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POTENTIAL OF CULTURAL ECOSYSTEM SERVICES IN POSTGLACIAL LANDSCAPE FROM THE BENEFICIARIES' PERSPECTIVE

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ABSTRACT: The paper presents the results of a questionnaire carried out among landscape users in Suwałki and Augustów Region concerning the perception of goods of nature. Respondents were asked to assign services to 7 ecosystem types (deciduous forest, coniferous forest, swamp forest, grasslands, croplands, wetlands, water bodies) and rank them in order of importance. Our intention was to show the potential/capacity of each ecosystem type to deliver four cultural ecosystem services: sport and recreation, inspiration for creative work, education and science and spiritual experience in the view of local community and tourists.

KEYWORDS: door-to-door survey, ecosystem potential, mapping ecosystem capacities, relative ranks

Introduction

This paper presents selected results of a questionnaire carried out among residents and tourists staying in the several dozen localities of three communes in Podlasie (north-east Poland). The aim of the study was to assess the potential of ecosystems in rural postglacial landscape to supply cultural services. We developed ranking of cultural ecosystem services (CES) for each ecosystem type considered, based on respondent preferences and mapped their spatial heterogeneity.

An overview of literature

Cultural ecosystem services are defined as 'the physical settings, locations or situations that give rise to changes in the physical or mental states of people, and whose character are fundamentally dependent on living processes; they can involve individual species, habitats and whole ecosystems' (Heines-Young and Potschin, 2013, p. 18). Among the main categories of ecosystem services identified in Common International Classification of Ecosystem Services, CES are those that due to their intangible nature and dependence from social constructs are particularly challenging to map and assess (Daniel et al. 2012). The challenges concern, for instance, establishment of a clear relationship between possible CES that might be allotted to certain elements of ecosystem and its functions or identification of distinct biophysical carriers to which these functions, benefits and values can be assigned. In the review of indicators for cultural ecosystem services, Hernández-Morcillo et al. (2013) observed that recreational services were easily identifiable and classifiable, but cultural heritage and knowledge of ecosystem services were more ambiguous to assess. Moreover, they found that recreation and ecotourism were the most accounted for services and rich in indicators, followed by aesthetic and educational services. Inspirational, religious and spiritual indicators were least developed. The similar proportion was recorded in mapping studies (Crossman et al. 2013). The visualization of CES is especially important for land management and planning. To make adequate choices, information on the spatial heterogeneity in the quantity and quality of services provision is needed (de Groot et al. 2010, van Berkel and Verburg, 2014).

Ecosystem potential is understood as an ecosystem capacity to deliver (supply) goods and services, linked to natural conditions and human impacts (Burkhard et al. 2012). Only human needs or demands actually convert

a potential into a real service. In other words, an ecosystem service is influenced not only by the capacity of a certain ecosystem, but also by the desired level of provision for this service by society, which connects inseparably supply and demand of ecosystem services (Bastian et al. 2013).

In case of cultural services, their social aspect is the most pronounced. Biophysical assessments, common in provision and regulating services, are replaced by alternative evaluation approaches based on a wide range of social science tools and methods (Daniel et al. 2012). Studies of perceptions, values, attitudes, and beliefs may generate more meaningful insights regarding the contributions of ecosystem services to human well-being (Plieninger et al. 2013). Stakeholder involvement is particularly important in order to understand people's values and needs (Menzel and Teng, 2009) and is frequently used in CES studies (Hernández-Morcillo et al. 2013).

Research methods

The survey was carried out in June 2014 and May 2015 in three rural communes (Giby, Nowinka, Suwałki) in Podlasie (north-east Poland). Study area encompasses 796 km^2. Forests comprise over 54% of the area, while arable lands about 13% and grasslands over 17%. Lakes cover about 5%. Lands of great natural value comprise a significant part of the study (e.g. Wigry National Park, three natural reserves, one Special Protection Area established for bird protection and four Special Areas of Conservation established for habitat protection). The population density of the studied communes accounts for 12 inhabitants/km^2 (Central Statistical Office, 2016).

