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Environmental-Economic Accounting in Sustainable Resource Use

Theory and Practice

INSTITUTE FOR SUSTAINABLE INNOVATION

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The monograph considers the development of the System of Environmental-Economic Accounting (SEEA) that enables analysis of the interaction between the economy and the environment at different levels of territorial organization. It provides the philosophical and methodological framework for the SEEA establishment and development; shows the essence of the SEEA, including its origins, its place and role compared to other information systems, its institutional and organizational specifics; describes the experience of implementing the SEEA provisions in Russia. The monograph also provides a number of examples demonstrating the effect that the results of assessment of environmental resources and ecosystem services have on addressing complex issues of resource management and strategic planning of territorial development and describes the SEEA development paths. The book is aimed at professionals from a wide range of backgrounds interested in environmental management and environmental protection.

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Abbreviations

GDP: Gross Domestic Product

GRP: Gross Regional Product

WTO: World Trade Organization

CEA: Classification of Environmental Activities

IAEA: International Atomic Energy Agency

RVM: Residual Value Method

ISIC: International Standard Industrial Classification of all Economic Activities

IEA: International Energy Agency

UN: United Nations

SPA: Special Protection Area

OECD: Organization for Economic Cooperation and Development

SNA: System of National Accounts

EPEA: Environmental Protection Expenditure Accounts

SEEA: System of Environmental-Economic Accounting

SEEA-W: System of Environmental-Economic Accounting for Water

SDG: Sustainable Development Goals

NDP: Net Domestic Product

NPV: Net Present Value

SEIS: Shared Environmental Information System

Glossary

ASSET is a store of value representing a benefit or series of benefits accruing to the economic owner by ownership or use of the asset over a period of time. It is the means of transferring value from one accounting period to another (Central Framework for the SEEA. UN, 2012).

MAN-MADE (PHYSICAL) CAPITAL includes man-made means of production, such as machines, buildings, production infrastructure, which are involved in the production process without being materialized in the final product (Renat Perelet. Systems Management of Transition to Sustainable Development, 2009).

RETURN ON PRODUCED ASSETS is the income from the use of produced assets in the process of production after deduction of the fixed capital consumed in this process (Central Framework for the SEEA, UN, 2012).

RETURN ON ENVIRONMENTAL ASSETS is the income attributable to the use of environmental assets in the production process after deducing all costs of extraction including any costs of depletion of natural resources (Central Framework for the SEEA. UN, 2012).

LIVING SYSTEM is a multiple interconnected network whose components continually change, are transformed and are replaced by other components. The network is characterized by exceptional flexibility and fluidity, which enables the system to respond in a specific way to disturbances or "stimuli" coming from the environment (Capra, F. The Web of Life. A New Scientific Understanding of Living Systems. Moscow: Sofia Publishing House, 2003).

GREEN ECONOMY is the economy, which serves to improve human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. The green economy is a system of economic activities related to the production, distribution and consumption of goods and services, which results in long-term improvement of human well-being without exposing

future generations to significant environmental risks and ecological deficits; it is environmentally harmless, eco-friendly and socially fair (Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication. UNEP, 2011).

GREEN GROWTH involves fostering economic growth and development while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies. This is achieved by catalyzing investment and innovation to underpin sustained growth and create new economic opportunities (Towards Green Growth. A Summary for Policy Makers. OECD, 2011).

INCLUSIVE GROWTH is a new approach to understanding economic growth, focused on improving living standards and achieving more equitable distribution among social groups of benefits from increased well-being (All on Board. Making Inclusive Growth Happen. OECD, 2014).

INSTITUTIONAL UNIT is an economic entity that is capable, in its own right, of owning assets, incurring liabilities and engaging in transactions and other economic activities with other entities (Central Framework for the SEEA. UN, 2012).

USE OF NATURAL RESOURCES is the exploitation of natural resources, their transfer to economic activity, including any way of affecting them in the process of economic or other activity (Federal Law of 10.01.2002 No. 7-FZ (as amended on 29.12.2015) "On Protection of the Environment").

