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Full Length Research Paper

A comparative study on activity selection with multi-criteria decision-making techniques in ecotourism planning

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Ecotourism is a nature- and culture-based type of tourism. Ecotourists demand more environmentally aimed tourism experiences. Ecotourism practices should result in a non-consumptive use of natural and cultural resources. However, while ecotourism activities contribute to the visited area by generating economic benefits and educational opportunities, they may affect some resources negatively. For this reason, ecotourism must be managed by sustainability principles. Resource managers have to apply ecological, economic, social and cultural criteria when choosing their alternative ecotourism activities regarding sustainability. Inappropriate activities may damage cultural and natural elements of visited areas. To consider all dimensions of the ecotourism, planners should use multi-criteria decision-making techniques and participatory approaches to take into account social, economic and environmental dimensions of ecotourism. The techniques designed in this paper consider decision makers, the public, and sector experts' preferences in choosing alternative activities of ecotourism planning. They were evaluated using ELECTRE I (Elimination and Choice Expressing Reality), ELECTRE III and AHP (Analytic Hierarchy Process) techniques to address the same decision-making problems in the Cehennemdere Valley in the Mersin province. By using the AHP, ELECTRE I and III models, the preferences of stakeholders could be clarified, the ranks of the activities could be generated concerning multiple criteria, and the results of these techniques could be compared with respect to using them for sustainable ecotourism planning. This research demonstrates that the results of different decision techniques may differ when applied to the same problem.

Key words: Sustainable ecotourism planning, analytic hierarchy process, ELECTRE I, ELECTRE III, Cehennemdere Valley, multi-criteria decision making.

INTRODUCTION

Interest in ecotourism has grown vastly in societies throughout the world, and the number of individuals wanting to explore nature or culture is increasing. It is generally considered that ecotourism is a particular form of tourism that occurs in natural areas, is ecologically sustainable, enables tourists to interpret and learn about the environment, that they are visiting and improves the socio-economic condition of local communities (Sharpley, 2006). According to Blamey, an ecotourism experience is one in which an individual travels to what he/she considers to be a relatively undisturbed natural area that is more than 40 km from his/her home with the primary intention of studying, admiring or appreciating the scenery and wild plants and animals and existing cultural manifestations found in the area (Rahemtulla and Wellstead, 2001). Ecotourism has been identified as a form of sustainable tourism that is expected to contribute to both conservation and deve-lopment. It has a great number of benefits for societies and nature conservation.

It provides an incentive for governments to expand protected areas and for private landowners to conserve

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their land. Ecotourism generates new demands on local resources and employment of people where economic conditions are often depressed and high rates of under-employment are common. In general, the related benefits or incomes of local peoples from ecotourism are greater than the share of national tourism organisations. Ecotourism requires less development and less investment. Ecotourists tend to stay longer and to spend more per day than the typical tourist and to seek out local goods and services for consumption (Rahemtulla and Wellstead, 2001). In addition, ecotourists may discover new natural and cultural values, and their awareness of conservation increases.

Regions that have ecotourism attractions are usually fragile ecosystems with associated natural and cultural values. Planning approaches in these ecosystems that may be damaged permanently for ecotourism activities are more important than planning of other tourism activities. Unfortunately, due to inadequate environmental assessments and audits, many ecotourism destinations tend to be both hazardous and self-destructive for eco-tourism attractions (Tsaur et al., 2006).

Similar concerns are shared by institutional organisations in ecotourism. According to the Association of Turkish Travel Agencies, although ecotourism has environmentally friendly intentions, if it is not managed by strong decision-making models, it may negatively affect natural and cultural values in rare and fragile ecosystems (Yücel, 2010). Planning tourism at all levels is essential for achieving successful tourism development and management. The experience of many tourism areas in the world has demonstrated that, on a long-term basis, the planned approach to developing tourism can bring benefits without significant problems and maintain satisfied tourist markets (Inskeep, 1994). However, environmental, social and economic characteristics of ecotourism require models that can measure different aims of the planners.

