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Accounting of Ecosystem Services in the Resource Efficiency Assessment of Specially Protected Natural Territories of the Komi Republic*

Tatyana V.
TIKHONOVA
Institute of Socio-Economic and Energy Problems of the North at Komi Federal Science Centre of Ural Branch of the Russian Academy of Sciences
Syktyvkar, Russian Federation
e-mail: tikhonova@iespn.komisc.ru
ORCID: 0000-0002-2912-1696; ResearcherID: J-8460-2018

Vitalii A.
SCHENYAVSKII
Institute of Socio-Economic and Energy Problems of the North at Komi Federal Science Centre of Ural Branch of the Russian Academy of Sciences
Syktyvkar, Russian Federation
e-mail: scvit@list.ru
ORCID: 0000-0001-9051-5769

Abstract. One of the integral methods for assessing resource efficiency is the adjustment of net savings. It happens due to many indicators, including the assessment of specially protected natural territories. The author's opinion is associated with the assessment of tourism activities at these sites and consideration of the value of regulating ecosystem territories' services. The objectives of the study are the identification of approaches and assessment of protected areas; selection of "profitable" ecosystem services in regional protected areas; and submission of proposals for the effective usage of these territories. The calculation involves a combination of two methods: assessment of the gross value added of tourist destinations in protected areas and the value of regulatory ecosystem services. Tourism efficiency from the position of creating value chains destinations reflects the rate of gross value added, which is calculated as the

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difference between the proceeds from sales of tourist services entities and their material costs. To determine the economic value of regulatory services, the methods of market indirect assessment and compensation costs were used. During the calculation of ecosystem services, we selected those with beneficiaries located in the region. Increasing efficiency of facilities requires conditions for the development of recreation and new activities. These conditions are shown in the strengthening of interaction between administrations of protected areas with service companies that provide a quality factor of infrastructure, availability of facilities and food services. The economic contribution of specially protected natural areas from the usage of regulating ecosystem services and tourist and recreational activities amounted to 20.4 billion rubles, or 3.2% of gross regional product, in 2018. The proposed approach allows us to show the socio-economic and environmental contribution of specially protected natural areas to the economy of the Komi Republic.

Key words: gross regional product, gross value added, monetary value assessment, specially protected natural areas, tourist destinations, ecosystem services.

Introduction

The term "ecosystem services" (hereinafter – ES) implies the recognition of the fact that well-being and survival of people depends on nature, and a man is an integral part of modern biosphere [1]. Only the search for adequate assessments is an indicator of modern economy. Despite the absence of specific/strict methods of particular ES cost characteristics, it is impossible to ignore this assessment.

In Russia, ES do not enter the market, which means that they cannot be competitive. Nevertheless, the assessment of their significance now becomes an important component of efficiency with the usage of natural capital. Research in this area indicates the beginning of the stage of recognizing the value of natural capital and conducting various assessments (biological, environmental, and economic), in terms of the impact on the economy of many entities [1–7]. Development of schemes and mechanisms for accounting ES concerned the organization of sustainable nature management on the territory of specially protected natural areas (hereinafter – SPNA), based on the inclusion of the tourism and agricultural economic sectors, as well as traditional nature management [5; 7]. Experience of foreign countries is filled with practical developments of economic nature, including payments, various schemes of support from governments, mechanisms for compensating losses from the ES loss [8–12]. Thus, the GIS-toolkit "Land Use Modeler" (LUMO) was developed and tested for the project "Landscape of Saxony 2015" (2009–2012), which allows displaying capabilities, potentials, risks, ES resources, and topographic relationships in the territorial context [13]. In the Republic of Belarus, ES are taken into account at the design stage of assessing the impact of economic projects on the environment; various compensatory measures and payment of damages in accordance with the developed methodology are provided[1]. At the stage of the conducted monetary ES assessments, their integration into the economic accounting of the usage of natural resources becomes relevant [1; 14]. There is a number of foreign studies aimed at the selection of activities on the SPNA territory: for example, modeling and analysis of the relationship between recreational ecosystem services and benefits of traditional nature management [15].

[1] Methodology for Determining the Valuation of Ecosystem Services and the Value of Biological Diversity. *Technical Code of Established Practice*. Bel NITS "Ekologiya". Minsk, 2010. 32 p.

At the same time, the value of recreational services in the SPNA varies tenfold, and it is highly dependent on the biodiversity of entities, population's well-being, infrastructure quality, and availability of objects [16].

In Russia, the main development driver is the national project "Ecology", where the preservation of biological diversity includes the creation of at least 24 new specially protected natural areas with the development of recreational services[2]. The objects of our attention were the SPNA from the point of view of the ecological factor of the increment of net savings. The overall purpose of the study is to assess the economic growth through adequate consideration of the social, economic, and environmental aspects of resource management at the regional level. The adjustment of net savings is proposed as an integral method for assessing resource efficiency. In accordance with the concept of resource efficiency, adopted in the study, inversion pairs are used in terms of eco-efficiency: resource productivity and resource intensity, environmental intensity and environmental productivity[3]. The adjusted net savings method (ANS), which takes into account social and environmental aspects, is acceptable for assessing environmental productivity[4]. According to the methodology for calculating adjusted net savings, the formula is used for Russia's conditions:

$$ANS = GF - IA - DNR - DEP + HCD + CEP + SPNA, \quad (1)$$

where GF – gross fixed capital formation;

IA – investments in fixed capital by type of activity "Mining";

DNR – depletion of natural resources;

DEP – damage from environmental pollution;

HCD – budget expenditures on human capital development;

CEP – costs of environmental protection;

SPNA – assessment of specially protected natural areas.