The questionnaire was distributed by two researchers among residents and tourists staying in 57 localities. The method *door-to-door* was applied. In total, 251 questionnaires were collected back. The survey was anonymous. The scientific term *ecosystem services* was not used in the questionnaire. We replaced it by more colloquial and intelligible phrase *goods of nature* (pol. *dobrodziejstwa przyrody*). The questionnaire was divided into 4 parts (the preliminary results of the first and second part were published in Affek and Kowalska, 2014). In the third part, respondents were asked to assign services to ecosystem types and rank them in order of importance[1]. Our intention was

[1] Task in the third part of the questionnaire: *Below, there are listed seven land cover types. Please, assign goods of nature (1. food: fish, fruits, mushrooms, honey, meat, milk, 2. natural medicines: herbs, juice, resin, 3. building materials: timber, reed, straw, 4. fuel: fuel wood, peat, biomass, 5. fertilizers and fodder, 6. ornamental resources: antlers, animal hides, wreaths, shells, 7. fresh water: retention, purification/detoxification, 8. recreation: sport and rest, hobby, 9. inspiration for creative work, 10. education and studying: nature observation, research, 11. spiritual experience) to ecosystem types and rank*

to show the potential/capacity of each ecosystem type to deliver particular services in the view of local community and tourists. We applied MAES level 2 typology of ecosystems (European Commission, 2013). Only forests, due to high proportion in the study area, were further divided into 3 subtypes: deciduous, pine and swamp. In total, 7 ecosystem types were distinguished (figure 1). We analysed 11 categories of goods and services, in that four cultural ecosystem services: sport and recreation close to nature, inspiration for creative work, education and science, spiritual experience. A set of socio-demographic data regarding age, gender, education, source of income, place of residence etc. was also gathered to verify sample representativeness and to perform between-group comparisons.

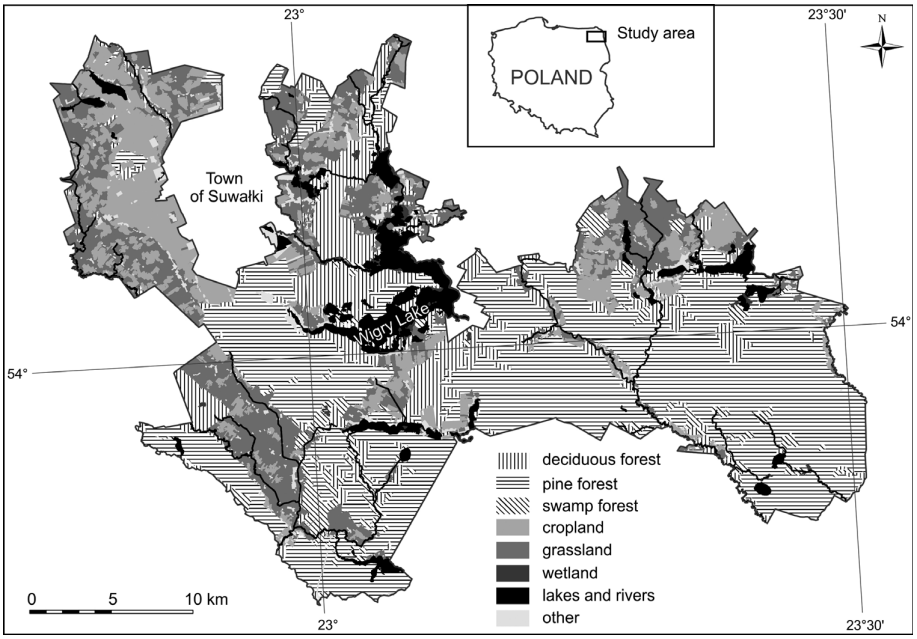

Figure 1. The study area – ecosystem types distinguished in the survey

Data from paper questionnaires were digitized and uploaded to the statistical program (SPSS ver. 17). We assumed that the intervals between numbers (from 1 to 11) assigned to services by the respondents are equal (interval scale), which allowed us to conduct parametric analysis (e.g. means, t-tests). Student t-test was used to compare mean importance of services in case of nominal independent variables (e.g. gender), whereas r-Pearson cor-

them in order of importance (Scale: 1 – the most important, 11 – the least important). In case, you recognized that a good is not delivered in a specific land cover type, please write 'not relevant'.

relation coefficient – to measure the strength of relationship with scale variables (e.g. age). The achieved average importance of ES within ecosystem types were ranked back for visualization and mapping purposes. Spatial distribution of the relative ecosystem capacity to deliver the four selected cultural services in the study area was presented on maps produced with the use of ArcGIS 10.1 software.

