Cultural Ecosystem Services and Recreational Use: A Review Study in Belgrad Forest, Istanbul

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Abstract

This paper discusses Cultural ecosystem services (CES) as a part of ecosystem services (ES) and recreational use as a sub issue in the CES. Concepts, perceptions, cultural differences, and historical processes on the subject are explored by examining previous research studies. Explanations are illustrated through a case study of Istanbul's Belgrad forest. Istanbul is the largest city of Turkey, with a population of over14 million inhabitants. Belgrad urban forest is located in the North West part of Istanbul, approximately 20km from the city center. An urgent management strategy is required to sustainably meet the recreational requirements of the population. Belgrad Forest is a multifunctional forest; it retains a protected status owing to its role in water production. In Belgrad Forest all ES are covered, but recently the recreational function of the forest has gained dominance relative to the other ES. It is operating over its capability from the perspective of CES. Picnicking, jogging, walking, cycling, and sight-seeing are the types of outdoor recreation activities most preferred by visitors. The total area of the forest is 5.442 ha, but the area allocated for recreation activities is just 181.5 ha. This allocated area is insufficient and other service areas are being used due to the high demands. For this review, recent studies and technological tools are examined using research papers and previous studies implemented on Belgrad Forest to identify the optimum management for the recreational requirements with consideration to the sustainability of ES.

Keywords: Ecosystem services, cultural ecosystem services, recreational use, Belgrad Forest.

Ecosystem Services and Cultural Ecosystem Services: Definition and Perceptions

Ecosystem services (ES) are the direct and indirect contributions of ecosystems to human well-being (Biodiversity Information System for Europe, 2015). They support directly or indirectly our survival and life quality. ES are the benefits people receive from nature (Constanza et al., 1997; Constanza & Folk, 1997; Millennium Ecosystem Assessment [MEA], 2005; Pickard, Daniel, Mehaffey, Jackson & Neale, 2015). Without human demand for a given ecosystem function there is no ES (Portmann, 2013).

According to the Economics of Ecosystems and Biodiversity D0 report and the MEA, ES can be categorized into four main types; provisioning services, regulating services, supporting services, and cultural services (MEA, 2005). Behind these four main types of ES, subtypes and constituent elements are provided below:

Supporting Services: Habitat, Biodiversity, Photosynthesis, Soil formation, Food, Nutrient Cycle, Clean water;

Provisioning Services: Fish, Wood, Pollination, Cool temperatures;

Regulating Services: Flooding control, Purifying water, Storing carbon, Disease regulation, Climate regulation;

Cultural Services: Aesthetic, Spiritual, Education, Stewardship and Recreational.

In recent years, the ES approach has become a conceptual and empirical link between ecological health and human wellbeing and a vehicle with which to communicate the importance of nature conservation to policymakers and the general public. The approach has evolved significantly over the past three decades.

The Economics of Ecosystem Biodiversity (TEEB) initiative draws attention to the economic benefits of biodiversity. It published a report on the economic significance of the global loss of biological diversity, classifying ES for evaluation. The Common International Classification of Ecosystem Services (CICES) was developed for environmental accounting purposes and proposes distinguishing between the material and energetic outputs from ecosystems, where material outputs are “goods” and non-material outputs are “services.” The ES approach requires the coupling of natural and human systems through the inclusion of multidisciplinary perspectives. ES has been described as a “core concept” of the rapidly developing interdisciplinary field of ecological economics (Portmann, 2013; Figure 1).

