ГЕОИНФОРМАЦИОННОЕ И КАРТОГРАФИЧЕСКОЕ ОБЕСПЕЧЕНИЕ СОХРАНЕНИЯ КУЛЬТУРНОГО НАСЛЕДИЯ И ТУРИЗМА

GEOINFORMATICAL AND CARTOGRAPHICAL SECURITY OF CONSERVATION OF CULTURAL HERITAGE AND TOURISM

DOI: 10.24057/2414-9179-2017-2-23-5-13

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WETLANDS ECOLOGICAL-ECONOMIC MAPPING AT COMMUNITY-TRIBAL LANDS IN THE RUSSIAN EUROPEAN ARCTIC COAST

ABSTRACT

An economic-ecological map for Nenets community tribal lands at the Russian Arctic coast wetlands was compiled. Wetlands supply a large variety of ecosystem services beneficial to ecological stability and biological resources for indigenous population support. Ecosystem services assessed in this project were mainly regulating: carbon deposition by different ecosystems (climate regulation function due to CO_2 consumption), water purification and "warming" effect of bogs. This list was limited by data and assessment methods availability. We used traditional methods for ecological services assessment, based on their existing and possible (virtual) market prices. Mapping approaches were based on Target 2 Action 5 Mapping and Assessment of Ecosystems and their Services (MAES) of the EU Biodiversity Strategy to 2020. Proportional value regulating services of peat bogs appeared to be nearly the same as maximal existing lands value. Our assessment results enabled us to present spatial dimensions of ecosystem services of community-tribal lands, whose value appeared to be higher than compensatory sums for "lost profit" in case they are replaced by oil extraction infrastructure. Traditional nature management lands may be regarded as an alternative to further primarily industrial land use type and attribute ecological buffers role to them as well as indigenous population material and spiritual support functions.

KEYWORDS:

mapping, ecosystems services, traditional nature management, Arctic coast

INTRODUCTION

Traditionally wetlands are referred to territories of minor economic value: they are difficult for cultivation and demand financial resources for amelioration. The Russian European Arctic coastal zone is mainly lowland occupied by tundra and wetlands. Indigenous population uses such territories as reindeer pastures, hunting and fishing lands etc. forming traditional nature management pattern. Their value for regional economy is calculated as "lost profit" in case of replacement

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and consider only biological resources. But economic value of wetlands is not limited to biological resources. They produce a large variety of ecosystem services valuable for ecological regional stability [D'Groot, Stuip, 2006]. Being "a common wealth" they are not economically assessed thus producing a great number of nature management conflicts. Ecological and social are the most common for the mentioned region. Ecological-economic assessment with spatial representation of its results is of vital importance to prevent such conflicts. This investigation follows the mainstream of the on-going TEEB joint project of CAFF [Arctic Council; Progress…, 2015], UNEP, WWF.

About 25% of indigenous population is nomadic or semi-nomadic (Figure 1). Due to Federal and regional activities during the last decade there is no trend of indigenous population decline nowadays in general. More than that, population number of Nenets, Khants, Chuckchi, Evens increased. The main threat for indigenous peoples now is decline and degradation of traditional nature management supporting their cultural identities. Aborigine cultural landscapes nowadays exist only within traditional nature management lands, though their virtual limits may be larger but still known to indigenous population and help to preserve regional identities [Krasovskaya, 2011]. Nowadays economic factors stipulate priorities in nature management: land use pattern bringing low income has all chances to be replaced.