On the other hand, some decisions in the planning process may cause conflicts among stakeholders related to ecotourism in a given area. For that reason, planners must take into account the social and economic impacts of the each decision alternative for local people and stakeholders in the planning process by using a participatory management approach. Thus, leaders of three ecotourism partnerships in the Amazon regions of Peru, Ecuador, and Bolivia joined in a comparative study in 2003. Local leaders discussed changes due to eco-tourism in their communities (Stronza and Gordillo, 2008). According to Rahemtulla and Wellstead (2001), the ecotourism phenomenon has attracted many parties: environmenta-lists, tour operators, small community planners, govern-ment and aid agencies, and tourists. The descriptions of the Amazon example in the literature demonstrate that, ecotourism planners have to accept the participatory approach to planning and management. Good planning depends upon the effective participation of all relevant stakeholders, such as protected area staff, community participants, tour operators, government agencies, specialists or scientists, and non-profit organisations (Drumm and Moore, 2002). In the present, planning process should include the participation requirements of ecotourism as an additional dimension, along with its economic, ecological and social effects. As seen from the factors described previously, ecotourism planning requires a multiple-criteria decision-making approach because of its multiple dimensions. While ecotourism values have ecological and cultural characteristics, ecotourism activities have economic, social and ecological results. In addition to social characteristics, ecotourism involves many stakeholders, increasing the dimensions of ecotourism planning and forcing the use of participatory and multi-criteria decision-making techniques.

When previous studies on ecotourism were evaluated, it was seen that most of them were descriptive studies and explanatory works on the concept or importance of ecotourism. Some studies focused on defining the capacities of specific sites for ecotourism. However, two studies (Yilmaz et al., 2004; Ok, 2006) using particular decision-making techniques at different sites for ranking ecotourism activities showed that, research can be done in such areas.

The studies prove that multi-criteria decision-making techniques may be used in ecotourism planning. However, the sensitivity of decision-making techniques and differences of the results obtained from different decision-making techniques have not previously been tested in an ecotourism area. The purpose of this study was to compare the results obtained from ELECTRE (ELimination Et Choix Traduisant la Realité - ELimination and Choice Expressing Reality) I, ELECTRE III and the AHP (Analytic Hierarchy Process) methods applied in the same site and using the same components of the models.

MATERIALS AND METHODS

Research area

The research area is the western part of the Cehennemdere Valley located in the Tarsus and Çamliyayla district of Mersin province in the Mediterranean region of Turkey (Figure 1). The town of Sebil, which is governed as a municipality, is the only settlement in the research area. Other related settlements are the villages of Körmenlik and Kisecik. Cehennemdere Valley has many natural ecotourism attractions, such as canyons, caves, mountains, fossil sites, rivers, waterfalls, forests and special stands, mammals, birds, and ecotourism activities that can be diversified by using cultural attractions such as historical places, ancient residuals, and the authentic lifestyles of local villagers. The authorities responsible for management of the valley tend to plan it regarding ecotourism capacity and protecting natural values. For that reason, Cehennemdere Valley was selected as a research area.

