Patterning and Prediction of Community Changes by Using Time-Delay Artificial Neural Networks

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Abstract

The feasibility of artificial neural networks in patterning dynamic data was demonstrated to predict changes in ecological communities. Community dynamics have been considered to be difficult for prediction since community consists of many species and they vary in a complex manner under different environmental conditions. Prediction of community dynamics, however, is an important topic in terms of monitoring ecological status, especially for the water quality control in aquatic ecosystems. In this study information lied in density and biomass of the selected taxa in community were extracted with time-delay artificial neural networks such as recurrent neural network. For input data, benthic macroinvertebrate communities were collected from the urbanized streams in Korea. The previous data sets for community data were provided in a time-sequence as input to the network while the present community data were correspondingly matched as output. The connectivity of computation nodes was arranged in such a way that the previous community data have time-delayed feedbacks through hidden and output nodes. In concurrence with the input of biological data, the corresponding data sets for environments (e.g., water velocity and depth, amount of sedimented organic matter, etc) were also given to the network in the process of training. The patterning through the network revealed the impacts of various environmental factors on the temporal development of the benthic macroinvertebrate communities. The short-time prediction of community changes in densities and biomass of selected taxa was also possible by the trained network after the new data sets were provided as input to the network for recognition.

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