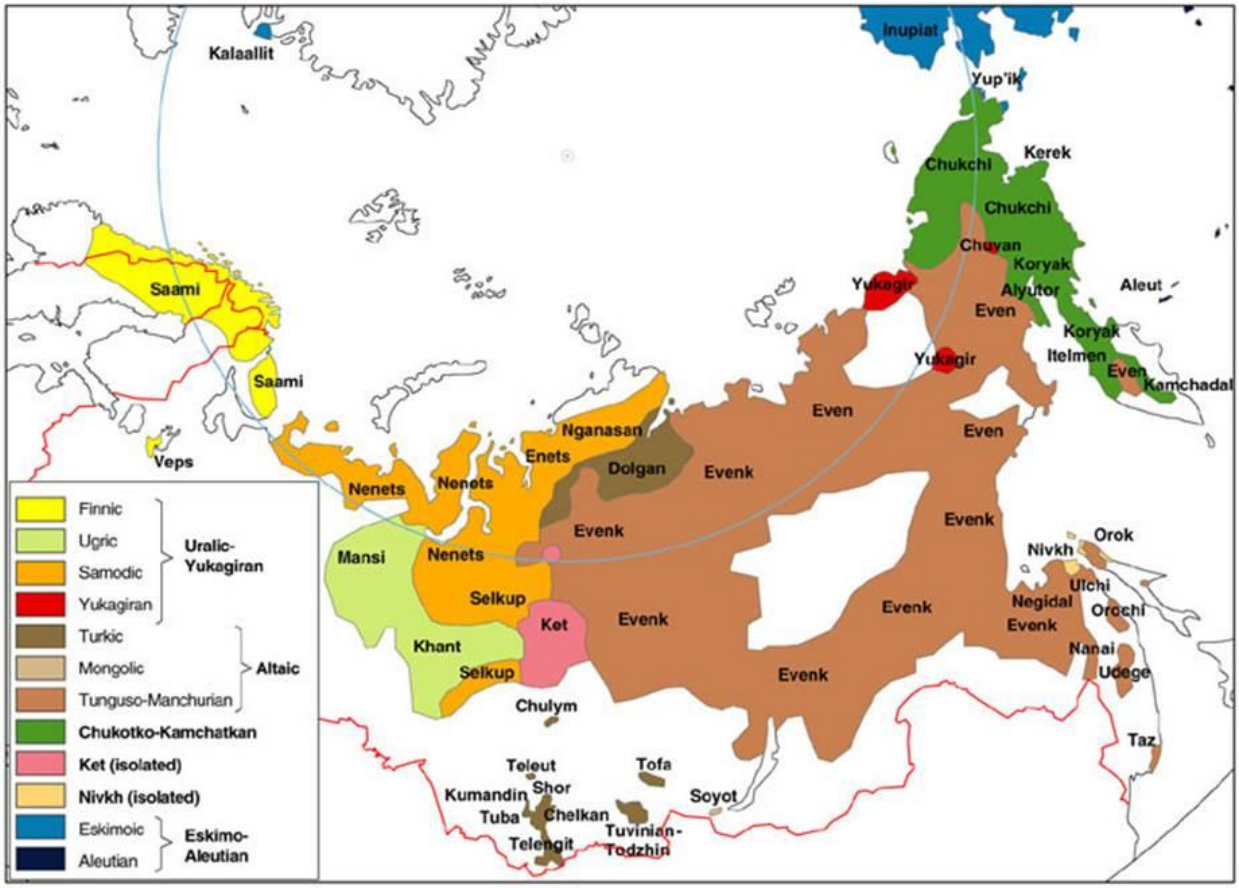

Figure 1. *Indigenous population of the Arctic zone*

Study area

We have chosen traditional nature management lands for ecological-economic assessment in Nenets Autonomous Okrug (AO). The number of indigenous population (mainly Nenets) is about 7500. Besides, Russian old-settlers – Pomors live in the western part of the Arctic zone, but their traditional nature management is different. Nenets traditional nature management includes mainly reindeer breeding, supplemented by fishing, hunting, wild berries and medical plants picking. No-

madic population total number exceeds 1500 people [Hantazeisky, 2013]. Nenets reindeer breeders are united in family-tribal communities, aborigine agricultural cooperatives, are presented as private owners and by state enterprises. In the focus of our attention were lands belonging to the Union of family-tribal community "Ya'Erv", Zapolyarny region of the Nenets Autonomous okrug. It was formed in 1998 and united several former agricultural collective farms which existed in the Soviet Union. Its total area exceeds 600 000 ha (Figure 2 a, b).