Materials

Our research team used two kinds of material during the research

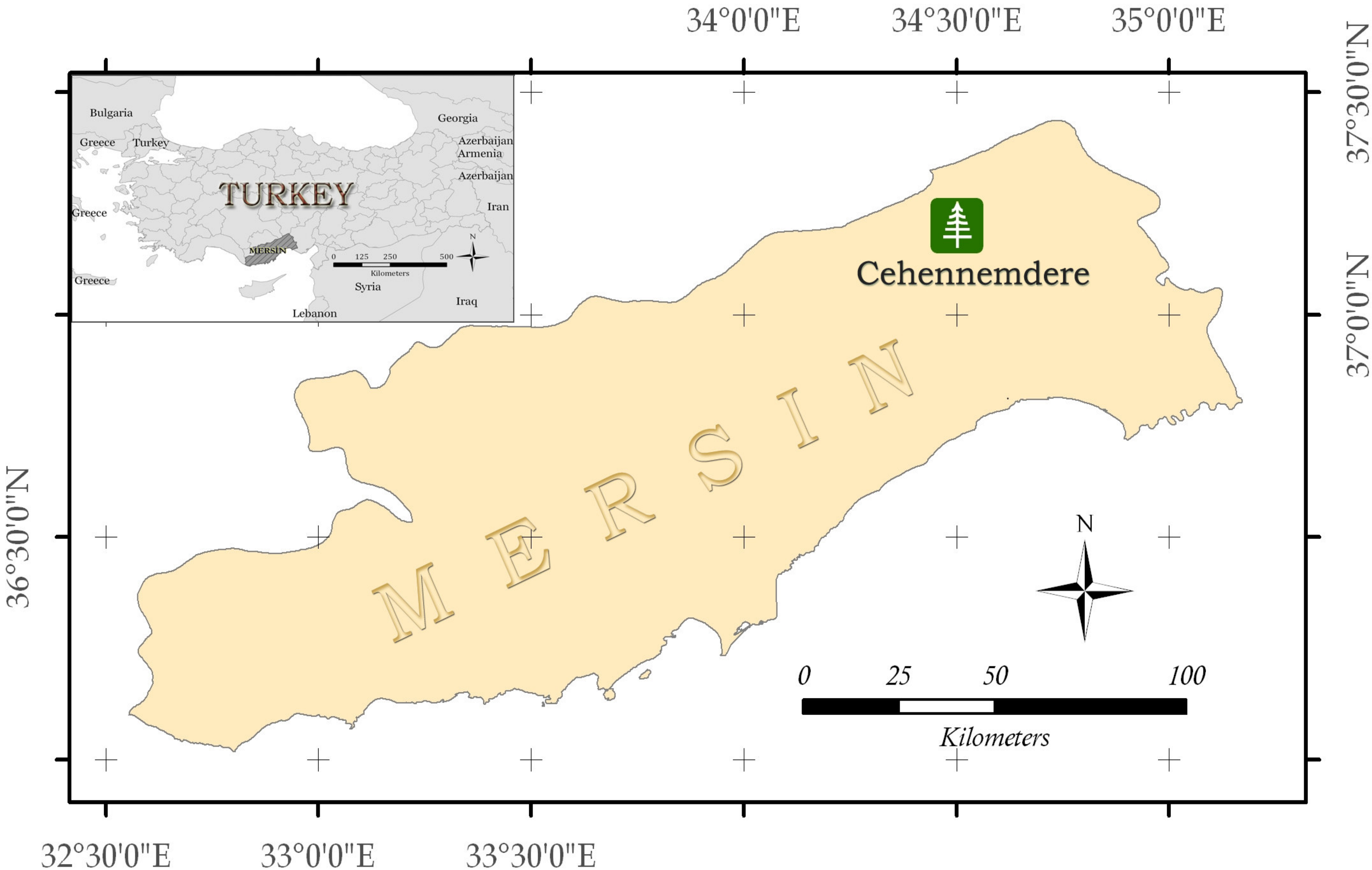

Figure 1. Location of the research area in Turkey.

activities. One of them was the ‘situation and value analysis form’ that was produced by the research team by investigating different forms designed for evaluation of areas for tourism purposes. A ‘situation and value analysis form’ for the Cehennemdere Valley was prepared and used by the research team in the initial steps of the ecotourism decision-making process to identify relevant values. The team benefited from other research and publications related to the Cehennemdere Valley. However, to obtain comprehensive knowledge about the Cehennemdere Valley and its ecotourism situation and to allow the participation of local stakeholders in the initial steps of the planning process, the team collected data on ecotourism attractions and constraints in the Cehennemdere Valley by negotiating with chiefs of the forestry districts, national park, forestation, forest guards, forest workers, hunters, shepherds, museum director in the Tarsus district, research engineers of the research institute at Tarsus and visitors in the Cehennemdere Valley. The results of the negotiations may be accepted as an inventory on ecotourism in the Cehennemdere Valley.

Secondly, the team prepared the forms needed for comparisons in the application of the AHP method. To this end, the ‘decision makers and stakeholders comparison form’ and ‘experts valuation forms for decision alternatives’ were prepared, reproduced and used in the AHP application. Similar forms were produced by the team to collect data for the ELECTRE I and III models. Forest management plans, maps, and research reports about the Cehennemdere Valley were also used by the research team.

