The Evolution of the Nature Management System and Modern Trends in Its Development

B. I. Kochurov\textsuperscript{a}, *, V. V. Chernaya\textsuperscript{b}, **, and R. M. Voronin\textsuperscript{b}, ***

\textsuperscript{a} Institute of Geography, Russian Academy of Sciences, Moscow, 119017 Russia

\textsuperscript{b} Pavlov State Medical University, Ryazan, 390026 Russia

\* e-mail: camertonmagazin@mail.ru

\** e-mail: harmony19721911@gmail.com

\*** e-mail: rmvoronin@mail.ru

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Abstract — We have examined the evolution of nature management systems in a historical context. An analysis has been made of the crisis of existing nature management models, an aggravation of contradictions, and an increase in threats and risks at the beginning of the 21st century. Modern trends in the development of effective nature management have been discussed, namely, low-waste technologies, technoeconomies, agroecopolises, and green clusterization. We have generalized and suggested conceptual prospects in the realm of effective nature management: the concept of a New Ecological Policy and a new “ecopolicy of containment.” We have explored the possibility of introducing the culture of nature management contributing to reinforcing the necessary rules and regulations—the binding force of the system of restrictions and prohibitions for humans in nature management, with due regard for the sustainability of natural systems. Emphasis is placed on a crucial need for changes in mass-scale consumer stereotypes and for an increase in the number of green technologies and production and the furthering of ecological education and medical—ecological tourism, as well as the importance of reorientation of the attitudes of the population from ecological—consumer to social—spiritual values in accordance with the Code of the Culture of Nature Management. We have substantiated the need for integrating the economic determinism of nature management and the ecological—economic imperative of sustainable development based on a noospheric approach.

Keywords: sustainable nature management, green technologies, nature-compatible technologies, new ecological policy, culture of nature management, noosphere

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INTRODUCTION

The development of life, the maintenance of species diversity, and even the emergence of new organisms is possible only if there are favorable environmental conditions. In the history of the Earth, due to changes in the natural environment, many organisms have disappeared without a trace and others suddenly appeared, more developed and adapted, with a unique body structure and exceptional abilities [1—6]. During the appearance of \textit{Homo sapiens}, on the one hand, all possible ecological niches had already been filled, but, on the other hand, there were favorable natural conditions for its existence. Today the most important global duty for a person is to maintain the environment of their habitat at the proper level. The unwillingness to fulfill this function threatens humanity with various dangers and, ultimately, extinction. The COVID-19 pandemic clearly demonstrates that it is impossible to eliminate global risks only by the development of medicine and the healthcare system [7, 8].

Man is an integral part of the single “living organism” of the Earth’s biosphere and must ensure the waste-free activity of all living things and maintain the most effective natural mechanism—the circulation of matter, energy, and information. According to the law of internal dynamic equilibrium, matter, energy, information and the dynamic qualities of individual natural systems in their hierarchy are interconnected so much that any change in one of these indicators causes concomitant functional—structural quantitative and qualitative changes that preserve the total amount of material—energetic, informational, and dynamic qualities of the system where these changes occur, or in their hierarchy.

Human economic activity has led to changes in biogeochemical cycles and the destruction of individual components of its “biological” link—many species of animals and plants—which makes this “living organism” sick and disturbs the human habitat, in some places completely destroying and degrading it.

Thus, in modern realities, the problem of effective nature management goes far beyond the scope of eco-
The most correct, in our opinion, is the neurobiological approach [13], according to which representatives of the genus *Homo* became behaviorally modern people with the acquisition of prefrontal synthesis (PFS), which is a conscious purposeful process of synthesizing new mental images. This date is defined as 42000 B.C., i.e., coincides with the time of the appearance of works of art—images of figures of people and animals [14, 15] (see Fig. 1). This important event in the history of mankind provided the grounds for American researcher V.V. Torvich [1–3] to single out the first group of resources during this period of time (consisting of similar types of resources), “new mental images,” which are very important for the development of human society.

According to V.V. Torvich, “resources are tools, things, qualities, and methods that can be used to achieve human goals” [2, p. 48]. In total, in the history of mankind, the author identified 26 groups of resources: from new mental images to artificial intelligence (AI).