The focus of the study is the assessment of the resource efficiency by adjusting net savings through the efficient usage of resources in the SPNA. Previously, we analyzed and evaluated the positive impact on the GRP by evaluating the value of ecosystem services and considering regional tourist and recreational destinations [17]. However, the use of these options without their combination has a limited focus. The objectives of our research are to identify the mechanism for calculating and evaluating the SPNA; to select "profitable" ES for the region; and to propose efficient usage of these territories.

Analysis of assessment methods

According to S.N. Bobylev's methodology [18], the logic of the SPNA assessment is that the GRP production on the region's territory is distributed evenly. The SPNA are territories which are fully or partially withdrawn from the economic activity, which means that the lost income relative to the GRP will be a necessary amount. The author's opinion is associated with more detailed and correct assessment of the value of the SPNA considering the ES. On the one hand, the budget receives less income from the exploitation of the territory; on the other – protected areas allow their untouched nature

[2] Passport of the national project "Ecology" (approved by the Presidium of The Presidential Council for Strategic Development and National Projects, protocol dated December 24, 2018. No. 16). Available at: https://www.mnr.gov.ru/activity/directions/natsionalnyy_proekt_ekologiya/ (accessed: January 16, 2019).

[3] *Resource Efficiency: Potential and Economic Implications. A Report by the International Resource Panel March 2017.* 167 p. Available at: http://www.unep.org/resourcepanel/KnowledgeResources/AssessmentAreasReports/Cross-CuttingPublications/tabid/133337/Default.aspx (accessed: September 14, 2017).

[4] Environmental productivity is an amount in which the environmental value is reduced due to losses from carbon dioxide emissions, resource depletion, and population morbidity due to polluted natural environment, but it increases by improving the quality of social and environmental factors (education and healthcare expenses; expenditures on preserving the environment and the value of the SPNA).

to ensure the environmental quality of adjacent territories that can bring income. Many regulatory services function, including the absorption of cross-border pollution. The understanding of this problem is shown even in the loss of financial benefits from business for the sake of preserving natural resources. Thus, a survey of managers of enterprises (more than 900 respondents) among small and medium-sized businesses in the field of tourism in the SPNA confirmed the willingness to lose financial benefits from tourism and direct use of resources to ensure living conditions, quality and environmental protection [19]. As a result of the research, it was revealed that the value of industrially active territories (for example, for coal mining) is comparable to the volume of ecosystem services in the form of recreation and aesthetic benefits for people [20]. The oxygen content in the air and river water outside and in protected areas contributes to the improvement of the natural environment of nearby territories due to the protected regime in the SPNA [21]. Thus, consideration of regulatory services (not just production and cultural services – ones that fit into market relations the most) provides many benefits for population. This fact explains the reason for using the economic assessment of the SPNA ecosystem services on the basis of the concept of total economic value according to the cost calculation of benefits provided at these facilities [2; 22; 23].

Most methods of assessing the SPNA in terms of resource usage efficiency are based on calculations of tourism, or recreation, benefits, as well as the traditional usage of natural resources by population at these objects. Thus, S.B. Boldyreva, according to the statistical reports of the Organization for Economic Cooperation (OECD), records a high contribution of tourism to the GDP, for example, in Iceland (27.2%), Greece (18.5%), New Zealand (17.4%), Portugal (16.4%), Spain (10.8%), Australia (10.8%), Italy (10.2%), Sweden (9.6%), France (9.1%), Germany (8.9%), the United States (8.2%), and other countries [24]. Obviously, such high values are most likely obtained due to business, event, and sea tourism. Nevertheless, ecotourism in the SPNA annually brings considerable income to national budgets of these states (from 660 to 1.2 trillion dollars). There is a synergistic effect, while the distribution of income of the territory itself and related businesses is not uniform. G.T. Shkiperova and other scientists refer to the experience of foreign studies on the costs of maintaining the SPNA and income received from eco-tourism (tour operators, public catering enterprises, hotels, gas stations, shops, etc.), which is estimated as 1:5 and higher[5] in many countries [25–27]. Currently, according to the UNWTO, the contribution of eco-tourism to the global tourism industry is only 10%, in the Russian Federation – 2%, or 11.7 million dollars[6]. The main flow of tourists who prefer ecological types of recreation appears in the SPNA.