Methods

Natural resources have multiple uses and purposes. Decision makers have not only economic objectives but also those of amenity and non-market values of recreation and nature conservation. Generally, economic, ecological and socio-cultural sustainability are required. The multi-functionality of natural resources requires multi-objective natural resources management planning and decision support systems. In addition, there is more and more often a need to take into account the aims of multiple decision makers or participants in natural resources decision making. This need, in turn, calls for group decision support and participatory planning (Kangas et al., 2001). Ecotourism planning may also be part of natural resource management. For that reason, in this study, the AHP, ELECTRE I and III methods were used to determine the ranks of these activities to determine their priority and to compare the results of different decision models. The AHP, ELECTRE I and III methods were selected in the study because of their suitability for choosing the multi criteria decision making problems with same data together with their common usage.

The analytic hierarchy process (AHP)

The AHP technique developed by Saaty (1980), is a commonly used multi-criteria decision-making method with many capabilities, and it is used in different scientific disciplines. The AHP’s capabilities include participatory decision making, problem structuring and alternative development, group facilitation, consensus building, fairness, qualitative and quantitative information, conflict resolution, decision support, and preference structuring (Schmoldt, 2001). The popularity of the AHP is due to its capabilities, simplicity, flexibility, and ease of use and interpretation in analysing complex decision problems. The first step in the AHP is to define the problem and determine the objective. Then, a decision model is constructed with a goal at the top of the hierarchy, one to several layers of criteria that are considered in the decision in the middle of the hierarchy, and the alternatives at the bottom of the hierarchy. Once a hierarchical decision model is developed, pair-wise comparisons are made at each level in the hierarchy.

Finally, the relative weights of the components of each level were estimated, and the consistency index and ratio were computed. A sensitivity analysis can also be performed at each level in the hierarchy. The AHP provides a means to elicit priorities when many other options fail. Saaty outlines six distinct benefits of the AHP in setting priorities (Saaty, 1980):

1. It is a systematic methodology that can force stakeholders to make regular judgments by tracking the logical consistency of the judgments used in determining priorities.
2. It will lead to an overall estimate of the desirability of each alternative by enabling people to select the best alternative based on their goals by taking into consideration the relative priorities of factors in a system.
3. With the capability of combining group references, the AHP does not insist on consensus but synthesises a representative outcome from diverse judgments.
4. By repeating the comparison process, the AHP enables people to refine their definition of a problem and to improve their judgment and understanding through reiteration.
5. The AHP can handle complex problems by integrating deductive and systems approaches in solving multifaceted problems.
6. By employing a hierarchical structure, the AHP reflects the natural tendency of the mind to sort elements of a system into different levels and to group like elements in each level.

ELECTRE I and ELECTRE III

The ELECTRE methods were originally developed by Roy (1968). Several versions of the ELECTRE method have been presented for different situations: ELECTRE I was the first decision aid method using the concept of outranking relation. ELECTRE I and ELECTRE IS are designed for selection problems. ELECTRE TRI was developed for sorting problems. ELECTRE II, III and IV are improved for ranking problems (Roy, 1991). In this study, ELECTRE I and ELECTRE III were used.

ELECTRE I: The method does not have a significant practical interest because of the very nature of real world applications, which usually have a vast spectrum of quantitative and qualitative elementary consequences, that lead to the construction of a contradictory and very heterogeneous set of criteria that are associated with both numerical and ordinal scales. In addition, a certain degree of imprecision, uncertainty or ill-determination is always attached to the knowledge collected from real world problems. The method is very simple, and it should be applied only when all the criteria have been coded in numerical scales with identical ranges. In such a situation, we can assert that an action “a outranks b (that is, ‘a at least as good as b’) denoted by *a* S *b* only when two conditions hold (Figueira et al., 2005). References in ELECTRE methods are modelled by using binary out-ranking relations, S, whose meaning is “at least as good as” considering two actions a and b.

