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Multiple Criteria Activity Selection for Ecotourism Planning in İğneada

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Abstract: Forests have many ecotourism attractions. Ecotourism can be defined as an opportunity to promote the values in the protected areas and to finance for related stakeholders. However, ecotourism can be classified as a possible threat to ecosystems because of ecotourism's attractions are based on fragile ecological relations. Activity selection regarding ecological, social and economic dimensions is important in forest and tourism management. Ecotourism activities were selected using a multi-criteria decision model based on an ELECTRE method. The model that was applied with a participatory approach consists of 19 alternates and 28 criteria. While horse-riding was determined to be the best activity, shooting and sportive fishing activities were determined to be the worst.

Key Words: Ecotourism, ELECTRE, global environment facility, multi-criteria decision making

İğneada'nın Ekoturizm Planlaması İçin Çok Ölçütlü Etkinlik Seçimi

Özet: Ormanlar ekoturizm açısından önemli pek çok çekicilik içerir. Ekoturizm, korunan alanlardaki değerleri tanıtma ve ilgililere finansman olanakları yaratma fırsatı olarak kabul edilebilir. Bununla birlikte, çekicilikler kırılgan ekosistem ilişkileri üzerine kurulduğunda, ekoturizmi ekosistemleri tehdit eden faktörler arasında sınıflandırmak da olanaklıdır. Etkinlik seçerken ekolojik, ekonomik ve sosyal boyutları dikkate almak orman ve turizm yönetiminde önemlidir. Bu çalışmada, ELECTRE yöntemine dayalı bir çok ölçütlü karar modeli ile etkinlik seçimi yapılmıştır. Katılımcı bir yaklaşımla uygulanan model 19 seçenek ve 28 ölçütten oluşmaktadır. Ata binme seçeneği en iyi etkinlik olarak belirlenirken, atıcılık ve sportif olta balıkçılığı etkinlikleri en kötü etkinlikler olarak hesaplanmıştır.

Anahtar Sözcükler: Ekoturizm, ELECTRE, küresel çevre olanakları, çok ölçütlü karar verme

Introduction

Forest and other wooded land cover in total 20,763,248 ha in Turkey (Konukçu, 2001). Turkey also possesses a rich biodiversity (World Bank, 2000). Forests and trees not only provide wood and non-timber products, but also provide numerous services. In recent decades, while assessments have shown that the area of the world's forests is shrinking, demand on services such as recreation and tourism values especially generated by protected areas has increased rapidly. Authorities responsible for natural resources in Turkey and other countries tend to manage their forests concerning the values without timber products. As a result of this change, the number of forest areas managed under the protection status has increased during last 4 decades. Protected areas in forests total 4,095,241 ha including national parks, nature parks, nature protected areas, nature monuments, gene conservation forests etc. (Konukçu, 2001).

Another change can be observed in the tourism area. Tourism in protected areas is a large and growing sector in many countries. However, there are many different forms of the tourism such as resort, mass, nature, adventure, special interest, rural and ecotourism. As a growing type of tourism, ecotourism is a concept that has evolved over the last 20 years. According to the IUCN (International Union for Conservation of Nature and Natural Resources), ecotourism is environmentally

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responsible travel and visitation to natural areas, in order to enjoy and appreciate nature (and any accompanying cultural features, both past and present) that promotes conservation, has a low visitor impact on nature and provides for beneficially active socio-economic involvement of local peoples (Drumm and Moore, 2002).

There are several reasons why ecotourism has attracted local and national governments, commercial operators, and conservationists. First, it provides an incentive for governments to expand protected areas and for private landowners to conserve their lands. Second, ecotourism's emphasis on local resources and employment and its tendency to operate in peripheral regions make it attractive to small rural communities. Third, its emphasis on local ownership implies fewer leakages from the economy. Fourth, it requires less development and less investment, and involves fewer cultural and environmental disruptions than other forms of tourism. Fifth, ecotourism can promote beneficial linkages within a diverse, integrated economy. Finally, ecotourists tend to stay longer, spend more per day than the typical tourist, and seek out local goods and services for consumption (Rahemtulla and Wellstead, 2001).

The Global Environment Facility (GEF) supports projects in developing countries to protect the global environment especially regarding global warming, pollution of international waters, destruction of biodiversity and depletion of the ozone layer. Turkey has 819,217 ha of forest areas allocated for conservation of biological diversity (Konukçu, 2001). To develop the national capacity regarding the management of biodiversity in forests, Turkey has 2 projects, both funded by GEF. The project entitled "Biodiversity and Natural Resource Management" is usually known as the GEF II Project in Turkey. The global objective of the GEF II is sustainable conservation of the biological diversity and ecological integrity of selected ecosystems that are representative of Turkey's 4 major biogeographic zones (World Bank, 2000). Camili, Sultansazlığı, Köprülü Canyon National Park and İğneada were selected for GEF II as project sites in Turkey. The immediate objective of the project is to establish effective, intersectoral, participatory planning and sustainable management of the protected areas and natural resources at 4 demonstration sites and build capacity at the national level to facilitate replication of these activities at priority conservation sites throughout Turkey (World Bank, 2000).