The methodology for assessing tourism in a region is based on the System of National Accounts developed under the United Nations, the IMF, the World Bank, the OECD, the World Tourism Organization, and Eurostat. It is based on methods for calculating the GDP[7]. The GRP is calculated by the production method as the sum of the values

[5] *Tourism and Visitor Management in Protected Areas. Guidelines for Sustainability.* International Union for Conservation of Nature, Gland, Switzerland, 2018. 136 p. Available at: http://www.iucn.org.pa_guidelines (accessed: April 22, 2020).

[6] Rosturism: Ecotourism in the structure of the Russian market has a share five times less than in the world. *TASS.* June 6, 2019. Available at: https:// yandex.ru/turbo/s/tass.ru/obschestvo/6518680 (accessed: April 20, 2020).

[7] *System of National Accounts 2008.* UN, MFI, OECD, European Commission, World Bank. New York, 2012. 764 p. Available at: http://unstats.un.org/unsd/nationalaccount/docs/SNA2008Russian.pdf (accessed: April 24, 2020); *Methodological Provisions on Statistics*. Issue 1. Goskomstat Rossii. Moscow, 1996. Available at: https://gks.ru/bgd/free/B99_10/Main.htm (accessed: April 24, 2020); *Tourism Satellite Account: Recommended Methodological Framework*. 2008. UN, UNWTO, OECD, Eurostat. Luxembourg, Madrid, New York, Paris, 2010. 145 p. Available at: http://www.cisstat.com/rus/SeriesF_80rev1r.pdf (accessed: June 23, 2018).

added created in the sectors of the economy in producers' prices[8].

Assessment of tourism at the SPNA objects of the region is performed using the cluster approach, reflecting the specificity of this activity, taking into account the geographically neighboring companies characterized by common activities [28] and the concept of chain and distribution values of the tourism product [29; 30]. Thus, protected areas act as destinations where the value added chain is created within the network interaction of tourism entities with the management system and mechanisms for promoting the tourist product. The level of the efficiency of tourism activities in the SPNA as destinations reflects the indicator of gross value added.

In 2019, «Methodology for calculating indicators "Gross value added of the tourism industry" and "Share of gross value added of the tourism industry in the gross domestic product of the Russian Federation"»[9] was approved. In it, gross value added of the tourism industry (GVATI), due to the classification grouping of types of economic activity "Tourism" [2], is defined according to the formula:

$$GVATI = OTI - ICTI, \quad (2)$$

where OTI – cost of production of goods and services,

ICTI – cost of intermediate consumption[10].

Gross value added of tourist destinations located within protected areas (GVATIд) is calculated as the difference between the amount of revenue from sales of tourist services of entities belonging to the "Tourism" classification group (OTIд) and their material costs (ISTIд). Restrictions in the calculation of gross value added were removed by expert means: in particular, in case of the extraterritorial nature of tourist companies or the lack of recording of tourist and recreational activities in the accounting statements of entities engaged in several types of activities at once.

Assessment of protected areas in the region

Considering tourism, the leading federal SPNA in the Komi Republic are Yugyd Va National Park and Pechora-Ilych Nature Reserve. The flow of tourists to the Yugyd Va National Park has slightly increased in 2000–2018: in 2000, it was 5,000 people a year, by 2018 – 7,300 visitors. At the same time, the share of local residents of the districts prevails (65% of the total flow), share of residents of Moscow and St. Petersburg does not exceed 11%; tourists from other Russian towns – 21%; foreign visitors – 3%[11]. Types of tourism include rafting on non-motorized vessels – 42%; hiking – 12%; water-hiking – 15%; weekend recreation – 31%.

The reserve includes many natural objects, ecological trails, a museum, and a unique moose farm (the first one in Russia). In recent years, the tourist flow has been growing (from 1,000 people in 2000 to 3,200 in 2018). This could be also explained by the fact that, in 2008, the Manpupuner plateau was included in the list of the seven wonders of the world in Russia. Despite the remoteness of the object from a convenient transport network, the flow of tourists in 2008–2012 reached 500 people a year. However, this fact is not considered positive for the plateau itself and the nature reserve trails. Only thanks to activities of the inspection, the installation of cordons and various restrictive

[8] Gross regional product according to Rosstat. Available at: https://rosinfostat.ru/vpr/ (accessed: April 24, 2020).

[9] On approval of the Methodology for calculating indicators "Gross value added of the tourism industry" and "Share of gross value added of the tourism industry in gross domestic product of the Russian Federation ": Order of Rosstat no. 267, dated May 14, 2019. Consultant Plus.

[10] On the adoption and implementation of the Amendment 1/2007 OKVED to the All-Russian Classifier of Economic Activities OK 029-2001 (KDETS Ed. 1), the All-Russian Classifier of Economic Activities OK 029-2007 (KDETS Ed. 1.1) and the All-Russian Classifier of Economic Activities OK 034-2007 (KPETS 2002): Order of Rostehregulirovanie no. 329-st, dated November 22, 2007. Consultant Plus.

[11] *Business Plan of FSBI Yugyd Va National Park*. Non-profit partnership "OOPT RK". PROON/GEF Komi. 2015. P. 54, 55. Available at: http://www.undp-komi.org (accessed: September 1, 2017).

