Instrumental potential of monetary valuation in managing natural ecosystems reproduction sustainability

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Abstract. The basic approaches to comprehension of economic nature and the subject content of the process of market transformation of natural ecosystem into nature-economy in the course of which there is a disturbing system of the formed geobiocenosis, human intrusion which creates artificial nature-ecosystem, which needs constant poly-resource support, are described in the paper. Scientific conceptualisation of the transition from the consumer attitude of man to nature as a natural "pantry" of production resources and free environmental benefits as gifts of nature to the understanding of the creative nature of partner interaction with nature and the commodity-market nature of ecosystem services rendered by it required an appropriate accounting and cost estimate of them as a tool to regulate this transition and manage the reproductive mode of functioning of the nature management system. Keywords: nature, natural ecosystem, natural resource use, reproduction, regulation, sustainability, environmental management, ecosystem service, environmental good, monetary valuation

1 Introduction

In the context of research into the transformation of the natural ecosystem into a nature-economic one, it seems appropriate to consider the problem of the paradigm shift in the human attitude to nature from a dependent and consumer appropriation of the gifts of nature to a partnership cooperation with it in the process of creation and reproduction of material and environmental goods, which acquire a commodity-market economic form of ecosystem services provided by the natural environment to man in the form of forming the favorable conditions of his livelihood. In the process of this change of worldview positions there is a need to regulate the ratio between economic goals and ecological imperatives of formation and sustainable functioning of the natural ecosystem in the reproductive mode. The integration of natural resources, as elements of the productive forces of the real sector of the economy, and ecosystem services, as ecological goods that form favorable conditions for human life, into the reproduction-value chain required their unified valuation by the value of natural resources, the methodological key to the use of which was the properties of these two types of "natural pantry" components of partial substitution and "flow" from one

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hypostasis to another. This opened up the possibility of full accounting of all costs in the regulation of the restoration of reproductive and adaptive-assimilative potential of the natural ecosystem, an objective assessment of national patrimony and justification of the approach to calculating the international ecological rent in favor of Russia as a world ecological donor.

A natural ecosystem should be understood as an ecological system formed naturally on the basis of metabolic processes in the natural environment without anthropogenic and technogenic impact of industrial and economic activities of man. Such an ecosystem is a biogeocenosis resulting from homeostasis processes in wildlife.

A natural ecosystem has the properties of equilibrium and sustainability due to the complementary diversity and symbiosis of living organisms of its flora and fauna. The principle of such an ecosystem functioning: "sustainability through diversity" applies not only to its components, but also to the organic links between them, providing the effects of emergence and synergy, as quality-forming features of system formation.

Having a significant adaptation-assimilation potential, the natural ecosystem is capable of restoring its reproductive mission even when up to 10% of the system-forming links are disrupted, due to the inclusion of redundant links taking over the functions of the main lost communications under such "mobilisation" mode. When this limit of destructive impacts on the natural ecosystem is exceeded, a "trigger effect" occurs, leading to its disintegration.

Therefore, the most important principle of regulating the sustainability of the functioning and development of the natural ecosystem is the steady adherence to the imperative of coordinating the production and economic goals of social development and the preservation of an ecologically clean habitat and vital activity of the present and future generations.

In this context, the strategic sustainability of the natural ecosystem should be viewed from a dynamic perspective, namely from the temporal aspect of the social responsibility of the present generation to their descendants for the state of its reproductive function and environmental quality [6].

2 Methods

The theoretical and methodological foundations of the problem study are represented by the imperatives of the reproductive approach to the analysis of the model of transformation and functioning of the natural ecosystem in the paradigm of commodity-market nature of ecosystem services provided by nature to man in the process of their partnership interaction in the organisation of environmental economic activity. Nature, as it were, acquires a subjective definition of its hypostasis as a partner cooperating with man in the process of reproduction of the ecosystem of nature. This methodological key made it possible to use a tool for the valuation of ecosystem services to include them in the chain of creating new value in the commodity product of nature management activities.