Before the project local villagers were working in the forest as timber harvesting workers or using it to feed their herds. A conservation project such as GEF II affects some people negatively in or around the project sites. The GEF II Project managers want to use income-generating features of ecotourism especially to compensate for losses incurred by the stakeholders affected negatively by the project. On the other hand, the lack of public awareness of the importance of biodiversity is a big problem for biodiversity conservation. Ecotourism especially based on the flora and fauna components of ecosystems can be used to promote public awareness at local and national levels.

GEF II in Turkey has 3 main components. The second component consist of A, B, and C subcomponents. Subcomponent A has a target to develop prototypes for effective protected area management. Subcomponent B deals with establishing mechanisms for sustainable natural resources management and contains 2 subjects. While the first subject deals with ecotourism directly to establish environmentally responsible tourism, the second is related to integrating biodiversity conservation into local land use plans regarding ecotourism. On the other hand, ecotourism may help to achieve the aims of subcomponent C, dealing with establishing public awareness programs for parks.

Materials and Methods

Research Area

İğneada was selected as the research area to support the GEF II project. İğneada is a district in Kırklareli province, northwest Turkey. İğneada has alluvial forests with associated aquatic and coastal ecosystems, and nature and wildlife conservation areas on the Thracian Black Sea coast. The alluvial forests have reduced in size, as the value of the timber species grown in them and the fertility of the agricultural land that is produced by clearing them are high. The proximity of this aquatic forest to littoral and marine ecosystems provides an opportunity for ecological interpretation and facilities for formal and informal education and public awareness about the value of this rare, remnant ecosystem complex

(World Bank, 2000). The alluvial forests in İğneada are covered by fresh water during some seasons. This kind of forest is known as “Longos” in Turkish and covers in total 1536 ha.

The main economic sectors in the İğneada project site are forestry, fishing, livestock and tourism. Unfortunately, the tourism industry in the area is seasonal and based on sea and sand. Tourism along the coast occurs between June and August and there are an estimated 30,000 visitors per year. The tourism sector in the region does not benefit from the rare ecosystems and natural tourism attractions except for the sea. There was no systematically conducted ecotourism activity in the project area before this research.

Method Applied

The development objective of the research is to demonstrate an application that can be used for ecotourism planning in İğneada concerning the GEF II purposes, ecological, economical and social dimensions of the ecotourism and participation in planning. The immediate objective of the research is to determine suitable ecotourism activities, which have priority for the İğneada project site concerning the role of ecotourism in the project.

Park plans for managing tourism attempt to maximize the benefits of tourism while minimizing its costs. Tourism policies are an important component of the overall document, sometimes called a management plan (Eagles et al., 2002). Planning and decision-making are more important in ecotourism than in other kinds of tourism. For that reason, one of the performance indicators of the project’s impacts is no increase in the percentage of area degraded by tourism impacts at the project site (World Bank, 2000). The impact of the ecotourism activities may be measurable concerning their environmental, economic and social results. While some results of ecotourism have quantitative characteristics, other results may be qualitative characteristics. Ecotourism in the project contains environmental, economic and social impacts and objectives. Decision-makers characterize their objectives by measures of performance, which they refer to as criteria (Bogetoft and Pruzan, 1991). Making decisions about tourism in protected areas is not easy; it involves not only protected area managers but also affected citizens, including the local public, visitors, private operators and scientists (Eagles et al., 2002).

As a result, decision making on ecotourism in the project must be based on a model that can use environmental, social and economic criteria and must be suitable for participation. For that reason a Multiple Criteria Decision-Making (MCDM) Model was chosen for this study. MCDM is both an approach and a body of techniques designed to help people make choices in accordance with their values in cases characterized by multiple, noncommensurate and conflicting criteria (Bogetoft and Pruzan, 1991). A model based on ELECTRE was used due to its simplicity in applying the selection problem of the ecotourism activities in this study.

The origins of ELECTRE methods go back to 1965 at the European consultancy company SEMA. A research team from SEMA worked on a concrete, multiple criteria, and real-world problem regarding decisions dealing with the development of new activities in firms. An atypical ELECTRE method was also created to deal with the problem of highway layout in the Ile de France region. Methods are designed to help decision-making in choosing and ranking actions (Figueria et al., 2005). The basic idea is that a ranking of alternatives is arrived at by means of a pairwise comparison of alternatives (Nijkamp et al., 1990). Models based on ELECTRE methods were used in forestry for decision-making problems such as ranking of the afforestation alternatives, and determination of the best rotation age in forestry (Türker, 1986, 2001).

The model used in the research was designed by the author and applied by the author and the members of the Protected Area Management Authority (PAMA) who are responsible for the management of the İğneada project site. PAMA consists of 4 forest engineers working on different aspects of the project such as wildlife, ecotourism, GIS applications and administration. The author and PAMA members participated in the designing of the alternates and decision of the best alternate steps in ecotourism planning as different experts. However, the participation of other stakeholders is also possible. During weighting of the criteria, villagers, hunters, pension owners or forest workers could participate in model solving. In this study, this was not preferred for simplicity.

