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AN APPROACH FOR ASSESSING ECOSYSTEM SERVICES WITH APPLICATION IN A PROTECTED AREA CASE STUDY: AL-PRESPA

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Abstract

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Nature provides us with the very essentials of life. It gives us clean air and water; enables us to produce and gather food, fuel and raw materials from the land and sea; regulates our climate; stems flood waters and it filters pollution. It also gives us personal benefits from enjoying it that increases our health and happiness. Collectively, these benefits are known as ecosystem services. Wetlands provide people with a wide range of benefits. Prespa Park is a good case study, as it is a wetland area of high biodiversity and long human history. It is situated in the Balkan Peninsula and is shared among the three neighboring countries Albania, Macedonia and Greece. A study to obtain information concerning ecosystem services issues in the Albanian part of Prespa Park (AL-Prespa) basin, south-eastern Albania, was conducted from 2008-2010. The main aim of the study was providing an assessment of services coming from a range of AL-Prespa ecosystems, and benefits of the services under different management scenarios. The problem of how to address and solve the complex issues of assessing ecosystem services is addressed, in this study, using a deliberative process based on citizens' juries aided by multi-criteria evaluation method of analysis. The main elements of the approach presented in this paper were: an inventory process to focus on sets of ecosystem services in AL-Prespa, and the development of specific management practices for management of ecosystems services in AL-Prespa. The next step in the process used a scenario analysis approach to look at the highly ranked issues and services in more detail. This approach presents an important tool in an analysis of ecosystem services and is essential for identifying and prioritizing the relative importance of the services and goods produced by ecosystems in a protected area.

Key words: AL-Prespa, protected area, multi-criteria evaluation method, deliberative process, citizen's jury, stakeholders

Introduction

Ecosystem services have been defined by Daily (1997) as the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfill human life. Ecosystem services are the benefits that people derive from nature. Some benefits, such as crops, fish, and freshwater (provisioning services), are tangible. Others such as pollination, erosion regulation, climate regulation (regulating services) and aesthetic and spiritual fulfillment (cultural services) are less tangible. The term "ecosystem services" have been coined to describe the processes and conditions by which natural ecosystems sus-

tain and fulfill human life (Constanza et al., 1997; Cork and Shelton, 2000; Daily, 1997; Pretty and Hardy, 2000; Proctor, 2001; Sterman, 2000). All, however, directly or indirectly underpin human economies and livelihoods. Ecosystem services have been conceptualized as transformations of natural assets (soil, water, atmosphere and living organisms) into goods and other products (including experiences) that are valuable to people. To enable the concept of ecosystem services to be applied in practice it is vital to both document and study the nature of the services provided by ecosystems and assess the value or importance (in economic and other terms) of the services in various decision contexts (Daily, 1997; Bennett, 1999).

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Despite their critical importance, the capacities of ecosystems to provide these myriad services are being degraded at an alarming rate. In 2005 the Millennium Ecosystem Assessment (MA), a four-year study of the state of the world's ecosystems involving more than 1300 experts from 95 countries, reported that over 60 percent of ecosystem services were already degraded. Concern has been growing over the last half century as evidence of decline in the world's ecosystems grows and ecologists, economists and other social scientists debate the underlying socio-economic causes. More than ever before in human history, people living in cities have lost their awareness of their reliance on natural ecosystems for food, regulation of the atmosphere and climate, purification of water, provision of building and raw materials for industry, protection from pests, diseases and extreme weather, and for cultural, spiritual and intellectual stimulation and fulfillment.

In this paper is reported on the inventory process and options for managing ecosystem services developed and tested in a case study of the AL-Prespa in south-eastern Albania. The approach has the following elements: a) a semi-quantitative inventory of what ecosystem services are present. How they are being used, and what is happening to them under current land use regimes and activities in the area; and b) identification of major decision scenarios for the future.

Materials and Methods

General Data on Case Study AL-Prespa

Prespa Park region is a good case study, as it is a wetland area of high biodiversity and long human history. It is located in the south-eastern part of our country, at the border to Macedonia and Greece (Figure 1). Decades-long efforts

to draw attention to the need for the protection of Prespa region were crowned on the World Wetlands Day, February 2nd, 2000, when the three Prime Ministers jointly signed the Prespa Park Declaration.

