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**The theory of biotic regulation of the environment as a framework concept for integrated environmental policy. An analysis of Russian scientific-political discourse on biodiversity, climate change and environmental services.**

**Abstract**

The paper highlights the relevant aspects of Russian scientific-political discourse on biodiversity, climate change and environmental services during the last decade. The core of the discourse is so call Theory of biotic regulation of the environment (BRET) developed by V. Gorshkov, V. Danilov-Danilian, K. Losev, A. Makarjeva. This theory may be formulated with the following major propositions:

- Natural ecosystems that are undisturbed by humans create and control their environment. They maintain it in a state optimal for the whole environmental community and, up to a certain threshold, compensate for all deviations from that optimum. Such biotic regulation occurs on both local and global scales.
- Biotic regulation is performed by the complex co-ordinated functioning of all species in the natural ecological community. The information needed to ensure such functioning is contained in the genomes of species. Stabilising natural selection protects this information from spontaneous decay. Evolution proceeds in the direction of enhancing the regulatory potential of the community.
- Information fluxes that are processed by the natural biota while performing environmental control exceed the information fluxes that modern civilisation would ever

be able to process by orders of magnitude. This means that the biotic mechanism of environmental stabilisation is unique and cannot be replaced by a technological one.

- Anthropogenic transformation of natural ecosystems completely destroys the regulatory potential of the ecological communities on a local scale and continually weakens the global power of biotic regulation. Anthropogenically disturbed and artificially created biological systems are not only merely deprived of regulatory abilities but themselves act as powerful destabilisers of the environment.

- Environmental parameters that are favourable for life on Earth are physically unstable. Without the stabilising impact of natural biota the environment and climate of Earth would rapidly degrade to a state prohibiting human existence.

According to protagonists of BRET this theory must be used as a framework concept for integrated environmental policy on both national and international levels. In particular BRET offers additional opportunities to overcome conflicts between major multilateral environmental agreements such as Convention on Biodiversity, UNFCCC, Kyoto protocol etc. If BRET will be internationally corroborated, it needs to formulate new international political-economic and legal agenda for environmental services.

Modern Russian scientific-political discourse on core issues of environmental policy is characterized by competition of two framework concepts – co-evolution of nature and society, and biotic regulation of the environment. The first one is based on the scientific and philosophic heritage of famous Russian natural scientist Vladimir Ivanovich Vernadsky (1863-1945). His doctrine on the biosphere of the Earth and on the inevitability of the evolutionary transformation of the biosphere into the reign of the human reason – the noosphere is of great importance for the modern environmentalist discourse in Russia. According to Vernadsky, the biosphere is a natural product and a factor of evolution of the Earth the external coverings of which: lithosphere, hydrosphere and atmosphere were generated and function under the direct influence of living substance such as plants, animals, and microorganisms. Vernadsky's biosphere is not a static life envelope, but an open system having existed since the very beginning of the

Earth's history. The contemporary life and its activities are the product of a long and complex evolution of the living substance.

Vernadsky's conclusion about mankind as a part of the biosphere capable to change radically all biospheric system was a logic development of his doctrine. Evolution of mankind as a force transforming the nature found its expression in appearance of new forms of exchange of substance and energy between the society and nature, in constantly growing geochemical and other influence of man on the biosphere. The mankind taken as a whole becomes powerful geological force. And he with his thinking and transforming potential faces a question of reorganization of biosphere in the interests of freely conceiving mankind as a single whole. This new condition of biosphere to which we, not noticing it, are coming nearer is "noosphere". Means of transformation of biosphere in noosphere is the scientific idea, production and application of scientific knowledge which are planetary by their scale. Vernadsky pointed out that basically the process of transforming biosphere is still going unconsciously, but the tendency to the realised, purposeful transformation amplifies. He connected negative influence on the environment, in particular, on the world ocean to spontaneity and insufficient sensibleness of transforming mission of mankind (Vernadsky 1988).