Alternative Ecotourism Activities in İğneada

To develop an alternative set, the ecotourism attractions of the project site were investigated. At this stage, a special ecotourism inventory was conducted in İğneada by using a questionnaire form that included questions on community and regional assets for attracting ecotourists in the summers of 2002-2003. Approximately 30 different people from the stakeholders participated in the inventory step of the planning process. Besides this inventory, other inventories conducted by the project on flora, fauna, and non-wood forest products were used to determine ecotourism values for planning.

All of the ecotourism attractions and constraints were assigned to a map to see them together. After the mapping of the ecotourism values, an imagination stage on alternative ecotourism activities in İğneada was started by involving 5 PAMA members. While the alternative activities were defined, participants took into account the time, place, rules and needed jobs or outputs to implement the activity. Necessary equipment and services were briefly explained for each activity. In addition, the participants tried to use at least 2 ecotourism values for each activity. The participants decided on the 19 alternatives seen in Table 1 for selection. The number of alternatives is not important to develop a decision model based on ELECTRE. Decision-makers could increase or decrease the number of them according to their needs.

Criteria Set

MCDM needs a criteria set. The participants discussed the criteria set that can be used to select ecotourism activities concerning the project objectives mentioned above. Some environmental impacts such as air quality, surface water quality, ground water quality, road traffic, noise level, solid waste disposal system, archaeological and historic sites, visual amenity, natural vegetation and wild animal life to evaluate tourism alternatives were recommended in the literature for tourism planning (McIntyre, 1993). In addition to the environmental impacts noted above, the economic and social results of the alternative ecotourism activities must be added to the criteria set. As a result, the participants determined the criteria set as in Table 2.

After determination of the criteria set, each criterion must be weighted. To achieve this, the participants created a value for each criterion on a scale of 1 to 4 concerning the ecotourism objectives of the project. The most important criteria were scaled by 4. At this stage every participant independently assigned values to the weights of the criteria set. Then the weight of each criterion was decided together by consensus among the participants.

In another stage of the model, each participant separately evaluated every alternative concerning the same criterion, using a scale of 1 to 5. While the best

Table 1. Alternative ecotourism activities evaluated in the model.

No	Name Exp.*	No	Name Exp.*
1	Boat trip I	11	Trekking I
2	Boat trip II	12	Bicycle tour II
3	Boat trip III	13	Tourist tour by bus
4	Boat trip IV	14	Shooting facility
5	Boat trip V	15	Trekking II
6	Sportive fishing at Hamam lake	16	History and technology trip
7	Sportive fishing at Pedina lake	17	Wetland discovery activity
8	Bicycle tour I	18	Photo safari I
9	Horse riding tour	19	Photo safari II
10	Bird Watching around Mert Lake		

*While model applied by participants, explanation columns were explained concerning place, time, duration, ecotourism values, rules and jobs or outputs that may be produced by activity

Table 2. First criteria set used in the model.

No	Criterion
1	Impacts on wildlife shelters
2	Impacts on prolific characteristics of wildlife
3	Impacts on wildlife food resources
4	Impacts on wildlife behavior
5	Impacts on the awareness level of the local people on conservation targets
6	Impacts on water quality
7	Impacts on endemic plant societies
8	Impacts on the level of motor vehicles in the project site
9	Impacts on income generating level of the alternatives for project administration
10	Impacts on the demand level for local goods and products
11	Impacts on accommodation usage level of the alternatives
12	Impacts on the level of the equipment and tools hired by the alternatives
13	Impacts on employment level generated by alternative for local people
14	Impacts on the awareness level of the visitors about importance of the project site
15	Feasibility and suitability in the period outside June and August
16	Impacts on air quality
17	Impacts on noise level
18	Impacts on soil characteristics
19	Impacts on the transfer of any plant or material from project site to out site
20	Impacts on the budget level of the alternative to implement it
21	Impacts on solid wastes
22	Impacts on visual amenity
23	Impacts on the stimulation of local hand craft production
24	Impacts on the promotion and usage levels of local cultural values
25	Impacts on local archaeological values
26	Suitability for current land use pattern
27	Suitability for current infrastructure
28	Impacts on level for the new job or activity on local scale

alternative was rated with a value of 5, the worst alternative was rated with a value of 1 concerning the aim of the criterion. For example, if the aim of the criterion was to decrease the level of motor vehicle, the most suitable alternate was rated with 5 points. All of the alternatives were rated from 1 to 5 for all criteria. The average of each participant's evaluation tables according to the revised criteria set were used as a pre-evaluation matrix for the model as seen in Table 3.

As seen from the criteria set, some criteria have similarities with others. Furthermore, the evaluation matrix of the method was based on the participants' intuitions. In this stage, some participants might not distinguish the difference among some criteria. For that reason, a correlation control was conducted by using participants' rates for alternatives and criteria before application of the model. Table 4 includes only correlation coefficients bigger than 0.75. As seen in Table 4, some criteria such as (1, 2, 3, 4), (12, 13, 28), (21, 22), (20, 27) can be regarded as the same criteria. Using the letter Y, a new criterion was constituted by combining with similar criteria. For this reason, the first criteria set and their weights were revised as seen in Table 5 and the criteria set was numbered again.

