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The aspects of problems of biological productive systems

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The article puts a question about determination of the form of interaction of various factors affecting productivity of populations and the evaluation of parameters of productivity. Such an analysis makes it possible to develop a special control procedure, by which a maximum production rate of studied resources will be provided.

Since the antiquity (Plato), scientists have warned of devastating impact that a civilization can have on productive forces of nature. They tried to warn the society of the coming danger by realistic estimation of increasing humanity's growing demand against the background of contrast with the productive capacity of Earth. As a result of this impact on more and more depleted natural resources humanity could come to the brink of extinction.

In this connection the most important problems are:

1. Correct and precise estimate of annually renewed natural resources in the world.
2. The choice of a way to achieve the maximum level of their production and maintenance. That is to choose how to maximize the output without damaging self-renewal ability of the population.

To solve them we should, first, estimate with a high accuracy maximum limit of renewable natural resources that the world can produce annually. And second, we should figure out how to achieve and maintain the maximum level of populations' producing ability.

These aspects of the investigations into the possibility of preservation of natural resources belong to the sphere of population ecology. In this area the following problems must be solved: what age distribution and exploitation pace for each population and environmental conditions can give maximum output and at the same time keep enough reproductively-active individuals to maintain maximum growth speed of biomass. What maximum will be reached in this way? Population ecologists can determine the form of interaction of various factors that influence producing ability of populations and evaluate parameters in the productivity equation. Such an analysis allows to develop a special control procedure leading to a maximum production rate of studied resources. [1]

Researches in this field try to examine producing ability of populations carefully in laboratories and in field conditions, but it's time to make serious efforts for the construction of theoretical population productivity model. To date, a lot of mathematical models of productivity have been formulated for particular populations. They are attributable mainly to the analysis of steady states of populations in a constant medium.

The constructed model of productivity could be universally applicable to renewable natural resources. Such a model must take into account different types of productive

[1] K.E.F. Watt. The Conceptual Formulation and Mathematical Solution of Practical Problems in Population Input-Output Dynamics, «General Systems» vol. IX, 1964, p. 159-165.

biological systems in order to identify those specific problems of productivity that may arise, and the factors that must be considered when addressing these problems. This will allow to approach to a general formulation of the problem of productivity of the population. Modern level of computing technology makes it possible to complete a detailed elaboration of the theory of populations for different regions of the Earth, primarily for productive significant areas and later for all others. This will create a global detailed system model based on region and species populations. The simplest possible type of the productive system is regularly exploited population supported in a controlled environment.

Attention must be focused on maximising the biological productivity, which is defined as the total biomass produced per time unit. Productivity determines the maximum output per unit of time, which you can get and maintain. The ideal mode of use is the one where supported output per unit of time is exactly equal to supported productivity less residue, which should be kept intact to maintain output. If the conditions of existence of a population are controllable, the only variable that depends on productivity is intraspecific competition. With such a method of use productivity for different species depends on the biotic potential of the species.

Such methods of exploitation are significant only where biomass production can really be increased with a program of use. In terms of basic environmental principles, this means that if the rate of conversion of food into biomass by some species is reduced due to the pressure of intraspecific competition, the weakening of this pressure may intensify species. This can occur only where the species lives in an environment adequate to its birth, growth and survival.

However, if the species lives at an edge of a favorable territory, the population may depend almost entirely on climate. It is also necessary to consider the time of extermination of the population, which could die a natural death caused by harsh climate and weather. Interspecies competition also needs to be considered.

In respect of complex exploited systems there are problems, related in a number of common features:

1. Output needs to be as high as possible, with the following restrictions. We mustn't cause excessive damage to the producing ability of a system. Productivity needs to be maintained at the maximum level. This is the highest possible supported output of the population.

2. Limitations of the methods of achieving the maximum output are necessary that would minimize intraspecific competition.

3. Productive systems always have their particular rhythm (seasonal, climatic, growth, reproduction, etc). Effective production rate of biomass is different for different species.

4. Biological productivity of the population can be controlled by environmental factors; distribution within a population by size and age, which regulates competition.

5. The regulatory way to control the population biomass are intraspecific competition, interspecific competition, food and water. We must take into account diseases, predators, parasites and etc. Model for a given population can be useful and real, if it takes into account all the regulators.

Bibliography

K.E.F. Watt. The Conceptual Formulation and Mathematical Solution of Practical Problems in Population Input-Output Dynamics, «General Systems» vol. IX, 1964, p. 159-165.