ELECTRE III: The ELECTRE III method starts with a pair-wise comparison of each action to the remaining ones with the aim of accepting, rejecting, or more generally, assessing the credibility of the assertion that “action *a* is at least as good as action *b*”, usually stated as “*a* outranks *b*” (denoted *a S b*), taking into account the following three steps in the process aspects (Dias et al., 2006):

1. The indifference and preference thresholds defined for each criterion.
2. The degree or coefficients of importance attached to each criterion.
3. The possible difficulties of the relative comparison of two actions when one is significantly better than the other in a subset of criteria, but much worse in at least one criterion from a complementary

subset.

For each criterion, two indices should be calculated. One expresses to what measure the performances of the actions *a* and *b* are in concordance with the assertion "*a* outranks *b*"; the other indicates to what measure they oppose this assertion. For this, the partial concordance indices are aggregated while taking into account the relative importance of the criteria to give birth to the comprehensive concordance indices (it should be noted that, the partial discordance indices are not aggregated). The fuzzy outranking relations, defined for each pair of actions (*a*, *b*) as a credibility index, s (*a*, *b*), comprehensively express in what measure "*a* outranks *b*" using both the comprehensive concordance index and the discordance indices for each criterion *gj*. By applying the ranking algorithm and using the distillation threshold, the final results provide a partial pre-order (Dias et al., 2006). Solutions of the models designed for AHP and ELECTRE I were applied manually by the researchers following the processes explained in Yilmaz et al. (2004) and Ok (2006), while the ELECTRE III models were calculated using a computer program produced by LAMSADE[1] for ELECTRE III to IV.

Alternatives, criteria set of the models and scenarios evaluated

Basic components of the multi-criteria decision models consist of alternative and criteria sets. To understand the models evaluated in this research, these sets are presented as follows. The alternative set of the AHP and ELECTRE models includes seven ecotourism activities, as shown in Table 1. Alternatives were determined regarding the capacity and ecotourism values of the research area. Although descriptions of the activities were omitted in Table 1, all alternatives were defined in the research concerning their ecological, economic and social effects. For that purpose, descriptions contained explanations on the place, time, rules, requirements, etc. of the activities for implementation. The criteria used for the models are shown in Table 2. As shown in Table 2, the criteria set consists of economic (income, infrastructure, employment), ecological (wildlife, vegetation) and social (demand, culture) dimensions of ecotourism. In descriptions of each criterion, expected situations were explained for the evaluation of alternatives to participants in the research.

By using the same criteria set and alternatives, different scenarios may be derived by decision makers in ecotourism; for example, whether participation of stakeholders in the decision process is possible or not. By changing participation levels for stakeholders, different decision models or problems may be generated. In this study, 16 different scenarios were arranged by changing the participants involved with respect to definitions of the weights of the criteria set. Indeed, each scenario should be accepted as a different problem or case. For that reason, in our research, only one ecotourism problem was not tested using different techniques, and our findings are based on 16 different cases. Representatives of forest villagers (presidents of the cooperatives, mukhtars), local administrators (district governors, administrators of forestry organisations), experts in research institutes, tour operators, tourists, and non-governmental organisations related to the environment and culture were the stakeholders and participants of the decision models.

RESULTS

While the AHP technique computes the weights of each criterion in the set, the participants appraised them in ELECTRE techniques. In the AHP technique, the participants compared each criterion with others, by using a form designed by the researchers, and then the weights of the each criterion in the set were computed by using the data in the forms. Additionally, to appraise weights in ELECTRE models, the participants created a value for each criterion on a scale of 1 to 4 concerning the ecotourism objectives of the decision problem. The most important criterion was designated as 4. At this stage, every participant independently assigned values to the weights of the each criterion in the set. The computed or appraised weights of scenarios I and 6 are shown in Table 3 for these techniques.

Another difference between the AHP and ELECTRE techniques is in comparisons of the alternatives. In the AHP technique, pair-wise compare-sons are also made at alternative levels in the hierarchy. In this step, another form was designed for use in the research, and priorities of the alternatives were computed by using its data. However, ELECTRE models require valuation of the participants for each alternative regarding the relation with each criterion. In this study, each participant separately evaluated every alternative concerning the same criterion using a scale of 1 to 5. While the best alternative was rated with a value of 5, the worst alternative was rated with a value of 1 concerning the goal of the criterion. The average points of the participants' evaluation are shown in Table 4. When the weights of the criteria set and performance values of the alternatives for each criterion are determined, models are ready for solutions.

