

Biotic Regulation of the Environment

Key Issue of Global Change

Victor G. Gorshkov, Vadim V. Gorshkov and
Anastassia M. Makarieva

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Preface

At the beginning of the third millennium, amidst the consequences of the explosive scientific and technological progress of the twentieth century, humanity is faced with a vague perspective of further development of civilisation. On the one hand, the inherent human claim for improving living standards urges further acceleration of economic growth and exploitation of biospheric resources. On the other hand, it becomes evident that uncontrolled spontaneous development of modern civilisation, determined by catering for immediate human demands, goes hand in hand with global environmental devastation. This, in its turn, inevitably impairs the quality of life and undermines the security of human existence.

Humanity is searching for a compromise between the two trends. Hopes for sustainable development are most often associated with creation of technologies capable of imposing a stabilising impact upon the global environment. This way of solving the problem necessitates further enhancement of civilisation's power, growth of human population and the inevitable cultivation of the remaining natural biota and other biospheric resources. The fact that many difficult issues have been successfully settled so far with the help of science and technology, works to convince people that current environmental problems of humanity can be similarly resolved. However, the statement that a technological solution to the problem of global environmental security is in principle possible, is not self-evident and requires a detailed scientific investigation.

A different path of development compatible with long-term environmental safety lies through conservation and restoration of a substantial part of the Earth's biosphere in its natural, nonperturbed state bearing in mind the stabilising potential of the natural biota of Earth with respect to the global environment. Stabilising properties of the natural nonperturbed biota become evident from the fact that the global environment has been supported in a stable state suitable for life for the last four billion years in spite of external destabilising factors. Restoration of the stabilising biotic potential would mean relaxation of anthropogenic pressure on perturbed territories and complete abandonment of further cultivation of the natural

biota. This strategy sets a ceiling to exploitation of biospheric resources, economic growth and global human population numbers.

There is a very essential difference between the two alternative strategies of civilisation's development. Ample scientific evidence accumulated up to now proves the reality of achieving a sustainable state of civilisation, were the second path of development associated with conservation of the stabilising biotic potential the one to be followed.

In contrast, sustainability of the first strategy of development based on complete cultivation of the biosphere and technological means of ensuring environmental stability remains entirely unproved. It may not be considered as real until a serious scientific investigation of this question yields a positive answer. Only then will humanity be free to choose between the alternative strategies of development, which may be done on the basis of the democratic choice of the majority of people of Earth.

Until such research is conducted, there is no free choice but only one safe strategy of civilisation development, namely to rely on the conservation of the natural biota of Earth. The technological way of development along which modern civilisation is now spontaneously moving is burdened with the risk of global ecological catastrophe and places the very existence of humanity under threat.

This book presents an attempt to perform scientific analysis of possible strategies for the development of civilisation and to work out quantitative recommendations that could be used by people when choosing their future. The obtained results show that it is impossible to substitute the existing natural biotic mechanism of environmental stabilisation by any technological means, whatever the advanced stage of technological progress of civilisation.

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1

General overview

We dedicate this book to Ella Gorshkova

This chapter presents an outline of all the problems to be covered in the book.

The natural biota (i.e. flora and fauna) of Earth undisturbed by human activities regulates the environment on both local and global scales and compensates for any deviations from the optimal environmental characteristics suitable for life as a whole and humans in particular. Natural biotic regulation of the environment is based on genetic information encoded in genomes of natural biological species combined into ecological communities. When the degree of anthropogenic cultivation of the biota goes beyond the ecologically-permissible level, the remaining natural biota of Earth loses its ability to stabilise the global environment. As a result, the global environment degrades. Namely the human-induced perturbation of the natural biota rather than direct anthropogenic forcing appears to be the primary cause of the observed global change. We quantify the area that has to be occupied by natural biota unperturbed by modern industrial society in order to ensure long-term environmental stability on Earth.

1.1 EXTERNAL ENVIRONMENT AND INTERNAL MILIEU

Each organism is characterised by an internal milieu and exists in an external environment, which drastically differ from one another. Such a situation is possible due to the fact that every organism has a natural envelope that protects and separates it from the external environment. Trees have bark, mammals have skin and hair, birds have feathers, living cells have special protecting membranes, etc. The internal milieu of an organism is maintained by the well coordinated work of its internal organs. Failure of any of the internal organs leads to deterioration of the internal milieu and impairment of the general condition (health) of the individual.

Functioning of the internal organs of the organism relies on the continuous consumption of nutrients and energy from the external environment. Within the living body, organic nutrients are decomposed and excreted from the organism