The largest amount of new resources was mastered by humans during the Holocene period (11700 B.C.) (see Fig. 1), when climatic conditions became most favorable for the development of human activity [1–3]. The cold climate on Earth has changed to a warmer one. The most dramatic warming occurred around 9700 B.C. Since this period, mankind has been able to successfully domesticate many plant and animal species (see Fig. 1), which has created unprecedented

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**Fig. 1.** Block diagram of a comprehensive assessment of the ecological and economic balance of the territory.

NP, natural protection of the territory; NRP, natural resource potential; AL, anthropogenic load; EES, ecological and economic state of the territory; and EEB, ecological and economic balance of the territory.
opportunities for various types of economic activities. A rapid increase in population began. In 2019 A.D., 7.6 billion people lived on Earth, which is 1 million times more than in 1000 B.C. [16, 17], primarily due to the high rate of technological breakthroughs. Traditional nature management is increasingly becoming a thing of the past. New types of nature management have appeared, on the basis of which the industrial period (stage) in the development of human society started several centuries ago, gradually giving way to the postindustrial one. These periods are characterized by the fact that the social systems created in them increasingly depend not on the effect of influences, but on the consequences of the development of the systems themselves [18–21].

In connection with the threat of an ecological catastrophe, to which human society as a result of its economic activity (especially over the past decades) has come close, there is a need to revise the old approach and develop new ones that can stop destruction and death and ensure the further development of mankind. How does one see the further development of human society? V.V. Tovrich [1–3] believes that humanity is subject to the so-called directed process and is moving towards an increase in the number of “great” opportunities for its development. This is confirmed by the increase in the number of various resources for development, which cannot always contribute to it and often lead to the degradation and death of all living things. As for the statement about the controllability of the process of emergence of new resources, technologies, tools, methods, etc., there is no evidence for this. It is only obvious that new resources expand the possibilities of influencing the environment [1, 3, 18, 20].

Human society must adequately respond to various threats and challenges, and this is the main and only condition for its development and preservation. The creativity of people who make new resources is what determines the development of human society today. However, creativity must be controlled, humane, and not provide conditions for self-destruction and the death of mankind. The ever-increasing insatiability of the modern consumer society, which negatively affects the natural environment, is manifested in the uncontrolled development of the market for biotechnologies, genetic engineering, and nanotechnologies, which in the future can cause irreversible consequences—mutations and the emergence of new viruses and diseases, which can lead to the extinction of humans on Earth. In this case, we are talking about irresponsible scientific activity in modern civilization.

The alternative is the development of low-waste technologies, technoeconomies, agroeconomies, and green clusters, which can minimize the impact of by-products of technogenesis; technogenic accidents and disasters should be reduced by decreasing the energy intensity of the economy and creating autotrophic natural–anthropogenic ecosystems [19–23].

There are a number of prerequisites for the development of this direction, first and foremost, the growth of our knowledge and ideas about the structure and patterns of functioning of the biosphere, geo-ecosociosystems, and the rapid development of green technological innovations that make the goal quite feasible. Today, a number of countries are developing low-waste industries and closed life support systems for outer-space, underground, underwater, and arctic purposes and sustainable green technologies and concepts. Cities of the future, from the point of view of the principle of autotrophy, are considered practically closed geosystems with a predominance of the eco-urban structure [24, 25].

According to experts [26], environmentally compatible technologies must correspond to the natural features and patterns of the Earth’s territory, cause no harm to nature, and be in harmony with it.

In recent years, as part of environmentally compatible technologies that are used on living organisms or in contact with them, nanotechnology products, hybrid and bionic devices, and biorobotic systems [26, 27] stand out; their environmental consequences are difficult to imagine or predict.

Environmentally compatible technologies include alternative energy—nontraditional ways of obtaining, transmitting, and using energy. Alternative energy sources are understood as renewable natural resources: water, sunlight, wind, biofuels, etc. However, the replacement of oil, gas, coal, and wood combustion technologies with alternative energy does not exclude its negative impact on the natural environment. This can be a serious reason for revising the prospects for its further development.