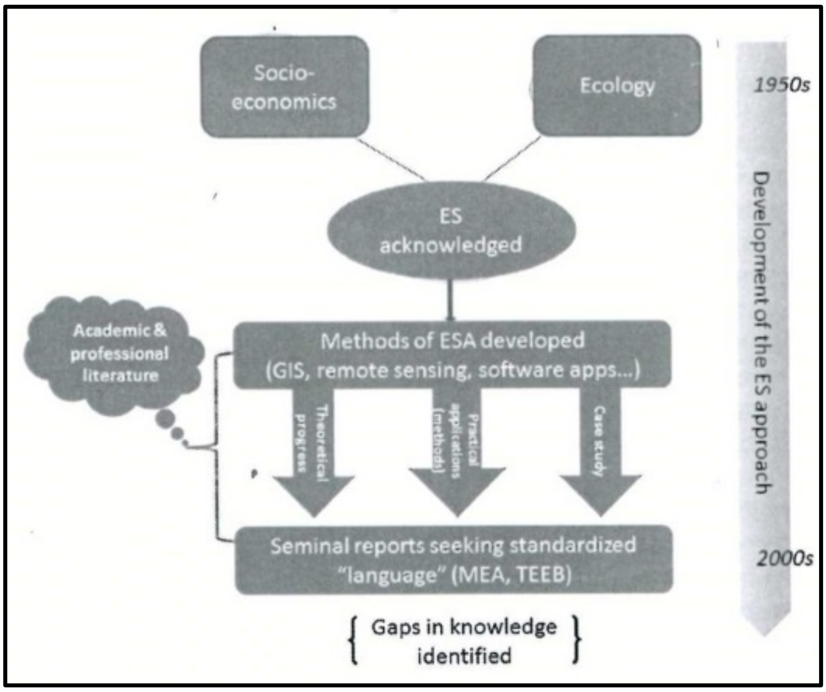

Figure 1. A schematic illustration of the ES approach progress over time (Portmann, 2013)

TEEB distinguishes three main types of ecosystem-based benefits and related values:

1. Ecological benefits and values;

2. Sociocultural benefits and values; and

3. Economic benefits and values.

Constanza et al. (1997) estimated the annual worth of ES at more than 33 trillion US dollars. About 63% of this value was estimated to be contributed by marine ES, with most coming from coastal systems. Terrestrial systems were estimated to make up about 38%, mainly from forests and wetlands (Constanza et al., 1997; MEA, 2005; Pickard et al., 2015; Portmann, 2013). Portmann argues that ES is the last great hope for making biodiversity and environmental conservation a priority for planning and resource management, and may in fact be the last great hope for making conservation mainstream. Portmann proposes that ES should be classified under the attributes knowledge of the peculiar landscape characteristics, that this classification should not be global and should be under local responsibility, by considering the public participation of residents, supported by the authorities and non-governmental organizations (NGO's) (Portmann, 2013).

In the MEA (Millennium Ecosystem Assessment) report, CES (cultural ecosystem services) are defined as "The non-material benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, and recreation and aesthetic experiences" (Riechers, Berkmann & Tscherntlche, 2016). The MEA considers cultural and amenity services to be as important as human cultures, knowledge systems, religions, heritage values, and social interactions. The Millennium Assessment (MA) focuses on the linkages between ecosystems and human well-being. The four main ES provisioning, regulating, cultural and supporting services are interrelated in the MA concept. CES are one of the four main service categories. However, cultural services cannot be treated independently and depend on provisioning, regulating and supporting services, at the same time as the expression of CES by the MEA (2005) and the way ecosystems are viewed and managed (Tengberg et al., 2012). In another definition, CES are presented as "ecosystems" that contribute to the non-material benefits arising from human–ecosystem relationships (Chan et al., 2012a; Riechers et al., 2016; Tengberg et al., 2012).

Recent global analyses indicate that although countries become less dependent on provisioning and regulating services in the course of their economic development, their dependency on cultural services increases (Guo, Zhang & Li, 2010; Plieninger, Dijks, Oteros-Rozas & Bieling, 2013). Current research on ES is strongly focused on biophysical assessments, on the one hand, and on economic/monetary valuation exercises on the other. A third, but largely overlooked, component of ES is the socio-cultural domain, which requires alternative evaluation approaches that draw on a wide range of social science tools and methods (Plieninger et al., 2013, p. 119). To capture this dimension, it is essential to address CES and the socio-cultural preferences toward ES. Socio-cultural studies need to be introduced into the science of ES (Chan et al. 2012b). Studies of perceptions, values, attitudes, and beliefs may generate more meaningful insights regarding the contributions of ES to human well-being than purely biophysical assessments (López et al., 2012; Plieninger et al., 2013).

