INTRODUCING THE CONCEPT OF ECOSYSTEM SERVICES: INVENTORY AND ECONOMIC VALUATION ON LOCAL SCALE IN LITHUANIA

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Abstract. *It is the first pilot study in Lithuania, introducing the concept and demonstrating the economic importance of the ecosystem services, as well as establishing the monetary values for the selected ecosystem services and goods. The relatively small but important as a provider of multitude ecosystem services for the local community site in Southern Lithuania was selected as the study area. The services with the highest importance, available in the study area, were identified, using the primary list of national ecosystem services for Lithuania as a background for the selection procedure. The methods of in-situ observation, territory mapping, face-to-face interviews and questioning were applied in the surveys to evaluate the stocks and actual use intensity of ecosystem services. The most proper economic valuation methods for this particularly case were chosen as well. As far as after the forest clear-cut the majority of ecosystem services were lost, it became a vivid example for the comparison of benefits gained and loosed. It was estimated, that the total direct and indirect monetary value of the selected ecosystem services and goods in the small study area could reach more than 20,000 EUR a year to compare immediate value of one-off harvesting timber less than 14,000 EUR, what means that if only the final services and actual use of them would be taken into account, it would be almost 1.5 times (annually) that it was when the forest harvested for timber once. But the main added value of the current research was the introduction, in well understandable, clear and acceptable manner, to local community the idea of ecosystem and biodiversity services and their importance. Limitations of the described study and possibilities for further development of case study approach in the ecosystem services inventory and valuation were also identified.*

Keywords: *ecosystem services, economics of ecosystems and biodiversity, cost-based pricing, provisioning services, regulating services, cultural services, supporting services*

INTRODUCTION

It is obvious, that the ecosystems provide majority of services, essential for human well-being and existence. And similar as other, but less complex providers, the ecosystems could stay on continuing of provision of their services only on condition that quality, functionality, operational features and resilience will be secured and maintained. Sustainable development process should ensure

inclusion of proper and sustainable management of ecosystem services in all development policies, possibly stating the exceptional importance of them, and putting emphasis on it in the list of environmental issues.

The Millennium Ecosystem Assessment highlights, that use of most of ecosystem services during last fifty years has increased, while the status or quality of majority of ecosystem services is degrading or balancing in the mixed status (Millennium Ecosystem Assessment, 2005). This worrying announcement was supported by evidences also from the European Union, where the specialised project, called RUBICODE, stated most ecosystem services in EU as degraded and not able to deliver the good quality or quantity even of basic services such as clean air and water provision, pollination, or controlling floods and erosion (EEA, 2010b).

Establishing effective management of multiple ecosystem services should be based on identifying, measuring the extent and status, and valuing of them. Ecosystem services would not be managed properly, if they will not be clearly described and recognized by decision makers (European Academics Science Advisory Council, 2009). The above mentioned three main pillars for the ecosystem services maintenance are tightly connected first of all to proper common understanding and acceptance of the approach by researchers and, what is not less important, by general public and local communities, directly or indirectly benefiting from these vital and mostly "free of charge" services and goods.

The current situation still shows, that the progress in this process is lagging because of lack of knowledge, especially on understanding of the service "primary provider" and importance of various services across the ecosystems.

Moreover, one of the shortcomings of the Millennium Ecosystem Assessment was the relatively weak economic evaluation provided in support of conserving ecosystem services. When the first interim report of project on the economics of ecosystems and biodiversity (TEEB) was presented to the Conference of the Parties to the Convention on Biological Diversity, it was also stated, that most of its examples are national or local, and a challenge is to ensure the development and continuance of the case studies on this issue in near future (UNEP, 2010). Nebhover emphasises, that "loss of biodiversity and ecosystem services is a global challenge, but problems and their solutions will often need a focus on the local and the regional level, thus integration of knowledge from these levels is needed as well" (Nebhover, 2011). Therefore, the methodological approaches to identify important for certain area ecosystem services, as well as approaches to monetary valuation of them (EC, 2011), alongside with development of tools for more fluent communication the economics of ecosystems and biodiversity to the public and decision makers are crucial for the success in securing and sustainable use of ecosystem services.