MODERN DIRECTIONS
OF THE DEVELOPMENT OF EFFICIENT NATURE MANAGEMENT

Modern environmental management is determined by three main indicators [1, 2, 5]: (1) the balance between the production (profit-generating) and environmental (green) sectors of the economy, (2) the creative activity of the population in two directions: national (to work for the state) and individual (to ensure their livelihoods), and (3) the balance between real and monetary efficiency of production.

As was shown by our calculations [20], for the regions of Russia and the world, a balanced and harmonious ratio of the main indicators of nature management is created when their ratio is 1.0–1.5:

1 < (PGS/GES) < 1.5, where POS is a profit-generating sector and GES is a green economic sector;

1 < (NCAP/ICAP) < 1.5, where NCAP is the nationwide creative activity of the population and ICAP is the individual creative activity of the population;

1 < (NCAP/ICAP) < 1.5, where NCAP is the nationwide creative activity of the population and ICAP is the individual creative activity of the population;
1 < (REP/MEP) < 1.5, where REP is the real efficiency of production and MEP is the monetary efficiency of production.

For example, the profit received from production activities provides a balance between the sphere of production and services, as well as the quality of the natural environment with its constant improvement [5].

If the values in the considered ratios exceed 1.5, then this indicates economic and environmental problems (a decline in production, a rapid depreciation of assets, pollution and degradation of the natural environment, etc.), which manifests itself in the form of economic, financial, and other crises that are cyclical. Thus, an increase in environmental safety and sustainability of development is seen only in a balanced approach and harmony between competing interests.

Increasing the efficiency of nature management, both from an economic and environmental point of view, is likely an insufficient measure, but it postpones the onset of a global environmental catastrophe for a certain period [18–21]. Therefore, effective environmental management can be considered with full confidence as a new “resource package” for the development of mankind, when the value of the results of this social and production activity exceeds the value of the natural resources consumed in this case.

The current crisis in the models of nature management is also due to problems in the environmental policy of Russia and other countries. The concept of the New Environmental Policy (NEP) of environmental expert A.I. Kalachev [28] deserves close attention, placing the following emphasis:

(i) The state is the main beneficiary of solving the problems of environmental protection and nature management.

(ii) Human-centeredness: the state is a partner for business and citizens in solving problems, and the main customer of environmental services.

(iii) There is a guideline for solving environmental problems that reasonably depend on the existing shortcomings of nature management models.

Understanding the threats looming over society (environmental disasters, pandemics, and economic crises) is a global challenge for fundamental science—the need to develop a new containment methodology (noospheric convergence) and create modern production, management, social, educational and other technologies on its basis [19].

It is urgent to achieve an ecological and economic balance on Earth based on the noospheric concept, efficient nature management, and the principles of sustainable development (see Fig. 1). The world, according to the capitalist model of society and based on Adam Smith’s idea of economic growth, gradually ceases to be attractive and loses its relevance [18–21].

The noospheric approach is the basis of the modern development of human society. It is a global concept aimed at a gradual transition to autotrophy, strategic initiatives and planning, a new environmental policy, the development of local communities (civil society), and the maximum conservation of natural landscapes and ecosystems. It can be viewed as a kind of convergence at the intersection of technological innovations, as well as economics, ecology, education, which will bring human society to a fundamentally new level of development [19].

Undoubtedly, the creation of the noosphere as an area of interaction between nature and society is associated with the emergence and formation in the biosphere of the Earth of the bearer of consciousness (mind)—humanity. Hence, consciousness is the basis of the noosphere. Its state completely depends on the adequacy of the reflection by the consciousness of humanity of the relationship between it and nature [25–27].

In modern realities, consciousness and its manifestations are, to a large extent, spontaneous and destructive for the biosphere and the geographical sphere as a whole. Obviously, this situation will continue until our consciousness is freed from the idea of anthropocentrism and humanity learns to adhere to objective natural laws and subordinate its needs to them.

The level of responsible consumption of natural resources in the sphere of production, aimed at meeting human needs, is determined by the culture of nature management [18, 19]. As a scientific direction, it studies the principles of rational use of natural resources, including the factors of anthropogenic and technogenic impacts on nature and their consequences for the population. The culture of nature management not only contributes to the consolidation of the necessary rules and norms, but also acts as a binding force for a system of restrictions and prohibitions for humans in the processes of nature management and the regulation of economic activity taking into account the sustainability of natural systems.