Figure 2 a. *"Ya'Erv" location*

Figure 2 b. *"Ya'Erv" community-tribal lands in Nenets Autonomous region*

Our choice is explained by the fact that this territory is fairly well provided by ecological-geographical data necessary for our assessments due to recent studies conducted at its territory within GEF and UNEP projects [Mihalev *et al.*, 2008] as well as our personal field research experiences. More than that, the mentioned above projects enabled us to compile an ecological-economic map of biological resources presenting provisioning ecosystem services. We used these materials to complete spatial characteristics of nature capital value presented in this report by wetlands regulating and supporting services value.

The study area occupies the Pechora lowland with absolute heights about 200 m and is characterized by severe climatic conditions. The major part of the land cover is presented by tundras (45%) and bogs (20%). 12% are occupied by forest-tundra vegetation, 5% – by meadows and 11% by water bodies [Mihalev *et al.*, 2008]. The rest 7% are presented by northern taiga. More than 12 hydro-carbon deposits with extraction sites are situated in the territory producing different kinds of nature management conflicts (Figure 3).

MATERIALS AND METHODS OF RESEARCH

Ecosystem services assessed in this project were mainly supporting and regulating: carbon deposition by different ecosystems (climate regulation function due to CO_2 consumption), water purification and "warming" effect of bogs. This list was limited by data and assessment methods availability. We used traditional methods for ecological services assessment, based on their existing and possible (virtual) market prices. This is a common practice for ecological-economic assessment of "common wealth" though it needs revision with time due to possible fluctuations of market prices. As far as regulating services are concerned this seems to be the only way to find their "social price". Their primary assessment was attributed to bogged lands in general comprising peat, grass and complex bogs plus meadows. Available data for meadows was limited to carbon sequestration. Supplying ecosystem services (wild berries and medical plants resources) were assessed using available botanical studies [Mihalev *et al.*, 2008].

