition is achieved and it ranks 7:1. It corresponds to the Klyazma basin location in south taiga zone and it is proved by intensive forest over growing of the abandoned agricultural lands.