3 Results

Revolutionary transition in the way of human activity from the consumer type of collecting the gifts of nature to the reproductive type of partner cooperation with it in the processes of production of material goods of natural origin necessary for life support and reproduction of its productive and ecosystem potential in the Neolithic Age has caused a paradigm shift in the worldview positioning of man in the ecosystem "society - nature", although, due to inertia of thinking, the thought image "free natural pantry" resource

The transformation of the natural ecosystem into a nature-oriented one signifies a paradigm shift in the scientific and worldview approach to the human relationship to nature as a result of the Neolithic Revolution. The transition from the consumer attitude of man to nature as a "free" storehouse of material and ecosystem goods in the era of "collecting the gifts of nature" to the model of partner cooperation with it in the creative and productive process of industrial and economic activity was intuitively perceived, but insufficiently mentally comprehended.

When man intrudes into the homeostasis of natural ecosystem, which disturbs the equilibrium-stable nature of its functioning, in order to adapt it to the regime of reproductive-productive management it is necessary instead of broken organically formed relationships of biological organisms of geocenosis artificially create a new ecosystem of cultivated plants and productive animals, which needs constant support by attracting significant resources: production and technological, energy, labor, financial, necessary for the production of animals.

If entropy is understood as positioning of ecosystem from the point of view of measure of its approaching to the state of stable equilibrium, then any human intrusion into natural ecosystem with the purpose of industrial and economic activity has anti-entropic (i.e. lowering entropy) character [4]. Indeed, such action violates its naturally formed homeostasis, destroys the established interrelations between its elements, weakens its stability and "deviates" from the state of stable equilibrium. This occurs both during the development of the area for industrial and economic activities and during its organisation on this prepared area.

This transformation from a natural ecosystem to a nature-ecosystem can be clearly seen in the example of agricultural production, as it most clearly demonstrates its bio-industrial character today. In order to organize agricultural production, it is necessary to clear the "wild" vegetation and cultivate the areas for farmland, organizing on them, subsequently, artificially created fields, orchards, and plantations of agricultural crops.

Such "cultivation" of the natural ecosystem requires considerable expenditure of various resources: production and technical, energy, labour and financial. At the same time, the potential of human creative activity is inseparable from the effect of destruction of a part of the system-forming links of the natural ecosystem. The active use of nature-like technologies, closed-cycle technologies, waste-free technologies in production and economic activities is a tool for regulating the transformation of natural ecosystems into nature-based ones that "mitigates" this effect of anti-entropic human impact on the natural environment [8, 9].

A progressive technology of environmentally friendly agro-technique of soil cultivation in crop production branches is its subsurface deep loosening to the depth of 60-80 cm with the help of cheesel ploughs. Such tillage reduces negative effects of anti-entropic-mechanical soil intrusion, its over-consolidation, prevents wind and water erosion, contributes to increase of organic matter, improves the structure, temperature regime and moisture content conditions in the soil.

An important direction of mastering of nature-like technologies in vegetable production branches is wide spreading of experience in organisation of vegetatories, which maximally use such natural factors as sunlight and heat, natural ventilation of production facilities for heating the greenhouses.

These can be measures of regulation of the natural ecosystem formation process, corresponding to the imperatives of ecologisation of production and economic activity of man as a result of its partnership with nature.

Consequently, the process of transition from collecting to organising nature-management activities has created the need for its regulation. However, a long period of lack of scientific understanding of the deep essence of the revolution that took place and the

inertness of human thinking for a long time preserved the notion of free gifts of nature received by man.

The real revolution in the public consciousness was the understanding of the economic nature and the underlying nature of the category of "ecosystem services" [1, 3]. The matter is that before there was an opinion according to which one of two components of natural "pantry" nature: natural resources (as elements of productive forces) have the commodity form and, accordingly, possess two hypostases of social value - social properties: consumer value and cost, and the second component: ecological benefits is a free gift of nature.

The methodological key to understanding the inadequacy of such a construct of the above thought-images was the emphasis on the presence of the limited interchangeability and "interflow" of natural resources and environmental benefits (favourable conditions for human life) from one hypostasis to another. Clean water of natural origin can alternatively act as a natural resource when used technologically, or as an environmental good in the commodity form of an ecosystem service when used for purposes of drinking. The same can be applied to clean air as a life good and as a production technology resource.

Since a unit of a natural resource, when incorporated into a production process, has a monetary value, it is logical to extend it to the corresponding unit of a vital (environmental) good as the value of a single ecosystem service.