Current paper is dedicated to present the results of the first case study in Lithuania, developed for the economic evaluation of ecosystem services in the small pilot area, important for local community. During implementation of the study, the primary research type was used, in-situ observations, interviews and question-

naires were applied for the estimation of ecosystem services and goods availability, and actual use intensity, while the Market value, Cost-based and Travel Cost methods were used for the monetary evaluation of selected services. The outcomes of the study enabled to establish a national example for economics of ecosystem services and goods, also quite intelligible and with relatively high level of acceptability by common people for the perception of ecosystem services per se and initial understanding of their importance and value.

1. SCOPE OF THE STUDY

Ecosystem services, as European Environment Agency describes in EU 2010 Biodiversity Baseline Glossary, are "the benefits that people obtain from ecosystems" (Biała et al., 2010). The Millennium Ecosystem Assessment classifies ecosystem services into four main types, or classes: provisioning, regulating, cultural and supporting services (Millennium Ecosystem Assessment, 2005). For better understanding of the problem, it is necessary shortly review all four of them, with some emphasis on the evaluation of the comprehensibility and "commonness" of the terms and definitions.

Provisioning ecosystem services in different sources are introduced as services, providing goods of direct benefit to humans the ecosystem could supply, like food, freshwater, fuels, timber, medicinal plants, etc., and usually with more or less available or presumptive monetary value, thus, quite well understandable and accredited.

Next class, regulating services, commonly are defined as the range of functions carried out by ecosystems which are often of the great value but generally not given a monetary value in the conventional markets. They include regulation of climate through the carbon sequestration and control of rainfall, the regulation of air and water quality, the control of diseases and pests, protection from natural disasters such as floods, the regulation of material flow, like combating erosion process, etc.

Cultural services, directly involving people, but typically not providing direct material benefits for users, but contributing to other important intellectual needs and aesthetical desires of society, include the spiritual value of particular ecosystems, aesthetic beauty of landscapes that attract eco-tourists and so on, then providing spiritual, recreational, cultural and scientific benefits.

Supporting services, not of direct benefit to people as well, are essential to the functioning of ecosystems and therefore indirectly responsible for production of all other services. Examples are the formation of biomass and soils, nutrient and water cycling, provision of habitat, pollination (in some cases pollination is suggested to include into the list of regulating services (Gallai et al., 2009)) and similar. Since society do not directly use supporting services, thus, people do not obtain benefits from them, so they may not strictly be part of services defined as the benefits obtained from ecosystems (Biała et al., 2010).

Despite of more than decade passed already before the ecosystem services and goods approach was developed, the idea of ecosystem services still could be counted as being relatively new and somehow overwhelming. The last term we would

prefer to use, as, to our mind, ecosystem services approach with its novelty, complexity and extent could be easily comparable with idea of species conservation via conservation of their habitats or even sustainable development approach at its dawn time.

Moreover, specific problem also arise with the understanding of biodiversity and ecosystem services interconnections. The link between biodiversity and ecosystem services is not well understood, and "better knowledge of ecosystems services and how they are linked to biodiversity is therefore needed, and also they values", as the European Commission stated in the Impact assessment, accompanying Communication on EU biodiversity strategy to 2020 (EC, 2011). The European Environment Agency cites Secretariat to the Convention of Biological Diversity, underlining, that "the loss of biodiversity often reduces the productivity of ecosystems, thereby shrinking nature's basket of goods and services, from which we constantly draw. It destabilizes ecosystems, and weakens their ability to deal with natural disasters such as floods, droughts, and hurricanes, and with human-caused stresses, such as pollution and climate change" (EEA, 2010b). Well understandable for ecosystem services analysts, thereby it also requires much more acceptable explanations and evidences of linkages for general public, as far as biodiversity itself for the time being is mainly conceivable as "many nice animals and plants" (i.e. as cultural-aesthetical value) or extent of the list of species, available for hunting and fishing (thus, of the direct use), and not usually understandable, as indispensable element for ecosystem services existence. The arguments like gene pools, habitat provision, life cycle maintenance or infrastructure formation (Morling et al., 2010) are not weighty ones for common people. The consequences of this situation could be similar to the common understanding of the importance of environmental monitoring elements with the clear prioritisation of, e.g., water and air, and not keeping biological diversity as of the same importance, thus, of the similar value.