Table 1. Gross value added of tourist destinations of protected areas (expert assessment of 2018), mil. rub.

Activity according to the "Tourism" classification group	Yugyd Va National Park			Pechora-Ilych Nature Reserve		
	$GVATI_д$	$OTI_д$	$ICTI_д$	$GVATI_д$	$OTI_д$	ICTIд
Organization of complex tourist servicing, services of tour operators*	31.55	38.67	7.11	3.20	4.00	0.80
Activities of hotels and tourist bases (hotel "Erkusei", Yugyd Va National Park base)	0.35	1.5	1.15	0.60	1.3	0.70
Aviation transport services and services of the tour operator "Severny Ural"	1.75	3.48	1.73	6.0	12.2	6.20
Railway transport services	24.0	52.0	28.0	-	-	-
Automobile and other transport services (SPNA and other entities, mainly in Inta town)	29.00	49.30	20.30	1.52	3.36	1.52
Retail sale of souvenirs	0.15	0.17	0.02	2.00	2.20	0.20
Total	**88.15**	**145.12**	**58.31**	**13.32**	**23.06**	**9.42**

*Active recreation in Komi, NordUral, active recreation in the Urals, IP Dan'ko V.Yu. NP Yugyd Va, Pechora-Ilych Nature Reserve, and other tourism sites.
Source: own calculation.

measures, a number of visitors was reduced to the amount allowed for the territory – 200 people a year, including tourists from the Sverdlovsk Oblast.

The information base for identifying the cost of tourist services was a survey of the heads of tourism entities and the Internet resources of travel agencies, where the cost of a tourist service or product was indicated. The volume of services was specified through a number of visitors, which is recorded by the administration of the national park and reserve. The material costs of tourism entities were determined in the course of a survey of managers and tourists who received services, as well as on the basis of tour programs. An expert assessment of the added value of the SPNA destinations based on actual indicators of revenue and costs of tour operators is presented in *table 1.*

The most important link in the food chain in federal protected areas is transport services. The volume of interaction between transport companies and the SPNA in terms of the delivery of tourists is 61.4% of the destination's revenue (62.27 million rubles). Tourist companies served only 27% of tourists (about 3,000 people) who visited these protected areas, which generate 42.5 million rubles (41.8%) of the gross value added of destinations. At the same time, it should be noted that the tour operator "Severny Ural" also provides services for the air transportation of tourists, primarily on the Manpupuner plateau. The calculations for 2016 and 2018, performed according to the studied scheme, gave the following results. The gross value added of tourist destinations in 2016 amounted to 91.10 million rubles. In 2018, when the tourist flow increased by 32.3% compared to 2016 (to 10,500 people), and the tour operator was added, it reached 101.47 million rubles (see *tab. 1*). The share of the value of the tourist product of destinations in the GRP[12] in 2016 was only 0.02%. Considering efficient usage of resources and increasing gross value added, the priority is the growth of tourist services, since, without the quantity and quality of tourist goods, the flow of tourists does not bring income but only increases the cost of maintaining security and tourist infrastructure of the SPNA. In this regard, it is important to strengthen the interaction of the SPNA administrations with service companies that provide catering and accommodation services for tourists. Only 0.2% of food is provided on the territory of the destination, the rest is purchased outside of it. Construction of a high-quality highway from Inta

[12] In 2016, the GRP amounted to 574.38 billion rubles; in 2018 – 665.74 billion rubles (*Finances in the Komi Republic: Stat. Coll.* Komistat. Syktyvkar, 2019. 240 p.).

Table 2. Gross value added of the regional SPNA (expert assessment of 2018), mil. rub.

Type of activity in the classification group "Tourism"	Zakazniki		
	$GVATI_д$	$OTI_д$	$ICTI_д$
Services of entities of tourist activity, including tourist bases located in relative proximity to protected areas	25.0	30. 2	5.2
Automobile and other transport services	13.5	15.6	2.1
Products of protected areas (mushrooms, berries, etc.)	-20.0	0.0	20.0
Total	**18.5**	**45.8**	**27.3**
Source: own calculation.			

to the national park could significantly reduce costs per tourist (from 4000 to 1000 rubles). In addition, low income from accommodation facilities (2.3% of total destination's income) is collected on the territory of destinations due to low capacity and high maintenance costs.

Unlike the federal SPNA, regional protected areas, which include 161 nature reserves, 67 natural monuments, and one protected natural landscape, generate 18.5 million rubles, but they do not form full-fledged tourist destinations with an appropriate level of tourist infrastructure development (*Tab. 2*). Currently, only one out of twenty regional districts (Knyazhpogostsky) includes tourism entities in the SPNA, which make it possible to consider it a proto-destination without an appropriate organizational structure. The implementation of the state policy in the sphere of regional national protected areas development, including ecological tourism, is governed by SBI KR "SPNA Center", which does not consider protected objects from the standpoint of the tourist destination formation.

The peculiarity of the tourist flow in these territories is the visits of residents of Syktyvkar, Ukhta, and Vorkuta for recreation and collecting berries, mushrooms, and other resources (about 10 thousand people). The services of tourism entities consist of the delivery and escort of tourists to protected areas and a possibility of living in neighboring territories. In general, tourism entities receive 25 million rubles from this type of activity.