The Prespa area in Albania, in 1999 was designated as a National Prespa Park (AL-Prespa) not only due to the specific geographical features, but and for its very high biodiversity, extremely rich flora and fauna and exceptional beauty; versatile cultural and traditional elements, valuable ecological sites, good food, picturesque villages and historical layers of Byzantine and Ottoman monuments that are spread across the basin. The distribution of villages and people located around the two Prespa lakes shows that approximately 5370 persons live in 12 villages, of which 75% are employed in agriculture. Livestock and fishing also contribute to the farmer's income. Farming consists primarily of small-scale production for personal consumption. It is labor intensive, with women's labor particularly important in crop production, and men's labor crucial in animal husbandry. Livestock husbandry is integral to the farming system. Thus, almost all of the households hold one or two cows mainly for milk, ten to fifteen chickens and a few sheep and goats. The total number of agricultural holdings is about 1450 and they are all mixed holdings.

Recently a notable tourism "boom" began in its coast, almost 27 km long. Visitors value a very narrow component of the high natural and cultural assets of Prespa. In the five villages round the shoreline of Prespa it can be developed the familiar tourism during the whole year because the four seasons offer different tourist distinctions. Since 2002, ecotourism has been identified as a tool to that can value these natural and cultural heritages.

Questionnaire development

For this study, a self-administered questionnaire dealing with economic, social and biophysical profile of the study area was developed. The questionnaire items were written to reflect a series of different variables. To refine the questionnaire, a pilot test was conducted to clarify the comprehensiveness and potential areas of ambiguity of the questionnaire (Fink, 2006; Nardi, 2006).

Validity and reliability of the questionnaire

The questionnaire items were sent to a panel of experts to check the content and construct validity. Following the judgments and recommendations from the panel of experts, the questionnaire was revised as necessary. A field test was used to assess the face and content validity. 25 people were chosen to make comments on the questionnaire clarity and ease of use. The suggested changes from the panel of experts

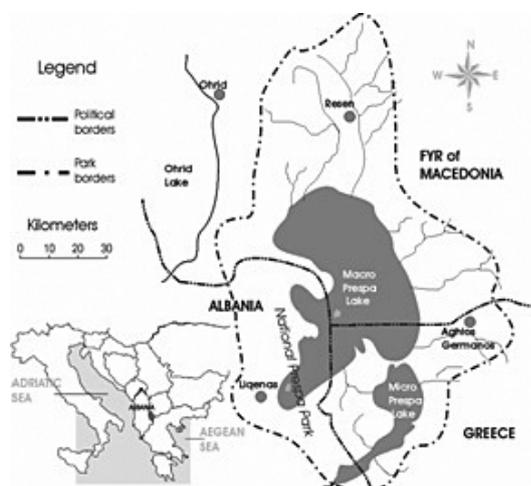


Fig. 1. Prespa Park watershed

and the field test were incorporated into the final draft of the questionnaire.

In this study, test-retest reliability and inter-item reliability were examined through pilot testing. Cronbach's alpha (α) was used to assess internal consistency: the closer the correlation is to 1.0, the more reliable it is (Nardi, 2006). In this study, the Cronbach's alpha (α) was 0.87.

Data collection

The data collection was conducted over approximately 20 days in the AL-Prespa watershed. In June 2008, from a small network of people (380) questionnaires was distributed to the residents in AL-Prespa. Each of the residents who took the questionnaire received a free scenic postcard of the AL-Prespa as a token of "thank-you" to ensure a high response rate based upon Dillman's tailored design method (2007). Respondents were asked to return the questionnaires in 5–7 days with a postage-paid envelope enclosed in the initial questionnaire. No monetary incentives were being provided to the respondents. The respondents filled out the questionnaires voluntarily. The initial packet that was sent to the respondents included the questionnaire, a contact letter, and a pre-addressed and stamped return envelope. The completed questionnaires were mailed back. The complete rate (the number of usable questionnaires) was 231 (60.8%).

Data survey analysis

Before the returned questionnaires were entered into the database, all of the questionnaires were examined to ensure that they were valid for the research. For data analysis, was employed SPSS 16.0.

Other data collection sources

This study was built also on the collection of secondary data pertaining to the study area (literature survey). This includes past research, local and international published materials, local and international reports and unpublished local information; Cases comparison: workshops organized with local stakeholders; Consultation of experts: Qualitative assessments of interactions between ecosystem services and land-uses were derived as expert judgments using staff from various institutions including Universities, Ministries, other research institutions, government land management agencies, and other stakeholders.

