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利用IANN建立县域种植业可持续发展预警模型

Early warning model of farming sustainability in counties based on improved artificial neural network

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中文摘要:

区域种植业系统的生存和发展易受到来自种植业经济社会、资源和环境等因素的干扰,使其可能偏离正常的运行轨道,产生各种警情。该文基于加权主成分分析算法,从优化网络初始权值入手,对误差反传BP算法进行改良,形成快速收敛和高精度的加权主成分网络模型WPCA-NN。从而将黄色预警法与非线性模拟方法巧妙结合,建立了科学合理的短期县域种植业可持续性预警指标体系和模型体系,并以黄河下游沿岸典型县市垦利和封丘为案例进行了实证研究。研究表明:1)种植业可持续性的空间尺度属性非常重要,以改进人工神经网络(IANN)为核心的县域种植业可持续性预警模型体系具有良好的可操作性。2)WPCA-NN既能反映决策者对各指标的偏好程度,又能规避经典BP算法学习速度慢和易陷入局部极小的缺陷。3)县域种植业可持续性预警实证分析达到预期结果并符合实际。2010—2014年两县警情以轻警和中警为主,资源和环境方面警兆的异常波动,尤其是权重较大的警兆指标对警情有着更为直接的影响。

英文摘要:

Vulnerable to the fluctuations of economy, resource and environment, the development of regional agricultural system may deviate from the normal orbit and result in a variety of warning conditions. In this paper, scientific early-warning model system for short-term county-scale sustainability of farming measure was established with the improved artificial neural network model as a core by combining skillfully with the “yellow” warning method and the traditional systematic approach. The BP neural network model was improved by the weighted principal component analysis method to optimize the initial weights of network. In the downstream region along Yellow River, two typical counties, Kenli and Fengqiu, were selected as the main study areas to complete the four key steps of early-warning. The results showed that, primarily, the county-scale early-warning model system for measure of farming sustainability based on the IANN method had good operability. Secondly, the improved BP algorithm can not only reflect the preferences of decision makers on the indicators, but also obtain a fast convergent and highly accurate neural network model. Finally, the empirical analysis of early-warning for the sustainability of farming measure in the county scale achieved the desired goals and was in line with reality. The warning degrees in two counties from 2010 to 2014 were mainly light and moderate, on which abnormal fluctuations of warning signs from resource and environment subsystems, especially those having greater weights, had a more direct impact.

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