In this situation, the role of regional protected areas is very specific. These are basic territories that do not receive money from tourism and give their resources to other users for free (minus 20 mil. rubles, see tab. 2).

As a result, it is necessary to focus on changing the role of the regional SPNA and redistributing income from tourism: at least partially compensating for losses from collecting resources of protected areas and creating an appropriate tourist infrastructure with an increase in the income of destinations.

The specifics of the author's calculation are the inclusion of ecosystem services in the income component of the SPNA due to the dependence of the quality and availability of services of the recreation territory. The essence of economic assessment is narrowed down to the calculation of the ES through the product of natural and cost values. The calculation procedure is determined by the methods and key parameters discussed in previous authors' publications [17; 31]. Thus, the key regulatory ES (water regulation, CO_2 deposition, water clearance, soil erosion protection, biodiversity conservation, and air pollution absorption) were initially selected and then calculated. The method of compensatory or alternative costs prevails in the evaluation of services, with the exception of the CO_2 deposit service for which an indirect market valuation is applied. ES were calculated within forestry and administrative districts; for the SPNA – proportionately to an area occupied by them in forest and administrative districts (*Tab. 3*).

A high capacity of forest ecosystems to absorb dust and harmful substances from the atmosphere

Table 3. Economic assessment of ecosystem services of the SPNA (estimated data for 2018), mil. rub.

SPNA	Area, thous.hect.	Ecosystem services*						
		WR	D	WC	P	BD	AP	Total
Reserve	721.3	87.1	105.3	57.7	461.2	17.0	2904.8	3633.1
National park	1894.1	208.6	104.5	50.5	698.8	16.5	10219.4	11298.3
Zakazniki	1281.8	202.0	67.3	115.1	775.3	72.0	11768.8	13000.5
Total	**3894.8**	**497.7**	**277.1**	**223.3**	**1935.3**	**105.5**	**24893.0**	**27931.9**
Percentage of total values, %		1.8	1.0	0.8	6.9	0.4	89.1	100

* Water regulation (WR); carbon deposition (D); water cleaning (WC); erosion protection (P); preservation of biodiversity (BD); Absorption of pollutants from air (AP).

Sources: own calculation according to data of SNiP 23-01-99. Table 2. Climatic parameters of a warm period of a year. RF. Kemerovo Oblast, Kirov Oblast, Komi Republic, etc. and SNiP 23-01-99. Construction Climatology. Table 1. Climatic parameters of a cold period of a year. RF. Kemerovo Oblast, Kirov Oblast, Komi Republic, etc..; *Atlas of the Komi Republic*. Moscow: Feoria, 2011. 294 p.; *Red Book of the Komi Republic*. Syktyvkar: Institute of Biology of Komi SC UB RAS, 2009. 791 p.; *Forest Plan of the Komi Republic*, 2019. 314 p.; *On the State of the Environment of the Komi Republic in 2019: State Report*. Ministry of Natural Resources and Environmental Protection of the Komi Republic, SBI KR "Territorial Information Fund of the Komi Republic". Syktyvkar, 2020. 162 p.

(9 t/ha of harmful emissions; 51 t/ha of dust per year) explains a maximum value in the calculations provided by the ES (89.1%). Forest ecosystems contain erosion processes, and the economic significance of this function is 6.9% of total economic effect.

When analyzing the cost values of the SPNA value, it is important to understand the goals and objectives of this type of action. It is obvious that, it is necessary to follow the rule of choosing those benefits that remain in the region for the SPNA assessment, thereby forming a regional product. In this regard, in the next section, we suggest discussing the choice of these services.

Discussion of the results

The main task of the SPNA is to protect natural ecosystems and preserve biodiversity, conduct scientific research in permitted areas – ecological tourism and recreation of population. It is obvious that only tourism and recreation of citizens form a real income and therefore contribute to the GRP. Despite a significant potential for ecotourism in the Komi Republic and the presence of world-class objects in it – the "Virgin Komi Forests" (UNESCO natural heritage site) in particular, the Manpupuner weathering pillars, Narodnaya mountain (the highest point of the Ural Mountains), it is not yet possible to get a sufficient economic effect from ecotourism in the SPNA of the republic.

Currently, an attempt has been made to obtain funds from the federal project "Ecology" (sub-program "Preservation of biological diversity and development of ecological tourism")[13] through participating in the all-Russian competition of investment projects for the development of the SPNA potential[14]. On demand of the Ministry of Culture, Tourism, and Archival Affairs of the Komi Republic, the competition application Tourist and Recreational Cluster "Seventh Wonder of the World" was prepared (geographically extending beyond the UNESCO site "Virgin Komi Forests") at the budget of 26.7 billion rubles. Within the project, four zones of the functional and planning organization of the tourist and recreational cluster were allocated: 1 – "Manpupuner Plateau", 2 – "Lesnaya (Yaksha village)", 3 – "Tima-iz Ski Area", 4 – "Zhelannoe". In particular, in zone 4 "Zhelannoe" (the Circumpolar Urals area), it is planned to create tourist bases (glamping for 20 people) at the foot of the Narodnaya mountain

[13] Passport of the national project "Ecology" (approved by the Presidium of The Presidential Council for Strategic Development and National Projects, protocol dated December 24, 2018. No.16). Available at: https://www.mnr.gov.ru/activity/directions/natsionalnyy_proekt_ekologiya/ (accessed: January 16, 2019).