Table 3. The average points of the participants for ecotourism alternatives according to revised criteria set (row: criteria, column: ecotourism activities).

No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Y1	4.1	3.4	5.0	4.6	4.5	4.0	4.0	4.4	3.8	4.6	4.1	4.5	4.5	4.0	3.8	4.6	4.2	4.1	3.7
5	4.0	4.0	3.8	4.2	4.4	2.6	2.6	3.4	4.2	3.6	3.8	3.2	3.6	2.2	4.0	3.6	4.4	3.6	3.6
6	4.8	4.6	4.8	4.8	4.8	4.8	4.8	5.0	5.0	5.0	4.8	5.0	4.8	4.6	5.0	5.0	4.0	5.0	5.0
7	3.6	3.2	5.0	5.0	3.2	4.0	4.2	4.4	3.8	5.0	4.0	4.8	5.0	4.8	3.4	4.6	4.0	3.6	4.0
8	3.8	3.8	4.8	4.8	4.4	3.6	3.8	4.6	4.6	4.6	4.6	4.6	3.6	3.6	3.4	4.4	4.4	3.4	4.2
9	2.8	2.6	2.0	2.0	2.8	3.4	3.4	3.0	3.0	3.4	2.4	2.0	1.8	2.2	2.8	2.0	2.0	2.8	2.6
10	3.0	2.8	3.0	3.0	3.0	2.4	2.4	3.2	3.2	3.6	2.8	2.6	3.6	2.6	2.4	2.4	2.2	2.2	2.2
11	4.2	4.4	4.2	4.2	4.4	3.4	3.4	3.2	4.0	3.8	3.4	3.6	3.4	2.2	3.4	3.2	2.4	3.8	3.4
Y2	4.0	4.1	3.9	4.0	4.1	2.3	2.4	3.1	4.1	2.5	2.3	2.7	3.5	3.2	2.7	2.5	2.2	2.6	2.5
14	3.6	3.6	3.0	3.2	3.8	2.6	2.6	2.8	3.4	3.8	3.4	2.4	2.8	2.2	4.2	2.8	3.8	4.0	4.0
15	3.2	3.2	2.8	3.0	2.6	3.0	3.0	3.0	3.8	4.4	3.6	3.2	3.6	4.4	3.2	3.6	3.6	3.4	2.4
16	4.6	4.6	4.8	4.8	4.8	4.8	4.8	5.0	5.0	5.0	5.0	5.0	4.4	4.6	4.6	5.0	5.0	4.8	5.0
Y3	4.4	4.3	4.7	4.7	4.4	4.5	4.5	4.4	4.4	4.7	4.5	4.6	4.5	2.8	4.5	4.7	4.3	4.6	4.6
18	4.2	4.0	5.0	5.0	4.0	4.4	4.4	4.6	3.8	4.8	4.2	4.4	4.4	3.8	4.0	4.4	4.0	4.2	4.4
19	3.8	3.8	5.0	5.0	3.8	4.2	4.2	4.0	4.0	5.0	3.8	4.6	4.6	4.8	3.8	4.6	4.2	4.2	4.2
Y4	2.9	2.8	3.0	3.0	2.7	3.9	3.9	3.8	2.6	3.3	4.3	3.9	4.4	2.2	3.8	3.5	4.1	4.0	4.3
Y5	4.4	4.3	4.7	4.7	4.4	3.8	4.0	4.5	4.5	4.4	4.6	4.4	4.4	3.8	4.2	4.5	4.4	4.4	4.5
23	2.2	2.0	2.2	2.2	2.2	2.0	2.0	2.4	2.6	2.8	2.6	2.2	2.8	1.8	2.2	2.4	2.2	2.2	2.2
24	2.2	2.0	2.2	2.0	2.2	1.6	1.6	2.8	3.4	2.2	2.0	2.6	3.4	2.4	2.4	3.4	2.2	2.6	2.2
25	2.4	2.4	2.4	2.2	2.4	2.8	2.2	3.0	3.4	2.4	2.4	2.4	3.0	2.4	2.2	3.2	2.4	2.2	2.4

However, the model needs another scaling operation before the solution to aggregate all of the criteria, which have different weights. In this stage, the criterion that has the biggest weight is used as a guide for scaling. In this study, criterion Y2, which has 8.7% of the total weights, was used as a beginning point of the scaling. Decision-makers regarded the lower and upper limits of the productivity degree of Y2 as 0 and 240. Productivity degree upper limits of other criteria (PC) were computed by using relation (1):

$$P_C = (240 / \text{biggest weight of the criteria}) \times \text{weight of the criterion}_C \quad (1)$$

The fifth column in Table 5 consists of the productivity degree upper and lower limits of each criterion. Table 6 was computed from Table 3 by using the productivity degrees in Table 5. While points in Table 3 contain a maximum of 5 values according to rating of the participants, Table 6 can consist of the points from 0 to 240. The evaluation matrix includes points transformed to the same weight by using the productivity degree of each criterion.

Results

The model needs computation of the concordance and discordance matrixes derived from Table 6 by comparing with each alternative to the others by using Microsoft Excel.

Table 4. Correlation coefficients.