As seen in Table 5, the best ecotourism alternative for the research area in all scenarios is alternative 1 (bird watching) for the AHP solutions, except for in scenarios 4 and 5. In scenarios 4 and 5, alternative 7 (wildlife observation) is ranked as the best activity. The same result was obtained for ELECTRE I models. According to ELECTRE I solutions, alternative 1 is the best ecotourism activity, except for in scenario 4. In the fourth scenario, the seventh alternative has the same rank as alternative 1. The results of the ELECTRE III solutions prove that, the first and seventh alternatives are the best alternatives for the research area. ELECTRE III could not separate the priority between alternatives 1 and 7. Similar grouping situations are generally observed in the solutions of ELECTRE III.

The *p* and *q* values are used in ELECTRE models and called preference and indifference thresholds, respectively. A veto threshold was not used in the solutions. These are important factors for solutions. To analyse the sensitivity of the results to the threshold values, all of the models were resolved by using different values. Table 6 shows the results of the sensitivity analysis for different (p= 0.7 q= 0.3) threshold values. When Tables 5 and 6 are compared concerning the ranks of the alternatives, a difference between the results of scenarios 5 and 6 can be seen. While ELECTRE III produces

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Table 1. Ecotourism alternatives evaluated in the models.

Number	Ecotourism activities (alternatives)	Brief descriptions
1	Bird watching	To watch eagle, hawk and partridge on the Bastepe hills between May and November
2	Trekking for discovering of flora	Trekking for discovering of the species consist of pin, cedar, yew etc. on the rout from Beytahti meadow to Cehennemdere bridge between May and September
3	Trekking in nature for sportive purposes	Trekking for sportive purposes on the rout from Sucati water course to falls of Depel hills between May and August together with a guide
4	Collection of non-wood forest products for recreational purposes	Collection of non-wood forest products such as mushrooms, thymes, sumac, etc. in the regions of Saydibi, Bogurtlenlik, Payam, Manastır between April and September together with a guide
5	Trekking for discovering of nature	Trekking for discovering of the natural and historical values in the regions of Saydibi, Cavşırsırtı, Candarbaşı Castle between May and August together with a guide
6	Bicycle tour	To bike on the route from Sebil, Böğütlenlik, Cehennemdere bridge to Gözne between April and October
7	Wildlife observation	To watch chamois, lynx, wild boar, badger in observation points of Dogma, Böğürtlenlik, Küre, Manastır between May and December together with a guide

Table 2. Criteria used in the models.

Number	Criterion	Description
1	Wildlife	Activity must not disturb wildlife, destroy habitats, or affect population dynamics or distribution of species
2	Vegetation	Activity must not change vegetation pattern in the area or cause it to decrease in intensity
3	Income	Activity must generate income directly or indirectly for local people and local administrations responsible for area
4	Infrastructure	Feasibility of using current infrastructure for each activity
5	Employment	Employment capacity of the activity for local people directly or indirectly
6	Demand	Demand level at present and in the future of local stakeholders for the activity
7	Culture	Effects of the activities on local cultural values and encouragement level of the activities for protection of local culture

the same result, the order of the ELECTRE I solutions is changed. In the fifth scenario, the fourth alternative (Collection of non-wood forest products for recreational purposes) is evaluated as the best alternative, together with alternatives 1 and 7. New threshold values cause grouping in the scenario. A similar grouping may be seen in scenario 6 for the ELECTRE I technique.

DISCUSSION

A comparison of several decision techniques in different fields was made by Salminen et al. (1998).

Table 3. Examples of the weights of criteria set in different scenarios for different decision techniques.

Criterion	Scenario I			Scenario 6		
	AHP	ELECTRE I	ELECTRE III	AHP	ELECTRE I	ELECTRE III
Wildlife	0.196	3.3	3.3	0.175	2	2
Vegetation	0.226	3.2	3.2	0.144	2	2
Income	0.124	2.6	2.6	0.144	3	3
Infrastructure	0.106	2.4	2.4	0.129	3	3
Employment	0.141	2.9	2.9	0.144	4	4
Demand	0.085	2.2	2.2	0.144	2	2
Culture	0.122	3.5	3.5	0.120	4	4

Table 4. Performance values of the ELECTRE models.

