

Evolution and Biodiversity:

The evolutionary basis of biodiversity and its potential for adaptation to global change



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Front cover photo credit:

The changing landscape (Peyresq, southern France). Allan Watt, CEH Edinburgh.



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RE: Changing organisms in changing anthropogenic landscapes
Global change and mechanisms of ecosystem function

Vladimir Vershinin, Institute of Plant and animal Ecology RAS, Russia

With the most common position - the evolution of biodiversity is on the way to maximize the use of environmental resources. The biosphere and all cycles of energy and substance flow are completed, step by step, during the evolution process. This is why the presence of higher biodiversity is one measure that is used to evaluate the stability of an ecosystem. The high degree of biodiversity, at different hierarchical levels of biogeocenoses, is an important factor in ecosystem homeostasis. The other criterion of ecosystem stability is the presence of complete functional blocks – the presence of producers, consumers and reducers guarantees ecosystem sustainability.

We have a lot of examples of functional changes in ecosystems that have occurred as a result of human-induced transformation of natural communities. Examples include food chains of native and invasive species, host-parasite relations, morphogenesis and genetic structure. Genetic structure, morphogenesis and reproductive parameters of populations are strongly influenced by life history canalization and interrelationships with different functional groups in man-transformed communities. Existing environmental changes are defined by long-term vector transformations of communities and population structure as well as the interrelationship of main functional blocks.

Reported changes in these functional relationships may seriously affect the environment-forming activity of biota. It is evident that the balance of ecosystem homeostasis depends on the contribution of the main functional blocks of a community. Transformed ecosystem structure is simplified due to the disappearance of some sensitive species, thus shortening food chains. Therefore, the stability of such systems is maintained by increasing the metabolic rate and energy. In the modern biosphere, along with ancient factors responsible for community's divergence are powerful new factors generated by human activity. Rapid transformation of the modern biosphere under effect of global change leaves no time for evolution, but only adaptation. In this situation pre-adaptive features of some species and populations play a very significant role. With this point of view, the adaptive potential of species and populations depends on their specific genetic structure and their ability to react to change (norm of reaction). This is why complex long-term monitoring is necessary for effective biodiversity conservation.

RE: Changing organisms in changing anthropogenic landscapes

Ferdinando Boero, University of Salento, Italy

I agree with Hans Van Dyck's statement: "The general aims of conservation biology are twofold: 1) documenting and interpreting patterns of change and 2) providing insights to manage biodiversity in order to alter patterns of change. For the latter, we need to understand the mechanisms behind the patterns." But we must distinguish ultimate from proximate causes. Proximate causes affect single species or habitats, and might be buffered in contingent ways (including ex situ conservation, or specific protection at given places, e.g. protected areas), but the ultimate cause is the unbearable anthropogenic pressure on natural ecosystems. There are too many of us, furthermore a part of us (the so called first world) is living in such a way that, if all other humans would live similarly, it would make the world inhospitable for our species. The first thing to do is to reduce the pressure of the first world. We are trying to do this, by simply transferring polluting activities elsewhere (Bhopal?).

Evolutionary ecology teaches us that all species tend to increase their fitness, but the world has no space to contain all these organisms. The most successful species, recognized by the large size of their populations, pose the premises for their own collapse, because their use of resources limits the turn-over of the resources themselves, hence: famine, war and disease.

RE: Changing organisms in changing anthropogenic landscapes

Vladimir Vershinin, Institute of Plant and Animal Ecology, Russia

I agree with Ferdinando Boero and I want to mention that the human population of our planet is not a unified reasonable society moving to common human interests. Unfortunately, we're not a united community, living in harmony with nature.

There is no common humanity living under the laws of collective intelligence which could stop or compel a reasonable limit to technological civilization. The elite of a modern industrial society will not refuse the boons, privileges and profits which it has got due to traditional ways of development of mankind. Changes in people's minds in a technological society is possible, but only for the part that is able to rise above the level of average minds, i.e. those able to voluntarily give up making individual or collective actions that can lead biota to disaster. The emergence of such a change would be an adequate level of significant interspecies differences in brain development. It is necessary to think how to change the minds of those whose whole life is living inside our technological civilization and enjoy all the benefits and privileges of an industrial society. And this is not a role-playing game, which is so abound in all kinds of training.