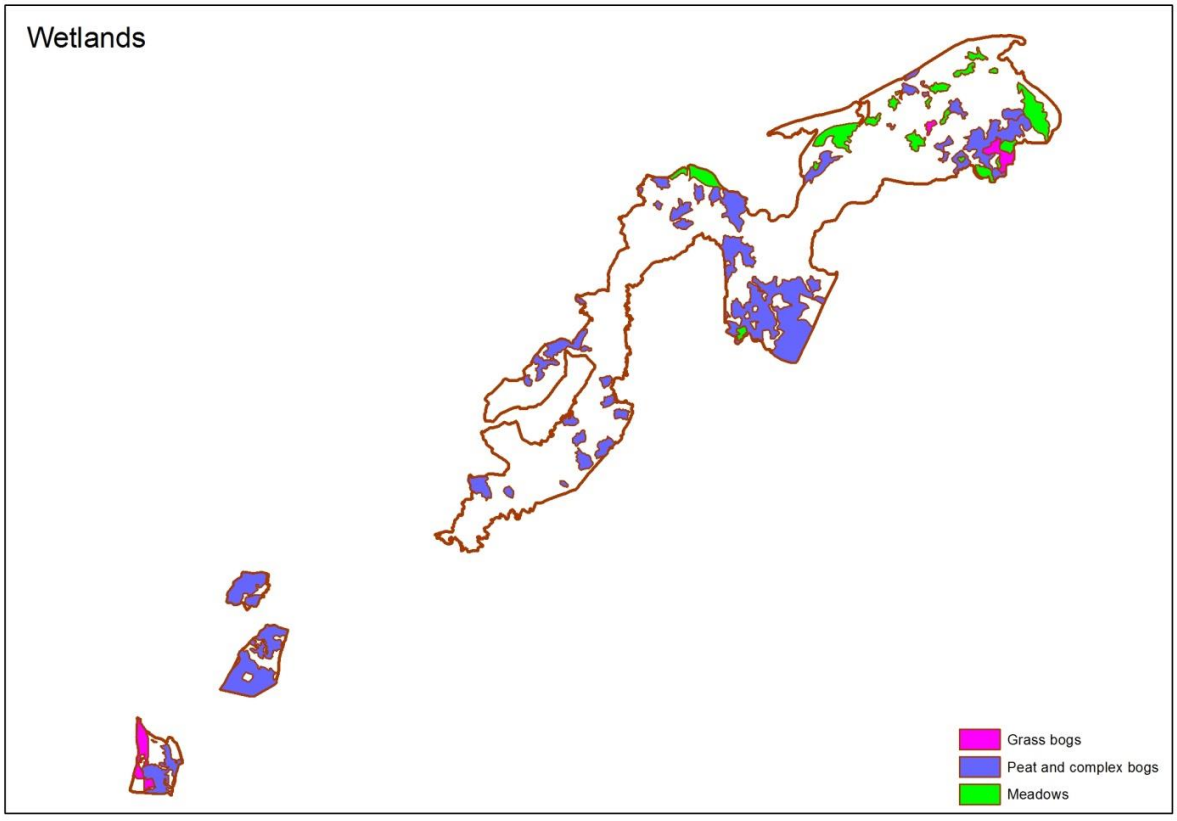

Figure 3. *Wetlands*

Table 1. *Carbon deposition by Ya'Erv ecosystems*

	Ecosystem type	Area, ha	Deposition rate, t/ha/year	Source of information
4	Bogs: Peat and complex bogs Grass bogs	 150461 14764	 0.65* 0.18*	Liss *et al.*, 2001, Ginsburg, 2005, Zamolodchikov, 2003 *et al.*
5	Meadows	33691	0.23	Moiseev, Alyabina, 2014

* Regarding average emission rate

Published data concerning regulating ecosystem services for carbon deposition was used [Zavarzin, 2007; Elsakov, 2003; Voronov *et al.*, 2012; Costanza *et al.*, 2014; Zamolodchikov, 2003 etc.]. Absence of experimental data related to the study area was completed by adequate data on carbon deposition referred to similar ecosystems in adjacent territories of the Arctic zone. Carbon emission was negligible compared to accumulation process because the territory belongs to stable permafrost. Table 1 presents data used for our assessments.

Water purification service assessment was based on analogies method. Total virtual bogs water purification capacity was assessed. Water purification ecosystem service exists due to water filtration capacity. Using H.Darcy law, K.E.Ivanov [1957] calculated an average filtration capacity in bogs: 0.015 cm/day for peat bogs and 0.005 cm/day – for grass bogs. Filtration process was limited by warm period, i.e. up to 3 months. Water purification service was assessed as an analogy of local water purification service (price for municipal sewage treatment – 20 r/m^3) [Prices…, 2016].

Bogs *"*warming*"* service is explained by increase up to 10% of radiation balance at bogged territories compared to dry lands. This phenomenon is typical for northern regions [Romanov, 1961]. For example, field data demonstrated that air temperature increase in Western Siberia during cold period was 2^0C due to warming effect of bogs [IMECS…, 2002]. Radiation balance in our case was 10-12 Kkal/ cm^2/year. Warming effect was assessed in local price units for heating - 1166 r/1Gkal in 2016 [Prices…, 2016].

Biological resources value (provisioning ecosystem service) for wild berries and medical plants was borrowed from published data [Mihalev *et al.*, 2008]. They supply 72% from the total value of biological resources (56.5 USD/ha). The total value of wild berries and medical plants was reduced to the level of possible picking, i.e. about 50% (28.3 USD/ha). The productive areas for different ecosystem regions were not less than 70% from the total [Mihalev *et al.*, 2008]. The assessed proportional value of resource ecosystem service is 19,8 USD/ha.

RESULTS OF RESEARCH AND ITS DISCUSSION

Assessment results enabled us to find proportional values of regulating several ecosystem services (Table 2). They were used for ecological-economic map compiling.

Within the frames of Target 2 Action 5 Mapping and Assessment of Ecosystems and their Services (MAES) of the EU Biodiversity Strategy to 2020 approaches and workflow were developed for the general state assessment of ecosystems linking biodiversity. They present technologies for various ecological data arrangement for mapping. These efforts may be regarded as the first step for ecosystem services economic assessment and deal mainly with individual ecosystem elements and their anthropogenic transformation. Recently similar mapping program was launched in Nenets AO sponsored by GEF and Ministry of Natural Resources of Russia. GIS technologies were used for compiling a geoecological regionalization map [Konovalova, Shumilova, 2008]. It is necessary

to mention that ecological-economic mapping exists nowadays at its initial stage. Though R. Costanza and his team succeeded in compiling the World map of ecosystems services value as far as in 1997 and its revised variant in 2014, very few examples concerning regional and local levels exist. Our experiences in this respect are connected with ecological-economic maps compiling based on the described above approaches for Khanty-Mansy Autonomous region (regional scale), Vorkuta, Mezensky, Numto regions (local scale) belonging to territories with traditional nature management lands of indigenous population [Evseev, Krasovskaya *et al.*, 2009; Krasovskaya, Tul'skaya, 2010].