Number of Criterion	2	3	4	12	13	17	20	21
1	0.89	0.85	0.81					
3	0.94							
7		0.75						
22								0.76
26						0.87		
27							0.88	
28				0.85	0.89			

Table 5. Criteria set, weight vector and productivity degrees of the model.

No	Criterion	Weight	%	Degree
Y1	Impacts on wildlife	3	6.52	0-180
5	Impacts on the awareness level of the local people on conservation targets	3	6.52	0-180
6	Impacts on water quality	2	4.35	0-120
7	Impacts on endemic plant societies	3	6.52	0-180
8	Impacts on the level of motor vehicles in the project site	3	6.52	0-180
9	Impacts on income generating level of the alternatives for project administration	2	4.35	0-120
10	Impacts on demand level for local goods and products	3	6.52	0-180
11	Impacts on accommodation usage level of the alternatives	3	6.52	0-180
Y2	Impacts on equipment usage and employment levels for alternatives in project site	4	8.7	0-240
14	Impacts on the awareness level of the visitors about importance of the project site	2	4.35	0-120
15	Feasibility and suitability in the period outside June and August	2	4.35	0-120
16	Impacts on air quality	1	2.17	0-60
Y3	Impacts on noise level and suitability for current land use pattern	2	4.35	0-120
18	Impacts on soil characteristics	2	4.35	0-120
19	Impacts on the transfer of any plant or material from project site to out site	2	4.35	0-120
Y4	Suitability for current infrastructure and budget level of the alternative to implement	3	6.52	0-180
Y5	Impacts on solid wastes and visual amenity	1	2.17	0-60
23	Impacts on the stimulation of local hand craft production	2	4.35	0-120
24	Impacts on promotion and usage levels of local cultural values	2	4.35	0-120
25	Impacts on local archaeological values	1	2.17	0-60
	Total	46	100	

Table 6. The evaluation matrix of the model (row: criteria, column: ecotourism activities).

No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Y1	137	106	180	160	158	135	135	153	126	162	140	155	158	133	126	160	144	140	122
5	135	135	126	144	153	72	72	108	144	117	126	99	117	54	135	117	153	117	117
6	114	108	114	114	114	114	114	120	120	120	114	120	114	108	120	120	90	120	120
7	117	99	180	180	99	135	144	153	126	180	135	171	180	171	108	162	135	117	135
8	126	126	171	171	153	117	126	162	162	162	162	162	117	117	108	153	153	108	144
9	54	48	30	30	54	72	72	60	60	72	42	30	24	36	54	30	30	54	48
10	90	81	90	90	90	63	63	99	99	117	81	72	117	72	63	63	54	54	54
11	144	153	144	144	153	108	108	99	135	126	108	117	108	54	108	99	63	126	108
Y2	180	184	176	180	184	80	84	124	184	88	76	100	148	132	104	92	72	96	88
14	78	78	60	66	84	48	48	54	72	84	72	42	54	36	96	54	84	90	90
15	66	66	54	60	48	60	60	60	84	102	78	66	78	102	66	78	78	72	42
16	54	54	57	57	57	57	57	60	60	60	60	60	51	54	54	60	60	57	60
Y3	102	99	111	111	102	105	105	102	102	111	105	108	105	54	105	111	99	108	108
18	96	90	120	120	90	102	102	108	84	114	96	102	102	84	90	102	90	96	102
19	84	84	120	120	84	96	96	90	90	120	84	108	108	114	84	108	96	96	96
Y4	86	81	90	90	77	131	131	126	72	104	149	131	153	54	126	113	140	135	149
Y5	51	50	56	56	51	42	45	53	53	51	54	51	51	42	48	53	51	51	53
23	36	30	36	36	36	30	30	42	48	54	48	36	54	24	36	42	36	36	36
24	36	30	36	30	36	18	18	54	72	36	30	48	72	42	42	72	36	48	36
25	21	21	21	18	21	27	18	30	36	21	21	21	30	21	18	33	21	18	21

Concordance Matrix

The concordance matrix consists of concordance indexes (C). If alternate A is bigger than or equal to alternate B (A>=B), it defines A concordance degree. C was computed by using relation (2).

C_{ab} = (sum of the weights of the criteria that fit the condition, A >= B) / sum of weights (2)

For example, the cell in the third row and second column of the concordance matrix in Table 7 was computed as C_{12} = (3+3+2+3+3+2+3+2+2+1+2+2+2+3+1+2+2+1) / 46 = 0.85. As seen, the weights of the criteria 11 and Y2 were excluded in the computation because of the condition (A>=B).

Discordance Matrix

The discordance matrix consists of discordance indexes (D). If alternate A is smaller than alternate B (A<B), it defines a disconcordance degree. D was computed by using relation 3.

D_{ab} = (maximum difference among the values of the alternates that suit the condition, A<B) / maximum scale (3)

For example, the cell in the third row and second column of the concordance matrix in Table 8 was computed as follows: D_{12} = (153-144) / 240 = 0.04. As seen from the evaluation matrix, criteria 11 and Y2 suit the condition A < B and criterion 11 has the maximum difference.