CULTIVATED BIOLOGICAL RESOURCES include animal resources yielding products on a regular basis, as well as timber, crop and plant resources yielding repeat products on a regular basis, whose natural growth and regeneration are under the direct control, responsibility and management of an institutional unit (Central Framework for the SEEA, UN, 2012)

BEST AVAILABLE TECHNOLOGY is a technological process or technical method based on advanced scientific and technical achievements, which is aimed at reducing negative environmental impact of economic activities and has an established service life with due account for economic, technical, ecological and social factors (Amendment No.1 GOST P 521004-2003 Resource Saving Terms, Definitions approved by Rosstandart Order of 30.11.2010 No.756-st)

NEGATIVE ENVIRONMENTAL IMPACT is the effect of economic and other activities resulting in negative changes in the environment (Federal Law of 10.01. 2002 No.7- FZ (as amended on 29.12.2015) "On Protection of the Environment").

NON-PRODUCED ASSETS are assets that have come into existence in ways other than through processes of production. (Central Framework for the SEEA, UN, 2012).

ENVIRONMENT is a complex of the components of the natural environment, natural, and part-natural, part-man-made objects as well as man-made objects (Federal Law of 10.01.2002 No. 7-FZ (as amended on 29.12.2015) "On Protection of the Environment").

FIXED ASSETS are produced assets that are used repeatedly or continually in production processes over a period longer than one year. (Central Framework for the SEEA. UN, 2012)

NATURAL RESOURCES are components of the natural environment, natural objects and part natural-part man-made objects which are used or can be used in economic or other activities as energy sources, production outputs and for consumption, and which have consumption value. (Federal Law of 10.01.2002 No.7-FZ (as amended on 29.12.2015 "On Protection of the Environment").

ENVIRONMENTAL CAPITAL (in terms of the theory of economic growth) is the aggregate of natural resources, which can be used in production processes. Any environmental asset creating a flow of eco-services with economic value is environmental capital (Dictionary of Sustainable Development Terms, http://www.ustoichivo.ru)

ENVIRONMENTAL INSTITUTIONS are the "rules of the game" in a society, a certain framework of limitations that organize relations between individuals with due account for environmental factors. Such institutions are the products of collective effort; they generate incentives that induce people to comply with environmental restrictions and regulations. They reduce uncertainty by structuring everyday life or, in other words, they determine or limit the range of alternatives available to each individual in his or her relations with the natural environment. Environmental institutions make the behavior of people and communities in the environmental sphere more predictable, reducing the probability of destructive behavior and conflicts caused by it (Fomenko, G.A. Environmental Management: A Socio-Cultural Methodology. Institute for Sustainable Innovation, San Jose, 2017)

PRODUCED ASSETS are assets that have come into existence as outputs of processes that fall within the production boundary of the SNA. (Central Framework for the SEEA. UN, 2012)

SYSTEM OF NATIONAL ACCOUNTS is an internationally coordinated standard set of recommendations to measure indicators of economic activities in accordance with strict rules of accounting and reporting at the macro level based on the principles of economic theory (System of National Accounts 2008. New-York, 2012 p. 64)

SYSTEM OF ENVIRONMENTAL-ECONOMIC ACCOUNTING is a multipurpose conceptual framework for describing the interaction between the economy and the environment and the stocks and changes in stocks of environmental assets. (Central Framework for the SEEA. UN, 2012)

BIFURCATION POINT is a critical state of the system when the system becomes unstable in respect of fluctuations and uncertainty arises whether the state of the system will become chaotic or whether it will ascend to a new, more differentiated and elevated level of regularity (Muzika, O.A. Bifurcation in Nature and Society: Natural-Science and Socio-Synergetic Aspect // Modern High Technologies 2011. №1 C. 87-91).

SUSTAINABLE PRODUCTIVITY is an excessive or surplus quantity of animals or plants, which can be absorbed from the population without affecting the capacity of this population for self-reproduction. (Central Framework for the SEEA. UN, 2012)

SUSTAINABLE DEVELOPMENT is development, which can meet the needs of the present generation without undermining the ability of future generations to meet their own needs (Our Common Future. Report of the International Committee on Environment and Development. 1987. Moscow: Progress, 1989)

VULNERABILITY OF ENVIRONMENTAL SYSTEMS is the inability of environmental systems (biological communities, landscapes, etc.) to withstand the impact of external forces (any forces, although man-made effects are of special significance). Vulnerable environmental systems can be easily disturbed; they can lose their structure and function, and may be rearranged in a harmful way (Malashevich Ye.V. Short Reference Dictionary on Environmental Protection. Minsk, 1987)

ENVIRONMENTAL ASSETS are the naturally occurring living and non-living components of the Earth, together constituting the biophysical environment, which can provide benefits to humanity (Central Framework for the SEEA. UN, 2012)

ENVIRONMENTAL RISK is the probability of occurrence of an event having unfavorable consequences for the natural environment, caused by negative impact of economic or other activities, or by emergencies of an environmental or man-made character (Federal Law of 10.01.2002 No. 7-FZ (as amended on 29.12.2015) "On Environmental Protection").