For the time being most of case studies and overall assessments of the processes and systems of ecosystem services accounting development do not include biodiversity itself, e.g., as provisioning (next to the genetic resources, as it was done in Switzerland study (Hauser et al., 2010) or supporting/regulating (e.g. birds of prey – rodents control) ecosystem service, and suggest leaving it as one of the key background elements for the ecosystem functioning, so, being a pre-requisite underpinning each of ecosystem services. Therefore, it is necessary to ensure, that the clear message about the biodiversity importance for ecosystems services diversity, resilience and continuity would be passed to the audience timely, despite "the precise link between the fact of diversity and the capacity of an ecosystem to provide services is a complex one, and an area in which science is still developing", as is noticed in Factsheet for ecosystem services, prepared by Secretariat of Convention for Biological Diversity (CBD, 2010).

Generally speaking, the main objectives of the case study, described in the current article, could be the support to upgrading the existing knowledge basis about ecosystem services and their social

and economic values for better informing decision making process and, first of all, local community. By laying stress on cultural ecosystem services and provisioning services, let us say, "inspired" by the use of cultural (recreational) services, we also took into account the remark of Joachim Maes from Joint Research Centre, European Commission, that data and knowledge on ecosystem services are still strongly biased towards provisioning services, such as timber or other commercial production, but evidences of regulating or cultural ecosystem services are lacking (Maes, 2011).

The main tasks of the case study were: (a) to elaborate and implement a first national small-scale case study, demonstrating ecosystem services and their importance to public and decision makers; and (b) visualize and prove of procedures and methods for economic valuation of ecosystem services, executing monetary evaluation of the most important ecosystem services in the selected pilot area.

2. STUDY MATERIAL AND METHODS

Implementation of the case study was executed following these procedures, listed in the study plan:

- Case study site, common to local community and with recent notable changes, was selected;
- Ecosystem services' comparative degree of significance for the case study area was assessed;
- Ecosystem services with the determined high and medium degree of significance were selected for further analysis;
- Selected ecosystem services extent and consumption intensity were evaluated;
- The economic value for the selected ecosystem services was identified.

The important background information, used for this study, was a primary set of ecosystem services and goods, relevant to Lithuania, established in cooperation with the experts from the Centre for Environmental Solutions. The explored for the study purposes a national list of ecosystem services was created during the first stage of the project *Lithuanian ecosystem services inventory and valuation: Pilot study,* carried out by the Centre for Environmental Solutions, according to classification, established by the Millennium Ecosystem Assessment.

2.1. Study area selection

Seeking as sharp as possible impression, also the purely psychological element of human behaviour was taken into account, when the feeling of loss of something good or of high value is much more intense than the sense of expectations for some good things happen or even a joy of already gaining valuable and important benefits. From this point of view, the area with clearly understandable and visible impact, at least, for some services and ecosystems' elements, was chosen (Fig. 1).

The site, selected for the current small-scale study, is situated in Southern Lithuania and belongs to Vilkaviškis district. This district distinguishes with the lowest area covered by forest in the Lithuania's territory. Short description of the important features of the pilot study site could be as follows:

- Ecosystem type: temperate (boreal) deciduous forest;
- Total area: 8.55 ha
- Forest cover (in year 2006): 6.5 ha;
- Agricultural area, water, infrastructure cover (in year 2006): 2.05 ha;
- Rivulet segment length: 0.2 km;
- Distance to big settlement (Vilkaviškis city, the centre of the district): 2.8 km;
- Forest ownership – private.

Fig. 1. The case study area in year 2006 (picture of the aerial survey from 2005–2006 year period)

The main impact to the pilot site characteristics was clear-cut of 6 hectares of forest in 2007 (Fig. 2).

Fig. 2. The case study area in year 2007 (picture of the aerial survey from 2010 year)

As the additional, or consequence impact for the neighbouring areas could be also recon in a 32 hectares of agricultural area (crop fields close to pilot study site) opened for prevailing winds - almost directly according to the common direction of wind for this particularly region.

2.2. Selection of methods

The national list of ecosystem services, previously mentioned, was created according to the classification, established by the Millennium Ecosystem Assessment and developed by the Economics of Ecosystems and Biodiversity (TEEB) project, using four types of services, already introduced above. This method of the classification of ecosystem services we found as more comfortable for the main purpose of the case study, represented in current article, taking into account more general approach of this classification, when comparing it to the Common international classification of ecosystems goods and services (CICES), developed for European Environment Agency by Centre for Environmental Management of the University of Nottingham, United Kingdom (Haines-Young and Potschin, 2010).

