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GRAPH ANALYSIS OF THE BIOLOGICAL SYSTEM

The goal of the report is the construction of a conceptual model of coordination of multidimensional biological data as a basis for the development of methods for integrated assessment of the state of biological systems of different levels of structural and functional organization and their software implementation.

To achieve the purpose of the study, the following tasks were set: 1.Based on the analysis of the set of biological data as a system object to develop a conceptual model of an integrated biometric data system. 2. Develop a model of levels of coordination of biometric data that meet the requirements of a given model description of the biological system. 3. To propose a criterion and substantiate the method of integrated assessment of the state of biological systems on the basis of statistical modeling of data sets. 4. To develop and test a set of problem-oriented computer programs for integrated assessment of the state of biological systems on the examples of assessment of the state of biological systems of different levels of structural and functional organization.

The methods of mathematical modeling, mathematical statistics, computer methods of computational experiment and system analysis are used in the work. The reliability of the obtained results and conclusions is based on the correct use of conventional mathematical methods, the results of modeling and verification of the proposed models, as well as the agreement of the results of mathematical modeling with conventional estimates of the parameters of the studied biological systems. Checking and modeling of the system is carried out on the studied effects of factors that affect the ecosystem in the cultivation of crops

To achieve the goal of research, we normalize the input data presented in the form of a matrix containing a set of values of morphological features by dividing by the norm calculated by the formula:

$$N_i = P_i.MAX - P_i.MIN$$

for each sign. For small amounts of data, statistical modeling techniques can be used to obtain samples that provide robust estimates of the biological system state. The next step is to cluster the data obtained. To do this, we use the Euclidean distance which gives an idea of the closeness of the options. Calculations are performed using the developed program CLUSTERS BIO xls which gives a cluster - a normalized matrix, and also calculates the normalized Euclidean distances for all combinations of pairs of variants. Based on the level of proximity (similarity) of options in the group we build clusters. To build them, we use the standard program STATISTICA 10. And also build a dendrogram of the dependence of the option in the study of the biological system which is used to obtain information about the main thing that affects the processes in the biological system. Those factors that have an accession of less than 0.5 have little effect on the problem being studied. For the analysis of the received data we use the Graph of the maximum coefficients of correlation of signs. This initial form of graph analysis is used to obtain information about the structure of relationships in biological systems. The graph is based on the hypothesis that the direct relationships between the components of the biological system have the largest modulus of correlation, and the correlation coefficients of indirect relationships are less modulo and are calculated by multiplying the correlation coefficients of the corresponding direct relationships.

The problem of biological system research conducted on the impact of the use of organic and mineral fertilizers on soil condition showed that the use of fertilizers gives a significant increase in crop yields. However, despite the positive results of the application of fertilizers in nature, we get a significant burden on the environment and changes in the ecological landscape.