ECOSYSTEMS are geographical locations that host a dynamic complex of plant, animal and microorganism communities and their inorganic environment, interacting as a functional whole to generate environmental structures, processes and functions (the Central Framework for the SEEA. UN, 2012)

ECOSYSTEM SERVICES are the functions of ecosystems in providing benefits to the users of such services through the natural achievement of various kinds of regulating functions. Users of the services may be at local level (individual enterprises), or at regional or global level, including entire countries and regions (Convention on Biological Diversity – International Agreement adopted in Rio de Janeiro on June 5, 1992).[1]

[1] Work has been urgently undertaken on an official translation of the UN Central Framework for the System of Environmental-Economic Accounting, 2012. Under the aegis of Rosstat, amendments are being made to the translation and contents of the basic terms and definitions included in the draft Russian translation of this document. Therefore, the definitions given above in the Glossary are not to be seen as final; they will be specified in the course of official approval of the respective international documents translated into the Russian language.

Foreword

Unprecedented in terms of its historical importance, the adoption of universal global sustainable development goals (SDGs) has produced a corresponding demand for information and analytical support in achieving these goals.[1] In instrumental terms, the comprehensive nature of SDGs requires a change in approaches to strategic environmental planning and program-oriented and goal-oriented management at all levels of territorial organization. In methodological terms, it means the enhancement of coverage and the goal-oriented shift of focus in addressing problems of territorial development at all stages of work with information resources, starting from data selection, generalization, analysis, interpretation and understanding, which, in fact, means a substantial change in approaches to creation and further development of information and analytical support. Alongside tackling data systematization and update challenges for the purposes of addressing management issues, a special emphasis should be placed on the goal-oriented synthesis of sustainable development and green economy indicators, environmental indicators and special socio-cultural measurements.

In our opinion, the nature of discussions around SDGs and how they can be achieved reflects the changes that are occurring in understanding of the use of natural resources and, more broadly, the very essence of nature, not only as a set of natural objects and resources but also in its system "integrity" (Cassirer, 2004). The importance of these discussions correlates with the fact that by the end of the 20th century, the "wholeness" of nature has been considerably rethought, primarily, in the context of phenomenological philosophy and sociology. Alfred Schütz submitted an important argument that a distinction must be drawn between nature as a discipline of natural sciences and nature as a "constructive element of the lifeworld" (Schutz, 2004). As a result, at the worldview level, it further justified the occurring changes in views on the

[1] The sustainable development goals are the result of the negotiation process with the participation of 193 UN member states at the 70th Anniversary Session of the United Nations General Assembly in September 2015.

reasonability of broad application, in the context of sustainable development, of the theory of utility and full economic value to natural resources and ecosystem services, which predetermined new information needs.

On the other hand, the adoption of the sustainable development goals (SDGs) itself has become possible due to the emergence and rapid development in the last years of instrumental methods for collecting and processing enormous amounts of empirical data (including those at the micro-level, including aggregation and disaggregation, various interpretations in accordance with the set objectives, etc.) accumulated by behavioral and social sciences and representing the characteristics of the described essences for the purpose of their identification, search, assessment and management (American Library Association, 1999).

The key problem of environmental and economic measurements is that of measuring the sustainability of the use of natural resources (which, in fact, this book is addressing). We, the authors, proceed from the fact that the modern theory of sustainable development constitutes the most developed and acceptable methodological basis for maintaining Peace and preventing a global environmental disaster. Today, the System of Environmental-Economic Accounting (SEEA) provides the best way of measuring the key interactions between the economy and the environment.

