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FOOD WEBS: LINKAGE, INTERACTION STRENGTH AND COMMUNITY INFRASTRUCTURE

THE THIRD TANSLEY LECTURE

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INTRODUCTION

It seems particularly opportune to discuss food webs and evolving views on their structure here for both their genesis and first modern treatment (Elton 1927) and much of their later development (May 1973; Pimm & Lawton 1978) has a decidedly British accent to it. The central significance of webs is derived from the fact that the links between species are often easily identified and the resultant trophic scaffolding provides a tempting descriptor of community structure. If this structure is in any fashion related to the persistence of natural communities or their stability, however defined, then we are dealing with issues of vital ecological importance.

Elton's views have admirably withstood the tests of time. They were especially useful to field biologists, and encouraged the assembly and organization of feeding data into networks of trophically bonded species or higher taxa. The early emphasis was on connectedness *per se*. Perhaps the first significant deviation from this theme was the development of the trophic dynamic viewpoint of Lindeman (1942) and all subsequent efforts to describe energy transfer and material flow through communities. A second departure, and one I believe to be conceptually richer, was the formalization of the view that web structure and community stability were related (MacArthur 1955). May (1973) in another landmark publication questioned this relationship and called attention to four primary web features: the number of species involved, the nature of their interconnections, the number of connections per species, and the intensity of interaction between web members. This focus has stimulated application to agroecosystems (Southwood & Way 1970), new interpretations of the number of trophic levels (Pimm & Lawton 1977), and a resurgence of interest in the significance of mutualism (Vance 1978). It has not been characterized by stunning breakthroughs, ecological stability remains a frustrating issue, and to a field ecologist, the ties between model and reality at times appear remote. All but ignored in these recent developments is an insightful recognition that trophic pathways might contribute little to ecosystem stability, and that the answers lie in the spatial patterning of the environment (Smith 1972). I wish to return to the basic observations on food webs as a naturalist and experimentalist, and employing an approach advocated by Sir Arthur Tansley (Godwin 1977), ask whether we are modelling their correct properties, and if not, what modifications might be made.

TERMINOLOGY

The assumed importance of predator-prey or consumer-resource relationships, their relative ease of observation, and an attractive, simple graphical format have accelerated the interest of ecologist and mathematician alike on web structure and organization

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