A study implemented in eastern Germany revealed that preferences for CES are comparable in magnitude to preferences for regulating or providing ES (Plieninger et al., 2013). The holistic nature of CES is also identified (Bileling & Plieninger, 2013; Daniel et al., 2012).

An ecosystem or landscape function translates into a service as soon as there is a societal demand for this function. CES are in contrast mostly regulating and supporting services, and motivators for owning, managing, and conserving lands, often being even more important than traditional livestock or timber production (Chan et al., 2012; Plieninger et al., 2013).

Assessing CES as considered by many different stakeholders and the conceptual human well-being explanation may be of different types. For this reason, publication in recent years related to human well-being and ecosystem assessment manuals have increased. The United Nations Environment Programme published an ecosystem human well-being assessment manual in 2010. This manual provides guidance on how to link assessment scales and how to bridge knowledge systems and enable integration of indicators of different types of ES based on scientific as well as local and traditional knowledge (Tengberg et al., 2012, p. 17). MA categories for cultural and amenity services provided by ES are heritage values, cultural identity, spiritual services (sacred, religious, or other forms of spiritual inspiration derived from ecosystems), inspiration (use of natural motifs or artefacts in art, folklore, etc.) and aesthetic appreciation of natural and cultivated landscapes and recreation and tourism (Tengberg et al., 2012).

A case study of this aspect of CES assessment implemented in eastern Germany reported mainly aesthetic values, social relations, and educational values (Plieninger et al., 2013). From the aspect of CES of urban landscapes, studies show that not only forests or urban forests are relevant, but that allotment gardens, urban green areas, and city parks also have an important although relatively limited role (Mohomal & Othman, 2012; Speak, Mizgajski & Borysiak, 2015). Finally, even urban forests and forest areas have a magnitude difference from the aspect of CES demand by residents (Arnberger, 2006).

Studies reveal that it is mainly forests, especially urban forests, that meet various CES demands (Arnberger, 2006; Bernath & Roschewitz, 2008; Ja-Choon, Sun & Yeo-Chang, 2013; Rusterholz, Bilecen, Kleiber, Hegetschweller & Baur, 2009). Many recreation choices are offered in urban forests, and in forests in general. Urban forest recreationists and forest recreationists have different preferences (Ja-Choon et al., 2013). Urban forests are generally preferred for daily activities, due to their location close to the urban area.

According to a research study implemented in Korea to determine the preferences of Korean citizens regarding forest use, a majority of respondents (48.3%) stated that recreation was the most important use of an urban forest, and biodiversity was for them a key factor in urban forest recreation. Most urban forest visitors came to the forest for relaxation (52.25%), followed by exercise (42.04%). Most of them visited the urban forest every week (82.40%). Study results in Finland and Korea show that urban forests are not just a superior good but are an essential component of everyday life (Ja-Choon et al., 2013).

Differences in recreational use between urban and backcountry forests and peri-urban forests are apparent (Hörnsten & Fredman, 2000; Konijnendijk, 2000). Urban forests are subject to more intense and multiple recreation use, with day-use oriented activities such as dog walking and jogging, with higher use levels on workdays. However, the level of recreation use differs according to the urban forests' closeness to settlements, business areas and schools. This may influence use levels, user composition, and the temporal distribution of activity types through commuting and recreation use (Arnberger, 2006). Inner urban forest is used 20 times more than peri-urban forest for daily jogging activities. Location is therefore very important for recreational use or the CES aspect of the inner urban forest for daily activities such as jogging or dog walking (Arnberger, 2006).

Recreational Use in Cultural Ecosystem Services

Recreational use is one of the most important cultural services in European context and represents probably the most tangible cultural service (Plieninger et al., 2013). Urban forest planning and management should consider the attributes of urban forests and the preferences of citizens visiting urban forests to improve urban dwellers' welfare. To increase citizens' satisfaction with urban forests, these forests must be designed in a manner that responds to and incorporates the current needs of the citizens as users of urban forests (Ja-Choon et al., 2013).