Deliberative multi-criteria evaluation method procedure

In this study, the steps followed by deliberative multi-criteria evaluation approach were as follow: (a) *Choosing the Citizen's jury* based on the demographic overview of the population that was affected by the decision. The choice

of jurors was made using a random sample of this relevant population; (b) *Choosing the options and objectives* which reflected the desired outcome of the decision making process to give clear and unambiguous purpose to the chosen option; (c) *Selecting the criteria*. The jury was given the task of selecting the criteria which were designed to compare and assess each of the options and therefore related to the overall objective of the decision-making task; (d) *Weighting the criteria*. In Multi-criteria Evaluations, the preferences of the decision-maker were accounted for by the weighting placed on each of the criteria and sub-criteria. In this study, the jury process was used in determining the weights of the criteria. The jurors discussed the relative merits of each of the criteria and call expert witnesses to help them reach a consensus on the weights; (e) *Assessing the options*. Beside the weightings of the criteria, the second component required in a multi-criteria evaluation is the assessment of the options with respect to each individual criterion. The result of this multi-criteria assessment was an impact matrix, where each of its elements represents the evaluation or impact of an option according to a particular criterion. Each criterion identifies a rank order of options determined by the degree to which each option performs in the particular criterion, and (f) *Aggregating the criteria*. In order to obtain a single compromise rank order, these multiple rank orders have to be aggregated in Разделът съдържа методични постановки some way. There exists a wide range of aggregation algorithms (Bana e Costa, 1990; Gal et al., 1999). The aggregation procedure used in this study is based on the PROMETHEE (Preference Ranking Organization Method for Enrichment Evaluations) multi-criteria decision aid which uses an outranking procedure as the basis of its evaluation (Brans and Mareschal, 1990). This procedure was utilized through the software program ProDecX which is also able to explicitly account for uncertainty when assessing various options (Klauer et al., 2002). In ProDecX, for each criterion, the weights are sampled from the weights given by the jurors in a fair way; i. e. the weighting of each decision-maker contributes equally to the final results.

Results and Discussion

Achievements, findings, recommendations and future work arising from this study are summarized in the next sections.

Inventory of Ecosystem Services in AL-Prespa

The first step in this study was an inventory of ecosystem services in AL-Prespa. The objectives of the inventory phase of this study were to: a) describe the full range of goods

Ten major ecosystem services were identified and assessed against 10 groupings of land-uses and activities (Table 1). Key to column headings (land use): 1 – agricultural farming; 2 – livestock breeding; 3 – forestry; 4 – fishing; 5 – tourism; 6 – fruits and grapes; 7 – vegetables; 8 – grazing; 9 – management of solid waste and uncontrolled wastewater discharge; 10 – areas of cultural and historical options. Key to row headings (ecosystem services): a – life fulfillment; b – regulation of climate; c – biodiversity; d – provision of genetic resources; e – maintenance and regeneration of habitat; f – maintenance of soil health; g – maintenance of healthy water bodies; h – water filtration and erosion control; i – waste absorption and breakdown, j – aesthetic values.

Shaded cells are high-priority interactions between ecosystem services (rows) and land uses (columns) as judged by expert opinion.

Some ecosystem services, i.e. regulation of climate, are very important to a range of land uses but only appear to be of high priority as defined above for one or a few. Other services, like waste absorption and maintenance of soil health, appear to be at high priority points for most land uses. The jurors placed overwhelming importance on only seven of the ten ecosystem services considered (life fulfillment, biodiversity, maintenance and regeneration of habitat, maintenance of soil health, maintenance of healthy water bodies, water filtration and erosion control, and aesthetic values). The process demonstrated that decisions on natural resource management can be very different when information on a full range of ecosystem services is available. It also demonstrated to the researchers and the decision-makers the importance of identifying the right questions to be asking and having the right information available in an appropriate form as part of the decision process.

Options for Managing Ecosystem Services in Study Area

A workshop on ecosystem services options was held, which procedure was to develop a set of options related to ecosystem services in AL-Prespa and to identify some criteria for assessing these options. The selected options were: 1. Continue current land uses; 2. Maximize ecosystem services; 3. Maximize social benefits; 4. Maximize economic benefits; 5. Sustainable production, environment, society.

An understanding of the above options can be aided by the following framework that describes the makeup of each option in terms of specific management practices (Table 2). For example, the current option has some elements of on-site management practices implemented but none of those related to riparian zone management, demand management or education.