Table 2. *Proportional value of terrestrial ecosystem services for "Ya'Erv"*

	Ecosystem service	Proportional value USD/ha 1 ha
1	Carbon deposition Grass bogs Peat and complex bogs Meadows	 6.6 23.8 8.4
2	Bogs warming	13.0
3	Bogs water purification	88.9
4	Biological resources	19.8

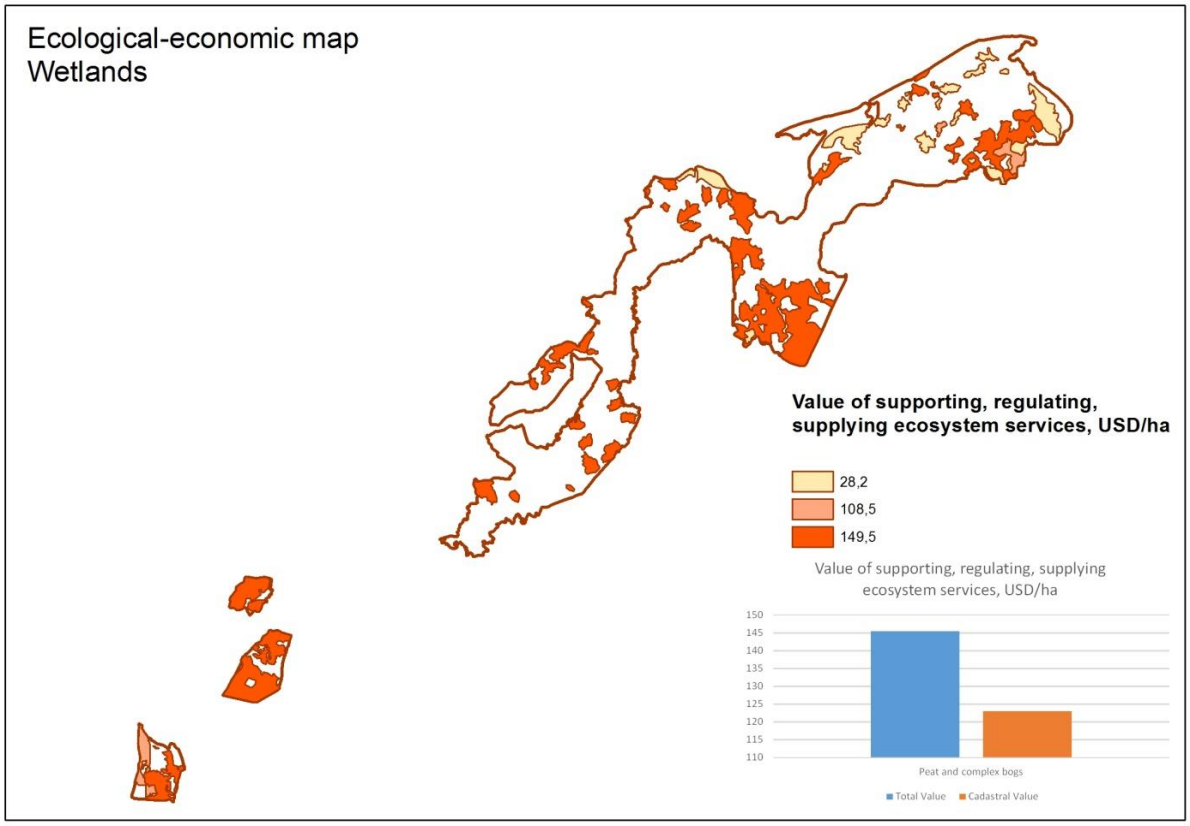

Figure 4. *Ecological-economic map*

Our studies enabled us to compile an ecological-economic map (Figure 4), demonstrating a relatively large spectrum for wetlands ecosystem services. Such maps compilation may be regarded as movement towards development of an ecological-economic Atlas information system which presents the top-level of electronic atlases supporting scenario approach to territorial planning proce-

dure and decision making [Ormeling, 1996; Tikunov, 2004]. They comprise advances modeling functions, may integrate expert systems and be presented as multimedia constructions. Spatial data visualization is their valuable service.

