

AN INTERACTION MODEL FOR LIVESTOCK FARMING AND STEPPE ECOSYSTEM

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This work builds a macro model for livestock farming based on aggregation of initial micro description for rational control of total number of vintage livestock (age cohorts). All variety of animal kinds is reduced to one by given recount coefficients. An optimal problem on co-hort total number of livestock (planning problem for life cycle of animals) is resolved. As a result the optimum age limit for the operation of animals, the optimum volume of the credits for the farm, the optimum speed of slaughter, and the optimum conditions of the farm purchase of young animals are determined. The integral equation for the equilibrium price of young animals, which contains forward-looking values of variables, is obtained. It means that for constructing of the model it is necessary to know how the farms forecast the prices. The problem is solved by the application of the rational expectations hypothesis: within the model framework all farms have the precise forecast of necessary prices on the planned period (they exploit available information without making systematic mistakes). A steppe ecosystem model based on a carbon cycle with grazed animals as part of the ecosystem is constructed. The model takes into account some external influences. The parameters of this model are identified on the basis of data on grassland ecosystems. Besides a model of credit-and-monetary system taking into account the organization of this system according to the Stanley Fischer currency board scheme with fixed exchange rate is constructed. In this case gold currency reserves change by the balance of payments. In the description of full ecological-economic model it is taken into account that the maintenance of animals damages the nature. Balance relationships on the product market and on the labor market are carefully extracted for closing the model. In the description of interaction of livestock farming and ecosystem and government regulated mechanisms it is assumed that the tax rate per head of animal grows when the degradation level exceeds a limiting value established by the law, and the raw material price changes proportional to the remainder of its biomass stock. Numerical experiments on the obtained ecological-economic model with the rational expectations are the complex computational problem, which is solved with the help of the highly productive calculations on the supercomputer MVS 1000M. Model is calibrated according to the Mongolian data. In the base scenario of the model calculations the basic indices of environment decrease down to 100. On the basis of base scenario the developments of processes in complex system of interaction of livestock farming and steppe ecosystem several alternative scenarios are built and calculated. The calculations showed that the specified system maintains also more rigid relation to the level of the environment degradation than in the base scenario. In this case it is possible to improve all macro indexes of the studied system. It is shown also that an increase of efficiency of actions for rational use of available resources improves the steppe ecosystem state, enables to increase the output of final production and the incomes of the population. One of scenarios demonstrates a regime in which the area of natural pastures is reduced by the virtue of external human activity (for example, space activity).