

This Week's Citation Classic

CC/NUMBER 52
DECEMBER 29, 1980

Margalef R. On certain unifying principles in ecology. *Amer. Naturalist* 97:357-74, 1963. [Institute for Fisheries Investigation, Barcelona, Spain]

Ecosystems that are more rich in structure, as reflected at diverse observational levels, are supported by a flow of energy that is relatively lower. Fulfillment of the tendency to fall into this state is succession. Recurrent successional change becomes a frame for evolution. Environmental fluctuation and exploitation from outside can result in irregular change, seen as reverse succession. Between adjacent systems, energy flows from the less organized to the more complex. [The SCⁱ® indicates that this paper has been cited over 155 times since 1963.]

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October 23, 1980

"At the beginning of the 1960s I was working in a research institute, with leisure and freedom, without administrative duties, and with just the supplementary stimulation provided by a small number of good students registered on a voluntary basis in a course on general ecology. A few years before I had shifted my principal interest from freshwater to the oceans, and had recently had the occasion to work in the Mediterranean and the Caribbean, as well as in the fjordlike Rias of NW Spain. Weekly strolls over the countryside with my children were regular. At the time, I had occasion to travel widely abroad, mostly in the US, and discuss my ideas in many personal contacts.

"I developed a feeling about the current trends in ecology and did not like

them completely. Mathematical ecology was attractive, but I could not see any essential improvement since Volterra, and many current assumptions did not make much sense to me from the point of view of physics. I had been nurtured in the tradition of the old continental European approach to ecology. Thienemann, Braun-Blanquet, and, later, Hutchinson influenced me strongly.

"My work leading to the speculations, or supporting the conclusions of this paper, was published in Spanish and was almost unknown. So this first summary published in English conveyed ideas born and bred in relative isolation.

"From my discussions with colleagues and from the reaction to my seminars at the time, I feel that a part of the success of this paper was because it provided a relatively orthodox frame related to physics, that is, to thermodynamics, and to information theory to supplement a strictly individualistic approach to ecology. Most biologists accepted and accept that the success of an individual who has passed part of its genes to a new generation is everything that counts, and that no more questions should be asked. My point was that physical laws place a number of constraints that add to the proximity and interaction between organisms, in a way that some anticipation can be made about who will overcome the selection test and what the ecosystem will look like. This was consistent with accepting that possibilities for life are almost boundless and that the approach called reductionistic is very effective in ecology. My approach could also be easily extended to the humanized ecosystems.

"I have tried to present my recent views on the whole subject in *La Biosfera entre la Termodinámica y el Juego*.¹

1. **Margalef R.** *La biosfera entre la termodinámica y el juego*. Barcelona, Spain: Ediciones Omega, 1980. 236 p.