[14] All-Russian competition for the creation of tourist and recreational clusters and the development of ecotourism in Russia. *Agency for Strategic Initiatives*. June 16, 2020. Available at: https://priroda.life/ (accessed: October 7, 2020).

(22 million rubles budget), Manaraga mountain (22 million); reconstruction of the Sanavozh base for 50 people (50 million) and quartz adit (20 million); development of helipads (12 million). The key project of the cluster is the construction of a highway (137 km, at the budget of 7.7 billion rubles) with bridges (including the one over the Kozhim River – 2.5 billion rubles) from Ints to the foot of Narodnaya Mount to ensure the delivery of tourists to the attractions. The project has reached the final stage of the All-Russian competition of investment projects for the development of the potential of specially protected natural areas.

Authors of the Tourist and Recreational Cluster "Seventh Wonder of the World" application state that, considering a general grandiosity of plans, only 30% of infrastructure exists now. Obviously, this is a serious exaggeration. It can be assumed that the expected flows are increased by several tens of times, as well as investments (from 0.2 to 5 billion rubles). Nevertheless, the tourism and recreation cluster project can be implemented after a professional revision with the definition of a group of priority local projects.

The functional zoning of the territory of the tourist and recreational cluster in the light of modern approaches to the management of protected areas also raises a big question [32]. The world has accumulated extensive experience in international practices for the development of protected areas using, among other things, cluster approaches. One of the interesting objects, located in climatic conditions similar to the Komi Republic's, is the geopark "Rokua" located in Finland – 200 km south of the Arctic Circle. It is visited by nearly 200,000 people, and the park's budget in 2013 was 500,000 euros: 50% from subsidies from the European Regional Development Fund, about 30% – own funds, and 20% – subventions of the Finnish government. In the geopark "Rokua", there are objects of recreational infrastructure (hotels, guest houses, cafes, and information centers), a developed network of roads and tourist trails. The service content of tourist zones coincides with the functional zoning of the geopark. The activity of the park is ensured by the coordination of the interests of state authorities, local communities, and tourists through the creation of clear mechanisms for involvement and cooperation. Much attention is paid to supporting local businesses; in particular, a right to use their own logo is given, and loans are issued to those who want to open their own business on the territory of "Rokua". The park has five food production companies (herb collections, mushrooms, berries, farm products) and organizations that install IT systems, produce souvenirs and power grids. The "Rokua" geopark is not a single nature protection complex.

Only the "Rokua" National Park located on its territory has a protected status. The managing organization of the park is Humanopolis Ltd., established by three municipalities. The Finnish Forest Administration and the "Rokua" Health and Rehabilitation Foundation are involved in the management and financing[15].

Currently, the federal SPNAs of the Komi Republic are far inferior to the leading Russian and foreign counterparts in terms of tourist flow and income, and they are comparable to the largest national park in Canada – "Wood Buffalo". However, the Canadian government allocated 27 million Canadian dollars (1.38 billion rubles) to the park in 2018. In Russia, within the federal project "Preservation of biological diversity and development of eco-tourism" in 2019, only 100.14 million rubles were allocated for the development of tourist infrastructure. The leader in a number of visitors in Russia in 2019 was the "Kislovodsk" National Park (more than 1.5 million people); more than 1.1 million people visited the Krasnoyarsk

[15] International experience in the development of eco-tourism in the SPNA. Guide to the SPNA development. *Agency for Strategic Initiatives*. 2015. Available at: https://mpr.rkomi.ru/page/20017/ (accessed: April 20, 2020).

Pillars, and almost half a million visited the "Russky Sever" National Park (the Vologda Oblast)[16]. One of the most visited parks in the world is the Yellowstone National Park in the United States (over 3 million people per year).

Thus, it should be noted that the main reasons for the success of the SPNA in the world are flexible mechanism of protected areas' interaction with business and population, the active use of the environmental education tool, transport accessibility and the formation of a compromise between nature preservation and tourism development, expressed, inter alia, through effective functional zoning of the SPNA territory.

Specially protected areas provide environmental services that deter or prevent negative environmental effects: sudden changes in runoff during spring floods of nearby territories and settlements, especially downstream of rivers; absorption of harmful substances (dust, pollutants, emissions, etc.) by forest ecosystems; dilution of storm pollution; prevention of wind and landscape erosion processes. It is widely known that the water protection and regulatory function of forests consists in the accumulation of water in forest soils and, as a result, the protection of adjacent territories from flooding and waterlogging of soils; increasing the intensity of groundwater formation. The preservation of the recreational qualities of landscapes, their recreational capacity, the productivity of bio-resources, and the ability to restore contribute to the development of recreation, ecological and educational tourism. In addition to direct income from the quality of the natural environment of existing PSNAs in the region, there is an indirect income that is not taken into account in this calculation. It can be formed through ecosystem services such as insect pollination of grasses, nesting of migratory birds, wild deer habitat, carbon and methane storage in the permafrost zone of wetlands and forest ecosystems (zones of tundra forests and rare-coniferous taiga). The role of such services is great, and it can be felt only at the moment of their loss. In this regard, many ecologists consolidate their efforts for economic and other modern assessments, creating models and schemes for the use of natural resources [1; 14].

