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Biodiversity Adaptations to Climate Changes

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Abstract

Climate change refers to changes in weather patterns, seasons, to global and regional meteorological phenomena over time. It refers to the increase in the greenhouse effect in the atmosphere, with an impact on the development and production of biomass. Such changes can be caused by human activities. The main change we are facing today is the increase in average temperatures (global warming), but there are other types of changes, including precipitation patterns and extreme weather phenomena. The most important factor in current climate change is the emission of greenhouse gases. Biodiversity can resist (at least temporarily) and adapt to climate change, through physiological adaptations by acquiring new morphological structures by behavioral attitudes-changes in circadian cycles, hibernation (if applicable-aestivation), migrations through the emergence of adaptive mutations, favorable to resistance in new habitat conditions by increasing resistance to the pressure of unfavorable factors.

Keywords: Climate change; Greenhouse effect; Biodiversity adaptations

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Introduction

Biological diversity includes three different levels: species, ecosystems and genetic diversity. In other words, biodiversity is expressed at the level of populations, communities, niches, landscapes, continents and biogeographic regions, being in fact more than the sum of all species, ecosystems or the entire genetic material; it is an attribute of life. Margulis & Schwartz [1] divided the organic world into Super kingdom procarya (I) with only one Kingdom-Bacteria (1) and Super kingdom eucarya (II) with other four-Kingdoms: Protoctista (2), Fungi (3), Plantae (4), Animalia (5). Millions of years before man species appeared, the earth's climate warmed up or cooled. The current phenomenon clearly indicates the temperature has risen. The novelty topic is to realize how human activities contributed to the climate changes and how biodiversity could adapt to new conditions. Physics, chemistry, agriculture, biology, geology, meteorology, oceanography, sociology are more and more preoccupied to better understand these changes, studying natural phenomena, thinking and creating theoretical tests of biodiversity conservation strategies.

Today conditions for biodiversity

We are witness to the alarming increase of the green-house effect. The water vapors, CO2, O_3, CH_4 are like a roof which blocks the heat scattering in the atmosphere and thus the global temperature is changing. The source of these gaseous bodies is mostly from human activities from burning the fossil fuels, drastic deforestations and complex pollutions, deep changes in land use etc. All of these sources are contributing to warming the Earth surface and lower layers of the atmosphere. At the break of day of the hominid species (in pleistocen or ice age) the biodiversity faced with fluctuations and high concentrations of CO_2 in atmosphere, with climatic and precipitation variations, supporting important evolutionary changes and adopting new strategies of adaptations to the new natural conditions. But those climatic changes developed in a longer period of time, enough to allow biodiversity to adapt or

migrate and the land was not so much fragmented as today; there was not the actual pressure and impact of human activities. Habitat administration, degradation and fragmentation pushed many species to smaller and smaller areas from their former range. Or, it is known that restricted species distribution is reflecting in reducing their genetic variability. The interglaciary warming periods affected much less the ecosystems and generally biodiversity than the alarming climate changes recently appeared. With his activities, man contributes to the climate changes and hurried up the unpredictable aggressiveness to the planet and humanity. The monitoring data are suggesting that to maintain the increasing of multi-yearly mean temperature less than 2 °C the emission of green-house effect gas in the developed countries must be reduced up to 2050, with at least 80%. An important green-house gas volume is resulting from factories, agriculture and zootechnics. Reducing forested land to the agriculture and to zootechnics favored, the important gas volume deposited in soil and in vegetation will be released and increase the green-house effects. The 4th International Working Group Rapport estimates that only between 1850-2005, the global mean temperature was risen with 0.76 °C and in the 20th century, the sea level increased with 25mm. These changes affect all the planet, from the small tropical islands to the huge polar areas. The above-mentioned working group prognosis is alarming. Up to 2100 (with today rhythm of the global mean temperature rising of the green-house effect) the temperature will be with 1.4 °C-5.8 °C higher. The impact of these climate changes will be increase of the global mean sea level deep modifications of the rainfall quantities increasing risks to human population, because of new (unknown) disease vectors. Understanding the global biodiversity spoliation because of the climate changes, the international forums in the field had concluded these changes will be most important factors which will determine significant loss of biodiversity up to the end of 21st century. At the same time, optimistic signals on the support and adaptations capacity of biodiversity to the impact of climatic phenomenon would be, if they were producing slowly, in a longer period of time. In relations between climate changes and biodiversity, this one can resist (at least temporary) by

a) Physiological, morphological and ethological behavior.

b) Favorable mutations will be encouraged.

c) Suitable adaptations to use the new habitat resources.

d) Changes of the life cycles.

e) New morphological characters.

f) Increasing resistance to the unfavorable factor pressure, etc.