What is the most preferred type of urban forests as a recreational site? 53 studies on forest landscape preferences show that people's preferences for a forest are increased by increasing tree size and preferences focused on attributes regarding the scenic or aesthetic benefits of a forest at the landscape level (Ja-Choon et al., 2013).

This study, implemented to identify Korean dwellers' preferences for urban forest's recreational values, revealed that numerous visual forest stands provide a variety of open air activities and provide enjoyment of peace and quiet (Ja-Choon et al., 2013). In fact, this is very complex to quantify and measure. Besides, those preferences can change according to the cultural characteristics. For instance, where the societies' preferences of Korea and Finland define aesthetic as more related with natural, not a man-touched; Malaysian society defines aesthetic as the natural elements that appear as beautiful, cooling, well maintained, and organized. Sceneries appearing as unsafe and not well maintained are less appreciated by visitors in Malaysia (Mohomal & Othman, 2012).

In the study implemented in Korea to reveal the urban forest attributes as trails, slopes, biodiversity, and environmental education, biodiversity was the most influential among Korean urban dwellers in their choice of urban forest recreation. Respondents are willing to pay for the higher cost entailed by urban forests with high biodiversity levels and environmental education programs. These two attributes directly enable visitors to have a richer natural experience. Forest ecosystems with a high level of biodiversity allow one to observe seasonal landscapes, listen to bird songs and observe the movements of small animals such as squirrels.

In another example of a research study, a questionnaire conducted in eastern Germany revealed that from the aspect of landscape characteristics by considering CES, water bodies were the most preferred areas for recreation, education, aesthetics, and heritage sites. Besides, forests were more preferred for education and spirituality (Plieninger et al., 2013).

There are still conceptual and methodological gaps in the CES perceptions. For example, there are conflicts on those questions: How are CES understand in the urban context? Which are the focus areas of the dwellers?

Sustainable management of CES is another important subject, especially for multifunctional urban forests. Multifunctional forests are the same forest areas used for timber production and recreation. It is indicated that in Europe, forests traditionally used for wood production are increasingly being used for recreational purposes (Brun, 2002; Niemelä et al., 2005; Rusterholz et al., 2009). A research study implemented in Switzerland revealed that the annual reduction in timber value due to recreation induced damage can account for up to 16% of the total proceed (Rusterholz et al., 2009). Recreational uses mostly occur in horse riding, dog walking, jogging, mountain-biking, picnicking, and grilling. 850,000 visitors come to the forests for recreational purposes per year. According to the damage classification of recreational use, damaged trees occur mostly at picnic sites and around fire places. In Allschwill forest, in Switzerland, totally 23% of the total area contained trees with recreation included damage (Rusterholz et al., 2009).

From the management aspect, the level of supply of an ecosystem service demanded by people determines the use of the service of interest (Sala, 2015). This is schematized below (Figure 2). Recreational use in cultural services comes closer to the whole demand of ES and Belgrad Forest's recreational use is a good example for this.