The culture of nature management is a membrane through which human interaction with nature takes place. Its most important direction, as we noted above, is the development of the mental qualities of the individual, primarily spirituality and harmony.

To balance the processes of nature management, it is extremely necessary to change consumer stereotypes; increase the number of green technologies and industries; develop environmental education, medical and environmental tourism, i.e.: reorient people from environmental—consumerism to social—spiritual in accordance with the Code of the Culture of Nature Management [18, 19], which consists of two sections that have specific postulates.

The first section considers the limits of human adaptation to nature, namely the following postulates:

(i) Nature is the natural source of human vitality; we cannot be allowed to deplete it or needlessly waste it.

(ii) Man-made quasi-natural developments may conceal unknown, untested dangers; therefore, before
offering innovations, constantly confirmed boundaries for their safe use should be indicated.

(iii) We cannot change natural conditions without taking into account even the smallest negative consequences, because they can cause unpredictable natural and man-made disasters.

(iv) Nature must be constantly taken care of by restoring its potential, and this restoration requires the same efforts and costs as are necessary for the extraction and consumption of natural resources.

(v) Humans are children of nature, and their increasing power should not be directed to its oppression, but to ensuring the creation of mutually beneficial and mutually enriching technologies for nature management.

The second section discusses the limits of nature’s adaptation to man, expressed in certain rules and prohibitions:

(i) One must not destroy nature; mankind has become powerful and capable of causing irreparable harm.

(ii) It is necessary to limit and control the level of scientific and technical progress in terms of possible damage to nature.

(iii) Natural resources cannot be used for excessive personal enrichment; they should be distributed in proportion to ability and labor.

(iv) One cannot build a relationship with nature built on half-truths: introducing even a small lie hidden underneath a grain of truth into the technologies of nature management will destroy nature over time and bring great misfortune.

(v) One cannot use natural wealth for excesses, praise, and out of envy for others, and the acquisition of the gifts of nature should be conditioned by the need for their consumption.

The culture of nature management, according to the Code of the Culture of Nature Management, is becoming the most important mechanism for achieving effective nature management, and we have to admit that other mechanisms are secondary and, without taking into account its requirements, lead to the destruction of the natural environment.

CONCLUSIONS

The development of human society and related nature management during the Holocene period (11700 years) is characterized by an ever-expanding use of natural resources and the rapid emergence of new resources (genetic engineering and nanotechnologies), which has led to unprecedented pressure on the natural environment and put the world on the brink of ecological disaster.

It should be noted that the current environmental crisis is perhaps the deepest in the periods of modern and recent history, and it is global in nature. Today, there is no single scientifically based approach to overcoming the ecological crisis, and there is no universal trajectory for the development of human society. Existing standards, regulations, and calls for the formation of a green economy and green technologies and cities for the environmental protection of the economy and regulations only temporarily postpone the onset of regional crises and a global environmental catastrophe [27, 29—31].

Obviously, in the 2000s, ecology, the rational use of natural resources, and environmental protection are becoming the leading force in the development of society. Nondecreasing emissions of ecopollutants, pseudoscientific concepts of energy supply, and gray technologies lead to local and regional environmental and economic crises and regional and global drops in the GDP. The scenarios of A. Pececi and A. King [32], according to which the global economic growth was supposed to stop in 2020, was justified to some extent, given the coronavirus pandemic.

The existing system of global consumer nature management leads to the fact that the main goal of society is stagnation and survival, rather than development and coevolution with nature. Understanding the threat of the COVID-19 pandemic looming over human society, global climate change poses a challenge to science, primarily geoecology and nature management, environmental resource science, etc., of enormous socioeconomic significance, as well as the further development of new concepts and models: the Ecopolitics of Containment and the New Environmental Policy. It is necessary to integrate the economic determinism of nature management and the ecological and economic imperative of the sustainable development of countries and regions based on the noospheric approach in the territory—resources—population—economy—ecology system.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

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