The received results may be regarded as an attempt of assessment of regulating and supporting services for the studied area. This was never done before. The future assessment may enlarge the received value due enlarging services spectrum (refugium, water regulatory etc.). Future changes in economic parameters used in this work will only increase the received figures because tariffs have a tendency for permanent growth. Results of ecosystem services per 1 ha demonstrate fair correspondence to similar assessments [Costanza *et al.*, 2014; De Groot *et al.*, 2006].

We compared proportional value of the assessed ecosystem services with existing lands value – maximal 132 USD/ha [Mihalev *et al.*, 2008]. Proportional value for the assessed services appeared to be nearly the same (Table 2). If we add average proportional value of provisioning ecosystem services for wild berries and plants (19.8USD/ha) the total value will be 10% higher. Mean proportion value of carbon deposition ecosystem service appeared to be close to value of bioproduction service (i.e. berries, medical plants) but it is not considered in cadastre lands value.

CONCLUSIONS

Our assessment results enabled us to present spatial dimensions of wetlands ecosystem services of community-tribal lands, whose value appeared to be higher than compensatory sums for "lost profit" in case they are replaced by oil extraction infrastructure. This fact gives a chance to preserve traditional nature management lands as an alternative to further primarily industrial land use type and attribute ecological buffers role to them as well as indigenous population material and spiritual support functions.

ACKNOWLEDGEMENTS

This work was supported by the Russian Foundation for Basic Research, grant No 15-06-02279.

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УДК 911:004:004.9: 910.26: 528.9:811: 811.161.1:94(574: 574.1) DOI: 10.24057/2414-9179-2017-2-23-13-26

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СОЗДАНИЕ СПЕЦИАЛИЗИРОВАННОЙ ТОПОНИМИЧЕСКОЙ ГИС ДЛЯ РАЙОНОВ ДЕРУСИФИКАЦИИ, ДЕСОВЕТИЗАЦИИ И ДЕКОММУНИЗАЦИИ

АННОТАЦИЯ

Главное назначение любого географического названия – фиксация конкретного объекта или территории с пространственной привязкой на земной поверхности. Региональная топонимия – бесценный памятник духовной культуры человечества, хранящий память народа о его прошлом. Каждое название отражает особенности именуемого объекта, обуславливая эффективность их привлечения для решения разнообразных исторических, географических и лингвистических задач. Известна определённая степень изменчивости – как отдельных названий, так и всего топонимического комплекса – не только в пространстве, но и во времени. Это связано с особенностями исторического развития этносов и территорий, а также происходящими политическими изменениями. Вместе с тем, ещё в 1972 г. Генеральная конференция ЮНЕСКО приняла Конвенцию об охране всемирного культурного и природного наследия, призвавшую не допускать искажений и переименований исторических топонимов.

В связи с этим важной и актуальной задачей является сохранение наименований географических объектов, широко известных в прошлом и существующих в настоящее время, как составной части исторического и культурного наследия народов различных регионов Земли. Остро стоят проблемы исследования топонимии отдельных регионов дерусификации, десоветизации и декоммунизации, как объекта комплексного системного многоаспектного изучения; анализа подвергшихся этим процессам топонимов с момента их возникновения до настоящего времени – сохранившихся как в исторических источниках, официальных документах и живой речи, так и в ретроспективных картографических материалах.

В соответствии с комплексной междисциплинарной направленностью исследования и топонимики в целом, решению названных задач, а также популяризации научных знаний и информации по топонимике в обществе, призваны способствовать разработка и создание пространственных баз данных специализированных топонимических ГИС. Поскольку топонимия отдельной территории представляет собой систему, ее основные структурные и функциональные элементы, взаимосвязи и взаимодействия позволяют достаточно широко использовать методы геоинформационного моделирования и картографирования.

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