As geographical scientists, we grew in the Russian cultural environment with its ambition for comprehensiveness and indivisibility of the world perception. These socio-cultural peculiarities of the vision (as well as the authors' multifaceted work experience in management, production, design structures) allow perceiving naturally and to use the multidisciplinary approach to research that is quite productive in finding paths to sustainable development. It should be noted that our understanding of territorial planning and holistic accounting for natural resources and ecosystem services was formed by the Russian geographical school. It also must be mentioned that it was a good school of holistic territorial accounting for natural resources. However, behavioral specifics of communities, monetary relations, especially in the context of resource use preferences driven by socio-cultural factors, were significantly limited by the then dominating labor cost theory that hindered development of the behavioral economy and institutional geography.

In the early 1990s, it could be seen particularly well. The lack of monetary assessment of natural resources and the environment inherited from the state-planned and command system became one of the cornerstone problems of effective use of natural resources. In the new situation, when businesses no longer took into account the environmental and social requirements of

territorial development of regions and settlements in locating their new manufacturing sites, the task of system accounting for natural resources to ensure multifaceted management and strategic planning of territorial development became more challenging.

Despite the economic difficulties in the Russian Federation, holistic environmental-economic accounting activities began in 1990s because information systems inherited from the state-planned and administrative system were set to collect information on key types natural resources and to address particular industrial issues. They did not allow conducting territorial analysis for comparing the real value of natural assets with income gained from their use, nor to conduct retrospective and forecasting research (including assessment of depletion of economically significant natural resources), nor to compare the value of various components of natural wealth (when planning investment). Moreover, the then existing information flows did not cover a wide range of natural resources; comparison of results was complicated due to the differences in collection, processing and visualization methods. Under such conditions, it is extremely difficult to justify and make effective management decisions on the multipurpose use, reproduction and protection of natural resources.

Our organization (Cadaster Institute), a scientific and production enterprise of cadasters of natural resources, was established by the Ministry of Environmental Protection and Natural Resources in the Russian Federation in 1992. Special attention in methodical and practical developments was paid to assessment of socially and environmentally dangerous exhaustibility due to extraction or quality deterioration of a resource as a result of economic activities (in physical and value, i.e. monetary, indicators); establishment of indicators of stocks and use of natural resources and ecosystem services not accounted in the existing statistical monitoring and departmental accounting systems; institutional aspects of the use of such indicators, including those driven by socio-cultural factors.

Today, we can identify the following stages of development of this area in the Russian Federation.

STAGE ONE: THE CONDUCT OF THE FEDERAL EXPERIMENT FOR IMPROVEMENT OF ACCOUNTING AND SOCIO-ECONOMIC ASSESSMENT OF THE NATURAL RESOURCE POTENTIAL (1993-1995). It was based on an attempt to develop and implement Integrated Territorial Natural Resources Inventories in environmental management practices. The experiment for developing Integrated Territorial Natural Resources Inventories was conducted under the guidance of the Ministry of Environmental Protection and Natural Resources of the Russian Federation in 35 constituent entities of the Russian

Federation and was developing quite successfully. Two all-Russian meetings were conducted at the premises of Cadaster Institute in 1992 and 1994, where the experiment results were discussed.

Integrated Territorial Natural Resources Inventory was initially planned to contain data on natural resources in physical terms and could serve as a basis for their assessment in the structure of the regional and, ultimately, national system of environmental-economic accounting. Economic assessment was considered a necessary completing link in the system of holistic cadastral assessment of natural resources allowing inclusion of natural assets into assessment of economic activities. It was expected that such assessment would give an objective idea of the economic value of natural resources and allow justification of investment in their reproduction and protection and to select the most effective way of using such resources.[2] In case of multipurpose use of natural resources, their monetary estimates could allow not only choosing how to use a particular resource (object) but also determining a strategy for sustainable use of the natural resource potential of the entire territory. Furthermore, they hoped that monetary estimates of natural resources could help optimize taxation of various types of natural resource use.

STAGE TWO: DEVELOPMENT OF THE REGIONAL ENVIRONMENTAL-ECONOMIC ACCOUNTING OPERATIONS IN ACCORDANCE WITH THE UN METHODOLOGY (1996-2006). By that time, the flaws of the methodology of multipurpose territorial cadasters of natural resources had become apparent. They included the loss of the modern geographical science integrity: the unity of natural sciences and humanities in geography was split into many disciplines while physic-geographic and economic-geographic branches diverged substantially. Thus, in methodological terms, the very structure of measurements in the system Society-Nature that could allow creation of multifaceted geographical description within Integrated Territorial Natural Resources Inventory turned out to be weakly developed. During the development of Integrated Territorial Natural Resources Inventories, the static nature of most indicators reflected in them (stocks of natural resources, production, emissions and discharges, etc.) was discovered, which became an obstacle in analyzing the efficiency of regulation in natural resource use and environmental protection. The need has become obvious, not only in the system territorial approach allowing for economic comparison of natural resource use options but also in the dynamics — changes in raw material flows and ecosystem services, including in monetary terms.