The introduction of the concept of 'ecosystem service' (instead of 'ecological good' as a free gift of nature) puts everything in its proper place. Since the ecosystem service also has a commodity form in the market economy, with its inherent attributes of use and value, both types of the natural conditions of human activity (both components of the natural store) acquire a common economic nature and a common form of valuation and accounting.

Only with a clear understanding of the commodity form of natural resources and the economic nature of ecological goods as ecosystem services, which also have a commodity nature, is it possible to account and evaluate the socially necessary costs of reproductive potential of the natural ecosystem as a source of natural resources and ecological goods as ecosystem services in a unified cost-value form.

It is in this economic form that they can be included and accounted for in the value chain of the process of new value creation and the process of reproduction of the natural ecosystem. The fact is that both natural resources, as elements of the productive forces in the system of production of material goods, and ecosystem services, as a commodity form of ecological goods, forming a favourable habitat for people, are oriented to ensure the reproduction of society and are equally important for the creation of the environment for human activity.

Thus, the recognition of the commodity nature of environmental goods as ecosystem services provides a unified form of accounting and valuation of technological resources and life-supporting goods as equivalent components-projections of the gradient of social reproduction process, aimed at creating favorable conditions of life and development of society.

In the form of such valuation of material, economic and environmental benefits of natural origin, society receives an effective tool for accounting, assessment and control to regulate the sustainable-reproductive mode of functioning of the natural ecosystem. Only in monetary form can natural resources and ecosystem services be integrated into the reproductive-value chain of the process of reproduction of the life-supporting potential of the natural ecosystem.

A set of tools for regulating the use of natural resources and stimulating the rational and efficient functioning of natural ecosystems is presented in the table below.

Table 1. Tools for regulating the processes of natural resource use and ensuring the effective functioning of natural ecosystems of the Russian Federation.

N	Main instruments	Structure of the complex of tools for regulating the processes of nature management and ensuring the effective functioning of ecosystems in the Russian Federation
1.	Administrative and supervisory tools of environmental management environmental activities	n1.1 Environmental legislation 1.2 Ecological standards and regulations 1.3 System for licensing of existing operations and environmental impact assessment of proposed operations (new production facilities) 1.4 Methods and tools for forecasting, planning and programming of environmental protection activities
2.	Market-oriented Instruments for the protection of the natural environment and environmental management	n2.1 Natural resource payments and payments for pollution of the natural environment 2.2 Market prices of natural resources inputs into economic turnover 2.3 Mechanism for the purchase and sale of pollution rights 2.4 A pledge system 2.5 Direct market agreements and other methods of environmental self-regulation 2.6 Voluntary environmental agreements between environmental control authorities and enterprises using natural resources
3.	Financial and credit instruments of environmental protection and environmental management	3.1 Instruments for financing environmental protection measures 3.2 Credit mechanisms aimed at environmental protection (loans, credits, subsidies, etc.) Environmental and resource taxes 3.3. 3.4 Ecological risk insurance system.

* Compiled by the authors.

If the gradient of the process of reproduction of the ecosystem, as well as all social reproduction, is represented by its main goal-orientation - the reproduction of society, then the projections of this vector of strategic development in three-dimensional space will be its components: factors-conditions ensuring the result of this process: reproduction of material goods, reproduction of environmental goods and reproduction of existing relations (in this case, relations in the sphere of natural resources management).

Only a coordinated (in terms of combination, functional correspondence, parametric characteristics) and time-synchronized interaction of all the components of this reproductive process can ensure the fulfillment of the imperatives of reproduction of favorable conditions of human life and the reproduction of society as a whole.

The correlation between economic goals and ecological imperatives can be illustrated on the example of the production function, where the former determine the goal orientation, and the latter the boundary conditions of the goal realisation. In the case of environmental problems, the goals and conditions are reversed. Maximisation of the ecological effect will be positioned as the production function, while financial constraints, infrastructure deficits, institutional traps and other limit-factors of the economic order will be the boundary conditions for its achievement.