It however should be mentioned, that definitions, used in CICES, are more common for the public and academy for naming services per se, therefore, for the national level of the relevant study, especially when seeking not only to establish a list of ecosystem services and goods, but, as it is of the same importance, also develop the core set of indicators, enabling to monitor the state, extent and distribution of these services, moreover, also keeping in mind very important need to

hereafter integrate it into the list of national indicators of sustainable development, CICES classification would be more advantageous, than used in current case study. Despite of these beneficent characteristics of CICES classification on national level, for the introductory purposes and primary understanding of linkages between the terms "service" and "ecosystem" more essential seem to be keeping classification of services as close as possible to the environmental content, and, to our mind, less anthropocentric classification system would be better accepted for this occasion.

In-situ observations, interviews and questionnaires were applied for the estimation of ecosystem services and goods availability and actual intensity of use, therefore, realizing the primary research method instead of well know and widely used on national level in other countries methods of value transfer. Unfortunately, the value (benefit) transfer methods (EEA, 2010a), enabling to gain research time and save financial resources, were recognized as unacceptable for this particularly case study, as there are no other cases of valuation in Lithuania available yet to borrow an existing valuation estimate for a similar ecosystem from. Therefore, less advantageous and much more time consuming and costly method of conducting the primary research to estimate ecosystem service values was chosen for the current study.

We should agree that this type of data and information collecting is one of the most expensive methods. Anyway, the authors took their chances to benefit from the added value of these communicational methods - to inform public and promote the idea of ecosystem services during direct communications. The must for successful implementation of developed surveys procedures was 4 local residents – so called "pilots" – involvement.

The method and principles of "local pilots" involvement was adopted from the case study methodology, used during Nordic Council of Ministers supported international study of traditional Nordic and Baltic rural landscapes and biotopes and their survival in modern times (Ikonen et al., 2004). The local investigators well acquainted with local community, including the responsible and relevant to the research issue representatives from the municipal authorities, being self-starting and well methodically prepared persons, assured face-to-face interviews and surveys quality and completeness, as well as in-situ observations of selected provisioning ecosystem services use intensity in territory.

Inventories (territory mapping method) and monitoring were performed by the authors during biodiversity evaluation study in Vilkaviškis district before the impact and, afterwards, in the two years after the clear-cut, evaluating the changes.

The commonly used methods for the economic valuation of ecosystem services and goods were analyzed and the most suitable ones selected for execution of the exercise. The following methods of monetary evaluation were reviewed – Travel Cost, Hedonic Pricing, Contingent Valuation and Choke Pricing, Choice Experiments, Marked Value, Cost-based Pricing and Production Function.

The Production Function method could provide researcher with the quite clear calculations of the rate of certain services, as it is connected to actual mar-

kets and mainly demonstrates the possible impact on the production of good caused by a change in the supply of the certain ecosystem service. For this, of course, well-identified causal relationships between the service and the product should exist (EEA, 2010a). This method also was not suitable, as no anthropogenically produced goods were taken into account nor provided in the selected study area.

The Market Value method is most welcomed by investigator, as enables to evaluate goods of ecosystems according to existing market prices for them, thus, data is always readily available and very reliable and easily understandable. However, the method is only applicable to directly marketed ecosystem services, mainly for, for example, provisioning services and goods. Therefore, the Market Value method was selected to use also in current case study for the valuation of the direct provisioning services.

The Hedonic Pricing method is frequently applied to estimate the economic value of ecosystems, directly influencing market prices of other goods, therefore, again, like in Marked Value method application, the data for monetary valuation are usually available and quite reliable. Commonly this method is used, for instance, to estimate the value of ecosystem services, mostly cultural ones, according to the price of houses or land in the area – usually the property is much more expensive in surroundings and landscapes, suitable for the rest or of high recreational value (EEA, 2010a; Ash et al., 2010). As the impact and ecosystem services in the study presented were not connected directly to housing estate and the area is not yet developed to meet requirements for the construction purposes, the method of Hedonic Pricing was not selected for this particularly study.

The Contingent Valuation method is based on survey, when respondents should evaluate one or other ecosystem service by expressing willingness to pay for it, if it would be available to buy on a real market (Ash et al., 2010). Applicable to all ecosystem services, but is known as being subject to bias and high uncertainty in some complex cases. In the stage of study plan preparation, the method was considered as thinkable for the evaluation of some cultural services, but after the recognition of quite short time schedule for the evaluation and taking in mind the situation of ecosystems services being not explored approach for the majority of foreseen audience of respondents, it was decided to refuse this method and replace it with the Substitution Pricing method.

