

LANDSCAPE RESEARCH AND ITS APPLICATIONS IN ENVIROMENTAL MANAGEMENT

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THE ROLE OF DISTURBANCES AND BARRIERS IN WORKING AND DEVELOPMENT OF BIOCECENOSIS

Discontinuity in Space and Time

The main attribute of living organisms (in more broad views – „biomonons”) is trending to expansion, propagation and persistence in space and time dimension (Montenat et al. 1993, Czachorowski 1993 c). This expansion finds expression in growth during ontogenese, reproduction and „augmentation” (sexless reproduction) (Bohr 1984), dyspersion, colonization, adaptation and evolution. This expansion is delimited by a space-time discontinuity of environment. Considering the hierarchic organization of life as soon as the hierarchy of spece-time discontinuity and continuity of the environment, the living organisms are dependence on discontinuity in unlike rank. A given discontinuity is a barrier for one species, but for another the discontinuity is manifesting as a continuity of environmental factors.

The discontinuity mentioned, in various rank of unconformity and gradient character, in a space dimension manifest on various scale of environmental heterogeneity, „granular” and occurence different barriers (Allen & Hoekstra, 1992, Czachorowski, 1993 b). The different scale and hierarchy of this barriers distinguishes various levels of the biological organization: from microbiocenoses of a interstine to large ecosystems and ecological landscapes.

The time discontinuity (also different in range and intensity) manifest, on time variation of environmental factors: a diurnal variation, a year-to-year variability, a climate changeability, every disturbances (e.g. floods, bushfires, forest fires), a predator impact and a competition. The time discontinuity manifests on instability of environmental factors, as soon as on unforeseeability (unpredictability, non-recurrence, acyclicability).

A given barrier or disturbance can possess real (i.e. to brake, to delimit) importance for one species (specimen, population or another defined of the life organization level) but for a second species can not real and it is possible examine as environmental continuity. In evolution and filogeny of the life there are trend to cross of the discontinuity thanks to various adaptations, evolution changes and towards to become independent of environmental factors (Montenat et al. 1993, Czachorowski 1993 c). In a way this independence is crossing of barriers and discontinuity too (Czachorowski, in press).

The living organisms and species represents different ability to crossing of the space-time

discontinuity. Therefore a landscape discontinuity has a different importance for various species. This differentiation of importance is resulted from not only size and mobility of organisms. It results from dispersionability, ability to diapause or hibernation, ecological specialization and life-history styles (Williams 1987, Bruton 1989, Czachorowski 1993 a).

To come into begining of some barrier (in time or space) to give occasion to distinguishing of a fragment of environment, to give occasion to free space, free resources, free „grain”, „island” or patch. This island is an attractive place for occupance and to makes it possible for colonization. A species, a specimen or a population who is ability to crossing of the existed barrier has ability to development and increase of the own biomass. Free from competition would be a resources and fizycal space. The more strong barrier the late colonization and the more faint competition. Only own growth and expansion the „victorious” population will be competition for itself. The time variant is goot illustrated by the filogenetic tree, however the space variant will be illustrated by very good suppling documentary evidence for expansions many species. It will be example of the filogenetic origin of insect wings (and fly ability) as soon as evolutionary development of amfibians in isolating freshwater pools (ponds), where this process has taken place (Czachorowski in press).

Life-History Styles

The species are characterized by different life-history styles, appeared in ecological specializations, „r” or „K” strategy, indirect or direct ontogeny, ability to dispersion, size and longevity, sexual or asexual reproductions and so on (Bruton 1989, Bohr 1984, Falińska 1990, Brzeziecki 1990, Williams 1987, Czachorowski 1993 a). Species compositions of a given landscape component (a environmental medium) is conditioned to environmental factors, degree of separation (barriers and disturbances) and life-history styles of the colonizing species (fig. 1).

The living organisms are adapted to crossing of existing discontinuities of an environment. At times only some ontogenetic phase are ability to the space dispersion (e.g. many larvas of marine invertebrates, imagines of Pterygota) or ability to survival of disturbances (cysts, spore, diapause, estivation, rest phases ect.). There are different abilities considering moving ability (compare plants and animals, ability to swimming, treading, flying etc.).