[2] The term "economic assessment" appeared in the Russian literature largely owing to the development of natural resource cadaster methodology.

Many other countries faced similar problems. It became possible to move forward owing to the System of National Accounts (SNA) and its satellite System of Environmental-Economic Accounting. The latter is a set of interrelated statistical indicators reflecting the state of natural capital (stocks, flows and other changes), allowing adequate determination of the value of natural resources and inclusion of it into the balance sheets of assets and liabilities within the framework of SNA. The System of Environmental-Economic Accounting is actively developing in many countries. A considerable contribution to establishment of the SEEA in the Russian Federation was made by the world-renowned scientist, Professor Markandya, one of creators of the very idea of "green economy" (Pearce, Markandya & Barbier, 1989); he personally consulted us during the initial stage of works in 1994-1999 (Fomenko, G., Fomenko, M., Markandya, & Perelet, 1997b). Development of the System of Environmental-Economic Accounting of the Yaroslavl Region should be deemed basic. As a result, based on the analysis of data on the availability and economic use of main natural resources (surface water, soil water collected from public water supply systems, ground water collected from wells, agricultural lands, timber and non-timber forest resources, recreational areas, hunting, fishing, mineral resources — sand and sand-gravel mix, bee resources), for the first time in Russia, the SEEA matrix was created, the amount of natural capital of the Yaroslavl Region was determined, the regional green GDP and NDP were calculated. As the research results has shown, the assessment of natural assets allows determination of the effectiveness of the current scenario of natural resource use (public water supply, forest, mineral resource complex, etc.) and to identify the most efficient areas of sustainable development.

Later, with the support of the Ministry of Natural Resources of the Russian Federation, the Federal Service for Supervision of Natural Resources Use and its territorial bodies as well as governmental and local self-regulation authorities of the Republic of North Ossetia-Alania, the Republic of Karelia, the Tomsk, Ryazan, Kaluga, Saratov, Kaliningrad and Kostroma Regions, the positive experience gained was used in other regions of the country. The emphasis was placed both on accounting for natural resources in physical terms and on economic assessment of natural resources. It was due to the extremely high role of the SNA/SEEA as a tool of analysis of socio-economic development in many countries.[3]

Not only did the results of regional research confirm practical applicability of the UN methodological principles of environmental-economic accounting in

[3] The need for comparable accounts that would allow carrying out international comparisons prompted the UN Statistics Division to prepare a set of recommendations for their development (1998, 2000, 2003). The UN Recommendations (and other similar documents) are used in many countries to prepare environmental accounts, both in monetary and physical terms.

Russia and demand for obtained results in environmental management but also detected gaps in statistical and departmental information. First of all, it was the lack of indicators characterizing stocks and flows of natural resources (quantitative and qualitative aspects). Ineffectiveness of the territorial analysis based only on the "top-down" approach has become apparent. In the course of the works, it was supplemented by the "bottom-up" approach implying clarification of regional indicators of availability and actual consumption of natural resources at the municipal district level (starting from local settlements and private households, with further aggregation of this data at higher levels of territorial organization).

STAGE THREE: WORK ACTIVATION AT THE FEDERAL LEVEL BASED ON THE TERRITORIAL APPROACH (2007-2011). At this stage, we conducted a pilot study to assess the possibility of application of the SEEA basic methodology at the federal level.[4] The study was conducted in accordance with the provisions of international methodological documents on accounting for the value of natural assets in national wealth.[5] More than ten years of experience in monetary assessment of natural resources in accordance with the SNA/SEEA approaches enabled us to conduct in Russian regions the analysis of conceptual approaches to recording natural resources in the SNA as a part of financial assets and establishing a satellite system of environmental-economic accounting. The state statistical monitoring system in use of natural resources and environmental protection was analyzed in terms of compliance with the SNA principles, and the methodology for valuating natural resources was summarized in accordance with the SNA/SEEA requirements.