Effect Matrix

The model uses the effect matrix to reach a result. By using concordance, discordance matrixes and threshold values, the effect matrix is created. There are 2 threshold values, the concordance (p) and discordance threshold value (q). While p is selected as near as possible to 1, q is selected as near as possible to 0.

As seen from Table 9, the effect matrix consists of only 1 and 0 values. 1 and 0 values are results of a logical condition. When C_{ab} is bigger than or equal to p and D_{ab} is smaller than or equal to q, $Cell_{ab}$ in the effect matrix is 1. If the logical condition is not true, $Cell_{ab}$ in the effect matrix is 0. In Table 9, the cell in the third row and second column is 1 because of 0.85>p and 0.04<q.

A 1 value in Table 9 shows a superiority of an alternate over another. For example, a 1 value in the

Table 7. The concordance matrix of the model (row and column: ecotourism activities).

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	0	0.46	0.72	0.80	0.78	0.39	0.43	0.70	0.72	0.78	0.59	0.63	0.61	0.24	0.5	0.63	0.61	0.63	0.57
2	0.85	0	0.65	0.70	0.89	0.50	0.54	0.70	0.78	0.78	0.70	0.63	0.61	0.35	0.67	0.63	0.70	0.63	0.67
3	0.57	0.37	0	0.87	0.54	0.24	0.22	0.39	0.52	0.59	0.39	0.33	0.39	0.15	0.39	0.37	0.39	0.35	0.33
4	0.50	0.35	0.76	0	0.54	0.24	0.24	0.39	0.52	0.65	0.37	0.33	0.39	0.15	0.35	0.43	0.39	0.37	0.33
5	0.59	0.43	0.7	0.63	0	0.43	0.41	0.67	0.65	0.78	0.52	0.57	0.61	0.22	0.52	0.63	0.59	0.57	0.50
6	0.65	0.54	0.83	0.87	0.63	0	0.98	0.74	0.63	0.91	0.76	0.89	0.93	0.43	0.57	0.83	0.59	0.70	0.76
7	0.67	0.57	0.80	0.89	0.65	0.76	0	0.74	0.63	0.93	0.72	0.91	0.87	0.37	0.59	0.83	0.54	0.72	0.72
8	0.35	0.30	0.61	0.65	0.37	0.30	0.30	0	0.76	0.76	0.48	0.52	0.76	0.24	0.37	0.63	0.28	0.41	0.41
9	0.33	0.30	0.48	0.54	0.48	0.37	0.37	0.59	0	0.70	0.48	0.46	0.48	0.26	0.30	0.46	0.41	0.35	0.39
10	0.30	0.24	0.63	0.50	0.35	0.13	0.11	0.37	0.43	0	0.26	0.37	0.48	0.20	0.35	0.41	0.28	0.43	0.41
11	0.57	0.48	0.74	0.72	0.59	0.46	0.43	0.61	0.70	0.85	0	0.61	0.74	0.30	0.48	0.52	0.41	0.52	0.63
12	0.5	0.43	0.78	0.76	0.52	0.22	0.20	0.61	0.67	0.80	0.50	0	0.72	0.37	0.37	0.59	0.37	0.52	0.46
13	0.46	0.39	0.72	0.72	0.52	0.33	0.33	0.30	0.57	0.78	0.46	0.39	0	0.22	0.33	0.61	0.30	0.35	0.46
14	0.80	0.74	0.87	0.85	0.80	0.65	0.63	0.76	0.78	0.87	0.72	0.78	0.85	0	0.54	0.65	0.57	0.61	0.59
15	0.76	0.54	0.65	0.72	0.65	0.61	0.61	0.74	0.80	0.70	0.67	0.76	0.78	0.52	0	0.63	0.57	0.74	0.54
16	0.30	0.37	0.72	0.72	0.43	0.28	0.28	0.61	0.67	0.76	0.54	0.61	0.67	0.35	0.48	0	0.35	0.41	0.41
17	0.48	0.37	0.76	0.70	0.76	0.52	0.50	0.74	0.61	0.87	0.74	0.78	0.76	0.46	0.52	0.83	0	0.59	0.76
18	0.52	0.37	0.78	0.72	0.57	0.37	0.37	0.63	0.70	0.76	0.59	0.67	0.74	0.39	0.48	0.70	0.59	0	0.65
19	0.54	0.39	0.72	0.65	0.61	0.46	0.43	0.67	0.70	0.87	0.61	0.76	0.72	0.43	0.61	0.78	0.54	0.70	0

Table 8. Discordance matrix of the model (row and column: ecotourism activities).