Criteria set	Alternatives						
	Bird watching	Discovering flora	Sportive trekking	Non-wood products	Discovering nature	Bicycle tour	Wildlife observation
Wildlife	4.6	3.1	3.4	2.5	3.1	4.3	4.1
Vegetation	4.6	3.8	3.3	2.4	3.6	4.3	4.3
Income	3.6	3.6	3.8	4.1	3.8	2.6	4.0
Infrastructure	4.5	4.1	3.5	3.5	3.6	3.5	4.0
Employment	3.6	3.8	3.9	3.9	4.0	3.1	4.5
Demand	4.3	3.5	2.9	3.6	3.3	3.0	4.1
Culture	4.0	3.4	3.3	3.6	3.9	3.1	3.8

In their study, ELECTRE III, PROMETHEE I, II, and SMART decision techniques were used to solve four real problems in environmental decisions in Finland. According to their findings, the best alternatives obtained with these methods may differ greatly. In this study, it was observed that methods may generate different ranks for the alternatives, similar to the results of Salminen et al. (1998). However, differences among the results of the decision techniques were not great with respect to the first ranks of the scenarios tested, but if second or other ranks are also investigated, differences may increase. This paper presents a case study that applied and compared the ELECTRE and the AHP techniques, taking decision makers, forest researchers (sector experts), stakeholders and public preferences into account, in choosing the alternative activities in ecotourism planning for a forest area in Mersin, Turkey. By using these techniques, different concerned parties' preferences were clarified. Alternative ecotourism activities of the study area were evaluated with respect to judgements made by different concerned parties.

As a result, with the help of these techniques, the optimum ecotourism activities were determined by having all the concerned parties participate, and conflict management was carried out. This study shows that ELECTRE and AHP allow decision makers to handle selection problems in a quantitative way, providing them with greater validity and less subjectivity in the analysis and choice of alternative activities in ecotourism planning. Additionally, these techniques are applicable to different concerned groups' participation in selection problems of alternative activities in ecotourism planning in which the optimum decision alternative is selected. As shown in this paper, ELECTRE and the AHP have great utility for solving complex problems in natural resource management. These techniques are powerful and flexible decision-making process tools to help decision makers set priorities and make the best decision when both qualitative and quantitative aspects of a decision need to be considered. Multi-criteria decision-making techniques, such as ELECTRE and AHP, are useful as instruments to make rational decisions in natural resource management.

Conclusion

Comparison of different decision techniques may be made regarding different aspects of the models. The findings of the research presented here were explained by focusing on the differences and structures of the results obtained from each decision technique and the suitability of the techniques in the ecotourism decision area. The results in Tables 5 and 6 show that, different decision techniques may produce different ranks of alternatives. In general, decision makers test their results by changing the weights of the criteria or other

Table 5. Solutions of the scenarios evaluated in the AHP, ELECTRE I and III models (p= 0.6, q= 0.4).