Considering succession as process exchanging of different life-history style species (fig. 2), it is possible to notice of some collisions. In instance a long living species, for example some trees, there is observed of occurrence a given species during long time, during many succesional phases (Falińska 1990). Are there consequently valid approach to uniting of the life strategies with at the present time of environmental factors (stability, predictability)? If we more clear-sighted look at this problem, we perceive change of life style during the ontogeny. There is very clear relationship between the life-history style (strategy) and the environmental discontinuity. On the unicellular level (fito- and zooplankton) there are observed changes of procreation strategy: alternation of sexual and asexual reproduction (parthenogenesis, neoteny), growth and spore-process and cyst-process (fig. 2 b). On the plant level there are observed change of intensity of vegetative propagation and generative propagation by seeds during the ecological succession and growth in ontogeny (fig. 2 c).

Therefore, it is more handy using a term „econe” for description this phenomena.

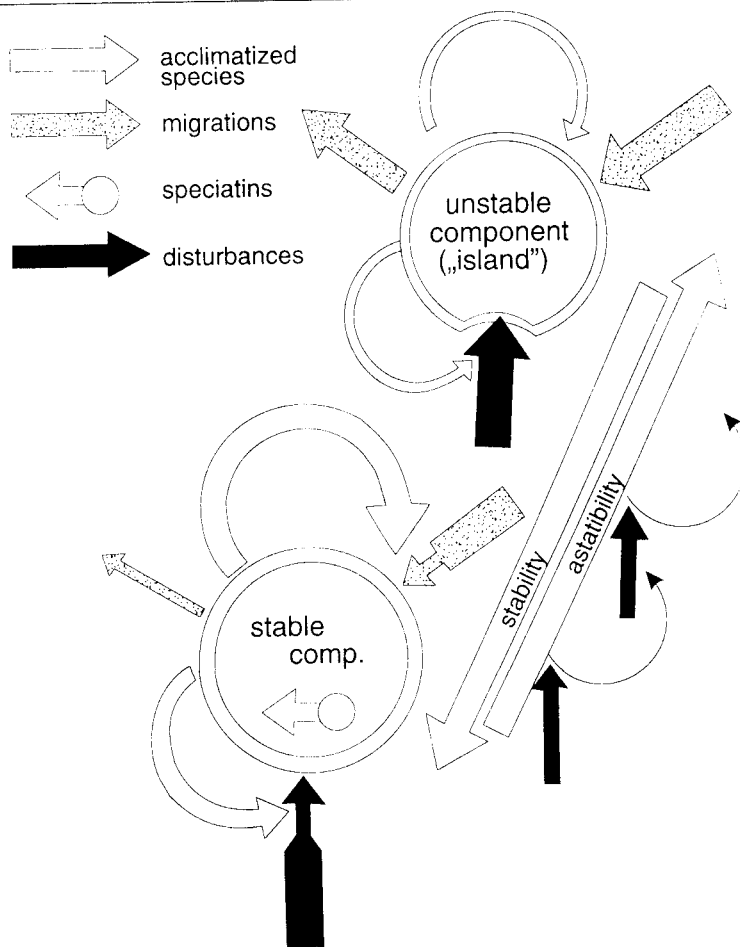


Fig. 1. A model of succession in distinguished components of landscape. a course of succession to stability or astability is resulting from intensity and frequency disturbances, life-history styles (ability to dispersion, colonization and competition) and from stabilization impact of biocenosis (according to Czachorowski 1993 ... changed).

(Heatwole 1989). The Econe is a one the ontogenetic stages with one ecological characteristics such as a diet or a habitat, i.e. occupy one niches. Many species made up of subgroups (life history stages: for instace larval instar and imagines, sexes, morphs, age classes) which differ fundamentally in important ecological characteristics (differ in dispersion, competition, integrating role an so on). So, we can divide of the species into nomoeconal and polyeconal species (the species may consist of one or more econes). Changes of life-history styles, as adaptation to differ environmental factors including predictability and stability, manifests not only as species replacement in the course of succession, but as the life strategy replacement during ontogeny of one specimen (or population) in the course of succession too (fig. 2).