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	0	0.13	0.10	0.10	0.08	0.42	0.40	0.23	0.06	0.38	0.43	0.33	0.15	0.38	0.32	0.37	0.45	0.35	0.38
2	0.04	0	0.08	0.08	0.08	0.43	0.42	0.25	0.08	0.40	0.45	0.35	0.19	0.41	0.33	0.38	0.47	0.37	0.40
3	0.26	0.34	0	0.08	0.34	0.40	0.38	0.22	0.23	0.37	0.42	0.32	0.23	0.38	0.30	0.35	0.43	0.33	0.37
4	0.26	0.34	0.08	0	0.34	0.42	0.40	0.23	0.23	0.38	0.43	0.33	0.23	0.38	0.32	0.37	0.45	0.35	0.38
5	0.11	0.22	0.11	0.10	0	0.43	0.42	0.25	0.13	0.40	0.45	0.35	0.19	0.41	0.33	0.38	0.47	0.37	0.40
6	0.19	0.15	0.18	0.18	0.23	0	0.04	0.05	0.24	0.11	0.13	0.18	0.2	0.32	0.11	0.18	0.19	0.08	0.10
7	0.19	0.21	0.18	0.18	0.23	0.04	0	0.05	0.24	0.11	0.13	0.18	0.2	0.32	0.15	0.18	0.19	0.11	0.10
8	0.17	0.23	0.15	0.15	0.23	0.19	0.17	0	0.23	0.15	0.2	0.13	0.19	0.23	0.23	0.15	0.22	0.23	0.19
9	0.15	0.18	0.15	0.18	0.15	0.43	0.42	0.25	0	0.4	0.45	0.35	0.19	0.38	0.33	0.38	0.47	0.37	0.40
10	0.26	0.34	0.20	0.18	0.34	0.23	0.23	0.18	0.23	0	0.19	0.19	0.2	0.30	0.30	0.23	0.26	0.26	0.26
11	0.26	0.28	0.24	0.24	0.3	0.23	0.23	0.09	0.32	0.19	0	0.13	0.19	0.39	0.23	0.15	0.19	0.23	0.15
12	0.23	0.21	0.17	0.17	0.3	0.19	0.15	0.08	0.24	0.11	0.15	0	0.19	0.32	0.26	0.08	0.23	0.23	0.15
13	0.28	0.34	0.26	0.26	0.34	0.28	0.27	0.11	0.34	0.25	0.3	0.19	0	0.41	0.3	0.23	0.32	0.26	0.26
14	0.23	0.30	0.20	0.18	0.3	0.22	0.2	0.18	0.19	0.18	0.23	0.15	0.1	0	0.26	0.1	0.25	0.23	0.25
15	0.17	0.19	0.15	0.15	0.21	0.26	0.26	0.18	0.23	0.09	0.12	0.23	0.13	0.34	0	0.18	0.19	0.08	0.10
16	0.19	0.26	0.15	0.18	0.26	0.23	0.23	0.08	0.17	0.15	0.18	0.1	0.15	0.26	0.23	0	0.15	0.19	0.16
17	0.23	0.24	0.21	0.21	0.26	0.34	0.34	0.19	0.28	0.15	0.11	0.23	0.15	0.41	0.19	0.15	0	0.19	0.15
18	0.21	0.23	0.19	0.19	0.24	0.19	0.19	0.15	0.26	0.13	0.08	0.2	0.15	0.34	0.08	0.15	0.26	0	0.13
19	0.26	0.28	0.24	0.24	0.3	0.19	0.19	0.15	0.32	0.19	0.08	0.2	0.15	0.39	0.15	0.15	0.19	0.15	0

Table 9. Effect matrix of the model (p = 0.6, q = 0.35, row and column: ecotourism activities).

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Total
1	0	0	1	1	1	0	0	1	1	0	0	1	1	0	0	0	0	1	0	8
2	1	0	1	1	1	0	0	1	1	0	0	1	1	0	1	0	0	0	0	9
3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
5	0	0	1	1	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	5
6	1	0	1	1	1	0	1	1	1	1	1	1	1	0	0	1	0	1	1	14
7	1	0	1	1	1	1	0	1	1	1	1	1	1	0	0	1	0	1	1	14
8	0	0	1	1	0	0	0	0	1	1	0	0	1	0	0	1	0	0	0	6
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
11	0	0	1	1	0	0	0	1	1	1	0	1	1	0	0	0	0	0	1	8
12	0	0	1	1	0	0	0	1	1	1	0	0	1	0	0	0	0	0	0	6
13	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	4
14	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	1	0	15
15	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	1	0	14
16	0	0	1	1	0	0	0	1	1	1	0	1	1	0	0	0	0	0	0	7
17	0	0	1	1	1	0	0	1	1	1	1	1	1	0	0	1	0	0	1	11
18	0	0	1	1	0	0	0	1	1	1	0	1	1	0	0	1	0	0	1	9
19	0	0	1	1	1	0	0	1	1	1	1	1	1	0	1	1	0	1	0	12

second column signifies that alternate 1 has superiority over alternate 2, 6, 7, 14 and 15. In the same way, number of the 1 value in a row can be used to determine the number of the superior alternatives from any alternative. For example, an 8 value in the total column of Table 9 means that there are 8 superior alternates from alternate 1. Alternate 9 that has a 0 total is the best alternate.

If threshold values (p, q) are changed, the effect matrix also changes. For that reason, different effect matrixes were computed by using different p and q threshold values. Table 10 was arranged from the results of different effect matrixes.

