

问题讨论

晋陕宁黄土丘陵区生态修复与农林牧业持续发展仿真研究

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摘要 晋陕宁黄土丘陵区土壤侵蚀严重, 生态环境脆弱, 不合理利用土地是其主要原因, 生态修复与环境重建是该区生态与经济持续发展的重要战略措施。应用系统动力学(System Dynamic, 简称SD)和“反馈控制(Feed back control)理论建立了该区生态修复和环境重建的SD模型, 它分为人口、农业、林业、牧业、农村经济、土壤侵蚀和生态环境6个模块, 仿真时间1990~2080年, 步长1a。经检验该SD模型的有效性为93.5%, 可用于未来仿真预测。根据该区的生态环境特点和农牧业发展现状, 选择生态环境恢复重建的3种典型模式——同步发展模式(A模式)、逐步调整模式(B模式)和现状发展模式(C模式)进行仿真研究, 预测3种模式2000~2080年的土壤侵蚀、土地利用的发展动态以及农林牧业和生态环境演化趋势。仿真结果表明: 土地利用与农、林、牧业持续发展密切相关, 坡耕地和草场退化是制约农林牧业发展的主要因素。合理调整土地利用结构和加速治理侵蚀, 可促进生态环境逐步恢复和农林牧业持续发展。同步发展模式(A模式)是该区生态修复和环境重建的3个仿真模式中的最优策略, 它可促进农林牧协调发展和生态-经济趋向良性循环, 并提出该区生态修复与环境重建的对策措施。该SD模型结构合理, 运行功能良好, 能较真实的模拟具有多变量、非线性变量的复杂生态系统的动态行为, 为生态修复研究提供一种有效工具。

关键词 [晋陕宁黄土丘陵区](#); [生态修复](#); [土地利用](#); [土壤侵蚀](#); [仿真研究](#); [持续发展](#)

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The simulation study of the rehabilitation of ecological environments and the sustainable developments of agriculture, forestry, animal husbandry in the loess hilly regions in Shanxi Province, Shaanxi Province and Ningxia Autonomous Region

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Abstract The hilly loess regions suffer severe soil erosion and thus form fragile ecological environments mainly because of their improper land uses and as a result ecological rehabilitation and environmental reconstruction are the strategies for the sustainable ecological and economic developments in these regions. With its simulation steplength standing at one year and its simulation period spanned between 1990 and 2080, the study, relying on the theories in system dynamics (shortened as SD) and feedback control and, has established the SD models of ecological rehabilitation and environmental reconstruction whose 6 modules being respectively aimed at agriculture, forestry, animal husbandry, rural economy, soil erosion and ecological environment. The models have been tested with plus software on PC computer to have an efficiency of 93.5% and can be used for the future simulation predictions.Considering the characteristics of ecological environments and the developmental actualites of agriculture and animal husbandry in the regions, there are three representative models, synchronous developmental model (Model A), progressive adjustment model (Model B) and actual development model (Model C), which have been be chosen for the ecological and environmental reconstructions of these regions in analyzing and predicting th

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e trends in soil erosion, land use, agriculture, forestry and animal husbandry and ecological environment evolution between 2000 and 2080. The simulation results show as follows:
Land use closely relates to the sustainable developments of agriculture, forestry-and animal husbandry, and the degeneration of slope-farmland and grassland degenerations are the main limiting factor in the sustainable developments of agriculture, forestry-and animal husbandry. Thus, properly-regulated land use and accelerated erosion control are capable of enhancing the gradual ecological rehabilitation and the sustainable developments of agriculture, forestry and animal husbandry. Of the three simulation models, synchronous developmental model is the optimal strategy for ecological rehabilitation and environmental reconstructions in these regions. It can promote the coordinative development of agriculture, forestry-and animal husbandry and help to form a good ecological and economic cycle.
With its good structure and performance, the SD model is capable of the dynamic actions of complex ecosystems involving multiple variables and nonlinear variables thereby becoming an effective tool in the research of ecological rehabilitation. The major problems of the SD model are that because the model covers a large scope and involves some statistically generalized parameter and field experimental data about erosion, which are not completely representative, it suffers in reliability and efficiency and thus needs to further modify the sampling and analyzing methods to guarantee proper parameters and thus make the model perform well.

Key words hilly loess regions Shanxi Province Shaanxi Province Ningxia Autonomous Region ecological rehabilitation land use soil erosion simulation research sustainable development

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