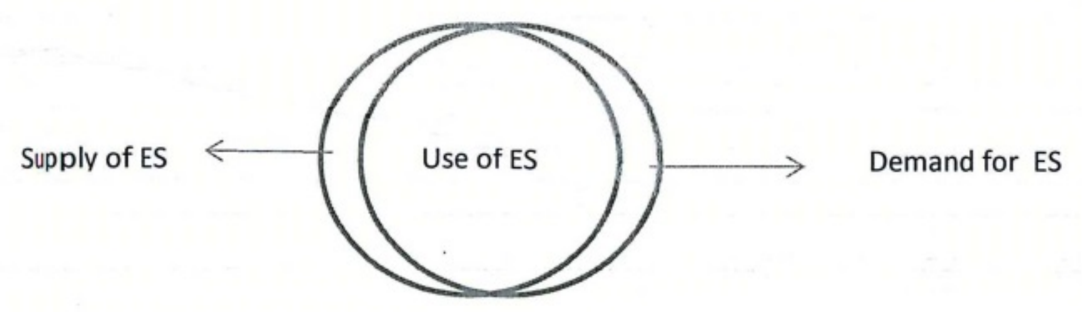

Figure 2. Schematic illustrating the uses of ecosystem services (ES) approach

Recreational Use of Belgrad Forest and Environmental Impacts

Belgrad Forest is a natural forest situated in Çatalca Peninsula within the geographical region of Marmara. Its exact location is between 28° 54′ 00″ - 29° 00′ 00″ east longitudes and 41° 09′ 0″ - 42° 12′ 30″ north latitudes (Colakoglu, 2003; Figure 3(b)). It has a total area of 5,524 ha (Asan & Saglam, 2012; Figure 3(a)). It has been used for centuries for water conservation, timber production, recreation, hunting, and grazing. Seven reservoirs were built in the forest in 14th century. In the management plan of Belgrad Forest, there were four main functions, namely, soil protection and erosion control, hydrology and water conservation, scientific function and aesthetic and recreational function (OGM, 1991). Currently, Belgrad Forest serves especially for recreational use and community healthcare purposes. It is also beneficial for all ES by preventing erosion (Uzun & Caglayan, 2012).

(a) **(b)**

Figure 3. (a) The area of Belgrad Forest; (b) Location of Belgrad Forest in Istanbul, Turkey (Uzun & Caglayan, 2012)

Belgrad Forest is 20 km far from the city center and is characterized by mature, large natural trees. The Forest has also richness of biodiversity in both fauna and flora (Table 1). Because of those features, it is most demanded forest in Istanbul by the dwellers.

Table 1. Common plant and animal species of Belgrad Forest (Tolunay, Karaoz, & Akkemik, 2012)

No	Common Woody Plant Species (Scientific Name)	Animal Species (Scientific Name)
1	*Quercus* sp.(*Q. Petraea, Q. Robur, Q. İnfectoria, Q. Frainetto, Q. Pubescens, Q. Cerris, Q. İlex, Q. Coccifera*)	*Erinaceus concolor*
2	*Fagus orientalis*	*Neomys anomalus*
3	*Castanea sativa*	*Talpa europea*
4	*Alnus glutinosa*	*Pipistrellus pipistrellus*
5	*Carpinus betulus*	*Plecotus auritus*
6	*Corylus avellana*	*Rhinolophus hipposideros*

7	*Populus tremula*	*Apodemus agrarius*
8	*Salix* sp. (*S. Alba, S. Cinerea, S. Caprea*)	*Apodemus flavicollis*
9	*Ulmus minor*	*Dryomys nitedula*
10	*Laurus nobilis*	*Glis glis*
11	*Cistus* sp. (*C. Salvifolius, C. Creticus*)	*Mus domesticus*
12	*Tilia tomentosa*	*Microtus subterraneus*
13	*Acer* sp. (*A. Campestre, A. Trautvetteri*)	*Rattus rattus*
14	*Ilex aquifolium*	*Sciurus vulgaris*
15	*Euonymus europeus*	*Canis aureus*
16	*Frangula alnus*	*Felis silvestris*
17	*Osyris alba*	*Martes foina*
18	*Rubus* sp. (*R. Fruticosus, R. Hirsitus, R. Tomentosus*)	*Mustela nivalis*
19	*Rosa* sp. (*R. Canina, R. Gallica*)	*Vulpes vulpes*
20	*Sorbus* sp. (*S. Torminalis, S. Aucuparia*)	*Capreolus capreolus*
21	*Pyrus elagnifolia*	*Sus scrofa*
22	*Malus sylvestris*	
23	*Pyrcantha coccinea*	
24	*Crataegus* sp. (*C. Monagyna, C. Pentagyna*)	
25	*Mespilus germanica*	
26	*Prunus* sp. (*P. Divaricata, P. Avium, P. Spinosa*)	
27	*Laurocerasus officinalis*	
28	*Genista* sp. (*G. Tinctoria, G. Carinalis*)	
29	*Spartium junceum*	