The fixation in the mentality of society of the fact that environmental good is recognized not as a gift of nature, but as an ecosystem service that nature as a partner in the process of reproduction of the reproductive potential of the nature-economic ecosystem

provides to man, has not only paradigmatically changed the scientific worldview on the positioning of man and nature in the system of their interaction, but also offered a toolbox of accounting and cost estimates of the costs of restoration and maintenance of sustainable functioning of the nature-economic ecosystem

Thus, for regulation of a mode of reproductive activity of nature economic ecosystem there is a necessary estimation-value toolkit of the market nature. This makes it possible to take full account of all the costs of reproductive potential of a natural ecosystem and to integrate them into the cost model of its natural resource capital cycle.

At the same time, to determine the price of a single ecosystem service when it is interchangeable with the corresponding unit of natural resources, it is possible to use the method of extrapolating the price of the latter to it. To calculate the total value of payments for ecosystem services, one can use the approach of determining the full replacement value of their source - the reproductive and adaptation-assimilative potential of a natural ecosystem.

To analyze the process of circulation and turnover of natural resource capital of the ecosystem, it is important to consider the effect of resource decoupling, manifested in the divergence of trajectories of the dynamics of productive use of natural resources and the obtained results of production and economic activity.

The progressive nature of this phenomenon is manifested in the outstripping growth rates of the results in comparison with the expenditures of natural resources, due to the effects of resource conservation and increased efficiency of resource use, as well as the growth of labour productivity. The instrumental possibilities of measuring the effect of decoupling and assessing its dynamics make it possible to judge the efficiency of the use of natural resource capital in the production and economic process [5].

Such are the instrumental possibilities of determining the value parameters of ecosystem services as the hardware of accounting, estimation and regulation of processes of transformation of a natural ecosystem into a nature-economic one and the reproduction of the latter's functioning. Their use is also extremely important for the full and objective accounting of all components (including the value of ecosystem services) of Russia's national patrimony, which is still significantly undercapitalized.

There is another important aspect (international) of macroeconomic functioning of natural ecosystems which is connected with aggravation of the global problem: increasing pollution of the lithosphere, hydrosphere and atmosphere of the Earth. Russia, with 10% of the global reproductive potential of the planet, is an ecological donor, which would give it the right, in a situation of rational world order, to claim an ecological rent. In this case, the valuation of the country's ecosystem potential would be extremely important as a tool for regulating international relations in the field of ecology.

The relevance of this problem is increasing as the environmental situation on the planet is becoming more complicated, climate change, the consequences of the greenhouse effect, melting of the glaciers in the Arctic and Antarctica, reduction of the area of permafrost, increasing of the world ocean temperature, etc. [7]. Complication of the ecological situation of global nature causes the justified concern of the mankind.

4 Conclusions

The research carried out allowed us to draw the following conclusions.

1. The transition from appropriation of "gifts of nature" to reproduction of material conditions of vital activity of the person in partnership commonwealth with the nature became the basis of paradigm change of world outlook positions in relations of the person with the nature, marking the end of an epoch of a consumer and deprivative way of life and

the beginning of the period of reproductive-creative vital activity and, together with it, transformation of natural ecosystem in nature-economy.

2. The deep comprehension of the economic nature of the ecosystem service rendered by the natural environment to the man, and the introduction of the corresponding category into the scientific turnover promoted the formation of the conceptual model of subject definiteness of the partner interaction of the man and the nature in the process of joint nature-economic activity.

3. The recognition of the commodity-market nature of the ecosystem service entailed the need to define its value assessment as a tool for regulating the sustainable reproduction regime of the natural ecosystem by embedding it in the value chain of the reproductive process of restoring its creative and adaptive-assimilative potential.

4. The property of natural conditions of human activity, functioning in the form of natural resources and environmental benefits, interchange and "interflow" from one hypostasis to another, as equivalent components of the process of reproduction of society, providing material and environmental benefits of natural origin, gives grounds for extrapolation of the unit value of natural resources involved in the production of material goods, to the same value of the corresponding unit ecosystem services as environmental benefits.

5. Such a unified tool for the valuation of these two components of the 'natural treasure trove' makes it possible to fully account for the socially necessary costs of restoring the productive potential of the natural environment as a natural source of resource provision and ecosystem services, both for the present generation and for its descendants.

6. The use of the valuation of ecosystem services also creates the possibility of a full and objective assessment of the national wealth of the country, including natural resource and natural-environmental potential, which has remained significantly undercapitalized, and also opens the prospect of quantifying the international ecological rent in favour of Russia as an ecological donor of the planet.

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