The Choke pricing is commonly used to calculate the consumer surplus when Contingent Valuation method is applied, and is defined as the price at which visitation or any use of or demand for the natural resources is zero (Beukering and Cesar, 2010). This method was purposeless for the current study, as the area investigated is of local importance, so, the main visitors' flow vectors and source (place of starting the trip to the area) is highly predictable and approximate amount of them being relatively low and there were almost no risk of visitors' number rise till overcrowding, moreover, the use of the ecosystem services in place was not influenced by any additional costs for visiting, like payments for car parking, etc.

The Choice Modelling or Choice Experiments method basically expands and makes more complex and multifac-

eted Contingent Valuation method. It is also survey-based, and the respondents in these circumstances are asked to state their willingness to pay for services, choosing and valuating different hypothetical alternatives of the possible ecosystem services packages, modelled by investigator in the way of combination of kinds of the services, their volume and other attributes (EEA, 2010a). This method, notwithstanding its complexity, could be of the high power on the national valuation of ecosystem services, especially if the proper set of communication technologies would be chosen, for the self-served questioning respondents, but for the local level case study, as described in this article, and possessing limited financial resources the Cost-based method was chosen as more cost-effective.

The Cost-based method, also known as Shadow or Substitution, or Replacement Pricing method is usually calculated as what someone would have to pay to get the valuated service in another way or to restore a service if it was lost or damaged (Ash et al., 2010). As, again, the method includes some uncertainties, it should be taken into account possible overestimation or underestimation of the actual value. Substitution method is the second method, chosen for the purpose of the current study for the valuation of selected regulating and cultural services.

Travel Cost method can be used to explore the willing to pay to travel to destinations where cultural services, often recreational ones, are present. It assumes that direct travel expenses and the time, dedicated to the journey, could be counted as a price paid for access to the place. It commonly depends on the length of the travel, and, in the certain cases, if a trip is made for many purposes, can overestimate the value of particular service (EEA, 2010a). As far as almost all ecosystems services, selected for the current study, were the ones, people were visiting the area for, hence the possibility of significant deviation in this case was counted as low, and, subsequently, the Travel Cost method was chosen for the application in the research, too.

3. RESULTS AND DISCUSSION

From the above mentioned national list of identified more than 40 complex ecosystem services the most suitable for the selected study area were picked up for the itemization and further analysis. The ranking of ecosystem services and goods for this aim was based not solely on the service supply extent and importance, but also the significance of benefits for users was considered. The valuation of the importance and specifying of the ecosystem services and goods was executed for the case study site before the impact. Ecosystem services' comparative degree of significance for pilot study was evaluated labelling the level of importance of the services as high, medium, low or insignificant, or not relevant.

The final package of main ecosystem services and goods, collected for further analysis and valuation, comprised of:

1. Provisioning services:
   - 1.1. Timber;
   - 1.2. Wild foods:
     - 1.2.1. Mushrooms,
     - 1.2.2. Nuts,
     - 1.2.3. Fish;
2. Regulating services – mass flow regulation:
   - 2.1. Soil wind erosion prevention;

3. Cultural services – recreation and community activities:
   3.1. Tent camping,
   3.2. Recreational fishing,
   3.3. Wedding day parties.

Almost all listed ecosystems services and related goods are well understandable and accepted, so do not require any specifying comments, maybe with the some additional words, introducing wedding day parties. The latter are the popular national wedding day custom, so-called "outing to nature". This custom is usually implemented as short obligatory trip to stay in a nice place in natural landscapes, commonly forest or grove, for resting, enjoying nature and taking pictures. It is worth to mention, that nice surroundings of semi-natural environment, successfully used by private owners as services for short stays, taking pictures, etc. activities for weddings are becoming more and more important – for example, in China privately owned blooming meadows are widely used and successfully "rented" as "background" for wedding pictures (Leon Braat, personal communication, October 2011).

The Marked Value method allowed us to establish harvested timber value. It was calculated according to the volume of timber produced and the average price of certain timber type and quality, excluding disbursements for services like felling and taking out of forest.

