Biocoenosis

Biocoenosis : the expression of "mutualism" in the biosphere
A biocoenosis can be defined as a community (the etymological meaning of the suffix –coenosis) of living beings (the prefix bio-) belonging to different species and associated by way of inter-species interdependence or mutualism that can be studied and modelled, as in the classic representations of food chains and trophic networks. If it is today used mainly to refer to the living fraction of an ecosystem (the biotope being the inert fraction), the term biocoenosis is much older than the theory of the ecosystem (Tansley, 1935), and it also impliesa much more mobile, unstable representations of reality. The German biologist Möbius coined the term in 1877 in one of the first studies, later to become a classic, to be conducted in the emerging science of ecology: the study was on oyster beds. He was seeking to determine why the oyster beds of Cancale, Marennes and Arcachon were becoming exhausted, while the oyster beds in the British river estuaries and the Schleswig-Holstein oyster beds were very rich. He related this phenomenon to the other species present, rather than to the oysters in the beds themselves. This study went beyond the approach inherited from the geography of plants established by Alexander Humboldt, an approach that had already been questioned by the work of Darwin and his disciples such as Ernst Haeckem (the "founder" if not of ecology, at least of the term in a publication in 1866). Phyto-geography, based on a mere observation of spatial coincidence between plant formations on the one hand (i.e. physiognomic vegetation types), and climatic or edaphic conditions on the other, viewed as pre-scientific, aroused little interest among ecologists. The evidencing of communities, and the recognition that the species forming these communities together form a system (incorporating elements of the environment in which they live) led to several decades of debate:

• Are these communities super-organisms? This organicist approach dominated in the United States with Clements, who conceived the biosphere as a collection of super-organisms that are born, develop and become adult, passing from the pioneer stages to the climax, or optimal stage of development, in which the bioceoenosis reaches a balance with the environment. On a global scale, biomes are the materialisation of these super-organisms. The theory of the ecosystem, in which the biocoenosis was to find its place, was constructed in reaction against the organicist approach in ecology.

• Is a biocoenosis the combination of a zoo-coenosis and a phyto-coenosis? Each biocoenosis comprises producer species (plants), consumer species (animals) and species that decompose living matter (bacteria, fungi). Nevertheless, should one go along with certain authors, who subdivide, implicitly or explicitly, the biocoenoses into zoo-coenoses and phyto-coenoses? If it is admitted that there are links between species in a biocoenosis, materialising the ecosystem, as in the classic patterns of food chains and networks, it is more debatable to consider only a part of the whole while allocating it the same property. If we consider the plant fraction of the biocoenosis, do the species that make it up form a phytocoenosis, a plant community in the strong sense of the word community? Does the presence of a given plant species condition the presence of the other plants, as is the case for the species associated with the oyster beds in the example studied by Möbius? It is, in all events, on the basis of the existence of such plant communities that phyto-sociology based itself, where the dominant school of thought, the "sigmatiste" school (SGMA, Montpellier), sought to achieve a universal hierarchical classification of plant groups, plant formations recurring across space the recognition of which enables the mapping of plant communities, seen as a faithful reflection of the geography of the biotopes. The spatial organisation model for the biosphere that is associated with this view of things is that of a mosaic of discrete units that are easy to delineate (or at least the transitions from one to another are considerably reduced). Yet the actual patterns of vegetation cover do not really fit this model, and there are many reasons why this is so. The main reason is that plants need only light, water and nutrients in the soil for their growth, development and reproduction (they are autotrophic). The plants of a given species rarely "need" plants of another species. Thus each species possesses its own manner of occupying space and using resources, as was underlined by Gleason in the 1920s (he termed this conception of vegetation "individualistic", a term that is not in fact well suited, since a species is not an individual but a collection of individuals). The presence side by side of plants belonging to different species does not generally mean that they entertain biocoenotic relationships one with another.

• The danger of analogies
Sociology, competition, mutualism, community, the individualistic conception: the vocabulary chosen in the 19th and 20th centuries is strongly connoted, while no analogy can be established between the biosphere and human societies, whether with respect to morphology, to organisation, or to dynamics. The deleterious transpositions of the concepts and theories of ecology to societies are well known, from eugenics propounded by Haeckel to "social Darwinism". In reverse, the intrusion of philosophical, religious or political positions has rarely brought light to the areas of bio-geography and ecology. One of the advantages of the terms ecosystem, biotope, or biocoenosis is that they do not lend themselves to these confusions.

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