These studies allowed development of methodological principles of recording the monetary estimate of natural wealth in the statistical system. *With the support of Rosstat (Federal State Statistics Service), the SEEA matrices were completed, for the first time, by constituent entities of the Russian Federation*. In our opinion, for Russia, such disaggregation is crucial because timely identification of dangerous trends of natural capital depletion, in both monetary and physical terms, is especially important for regions. The results

[4] The studies were conducted on the assignment of the Ministry of Natural Resources of the Russian Federation (Cadaster Institute, 2007-2009).

[5] As key information sources, we used the effective international methodological guidelines on reflecting indicators in the SNA (US Documents (Statistics Division, Committee of Experts on Environmental-Economic Accounting, London Group on Environmental Accounting), OECD/ Eurostat, World Bank, International Monetary Fund and the results of a number of projects in different countries aimed at improving the system of national accounts in respect of recording financial assets, data of the federal statistical monitoring system, forms of the federal state statistical monitoring and instructions for completion thereof, methodological developments of the Federal State Statistics Service, data of its territorial authorities, etc.

obtained visibly intensified activities of accounting for natural assets in national wealth within the framework of the Federal Target Program "Development of the State Statistics in 2007-2011."[6] This program envisaged improvement of statistical monitoring of the use and replenishment of natural resources and environmental protection based on the effective system of indicators and methodology of their establishment.

STAGE FOUR: ASSESSMENT OF THE COUNTRY'S NATURAL CAPITAL BASED ON THE INDUSTRIAL APPROACH (2012 UNTIL PRESENT). The development of works in the Russian Federation was based on the following documents:

1. System of National Accounts, 2008, Central Framework of the System of Environmental-Economic Accounting, 2012, System of Environmental-Economic Accounting for Water, 2012;
2. Roadmap for Accession of the Russian Federation to the OECD Convention adopted at the 1163rd session of the OECD Council of November 30, 2007;
3. Decree of the Government of the Russian Federation (October 12, 2012 No.1911-r) on Making Amendments to the Federal Plan of Statistical Works Approved by the Government of the Russian Federation (May 6, 2008 No.671-p);
4. Action Plan to Perform Works Envisaged by the Decree of the Government of the Russian Federation (October 12, 2012 No.1911-r), in respect of the monetary estimates of natural resources and calculation of resource efficiency (Order of Rosstat of July 8, 2013 No.274).

Under the guidance of Rosstat, methodological recommendations were prepared on economic assessment of water, mineral resources, ground and water bio resources in the SNA. In this area, in 2014-2015, the Cadaster Institute developed "Methodological Recommendations for Economic Assessment of Forest and Hunting Resources (as Non-Cultivated Biological Resources)," covering the following:

1. key concepts of forest and hunting resources as non-cultivated biological resources in terms of their assessment as a part of natural capital in accordance with the SNA/SEEA principles;
2. the SNA/SEEA methodological approaches in relation to the general principles and peculiarities of assessment of these resources at the

[6] Approved by the Resolution of the Government of the Russian Federation (October 2, 2006 №595).

current market value in the institutional conditions and statistical reality of the Russian Federation;

3. procedure for conducting calculations in assessment of forest (timber and non-timber forest products) and hunting resources and calculation of the resource rent and discounted value of non-cultivated biological resources (Fomenko, G., Fomenko, M., Loshadkin & Arabova, 2016).

The work conducted is particularly topical due to the introduction of a range of statistical indicators of stocks of non-cultivated biological resources (timber and animals, in physical terms and current market prices as of the beginning and the end of the year), changes in non-cultivated biological resources starting from 2016 and indicators of the use of non-cultivated biological resources in the economy, in physical terms and current market prices, starting from 2019.[7]

Our work on this book was designed to demonstrate our vision of ways and specific features of development of information systems in natural resource use and environmental protection using SEEA. For this purpose, we deemed necessary to provide the philosophical and methodological framework for establishing and developing the SEEA based on the theory of living self-organized systems; to show the essence of the SEEA, including its origins and development, its place and role compared to other information systems, its institutional and organizational peculiarities; to describe the experience of implementing the SEEA provisions in Russia; to demonstrate, on the example of a number of projects, the effect of the results of assessment of environmental resources and ecosystem service on addressing complex issues of natural resource management and strategic planning of territorial development; to describe the SEEA development paths. Our aim was to take into account the new requirements for SNA/SEEA development to the maximum extent possible, to present some of our conclusions and observations, to make the material useful for a wide circle of experts and practical specialists.