However, there is an opinion about an inappropriate inclusion of the ES value in the calculations of key financial indicators of the economy. Thus, realizing the role of the ES in the economic processes of society's development, Yu.G. Puzachenko proves a small contribution of natural resources to the market value and integral indicators (for example, the GDP) [33].

Traditionally, "green" indices are based on subtracting from the GDP losses of natural capital and potential costs of preventing and eliminating pollution in the atmosphere, water basin, and soil. Nevertheless, foreign authors see this as a violation of the correctness of estimates and the resulting distortion of information [34]. The main reason for this distortion is hypothetical nature or replacement of indicators that only indirectly reflect the situation, as well as low reliability of information. According to D. V. Kasimov, "it is important to understand that economic and especially monetary valuation will always cover only a part of actual or total value of the ecosystem or its services. Despite the improvements, there are still large gaps in knowledge and the need to improve approaches, models, and databases for calculating total economic value of an entire set of ecosystem service" [4].

An important component of the ES economic assessment is the identification of recipients of benefits from its usage. This fact allows the selection of the subsequent evaluation of protected areas (*Tab. 4*).

[16] Popularity of ecotourism in Russia is growing. In 2019, a number of visitors to the SPNA exceeded 8 million people. The Ministry of Natural Resources. February 7, 2020. Available at: http://www.mnr.gov.ru/news/populyarnost_ekoturizma_v_rossii_rastet_v_2019_godu_kolichestvo_posetiteley_oopt_prevysilo_8_mln_che/ (accessed: April 20, 2020).

Table 4. Distribution of recipients of benefits from the use of ecosystem services

Ecosystem service	Recipients of benefits	Positive effect
Carbon deposition	Global community	Carbon dioxide absorption from the atmosphere
Water regulation	Nearby areas of the region; enterprises that depend on the water quality downstream; agricultural areas	Regulation of the flow of small rivers and streams; flood prevention
Water clearing		Natural clearing of storm water and wastewater entering water bodies
Protection of soils from erosion		Prevention of damage from the demolition of soil by rivers; preservation of natural soil fertility
Conservation of biodiversity	Country, region	Preservation of the species diversity inherent in this natural zone; regulation of the number and abundance of different groups of plants and animals (for example, some species of rodents, predators and ungulates); reduction of the risk of invasions of alien species, the development of natural focal diseases, the occurrence of conflict situations in agriculture
Absorption of pollutants from the air (dust, suspended particles)	Nearby areas of the region	Preventing diseases; improving mental health; reducing the cost of cleaning the air

Sources: *Ecosystem Services in Russia: Prototype of the National Report. Vol. 1. Terrestrial Ecosystem Services.* Ed. by E.N. Bukvareva, D.G. Zamolodchikov. Moscow: Publishing House of the Biodiversity Conservation Center, 2016. 148 p.; *Millennium Ecosystem Assessment. 2005. Ecosystems and Human Well-being*. UNEP, Island Press, Washington DC, 2005. 283 p.; K. Grunewald [et al.]. *Erfassung und Bewertung von Ökosystemdienstleistungen (ÖSD)*. Bundesamt für Naturschutz. 2014. 374 p.

As in the table, only one function of natural capital – carbon deposition – can be excluded from the calculation according to the criterion of beneficiaries. To determine the value of the territory, it is of global importance, but for the benefits of the region without the introduction of market mechanisms of trade, as is the case in other countries, this eco-service cannot be included in the calculation of the "SPNA" indicator of formula (1).

Water regulation and water clearing services are extremely important for the surrounding areas, as well as for businesses situated at the river downstream. By accumulating water in the underground runoff and cleaning up pollution by swamp ecosystems, forest and water ecosystems save the money that would be needed to clean up the runoff and prevent flooding.

In order to assess the significance degree of these functions, it is possible to use the criteria of E.N. Bukvareva. She argues that, for the beneficiaries of water regulation and water clearing services, the relevance is determined by population density (especially in rural areas) and agriculture development [2]. The protective function of forest ecosystems from soil erosion in nearby areas is usually important when these lands are actively used for agricultural purposes.