The same method was used for the valuing of commonly used wild foods. The estimations of the average amount and exploitation volume for the wild foods were based on data of nut-trees inventory, average yields, rate of mushroom growth, average amounts gathered and usual average fish takes, and market prices for them, also different calculations of visit numbers, according to the type of wild foods and common behaviour of visitors.

Soil erosion prevention value was established, using substitution pricing method, and calculating expenditures necessary for the application of the additional alternative compensational agro-technical measures to generate similar effect to combat soil wind erosion effect in the area under impact of it, opened after the described clear cut. The final estimated value for additional agro-technical measures, depending on peculiarities of the selected measure, could fluctuate in the range of 145-171 EUR per hectare per year (Mažvila et al., 2009).

Evaluation of cultural services – both actual use intensity and economic value – was the most complicated and challenging. Substitution Pricing method was the main tool to estimate the monetary value of selected cultural services, while intensity of using them was calculated according to data and information received during the in-situ observations and with the help of interviews/questionnaires. The costs of described cultural ecosystem services were established, taking into account different calculations of the average of visits' and visitors' numbers per year, according to the type of service used, average prices for the services if provided on market basis (payments for different types of services, like parking, camping, fishing, etc., for the stay in privately operated recreational territory with relevant features) and common behaviour of visitors.

The travel costs to access namely the study area are insignificant because of the site proximity to the city, and would com-

prise from zero (using bicycle, as it was a usual case, or even travel on foot) up to 1.5 Euros per travel, calculating travel expenditures on the basis of the common in EU kilometric allowance 0.22 EUR per kilometre. But, after the impact, the situation became different. The main reason of that is the fact, that the closest available alternate place of similar conditions, in other words, services (forest, relatively safe and comfortable for family or individual recreation – camping, fishing (in this case - lake) and mushrooms/berries gathering) is situated four times further than the study area – approximately 12.4 km away from Vilkaviškis city, and not reachable by public transport, thereby the only alternative is to travel with private cars. To reaching this alternative site, comprising similar complex of ecosystem services though being several times further, will require up to 7 EUR per travel per individual car. If the use of the selected ecosystem services extent and intensity would be as low as up to 700 individual cars per year only for the tent camping, wedding parties, fishing and mushroom gathering activities (not even counting a number of short stay visitors), it will reach quite significant additional expenditures in value of 4,900 EUR per year.

The final evaluations, retrieved from the study, are presented in Table 1.

Table 1. Monetary evaluation of the selected ecosystem services in the study area

Ecosystem service class	Ecosystem service/goods	Annual monetary value, €/year	Immediate (harvested once) monetary value, €
1. Provisioning	1.1. Timber		13,900
	1.2.1. Mushrooms	2,200	
	1.2.2. Nuts	300	
	1.2.3. Fish	800	
2. Regulating	2.1. Soil erosion prevention	5,100	
3. Cultural	3.1. Tent camping	5,000	
	3.2. Recreational fishing	1,000	
	3.3. Wedding day parties	720	
	Total value of selected services:	15,120	13,900
	Travel costs saved	4,900	
	Total value:	20,020	13,900

Hence, the results of the current study demonstrated, that the total direct and indirect (saving of the access expenditures) monetary value per annum of the selected ecosystem services and goods, operating in Lithuanian market prices, will reach more than 20,000 EUR, to compare immediate value of harvesting timber less than 14,000 EUR.

Despite of anyway being "the better than nothing", i.e., the first case study implemented and described for Lithuania on ecosystem services economic valuation, it is important to acknowledge also the limitations of the current case study.

First of all, mostly the final ecosystem services and goods ("final products") were taken into account, thus, the services that are closely related to final demand, as far as they are already somehow understandable directly or via associations with other well-known market products and services. Moreover, the actual use of the services (with the exception for the soil erosion prevention) was analysed, and not the capacity of the ecosystems to provide a service (stocks of ecosystem services), hence, again, not a full-scale value estimated.

But the most substantial drawback of the study could be a list of the ecosystem services, important to the area, but not taken into account because of data shortage or relatively small impact to overall value of final ecosystem services in place. This list would consist at least of the following items:

1. Provisioning services:
   1.2.4. Wild berries (strawberries, raspberries),
   1.2.5. Wild flowers,
   1.2.6. Medicine plants;
2. Regulating services:
   2.2. Hydrological regime stability;
3. Cultural services:
   3.4. One-day camping,
   3.5. School excursions (educational service),
   3.6. Bird watching;
4. All supporting services, including the quite important for the study area habitat provision or pollination services, because of being:

- Non-final ecosystem services,
- Less significant because of too small pattern investigated (not in case of habitat provision!),
- Less clear for non-specialist, therefore of lower importance for the study objectives to reach.