Table 2
Frameworks for options

Management practices	Options				
	1	2	3	4	5
On site management:					
Fences	s	+	s	x	s
Boardwalks	s	+	s	x	s
Toilets	x	+	s	x	s
Car parks	x	+	s	x	s
Horse yards	x	+	s	x	s
Lakes harbors	s	+	s	+	s
Weed control	x	+	s	+	s
Riparian zone management:					
Fencing	x	+	x	x	s
Demand management:					
Marketing to more sustainable recreation activities	x	+	+	x	+
Scheduling/ closures/ limiting numbers	x	+	+	x	+
Marketing sustainable activities	s	+	+	x	+
Use of private land	x	+	+	x	+
Education:					
Signs/pamphlets	x	+	+	x	s

“+” = present, “x” = not present, “s” = some present

On site management: In areas of minimum impact, these can be used to good advantage. They can take the form of fences to keep people away from sensitive areas or keep vehicles and horses out. Boardwalks and bridges have been used in many tourist sites to stop the impact of trampling (erosion) and driving (pollution). Provision of toilets can minimize the effects of wastes polluting sensitive areas (as well as improving aesthetic values). Properly constructed car parks can keep vehicles confined to non-sensitive areas and away from areas where erosion could be significant. Horse yards in areas that are popular for horse riding can limit the effects of trampling and grazing by unconstrained horses. Weed control is another necessary on-site management activity. It should be noted though that these sorts of man-made solutions can decrease the visual or aesthetic appeal for some people.

Riparian zone management: The riparian zone is that area beside the waterway that is essential to the health of the waterway. Correct management of the riparian zone can be crucial to the health of the waterway. It is also essential for the provision of shade. Riparian zone management can take the form of restricting access to these zones usually by fencing. Again, these sorts of interventions can decrease the aesthetic appeal.

Demand management: Marketing programs may be very effective. Such activities could include: targeting marketing to more sustainable recreation activities; scheduling and

Table 3
Impact matrix

Criteria	Indicator	Options				
		1	2	3	4	5
Maintenance of water quality	mg/l P	0.02	0.005	0.05	0.1	0.0
Biodiversity	QI ¹	7	10	4	5	10
Nutrient management/waste assimilation	QI	3	8	7	3	8
Maintenance of healthy water bodies	ISC ²	35–41	42–50	35–41	26–34	35–41
Maintenance of soil health	QI	5	8	7	4	8
Water filtration and erosion control	QI	7	10	6	2	9
Aesthetics views	QI	5	8	6	2	9
Public access	QI	5	1	7	9	10
Cultural/heritage sites	BI ³	1	1	1	1	1

¹QI = Quality Index: high = 10, low = 1; ²ISC = Index of Stream Condition: very poor = 0–19; poor = 20–25; moderate = 26–34, good = 35–41, very good = 42–50; ³BI = Binar Index: 1 = present, 0 = not present

closures of sites and limiting numbers at peak times; user charges to limit numbers and fund programs; the use of private land where appropriate to supplement the “traffic” on public land; and targeting education, which can, over the long term, have significant impacts. This could include on-site education with pamphlets and signs to encourage users to take rubbish away, to keep out of certain areas and not to take firewood etc.

The options workshop also helped to identify the relevant assessment criteria. The following nine criteria have been applied for the five options: Maintenance of water quality, biodiversity, nutrient management/waste assimilation, maintenance of healthy water bodies, maintenance of soil health, water filtration and erosion control, aesthetics views, public access, and cultural/heritage sites. The impact matrix showing the value of each of the different criteria under each of the different options was completed (Table 3). The matrix included both qualitative and quantitative indicators as well as ranges for some indicators that were uncertain. Decision criteria are listed in the left-hand column followed by the indicator used to assess the criteria. The quantitative and qualitative values assigned to the criteria from available data and expert judgment form the body of the Table 3.

The results taken by ProDecX run indicated a top ranking of sustainable production, environment, society (option 5). The next best options were maximize ecosystem services, maximize social benefits, maximize economic benefits, and lastly, continue current land use.

Conclusions

This paper has revealed the development of a deliberative multi-criteria evaluation approach for assessing change

in the provision of ecosystem services under alternative management scenarios. Some practical steps on how this might be achieved have been presented here and these steps were applied to a case study identifying and prioritizing ecosystem services in the AL-Prespa, Albania.

The approach presented above is an important tool in an analysis of ecosystem services and is essential for identifying and prioritizing the relative importance of the services and goods produced by ecosystems. This was essentially a process to engage a wide range of stakeholders in thinking about the study area’s values and challenges and to identify where is needed a more detailed quantitative analyses.

The key feature of the approach is its use to engage a broad segment of society in understanding and debating the benefits and costs of decisions that affect natural ecosystems. We are suggesting this approach as a complement rather than an alternative to more traditional approaches to decision making based on economics and policy or political sciences.

A high priority for future work is to analyze the institutions needed to maintain ecosystem services, and in particular explore ways of matching the scale and the design of institutions to the scale and nature of the ecosystem processes they are intended to influence. Another priority is to explore the feasibility of markets for ecosystem services, including the supporting institutions.

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