[7] Decree of the Government of the Russian Federation of May 6, 2008 No.671-r (edited June 23, 2016) on Approval of the Federal Plan of Statistical Works.

Conclusion

The book demonstrates that creation of an effective environmental management system oriented towards achievement of the SDGs requires a change in approaches to information support. Under the conditions of accelerated technological transition to the post-industrial economy and the adoption of the Paris Agreement on Climate (2015), the measurability crisis is observed. When assessing the development trends of the end of the era, the current statistical and departmental information systems lag behind in identifying new growth trends and threats to sustainable development. In this situation, the need has increased not only for new indicators, but also for changes in the very approach to statistical monitoring of socio-economic phenomena.[1]

Under the conditions of active changes that have begun, we should analyze socio-economic phenomena and processes not in isolation, but in interaction, in interrelation; not in statics and steadiness, but in movement, in change, in development. The emphasis should be placed on inclusive green growth indicators in territorial development, with weakened emphases on industrial data collection. It corresponds to today's demand for a balanced system approach to territorial administration.

We have studied this issue for more than 20 years, looking for answers to these questions.

What is the most important, in our opinion?

Today, the modern theory of sustainable development that is based on the system concept of Life, multivariance of the future, multiplicity of rationalities in natural resource use constitutes the most developed and acceptable methodological framework for maintaining Peace and preventing a global environmental disaster. The most important aspect is that in accordance with the Sustainable Development theory, man's worldview, his idea about how the natural and social world works, in general, cannot be disrupted,

[1] It is widely accepted that the methodological framework for statistics is the cognitive theory, which determines the scientific approach to studying natural and social phenomena (author's commentary).

ambivalent. Such understanding of sustainable development both forms new requirements and implies re-thinking of methodological framework for measurements in the system Society-Nature, primarily, statistical. The key criteria of new measurements are:

1. 1) flexibility, i.e. the ability to see new emerging development trends in the system Society-Nature and to assess them;
2. 2) the ability to provide necessary and sufficient information for work aimed at determining environmental and economic safety criteria that must be met to avoid non-controlled system destruction and the ability to find optimal values of system variables.

While working on the book, we became certain that recognition of multivariance of the future implies identification and assessment of possible scenarios-trends from the prospect of sustainable development and detection of those dangerous for humanity and ecosystems. Recognition of the necessity and feasibility of limitations to avoid negative trends implies a substantial increase in the role of indicators of impact on the environment and the importance of green growth indicators describing the processing between ecology and the economy. Therefore, within the framework of the SEEA, in the big picture of measuring natural capital amount and structure, it is feasible to timely form indicators characterizing the risks of its environmentally and socially dangerous exhaustibility. It allows prompt identification of the danger and ways to substitute shortfall in income (first of all, budgetary and household income) and, thus, to take actions to prevent conflicts in natural resource use at early stages.

The need for wholeness in the world perception in order to make balanced and holistic sustainable development decisions implies coordination and mutual agreement between humanitarian and natural-science knowledge. However, addressing this problem comes across the paradox that the laws of nature are the same for everybody in every place but worldviews, standards, ideals and attitudes towards oneself, others and the world around are different and sometimes incompatible and even hostile (Sadokhin, 2006), whereas man's being requires approximation of natural-science and humanitarian cultures. Today, owning to achievements of the scientific and technical progress and the spread of the system approach, the former confrontation between the natural-science and humanitarian approaches has weakened considerably. We believe that ongoing additional efforts for instrumental support of the new synthesis are necessary. The existing SEEA basic methodology (especially, the first one of 1994) constitutes quite an efficient platform for approximation of these approaches, emphasizing their *complementarity*. The book shows the

key areas of this synthesis: 1) humanization of ecosystem service estimates; 2) establishment of additional socio-cultural measurements for understanding, implementing the results and developing recommendations for institutional transformations in environmental protection in each country and community; improvement of statistical studies within the SEEA in the following aspects: statistical observations; primary processing, summarizing and grouping observation results; analyzing summarized materials. All these stages are interrelated, and if any of them is missing, it will lead to violation of the statistical study integrity.

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