Adaptations are at the individual, populational and especially at the ecosystemic level [2]. Inside and between species' relations, the biodiversity can adopt suitable strategies to use the ecosystem's resources by sustainable management to protect the coastline areas (e.g. mangroove forests and pioneer plant associations) preservation of the plain and coastline wetlands to reduce the flooding effects preservation of the higher altitude wetlands, as a source of the rivers' flow and the fresh/drinking water's quality. Natural terrestrial, fresh-waters and marine ecosystems conservation, the restoration of the degraded ecosystems, of their genetic and specific diversity are priorities to the biological diversity convention and to the climate change convention, inside the UN. Why? Because the natural ecosystems have a key role in the global carbon cycle in nature and in the biodiversity adaptations to the climate changes. These ecosystems deliver essential services to human welfare and to the successful progress of the sustainable development. When we are talking that biodiversity can support (in certain limits) the negative effects of the climate changes, we mean that the habitat conservation and restoration are contributing to the atmospheric CO_2 reduction. In addition, the ecosystem conservation can reduce the climatic changes' effects as floodings, storms, soil erosion, desertification, etc. Adopting ecosystem's strategies of adaptations can offer benefits on the social, economic and cultural plans to the humanity. At the same time, we must not forget that climate changes are in different rhythms and with variable intensities. Facing these fluctuations, the biodiversity adaptations can become more and more difficult or impossible and suppose higher and higher charges if there is not reduced the non-climatic stress like complex forms of pollution extension of urbanization/infrastructure natural resources overexploitation destruction and fragmentation of habitats. The invasive species control etc. For the period 1901-2000 only on Romania territories, the annual mean temperature was of 0.3 °C higher. At the global level (for 1901-2005 it was 0.74 °C. Also, in the 20th century, the annual quantities of rainfall significantly decreased. Because of the global heating, the frequency and intensity of the extreme meteorological phenomena, alarmingly increased. Biodiversity, agriculture, water resources, silviculture, infrastructure (constructions and buildings), tourism, energy, diff. industries, transport, health care, recreational activities are affected both by the temperature rising and by the decreasing precipitation quantities as well as by disastrous meteorological phenomena. Indirectly there are affected economic sectors: food industry, wood restoration, textile industry, biomass production and of renewable energy. The climate change effects attenuation in agriculture, represents a priority objective in the strategic development actions of the European Union State Members. The inner and between sectorial measures with those to answer to the climate change effects have an interdisciplinary character and imply a global approach. Under the climatic fluctuant conditions (e.g., extreme meteorological phenomena), the vegetal production became variable and the impact should be higher and higher. Thus, recently appeared the European programmes interreg iiib cadses acrete. Agriculture and climate change, how to reduce human effects and threats. Into code there are recommendations to adapt the agricultural practices and all specific technologies, to the climate change effect as well as examples of good practices to reduce gas emissions with green-house effect. Therefore, humanity promoted International Programme of Biodiversity (PBI), Man and Biosphere (MAB), International Union for Nature Conservation (IUCN), Bern Convention (1979), Habitat Convention of Biodiversity Conservation [3] etc. In national legislation there are National and Natural Parks, Biosphere Reserves, Natural Reservations, Natura

2000 sites (SCI and SPA). Under the climate changes, all species will be drastic tested on their capacity to adapt and finding genetic resources to the populational level will be the basic premise to generate new species. It is possible to foresee coming into being at the global and national levels of new species, with surprising adaptive capacities, to resist to the unusual thermic variations or to the high aridity and to reduced precipitations. Today we know at least a part of threatening on biodiversity, like

a) modification of species behavior.

b) deep changes of distribution and habitats' components as a result of species structure changes.

c) extinction of some autochthonous species and the existence of ecological pockets.

d) increasing number of the exotic species, which (in new conditions) can become invasive.

