
What may be General Ecology?

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Abstract

Ecology is the science of the relations between living beings and their environment. It is divided in animal ecology, vegetal ecology, microbial ecology, human ecology, etc. Is it possible today to find commonalities in these particular ecologies and to see what may be general ecology ?

To find an answer, we must remind the essential difference between living beings and inanimate objects : according to the classical definition, living beings differ from inanimate objects because they are able to move by themselves, to grow and to reproduce. More precisely, the physical reaction of an inanimate object to a stimulus coming from its environment is unique and strictly determined by the laws of mechanics. On the contrary, several reactions of a living being to a physical change in its environment are possible and they are controlled by a **cybernetic system** where a memory gives the information which is necessary for the control.

Any living system stays alive as long as it reacts to the perturbations, so as to evolve around a "metastable" equilibrium state. To understand this, the simplest comparison is that of a ball wobbling in a hollow dug in the bottom of a box. The ball stays in the hollow as long as the perturbations are feable. If a perturbation is too strong, the ball escapes from the hollow, and this may be the death of the living system. The ball may also fall in an another hollow where it will again wobble if the system may find a new model of control.

In the language pf cybernetics, the hollows are named "attractors". The transition phase of the system between two hollows is short, because the system is then instable, and it is named "crisis" which meant in greek language "decision". The crisis is a gate opened to innovation.

The simplest example of this way of functioning is the equilibrium found by a vegetal or animal population pertaining to one species in its environment. As long as the **memory** included in he DNA of its genetic pool is able to counter-react easily to the usual perturbations of the environment, the population remains inside the species. But if the environment changes too strongly, the population disappears, unless its genetic pool is rich enough to create a new species adapted to the new environment. In this case, the after crisis innovation is the new species. The result of this process is the diversity of the biosphere.

This model of functioning operates at all scales of the living world, with a type of memory different for each scale.

1 At the level of the cells and tissues of an individual, where the information is "epigenetic", the stable phase is the addition of new cells to a growing organ ; the crisis is the birth of a new type of organ, for example the birth of the neurons in the exodermis.

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2 For the evolution of vegetation from bare soil to a grassland, and after to a forest, the memory which contains the possibilities of change is the sets of genomes and life traits of the species present and of the species able to build the new type of vegetation. The crisis is the arrival of seeds of new species, and the transition is smoother than in the previous examples. The result is the diversity of landscapes.

3 The human societies are collections of persons who have a collective memory in the books, computers, data banks on the economy of companies and governments. Each tribe, society or nation has its own memory which gives an original functioning. The crisis is a civil or international war, which gives a new equilibrium.

At all these scales, the process is the same : the memory of each subsystem contains **information** which holds the possibility to regulate its functioning till the moment of a crisis which destroy it or leads to a new innovating system. In all these cases, it is the reaction of the system to the more or less important change of its **environment** which drives the evolution of the system. This process is therefore the heart of a rally general ecology.