Discussion

Ecotourism activities in protected areas have ecological, economical and social impacts. A criteria set consisting of these impacts was offered by McIntryre (1993) for sustainable tourism planning. Some analysis deals with the results of ecotourism activities, or assessment models such as Limits of Acceptable Changes (LAC), Visitor Impact Management (VIM), Visitor Experience and Resource Protection (VERP), Visitor Activity Management Process (VAMP), Recreation Opportunity Spectrum (ROS) were used in ecotourism planning (Eagles et al., 2002). LAC is a specific system for measuring tourism impacts (Drumm and Moore, 2002). However, criteria sets and assessment models in the literature are not filling the gap in the decision process for ecotourism planning.

According to Eagles et al. (2002), it is important for protected area planners to develop incentive measures that will influence the decision-making process within society. However, while some decision models were used to choose between alternatives on the basis of environmental criteria for highway projects (Rogers and Bruen, 1998), this kind of model could not become widespread in ecotourism planning.

As seen from the GEF II experience in İğneada, the designed model based on ELECTRE is a suitable decision technique that can be used in the ecotourism activity selection problem. However, some points must be discussed before using this model. Firstly, the model needs alternates. The number of the alternates in ecotourism is very rich. While the number of alternates is not important for ELECTRE, definition of them is critical. The alternates must be defined clearly concerning their application time, place, rules and carrying capacity for evaluation. When the number of alternates increases, evaluation of them becomes harder. However, if the alternates are defined uncertainly, participants cannot evaluate them with regard to any criterion.

Secondly, the criteria used in the ELECTRE model and their weights can be discussed. In this study, 28 criteria were used at the beginning. However, this number was decreased to 20 because correlations were found among them. Correlation control was conducted by using only 5 observations in this model. The number of observations for correlation control may be increased. If the number of the criteria decreases, the solution and usage of the

Table 10. Groups of the best and worst alternatives for different threshold values.

(p, q)	Best Alternates			Worst Alternates		
	1	2	3	3	2	1
0.80-0.20	4, 5, 8, 9, 10, 13, 15, 16, 18	1, 3, 11, 12, 19	2, 17	14	7	6
0.75-0.25	5, 9, 10	3, 4, 11, 13, 16	1, 18	7	14	6
0.70-0.30	5, 9, 10	3, 4	2, 8,13, 16	17	6	7, 14
0.70-0.35	5, 9, 10	3, 4	2, 8,13, 16	19	6	7, 14
0.68-0.32	9, 10	3, 4, 5	8, 13, 16	15	17	6, 7, 14
0.65-0.35	9, 10	3, 4	5, 13	15	6	7, 14
0.60-0.35	9	3, 4, 10	13	19	6, 7,15	14
0.62-0.33	9	3, 4, 10	13	17	15	6, 7, 14

model will be made simpler. However, some impacts of the activities cannot be measured in the model. On the other hand, the weights of the criteria were determined by a participatory approach in this study. If participants change, the results may change also. Especially the stakeholders could do this stage with broader participation. The ELECTRE model can be resolved by using different weights to see the sensitivity of the model and solutions to test the effects of the weights used in the model solution. Alternate 14 was retained in the alternative set because of local demand, but it remained behind the others. Participants in the model solution and their preferences can also affect the alternate 14. If local hunters and amateur marksmen had participated in the solution, the ranking of the alternates would probably be different.

Thirdly, valuation of the criteria must be discussed. In this study, participants assigned values to the alternates for each criterion regarding the definitions of the alternates and their own experiences in the research area. The evaluation matrix is based on the feelings and estimations of the participants. On the other hand, the ELECTRE model could be designed by combining an assessment model such as LAC and VIM. In this way, while the computation and analysis burden of the model increase, subjectivity in the model decreases. Decision-makers may determine the valuation or computation of the criteria regarding expected benefits of the decision problem.

Conclusion

Results of the model used in this study show the priority of the alternates as seen in Table 10. As seen in the model results, alternate 9 (horse-riding tour) is relatively the best alternate concerning ecological, economical and social criteria. Although threshold values change, the rank of alternate 9 does not change and Group 1 always includes it. Alternate 10 (bird watching), alternate 3 (boat trip III) and alternate 4 (boat trip IV) follow alternate 9. On the other hand, alternates 14 (shooting facility), 6 (sportive fishing at Hamam Lake) and 7 (sportive fishing at Pedina Lake) are the worst alternates. Changing of the threshold values does not affect the rank of the alternates (6, 7, 14).

These results are consistent with the objectives in the GEF II project. Indeed, while horse-riding tour has superior economical and ecological characteristics, the worst alternates have some disadvantages. Furthermore, shooting, which may not be classified as an ecotourism activity, was also computed as the worst activity by the model. The manager of the GEF II project in İğneada must allocate their budget and other source to implement alternate 9 firstly. After that, alternate 10, 5 and 4 must be implemented by the project administration. On the other hand, planners in any protected area can resolve the model by changing alternates and the members or weights of the criteria set concerning new positions in time.

This research proved that ELECTRE is a suitable decision method for ecotourism planning. Managers responsible for determination of the ecotourism activities in any area can use the models based on ELECTRE methods to involve stakeholders and to manage the conflicts among them regarding some special points explained under discussion. Professionals responsible for the planning and management of the forests for ecotourism can easily use the models based on ELECTRE methods after a short training period.

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