The great importance of these not evaluated in the study ecosystem services could be based on vivid example for damaged habitat provision service.

Fig. 3. The cover of forest habitat around the case study area in the year 2006

Fig. 4. The changes of forest cover around the case study area in the year 2007

As the forest coverage in the region is the lowest in Lithuania's territory – less than 11 percent, or approximately three times lower than average forest cover – the existence and continuity of the semi-natural habitats is highly important for the successful functioning of the ecological network. This supporting service – habitat provision – was also negatively impacted, as it could be easily seen on Fig. 3 and 4, especially in the area around the road with the hard cover, what is even more obvious, when using the schematic visualization (Fig. 5).

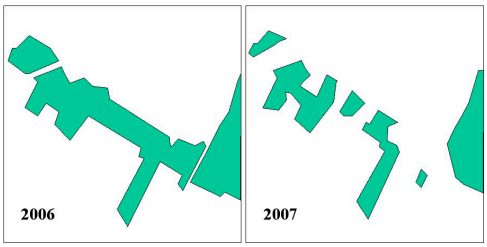

Fig. 5. The schematic presentation of increase of natural (forest) habitat fragmentation in and around the case study area after the forest felling

Moreover, we do not evaluated the costs of increase of amounts in carbon dioxide production and emission from private cars in a case of replacement of lost services in study area with the similar services in closest available site. As far as the car fleet in Lithuania today comprises more than 35 per cent cars with the age exceeding 10 years (ACEA, 2011), the expected average of CO2 emissions from one private car could reach approximately 234 g per kilometre. Therefore, it will amount more than 2 tones of carbon dioxide annually for only above mentioned 700 cars travelling to this recreational place and backwards, what also results in considerable increase of recreational footprint in the region, if to compare it to the situation, when the preferred ecosystem services were within the confines, reachable on foot or bicycle.

All these additional concerns are provided here not only for realizing the possibilities for further research, but, moreover, for clear understanding of the fact, that the real "price" for the ecosystem services is still underestimated, and every of above mentioned additional points would only add more weight to the annual monetary value column of the Table 1.

The results and conclusions of this study could be supported by quite numerous evidences from other countries, when the studies of the wider and more complex extent were executed, trying to evaluate costs and benefits, when comparing values of the obvious, market based immediate gain versus benefits from existing in place packages of ecosystem services.

In watersheds of the Yangtze River in China, by quantifying the value of complexes of vegetation, soil and slopes, and the existing interactions inside, researchers estimated the annual economic benefit of maintaining forests in the watershed for power services to be more than 2 times that if it were harvested once for timber (Guo et al., 2000; Nunez et al., 2006), as it was done also in our case study area.

The costs of ecosystem services were evaluated in the Idaho, United States, weighting the gains and losses in case of the reintroduction of grey wolves to Yellowstone National Park and Central Idaho. It was stated, that in case of recovery of wolves' population, the losses in hunt-

er benefits and livestock will be covered with more than 20 times higher income from the increased visitor expenditures in the recovery area (U.S. Fish and Wildlife Service, 1994).

The shoreline protection benefits of coral reefs in the Maldives were evaluated by using the Substitution Pricing method, as well as willingness to pay (Contingent Valuation) for biodiversity conservation, and cultural values of locals and tourists. It was realized, that, e.g., a single grey reef shark is worth hundred times more ($3,300) a year to the Maldivian tourism industry, compared with the one-off value ($32) of that a fisherman would get from the same shark (Emerton et al., 2009; Baig, 2010).

CONCLUSIONS

The study realized the importance of the value of ecosystem services in the investigated pilot area. It was indicated, that if only the final services and actual use of them would be taken into account, it would be almost 1.5 times (annually!) that it was when the forest harvested for timber once.

Of course, the main added value of the current research is the following: the study in well understandable, clear and acceptable manner introduces to local community the idea of ecosystem and biodiversity services and their importance.