Several proposed measures to help biodiversity adaptations

a) Maintaining and restoration of forests (risk of deforestation) for slopes stabilization and river's flow regularization.

b) Practicing agro-foresting systems to diminish the climate change risks.

c) Conservation of the agro-biodiversity's genetic fund to ensure the gene-flow of the cereal and zootechnical species, with high resistance and adapted to the climate changes.

d) Extension of good practices in the protected areas management (e.g., Natura 2000), by sustainable policies (carefully monitoring and evaluation of ecosystems), can increase the biodiversity adaptation degree to better resistance in new climatic conditions.

e) The above-mentioned strategies of the biodiversity conservation can (in a certain degree) reduce the negative impact of the climatic changes.

f) Land systematization according to the ecological laws.

g) Preservation of a 1:1 ratio between cultivated areas and those of natural ecosystems.

h) Concordance/harmony of landscape with local communities (e.g., one adult need 4-5ha land); the standard for an auto vehicle is 1-3ha, the developed countries, with a privileged environmental situation provide more than 2ha/person.

i) Countries with a precarious environmental situation (e.g., Japan, the Netherlands, Italy) provide less than 0.5ha/person, but they have a brainy management. Thinking for a human population of 10-15 billion inhabitants in 2050, the problem of human harmony with Nature will be will become more important.

j) Implementation of the scientific research results to establish a national system of species monitoring: vulnerable, rare and endangered.

k) Periodical evaluation of the monitoring system, to estimate its efficiency, according to the evolution of the climate changes and identification of the opportunities to modify the monitoring strategy.

l) Establishing national programmes of biodiversity conservation, coordinated by the academic specialized institutions and NGOs.

m) Extension of data base use, got from monitoring and adapting results, using mathematic patterns/modelling.

n) Working out a special management plan for natural habitats, to prevent and stop the habitat's degradation processes, because of the climate changes.

o) Reducing additional pressure, which affect the vulnerable species.

p) Reducing agricultural activities in the affected areas and adopting suitable measures to protect nat and deminat. habitats close to the agricultural areas.

q) Identification of the compensatory measures, nec. to survive the affected population/species.

r) Reduce the impact of the industrial activities on the phreatic waters and air quality, isolating them with forestry curtains.

s) Increasing forested areas, restoration of those degraded and their extension to the favorable areas.

t) Organizing surveys to evaluate the different ecosystem/species vulnerability to the climate changes.

u) Involve all society to provide the necessary resilience/shock to the future negative effects of global heating.

v) Involve all resources to apply these adaptation measures.

w) They could be periodically revised and correlated with the E.U. environmental directions; a continental and global policy.

However, the-flexibility and predictions play an important role in alerting scientists and decision makers to potential biodiversity's future risks. At the same time, the multiplicity of approaches and the resulting variability in projections make it difficult to get a clear picture of the future of biodiversity, under different scenarios of global climatic changes. In order to persist individuals, populations or species, they must produce adaptive responses, which could be of the before mentioned types: morphologically, physiologically, behaviorally, genetically, etc., in space and time. Predictions provide a means to bolster attribution of biological modifications to climate change and can support the development of proactive strategies to reduce climate change impacts on biodiversity. At the same time, the multiplicity of approaches and the resulting variability in projections make it difficult to get a clear picture of the future of

biodiversity, under different scenarios of global climatic changes. However, to persist individuals, populations or species, they must produce adaptive responses, which could be of the before mentioned types, morphologically, physiologically, behaviorally, genetically, etc., in space and time. Frequently we hear that climate changes produce critical outcomes, not only to the biodiversity conservation, but indirectly on the human civilization survival. Why? Because the biodiversity's services and products are at the base of the human species outliving.

Conclusion

In conclusion we can say the man must become fully aware because the human species is part of the biosphere and loss of the ecosystem balance and of biodiversity will affect directly and gravely the continuation of the human civilization development. The above-mentioned measures to slow down climate changes and to protect biodiversity must be taken today, by us and not left to the next generations, when it could be too late.

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