Considering the fact that the nearby districts (Intinsky, Pechorsky, Vuktylsky, and Troitsko-Pechorsky), adjacent to the national park and nature reserve, are located in a zone of rural underdevelopment and low population density, we think that it is possible to reduce the calculated values by half. Air purification by vegetation (pollution absorption and dust deposition) refers to the ES of climate and atmospheric regulation and allows enterprises to save on air purification by dust collection plants. There are no production facilities that produce technogenic pollution and are located in the vicinity of large SPNAs of the region. Thus, it is most likely that the SPNAs absorb pollution from transboundary air movement. Regulatory services of regional zakazniki can fully participate in the assessment of protected areas with the exception of carbon deposition services. Despite the underdevelopment of agricultural economic sectors in the regions of the Komi Republic, they play an important stabilizing role in preserving

Table 5. SPNA assessment for the calculation of adjusted net savings

SPNA	Area, thousand hectares	Value of ecosystem services, million rubles	Gross value added of tourist destinations, million rubles	SPNA assessment, million rubles
Reserve	721,3	1763.9	88.2	1852.1
National park	1894,1	5596.9	13.3	5610.2
Zakazniki	1281,8	12933.2	18.5	12951.7
Total	**3897,2**	**20294.0**	**120.0**	**20414.0**
Source: own calculation.				

natural capital [36]. Presence of large production facilities and life of urban and rural populations near nature reserves make it possible to include regulatory services in the calculation. Thus, with the exception of the carbon deposit service, the calculations fully use the ES for regional zakazniki (complex and forest ones) and partially – for federal SPNA areas.

Therefore, the combination principle includes the sum of the regulatory ecosystem services and gross value added of tourist destinations of the region's SPNA (GVATId). Thus, the SPNA assessment in the calculation of adjusted net savings for the Komi Republic has the following form:

$$SPNA = ES + GVATI_д, \quad (3)$$

where the ES is composed of water regulation, water clearing, soil protection from erosion, biodiversity preservation, and the absorption of air contaminants. *Table 5* combines these two approaches to the assessment of the SPNA for the calculation of adjusted net savings.

According to the proposed approach, the SPNA assessment is 20.4 billion rubles according to 2018 data, and the share of the ES exceeds 90%.

The principle of combining the assessment of eco-services' value and tourist destinations' gross value added can also be used for other regions. The value of regulatory services may vary depending on population density of surrounding areas, development of agricultural sector, and presence of large industrial facilities that have a negative environmental impact.

The significance of including the ES in the assessment of protected areas is not to "sell" these resources or receive compensation for their loss. The value of the ES in monetary terms is an estimate of its benefits to society – benefits that will be lost in case of destruction [16]. Thus, the inclusion of a value assessment of the value of ecosystem services to society can serve as a powerful tool for making more effective and balanced decisions.

Conclusion

Currently, the approach to assessing the SPNA in the regional context does not fully take into account the role of protected areas as a reserve for preserving the ecosystem functions of natural ecosystems and an object of economic activity. As a result, there is a qualitative underestimation of the ecosystem services of protected areas and key economic activities – tourism in particular. The presented approach within the framework of adjusting net savings by determining the value of regulatory ecosystem services and measuring the value added of the SPNA tourist destinations allows us to determine the contribution of protected areas to the regional economy more correctly. Water protection, regulatory and clearing services of ecosystems, protection of soil cover from erosion, biodiversity preservation, and absorption of pollutants from the atmosphere by forest ecosystems can be used to calculate the SPNA value at the regional level. It created the conditions for introducing permissible business activities in the SPNAs and reducing production costs in the neighboring territories in the presence of industrial plants and agricultural farms (personal and state).

Consequently, these functions are involved as resources in the assessment of SPNA and its effectiveness. The preservation of this potential should become the norm for conducting permissible economic activities at protected sites. At the same time, in order to increase the efficiency of facilities, conditions are necessary for the development of tourism, which consists of strengthening the interaction of protected area administrations with service companies that provide a quality factor of infrastructure, accessibility to facilities and food services.

As a result of the SPNA assessment, a value of 20.4 billion rubles for 2018 was obtained, which can be used for subsequent calculations when adjusting net savings. The economic contribution of specially protected natural objects in terms of the use of regulatory ecosystem services, tourist and recreational activities amounted to 3.2% of the GRP in 2018. Thus, the proposed approach allows us to reflect the socio-economic and environmental contribution of the SPNA to the economy of the Komi Republic. Currently, the services provided by ecosystems cannot be put up for sale, such as wood, berries or mushrooms, hunting or fishing resources. However, the disclosure of their potential in the value system of the SPNA is considered one of the steps toward resource efficiency.

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Information about the Authors

Tatyana V. Tikhonova – Candidate of Sciences (Economics), Associate Professor, Head of Laboratory, Komi Federal Science Centre of Ural Branch of the Russian Academy of Sciences, Institute of Socio-Economic and Energy Problems of the North (26, Kommunisticheskaya Street, Syktyvkar, 167982, Komi Republic, Russian Federation; e-mail: tikhonova@iespn.komisc.ru)

Vitalii A. Schenyavskii – Candidate of Sciences (Economics), Senior Researcher, Komi Federal Science Centre of Ural Branch of the Russian Academy of Sciences, Institute of Socio-Economic and Energy Problems of the North (26, Kommunisticheskaya Street, Syktyvkar, 167982, Komi Republic, Russian Federation; e-mail: scvit@list.ru)

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