Moreover, following the experience of countries, participated as partners for the Millennium Ecosystem Assessment, is essential to notice, that local and sub-national case studies were of great use for the national assessments development, e.g. the Portugal sub-global assessment comprised of 5 case studies of different extent and coverage (PtMA, 2009).

We believe, that the outputs received and lessons learned during the presented study will support the understanding as well as promote of the ideas of ecosystem and biodiversity services. Also the TEEB initiatives, especially on local or sub-national levels, could benefit from it for knowledge-building, when elaborating procedures of involvement of policy makers and public into sustainable use of ecosystem services – this process usually requires as clear and understandable evidences and examples as possible, at least in the initial stages.

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PIRMIEJI ŽINGSNIAI DIEGIANT EKOSISTEMŲ PASLAUGŲ KONCEPCIJĄ LIETUVOJE: INVENTORIZAVIMAS IR EKONOMINIS VERTINIMAS VIETINIU LYGMENIU

Vytautas Naruševičius, Gintaras Matiukas

Santrauka

Ekosistemų paslaugos – palyginti nauja koncepcija, pabrėžianti ekosistemų ir biologinės įvairovės reikšmę žmonijos egzistavimui ir gerovei. Verta paminėti, kad, mūsų nuomone, terminas „ekosistemų paslaugos“ yra žymiai tikslesnė angliško termino „ecosystem services“ išraiška ir labiau atitinka apibrėžimą, nei kitą prasmę turintis junginys „ekosistemų funkcijos“, kartais naudojamas kai kuriuose dokumentuose, pvz., netgi EK Komunikato dėl ES Biologinės įvairovės strategijos iki 2020 m. vertime. Įgyvendinant darnaus vystymosi procesą, būtina užtikrinti, kad tausus ir tvarus ekosistemų paslaugų naudojimas, jų kokybės ir tęstinumo išlaikymas taptų įprastais elementais visų sričių darnaus vystymosi priemonių sąrašuose. Straipsnis aprašo pirmąjį mokslinį tyrimą Lietuvoje, pristatantį ekosistemų paslaugų koncepciją, vaizdžiai parodantį ekonominę šių paslaugų svarbą ir pateikiantį finansinę išraišką kai kurioms iš jų. Siekiant kuo efektyviau pademonstruoti ekosistemų paslaugų reikšmę žmogaus poreikiams, tyrimui buvo pasirinkta nedidelė teritorija Pietų Lietuvoje, pasižyminti vietiniams gyventojams svarbiu ekosistemų paslaugų sąstatu, kuriam buvo padaryta žymi žala, plynai iškirtus mišką. Tyrimo metu, pasinaudojus turima biologinės

įvairovės inventorizacijos medžiaga, parengtu preliminariu ekosistemų paslaugų Lietuvoje sąrašu bei surinktais papildomų stebėjimų, pakartotinės inventorizacijos bei kartografavimo, o taip pat apklausų duomenimis buvo identifikuotos, prioritetizuotos ir atrinktos ekonominiam vertinimui aktualiausios ir intensyviausiai naudojamos ekosistemų paslaugos. Buvo įvertinti dažniausiai tokiems tyrimams naudojami ekonominio ekosistemų paslaugų vertinimo metodai ir atrinkti tinkamiausi, atsižvelgiant į tyrimo vietos specifiką bei teritorijoje teikiamų svarbiausių ekosistemų paslaugų įvairovę. Atsižvelgiant į naudojimosi ekosistemų paslaugomis intensyvumą, buvo nustatyta, kad, iškirtus mišką tirtoje teritorijoje, buvo prarastos paslaugos, kurių kasmetinė finansinė išraiška ir teikiama nauda vietiniams gyventojams mažiausiai 1,5 karto viršijo vienkartinę finansinę naudą, gautą pardavus mišką kaip medieną.

Svarbu pažymėti, kad didžiausia šio tyrimo pridėtine verte visgi reikėtų laikyti tai, kad aiškiu, suprantamu ir priimtinu būdu buvo pristatyta ekosistemų paslaugų samprata bei šių paslaugų reikšmė gyventojų gerovei.

Straipsnyje pateikiami ir tyrime taikyti apribojimai bei jų, kaip papildomų ir tolimesnių tyrimų pagrindo, svarba.

***Reikšminiai žodžiai**: ekosistemų paslaugos, ekosistemų ir biologinės įvairovės ekonominis vertinimas, aprūpinimo, reguliavimo, kultūros ir palaikymo paslaugos*