30	*Daphne pontica*
31	*Cornus* sp. (*C. Mas, C. Sanguinea*)
32	*Arbutus unedo*
33	*Erica* sp. (*E. Arborea, E. Verticillata*)
34	*Calluna vulgaris*
35	*Phyllyrea latifolia*
36	*Ligustrum vulgare*
37	*Sambucus nigra*

Due to heavy recreational use of the forest, damages occur such as soil compaction, water, pollution, and trees' destruction, landscape fragmentation by roads, vehicle crashes, and destruction of wild life population (Figures 4–8). The recreational use density in Belgrad Forest clustering is mostly in picnic areas (Uzun & Caglayan, 2012; Figure 9). On an average, 1,050,000 people in 350,000 motor vehicles visit Belgrad Forest annually (Asan & Saglam, 2012).

Figure 4. Soil compaction in Belgrad Forest (Tolunay, Karaoz, & Akkemik, 2012)

According to the results of a research study implemented in both picnic and undisturbed areas in Belgrad Forest to investigate the recreational impacts on some soil properties, soil was found significantly compacted by recreational activities in the picnic areas. Sand, silt, clay, pH, electrical conductivity, organic carbon, bulk density, fine soil weight, compaction and saturation capacity, and litter properties as unit weight-mass, organic matter content (%) and organic matter mass are investigated in 0–5 cm soil depth. Organic carbon content (1.328%) on the picnic area has found quite lower depending on the compaction of the soil and lessen quantity of soil organic matter, the value of saturation capacity (24.13%) in the picnic area was considerably lower, bulk density and fine soil weights significantly higher; thus, the soil properties in the picnic area were negatively affected by recreational pressure (Cakir, Makineci, & Kumbasli, 2012).

Figure 5. Water pollution in Belgrad Forest (Tolunay, Karaoz, & Akkemik, 2012)

Figure 6. Plants destruction in Belgrad Forest (Asan & Saglam, 2012)

Figure 7. Destruction on wildlife population due to vehicle crashes (Tolunay, Karaoz, & Akkemik, 2012)

Figure 8. Habitat fragmentation by roads (Asan & Saglam, 2012)

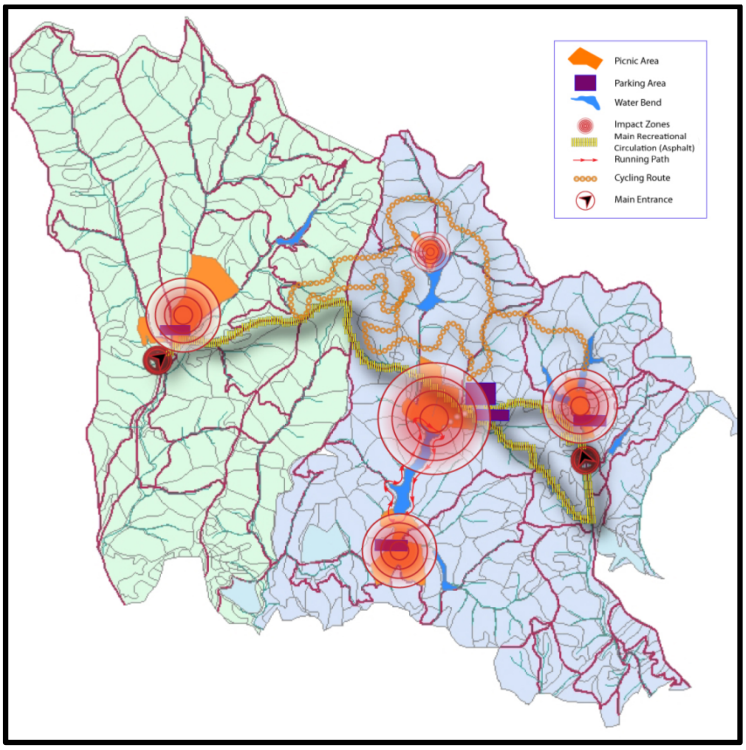

Figure 9. Impact zones of recreational use in Belgrad Forest (Uzun & Caglayan, 2012)