Results of the research

Respondents

Of 251 respondents interviewed, 69% were female and 31% male. The majority of them (73%) were between 30 and 60 years old, 12% were under 30 and about 15% were above 60. Most respondents declared secondary (50%) or higher (39%) education. Farming (~30%), mental work (~30%) or pension (~21%) were the most frequent income sources among surveyed people (in this case more than one answer was admissible). A significant group worked also in tourism services (~14%). More than 71% of the respondents were permanent rural residents, while 28% came as tourists from towns and cities.

Potential of ecosystems to deliver services

Education and science as well as sport and recreation were the most valued CES in the survey (table 1, figure 2).

Table 1. Hierarchy of cultural ecosystem services in various ecosystem types based on respondent preferences; mean ranks on a scale from 1 to 11, where 1 – the most important, 11 – the least important

Cultural service	Ecosystem type							Mean rank
	deciduous forest	pine forest	swamp forest	grass-land	crop-land	wet-land	lakes and rivers	
Sport & recreation	3	3	6	5	7	8	2	5
Inspiration for creative work	7	8	5	6	5	4	5	6
Education & science	5	5	3	4	4	1	4	4
Spiritual experience	9	9	9	7	6	5	6	7

Source: own elaboration.

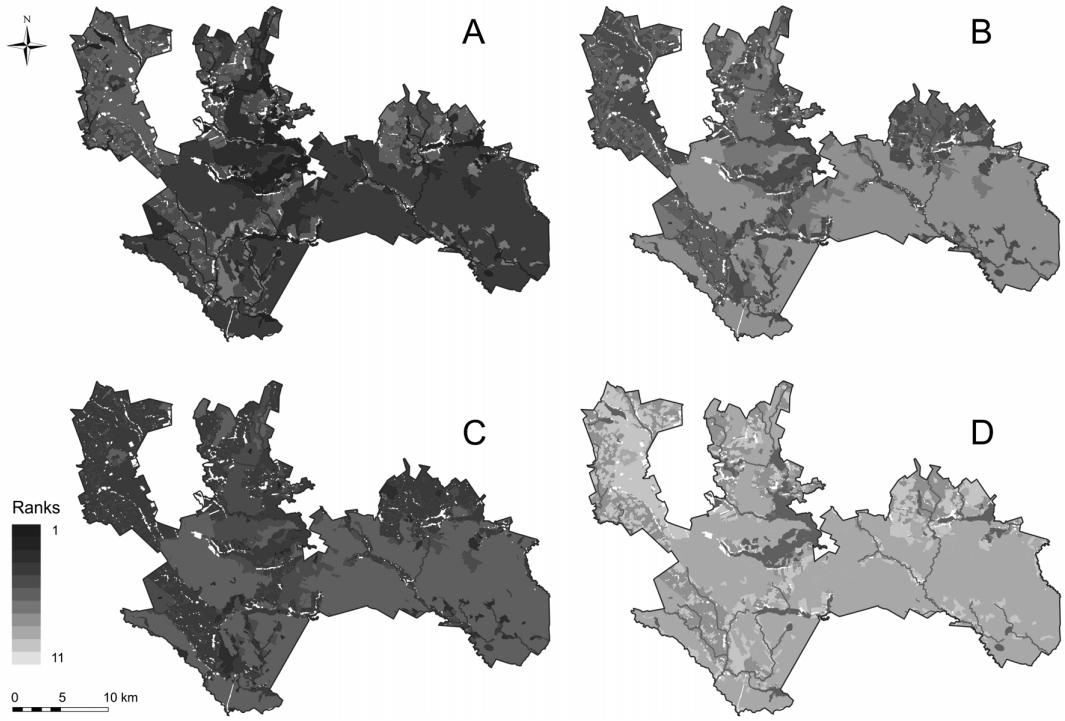

Figure 2. Spatial distribution of the relative ecosystem capacity to deliver the four selected cultural services in the study area: A. sport and recreation, B. inspiration for creative work, C. education and science, D. spiritual experience

Lowest ranks were assigned to spiritual experience. Water bodies along with deciduous and coniferous forests were identified as having the highest capacity to supply sport and recreation services. Swamp forests and wetlands as well as arable lands and grasslands were thought first of all to deliver education and science services. Inspiration for creative work as well as spiritual experience were highest rated in wetlands.