It is necessary to emphasize, that detailed development of the concept of noosphere was not completed by Vernadsky. The more biogeochemical process was transformed to object of historical and philosophical analysis the more tremendous became the problem of the founder of the doctrine of transition from biosphere to noosphere. Vernadsky himself understood it well. His book "Scientific Thought as a Planetary Phenomenon" which contained practically all his arguments about noosphere, was not completely finished and prepared for printing. However, under Stalin its publication in any case was impossible, in fact even in 1977 only an abridged version of this book was published where some fragments were omitted. A number of theoretical problems that are of great importance in connection with the concept of noosphere, has remained open. In particular, Vernadsky's works do not allow giving a direct answer, whether it is possible to consider the noosphere a special covering of the Earth by analogy with other geospheres, or, perhaps, such comparison is metaphorical. Not quite clear is the question about the limits of scientific research. In the epoch of noosphere not

the state but the new ethics of science should place certain restrictions on scientific research. At the same time the contents of the new ethics can be partly reconstructed only by separate, sometimes contradictory statements by Vernadsky. It is no wonder therefore, that in the second half of the 20<sup>th</sup> century Vernadsky's ideas were interpreted in very wide range.

During the first fifteen years after V.I.Vernadsky's death his scientific heritage was appreciated selectively and differently in the Soviet Union. It was a characteristic official approach. Vernadsky's contribution to natural sciences was accentuated in every possible way, and at the same time his philosophical views were ignored or exposed to constrained criticism.

The attitude to Vernadsky's scientific heritage gradually began to change during Khrushchev 'thaw' period. From the middle of 60s the publication of Vernadsky's works, including the works not published earlier resumed. The studying of his scientific heritage, including the doctrine of biosphere and transition to noosphere amplified considerably. The interest to Vernadsky's ideas increased greatly in 1970es. Development of system studies and models of world dynamics showing the threat of exhaustion of major renewable resources, necessity of coordinated actions of the international community for the solution of global problems, induced many researchers to acquaint with Vernadsky's intellectual heritage to find answers to urgent questions. An additional stimulus for this under Soviet conditions was that in 70s-80s the ideas of Vernadsky were a sort of non-Marxist discourse, which to a lesser degree was exposed to ideologically motivated criticism. Thus the opportunity for wide interpretation of Vernadsky's ideas, as well as for the development of original concepts on the basis of these interpretations appeared. However, even in the West where Vernadsky and his ideas are considerably less known, there are quite different opinions of his doctrine. So, J. Lovelock who together with L. Margulis developed the Gaia hypothesis in the beginning of 70s recognized Vernadsky as his predecessor after studying the main works by Vernadsky in the middle of 80s. On the other hand, in E.Odum's classic work "Fundamentals of Ecology" Vernadsky's concept of noosphere was named a "dangerous philosophy", based on a false "assumption that mankind is now able to understand the results of all its actions, and survive in completely artificial environment" (Odum 1975 : 35).

In the Soviet Union N. V. Timofeev-Resovsky contributed very much to the development of Vernadsky's doctrine of biosphere. Timofeev-Resovsky highlighted key points otherwise: he placed emphasis on inadmissibility of destabilization of biosphere, not on the purposeful transformation of biosphere by man: "...the biosphere of the Earth is a huge living factory, transforming energy and substance on the surface of our planet. It also forms equilibrium structure of the atmosphere and structure of solutions in natural waters as well as power base of our planet through the atmosphere. Biosphere influences the climate. It is enough to mention a huge role of evaporation of water by vegetation, the vegetative earth's mantle in the circulation of water on the globe. Hence, the biosphere forms all environment of man. Any negligent attitude to it and undermining its normal work, would mean not only undermining food resources of people..., but also undermining their gas and water environment. In the latest account without biosphere or with badly working biosphere people cannot exist at all on the Earth". Thus Timofeev-Resovsky formulated the general principles of the future concept of biotic regulation of the environment (Timofeev-Resovsky 1968).

Thanks to the works by N.V.Timofeev-Resovsky, A.L.Yanshin, E.V.Girusov, N.N.Moiseyev, N.F.Reymers, A.D.Ursul, etc., Vernadsky's ideological heritage is considered as one of the basic theoretical sources of ecological movement in the Soviet Union. In particular, in Nikita Moiseyev's works the process of transition to the noosphere was interpreted as an achievement of co-evolution, i.e., joint harmonious development of nature and society. In Moiseyev's last works the term co-evolution was often considered as a synonym of sustainable development (Moiseyev 1997). Co-evolution is a sort of drawing together two mutually connected evolutionary systems, not with the idea of their moving to one common standard (convergence), but with the idea of their mutual adaptation, sort of coordinated development when changes, taken place in one of the systems initiate such changes in the other which do not lead to undesirable or unacceptable for the first system circumstances.