According to the results of survey implemented with the visitors in the Belgrad Forest, the biggest impact zone was Neset Suyu Picnic area. Preferred recreational use types and percentages for summer and winter seasons were indicated in Table 2. According to the entrance registration data, 68% of the visitors mostly come for trekking in winter, and 66% mostly come for picnic in summer (Uzun & Caglayan, 2012).

Table 2. Recreational use types and user preferences (Uzun & Caglayan, 2012)

Recreational Use Types	Preferences in Winter (%)	Preferences in Summer (%)
Running	64	38
Trekking	68	63
Cycling	17	7
Photographing	8	10
Picnicking	30	66
Research	8	20

Discussion and Comments on Management Plans

In order to identify sustainable urban forest management strategies, firstly, reliable and detailed visitation data on activity types should be kept (Arnberger, 2006). User characteristics and daily use levels of activity types are useful tools for analyses to identify peak loads. Daily use patterns which also provide information about under-use are indicators of the amount and temporal usage of, and demand for, recreational infrastructure, and form the basis for many management decisions. Especially for multiple-use forests like inner-urban forests preferred activity types are more important for producing sustainable management strategies. Recently, image-based long-term observations have been carried out in urban and suburban forests and data collected from these video observations for a period of one entire year from dawn to dusk. Data captured includes time of visit, direction of movement, numbers of people in groups, activity type (jogging, walking, dog walking, bicycling, etc.), and leashed or unleashed dogs (Arnberger, 2006). Anthropogenic data should cover demographics, suburbanization, and changing policies, in order to fully explore the relationships among ES and human activities (Pickard et al., 2015).

The number of decision support tools specifically focused on ES has grown substantially with the increased interest in ES, though the applicability of these tools for widespread use varies (Bagstad, Semmens, Waage & Winthrop, 2013). Two commonly used tools are VEST (Value ES Tool) and ARIES (Artificial Intelligence for ES) (Chan et al., 2011; Crossman et al., 2013; Vigerstol & Aukema, 2011; Villa, Ceroni, Bagstad, Johnson & Krivov, 2009). There is an increasingly urgent need for tools that help incorporate ES into planning, policy and decision making (Burkhard, Crossman, Nedkov, Petz & Alkemade, 2013; Crossman et al., 2013; De Groot, Alkemade, Braat, Hein & Willemen, 2010; Maes et al., 2012; Pickard et al., 2015; President's Council on Science and Technology, 2011).

EnviroAtlas is a tool that has been developed by the United States Environmental Protection Agency to gather data, and its partners are a key component of Eco INFORMA. This open access geospatial tool allows users to access, view, and analyze diverse information focusing on ES and to assess how their many benefits affect human health and well-being (Pickard et al., 2015). EnviroAtlas includes a mapping application for benefit categories such as clean air, clean and plentiful water, natural hazard mitigation, climate stabilization, recreation, culture and aesthetics (recreational opportunities, culturally important resources, rarity or aesthetic qualities), food, fuel and materials, and biodiversity conservation (Pickard et al., 2015).

A study implemented by using EnviroAtlas mapping system is shown in Figure 10. In this analysis, evaluation values range between 0 and 1. "0" represents the most beneficial for an ecosystem service and "1" represents the least beneficial. EnviroAtlas uses spider diagrams. According to the spider analysis in Figure 10 including seven benefit categories, recreation, culture, and aesthetics provide the most beneficial ES relatively, with the value of 0.3 (Pickard et al., 2015).