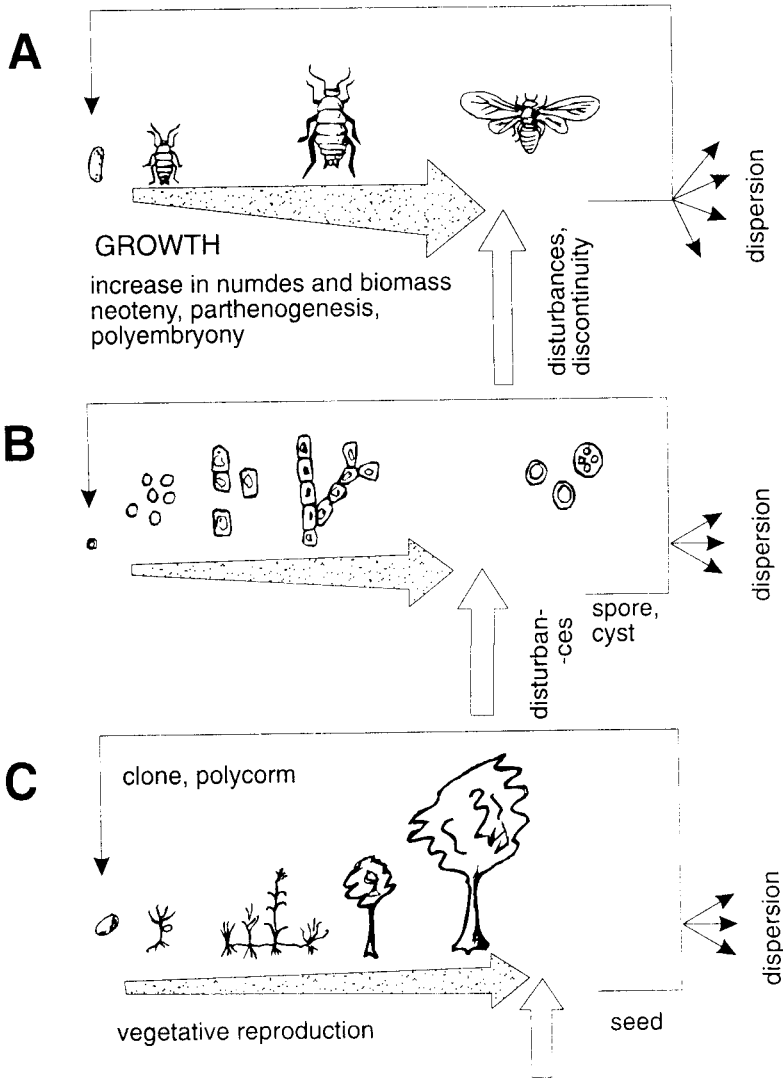


Fig. 2. A schematic diagram of change of live-strategy during ontogeny of polyecial species, in connection with time and space discontinuity (disturbances and barriers – heterogeneity).

The Role of Discontinuity

The role of discontinuity is related with ability to migratoin (colonization and recolonization) of species differ in life-history styles between various components of landscape (Brzeziecki 1990, Czachorowski 1993 a, b, Czachorowski et. al. in press). The occurrence of species with a suitable strategy and adaptations is a very important factor for a recolonization rate in the differ phases of succession. The more space discontinuity (barriers), the this recolonization

more slow. The importance of interdependence and a spatial nearness of stable and unstable habitats there was designated (eg. Czachorowski 1993 b, Czachorowski et. al. 1993).

If we take the environmental discontinuity on the landscape level and space-time discontinuity occurring in the landscape and its hierarchy and relativism of barriers and disturbances in comparison with different species (or ontogenic stages), we can design the role of barriers and disturbances in working of biocenosis. There are important not only space-independent phenomena (Banach et al. 1992, Banaszak 1993). There are very important the spatial nearness of habitats differing in stability and environmental predictability. This spatial nearness of more or less stability habitats affords possibilities for existence and working econes (species of life history stages) differing in life-history styles or strategies in the landscape. A mutual nearness of donoric habitats (giving various econes) enable living (existence) more number of species in the landscape and affect to more biodiversity. Consequently, it is possible more speed and more effective crossing every environmental disturbances and barriers. The discontinuity are very important and distinct in a antropogenic landscape: agrocenosis and urbicenosis. Hence, there is important not only spatial heterogeneity of landscapes, there is important occurrence stability habitats in this landscape.

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