The idea of co-evolution of nature and society has been criticized recently. The criticism was based on the fact that the time of course of evolutionary processes in nature and society differs greatly. It was also emphasized that in Vernadsky's works the "aspect of stability of biosphere as a system and regulative processes providing this stability"

were not in any way reflected. Theoretical framework of this sort of criticism is the Biotic regulation of the environment theory (BRET).

Unlike co-evolution concept, BRET is primarily based not on the philosophic speculations, but on the development of modern biological theory. BRET developed by V. G. Gorshkov, biologist from St.-Petersburg. According to the theory, since its emergence biota has not only been adjusting to the environment but it has also had powerful forming impact on it which grew as biota developed. Under the influence of biota, the regulated environment was formed, and the same time the corresponding regulating mechanisms of biota itself evolved. As a result, there formed a highly-organized system – the biosphere in which through the proper regulation of flows of biogenes (substances, participating in biota's functioning) unprecedentedly high accuracy of regulating all parameters, which are essential for the biota (physical and chemical characteristics of the climate, atmosphere, soil, surface water of land and World Ocean) is provided within the broad limits of the variation of distributions.

Briefly, Biotic Regulation theory may be formulated with the following major propositions:

- Natural ecosystems that are undisturbed by humans create and control their environment. They maintain it in a state optimal for the whole environmental community and, up to a certain threshold, compensate for all deviations from that optimum. Such biotic regulation occurs on both local and global scales.
- Biotic regulation is performed by the complex co-ordinated functioning of all species in the natural ecological community. The information needed to ensure such functioning is contained in the genomes of species. Stabilising natural selection protects this information from spontaneous decay. Evolution proceeds in the direction of enhancing the regulatory potential of the community.
- Information fluxes that are processed by the natural biota while performing environmental control exceed the information fluxes that modern civilisation would ever be able to process by orders of magnitude. This means that the biotic mechanism of environmental stabilisation is unique and cannot be replaced by a technological one.
- Anthropogenic transformation of natural ecosystems completely destroys the regulatory potential of the ecological communities on a local scale and continually weakens the

global power of biotic regulation. Anthropogenically disturbed and artificially created biological systems are not only merely deprived of regulatory abilities but themselves act as powerful destabilisers of the environment.

- Environmental parameters that are favourable for life on Earth are physically unstable. Without the stabilising impact of natural biota the environment and climate of Earth would rapidly degrade to a state prohibiting human existence.

(Gorshkov, Gorshkov, Makarieva 2000 : 32).

The BRET proponents are considering two paradigms lead to drastically different implications in terms of what needs to be done to address the global environmental crisis. One interpretation based on the generally accepted paradigm is that the global biota will adapt to anthropogenic transformation as it has been adapting to spontaneous environmental changes during the four billion years of life existence. Given this, a solution to the problem of long-term environmental stability is sought in the creation of environmentally-friendly technologies that reduce the impact of modern industrial production and consumption. This solution provides incentives for the further cultivation of the remaining natural biota and other biospheric resources, and does not recognise or value their environmental stability functions. The idea that a technological solution to the problem of global environmental security is even in principle possible is not self-evident and demands rigorous scientific investigation. At best a technological solution is a necessary but insufficient condition.

A very different path of development compatible with long-term environmental safety follows from BRET proposed alternative paradigm view. It lies in the conservation and restoration of a substantial part of the Earth's biosphere in its natural non-perturbed state in order to enable the stabilising potential of the natural biota of Earth with respect to the global environment will continue to function. This strategy sets a ceiling to the exploitation of biospheric resources, and places strict guidelines on the kinds and extent of allowable economic activity and ultimately the global human population number (Makarieva, Gorshkov, Mackey, Gorshkov 2002 : 309).

According to protagonists of BRET this theory must be used as a sounder basis for global change science as well as a framework concept for integrated environmental policy on both national and international levels. On the one hand, BRET offers additional

opportunities to overcome conflicts between major multilateral environmental agreements such as Convention on Biodiversity, UNFCCC, Kyoto protocol etc. On the other hand, such huge areas of the stabilization of global environment as Amazonian Selva or Siberian Taiga can be considered in sense of common goods. This means new direction of conflict between national sovereignty principle and global environmental governance. If BRET will be international corroborate, it needs to formulate new international political-economic and legal agenda for environmental services.

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