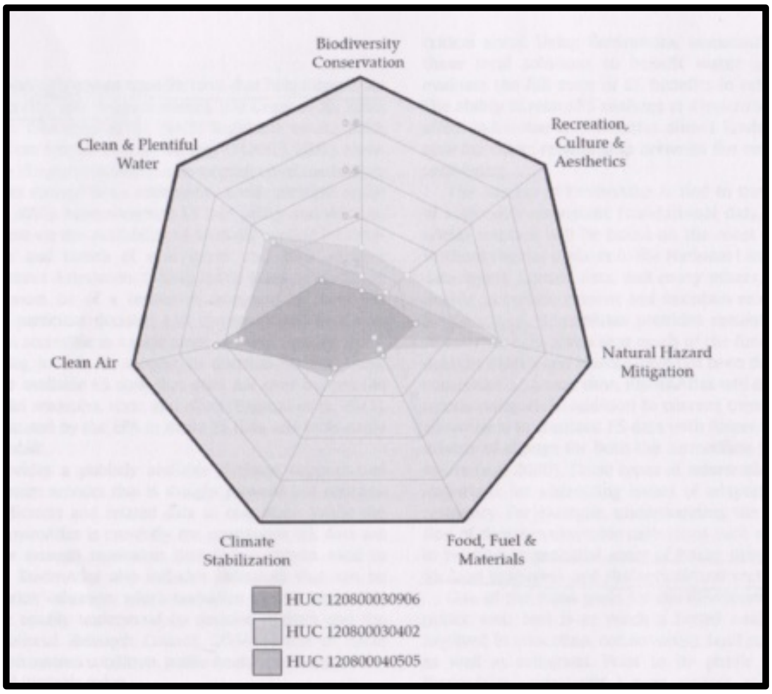

Figure 10. Example of spider diagram output from the ecosystem services (ES) analyzer (Pickard et al., 2015)

The tools described should be used for the analysis of Belgrad Forest in order to determine management strategies for the forest. The use area which should be given weight can be determined using those tools, and the dominant recreational use can move to other ES uses.

The EnviroAtlas mapping system can also help in decision-making for green infrastructure plans, as it includes quantitative estimates of a selected population's health benefits by considering population proximity to green infrastructure in urban lands. For instance, residents beyond 500 m from a park entrance, residents with minimal views of trees, residents within 300 m of a major road that lacks tree cover along the roadside. The health implications of these maps include obesity and depression due to reduced opportunity for physical activity, stress and reduced cognitive functions due to lack of visual access to green space and asthma exacerbation from vehicular pollution (Tennessen and Cimprich, 1995; Hartig, Evans, Jamner, Davis & Gärling, 1997; HEI, 2010; Pickard et al., 2015). Such data is very detailed and can be effectively used to help with future plans and to determine priorities for planning green infrastructure for a settlement. Forests especially located in urban areas comprise a major part of the green infrastructure. As an urban green infrastructure, the World Health Organization has recommended a minimum urban forest area 9 m^2 per capita (Ja-Choon et al., 2013).

Studies that include the data of usage preferences and searches for daily use levels and activity types, and that answer the question "who comes when?" are essential for the sustainable management of urban forests and for their recreational infrastructure, in order to avoid user conflicts (Vuorio, Emmelin & Sandell, 2003). User conflicts generally have been observed between cyclists, walkers, and dog walkers. Separating bicyclists from other users could be one possible management option (Arnberger, 2006). Another important factor for gathering data through interviews with the users is that the length of the questionnaire has to be as short as possible in its design, and demographic questions should come towards or at the end (Bernath & Roschewitz, 2008; Plieninger et al., 2013). These actions will to make respondents more willing to complete the questionnaires.

Specifically to Belgrad Forest, as explained above, a detailed user profile should be determined by using both questionnaire methods and analysis tools for ES planning, policy and decision making. The destructive effects of recreational use dominance can be regulated by taking some simple precautions by rotating service areas, limiting visitor accessibility at the entrances by considering carrying capacity, zoning for used areas, and taking current picnic areas out of action for reclamation since the most serious damage occurs by picnicking, and directing visitors to use other picnic areas that are located in suburban man-made forest areas (Sat Gungor, 2015).

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