Subgroup comparisons

The between-group comparisons showed different approach to CES among respondents. In general, better educated respondents ($t=-2{,}12$; $p=0{,}04$) and urban residents ($t=-2{,}19$; $p=0{,}03$) value cultural services more. Also, better educated people appreciated more the potential of deciduous ($t=2{,}23$; $p=0{,}03$) and coniferous forests ($t=2{,}23$; $p=0{,}03$) as well as lakes and rivers ($t=2{,}85$; $p=0{,}01$) to supply spiritual experiences. Taking into account gender, women evaluated significantly higher the capacity of coniferous forests for education and science services ($t=-2{,}00$; $p=0{,}05$), and of arable lands

for inspiration to creative work (t=–1,99; p=0,05). While urban residents, being tourists in the study area, recognized higher value of forests to deliver inspiration for creative work (t=–2,3; p=0,02) and wetlands for education and science (t=–2,14; p=0,03) and for spiritual experiences (t=–2,3; p=0,02), compared to local residents. Younger respondents highlighted the potential of grasslands (r=0,21; p=0,01) and wetlands (r=0,17; p=0,04) for education and science and of grasslands (r=0,2; p=0,02), and lakes and rivers (r=0,2; p=0,01) for inspiration to creative work.

Discussion and conclusions

Natural ecosystems provide many opportunities for spiritual enrichment, cognitive development, leisure and recreation (de Groot et al. 2002). The study of CES has been considered one of the most difficult and least accomplished tasks in ecosystem research. In most cases, CES assessments are built on individual perceptions and cover specific ecosystems/landscapes/regions. Only few studies clearly identify the spatial units in which cultural services took place (Hernández-Morcillo et al. 2013, Norton et al. 2012).

Results of our survey confirmed the observation of Daniel et al. (2012) that most cultural services are easily identified and intuitively appreciated by people. In some ecosystem types, CES ranked high, following various, mostly provisioning services. In our research, the resultant CES importance is relative, nonetheless, the absolute value can be estimated indirectly with the use of the obtained hierarchy and easily measurable values of other, non-cultural services.

The opinion of the local community on the potential of specific ecosystems to deliver CES is valuable and may have a wide range of applications. However, local people are not homogeneous and do not share all the views. In our study, between-group comparisons based on such variables as place of residency, education, gender and age showed significant differences in the CES hierarchy. Also, many other studies reported that the individual features play a decisive role in the perception of ecosystem services. Place and length of residency were important differentiating factors in the research of Soini et al. (2012) concerning landscape perceptions at the rural-urban interface. In turn, Sodhi et al. (2010) demonstrated that education affected people's views on aesthetic and recreation services provided by Asian forests. Moreover, Suckall et al. (2009) observed that also social class and ethnicity shaped perceptions of recreation opportunities in rural landscapes of northern England. Therefore, management authorities should integrate all people's needs and attempt to balance the often contrasting and competing interests (Brown, 2005).

The landscape structure in the study area promotes outdoor sports and recreation. These activities, in the view of our respondents, are among the most important services delivered by water and forest ecosystems. Our results are in line with the observations of Norton et al. (2012), van Berkel and Verburg (2014), and Plieninger et al. (2013). Soroka et al. (2016) reported that inhabitants of Suwałki town not only notice recreational and tourism as well as therapeutic opportunities of forests in the Wigry National Park, but also take advantage of them in daily life. In our study, the potential of wetlands and swamp forests for education and science was particularly appreciated. It may be associated with their widely acknowledged biodiversity value (Meli et al. 2014) and rather low capacity to deliver other services. Surprisingly, grassland and cropland potential for education and science turned out to be also well recognized (rank 4 out of 11). So far, these ecosystem types were hardly related to educational services (Lamarque et al. 2011). Inspiration for creative work and spiritual experience were rated rather low in the survey. Our respondents seem not to relate them to any particular ecosystem type; the similar approach was observed by Brown (2005). In contrast, spirituality was mentioned as important by every interviewee in the research of forest ecosystems in Hawaii (Gould et al. 2014). Probably the ratings in our study may have been different if the respondents had had to identify services by themselves, since ES recognition and appreciation depend strongly on their actual use (Scholte et al. 2015).

The method applied in the research to relatively rank ecosystem services has received limited attention in to date studies (Lamarque et al. 2011). However, the user-derived hierarchy of services for different ecosystems, along with the maps showing ecosystem capacities to deliver cultural and other services in the landscape scale both constitute an important and unique tool for spatial planning and scenario assessments. Spatial inventories of ES bundles, broken down into several ecosystem types, can additionally enable identification of possible trade-offs and may support decision making in local planning (van Berkel and Verburg, 2014, Butler and Oluoch-Kosura, 2006, Raymond et al. 2009).

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