FOOD WEBS, ECOLOGICAL COMMUNITIES, AND RANDOM GRAPHS

Joel E. Cohen
Rockefeller ~~University,~~ 1230 York Avenue,
New York, NY 10021, USA

I review joint work with F. Briand and C. M. Newman.

An ecological community is whatever lives in a habitat that some ecologist wants to study. A food web describles which kinds of organisms in a community eat which other kinds. A web may be represented as a directed graph. The nodes or vertices correspond to trophic species (a collection of organisms that have the same diets and the same predators). A link in a web goes from food to eater, or from prey to predator.

A collection of 113 community webs from 89 distinct published studies supports five empirical generalizations. First, excluding cannibalism, cycles are rare. Second, chains are short (rarely more than four or five links). Third, there is no increasing or the decreasing trend in the proportions of top, intermediate and basal species as the number of species increases. Fourth, the proportions of different kinds of links show no increasing or decreasing trend as the number of species in a web varies. Fifth, a web typically has about twice as many links as species.

These "laws" can be explained by a simple model of random graphs called the cascade model. For example, as the number of species becomes large, ~~the cascade model. For example, as the number of species becomes large,~~ the cascade model predicts 26% top species, 48% intermediate species, 53% intermediate and 19% basal. The model predicts 27% basal-intermediate, 13% basal-top, 33% intermediate-intermediate and 27% intermediate-top links. We observe, correspondingly, 27%, 8%, 30%, and 35%. The cascade model also describles acceptably the number of chains of each ~~lenght~~ in all but 16 or 17 of 113 webs. The cascade model makes new predictions and has numerous potential extensions and applications.

and 26% basal species. We observe, correspondingly, 29% top,

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