Scenario number	Decision techniques	Ranks of the alternatives in solutions						
		1	**2**	**3**	**4**	**5**	**6**	**7**
1	AHP	1	7	6	5	3	2	4
	ELECTRE I	1	7	4, 5	2	3	6	
	ELECTRE III	1, 7	2, 5	3, 6	4			
2	AHP	1	7	6	5	3	2	4
	ELECTRE I	1	7	4, 5	2	3	6	
	ELECTRE III	1, 7	2, 5	3, 6	4			
3	AHP	1	7	6	2	3, 5	4	
	ELECTRE I	1	7	2, 4, 5	6	3		
	ELECTRE III	1, 7	2	5	6	3, 4		
4	AHP	7	3	5	4	1	2	6
	ELECTRE I	1, 7	5	3, 4	2	6		
	ELECTRE III	1, 7	2, 5	3, 6	4			
5	AHP	7	1	5	3	4	6	2
	ELECTRE I	1	7	4, 5	2, 3	6		
	ELECTRE III	1, 7	2, 5	3, 6	4			
6	AHP	1	7	5	3	4	2, 6	
	ELECTRE I	1	7	5	2, 4	3	6	
	ELECTRE III	1, 7	2	5	4, 6	3		
7	AHP	1	7	6	5	2, 3	4	
	ELECTRE I	1	7	2, 4, 5	6	3		
	ELECTRE III	1, 7	2, 5	6	3	4		
8	AHP	1	7	6	2	3	5	4
	ELECTRE I	1	7	2, 6	4, 5	3		
	ELECTRE III	1, 7	2, 5	6	3	4		
9	AHP	1	7	5	4	3	2, 6	
	ELECTRE I	1	7	2, 4	5	6	3	
	ELECTRE III	1, 7	2, 5	6	3, 4			
10	AHP	1	7	5	6	3	2, 4	
	ELECTRE I	1	7	4, 5	2	3	6	
	ELECTRE III	1, 7	2, 5	3, 6	4			
11	AHP	1	7	6	5	3	2	4
	ELECTRE I	1	7	5	2, 4	3	6	
	ELECTRE III	1, 7	2, 5	3, 6	4			
12	AHP	1	7	6	5	3	2	4
	ELECTRE I	1	7	5	2, 4	3	6	
	ELECTRE III	1, 7	2, 5	3, 6	4			
13	AHP	1	7	6	5	3	2	4
	ELECTRE I	1	7	4, 5	2	3	6	

Table 5. Contnd

	ELECTRE III	1, 7	2, 5	3, 6	4			
	AHP	1	7	6	5	3	2	4
14	ELECTRE I	1	7	4, 5	2	3	6	
	ELECTRE III	1, 7	2, 5	3, 6	4			
	AHP	1	7	5	3	6	4	2
15	ELECTRE I	1	7	4, 5	2	3	6	
	ELECTRE III	1, 7	2, 5	3, 6	4			
	AHP	1	7	6	5	3	2	4
16	ELECTRE I	1	7	4, 5	2	3	6	
	ELECTRE III	1, 7	2, 5	3, 6	4			

Table 6. Solutions of the scenarios evaluated in the AHP, ELECTRE I and III models (p= 0.7, q= 0.3).

Scenario number	Decision techniques	Ranks of the alternatives in solutions						
		1	**2**	**3**	**4**	**5**	**6**	**7**
	AHP	1	7	6	5	3	2	4
1	ELECTRE I	1	4, 7	2, 5, 6	3			
	ELECTRE III	1, 7	2, 5	3, 6	4			
	AHP	1	7	6	5	3	2	4
2	ELECTRE I	1	4, 7	2, 5, 6	3			
	ELECTRE III	1, 7	2, 5	3, 6	4			
	AHP	1	7	6	2	3, 5	4	
3	ELECTRE I	1	4, 7	2, 5	3	6		
	ELECTRE III	1, 7	2, 5	6	3, 4			
	AHP	7	3	5	4	1	2	6
4	ELECTRE I	1, 7	4, 5	2, 3	6			
	ELECTRE III	1, 7	2,	5	3, 6	4		
	AHP	7	1	5	3	4	6	2
5	ELECTRE I	1, 4, 7	5	2, 3, 6				
	ELECTRE III	1, 7	2	5	3, 6	4		
	AHP	1	7	5	3	4	2, 6	
6	ELECTRE I	1, 7	4, 5	2	3	6		
	ELECTRE III	1, 7	2	5	4, 6	3		
	AHP	1	7	6	5	2, 3	4	
7	ELECTRE I	1	4, 7	2, 5, 6	3			
	ELECTRE III	1, 7	2, 5	6	3	4		
	AHP	1	7	6	2	3	5	4
8	ELECTRE I	1	4, 7	2, 5, 6	3			
	ELECTRE III	1, 7	2, 5	6	3	4		

Table 6. Contnd.

	AHP	1	7	5	4	3	2, 6	
9	ELECTRE I	1	4, 7	2, 5, 6	3			
	ELECTRE III	1, 7	2	5	3, 6	4		
	AHP	1	7	5	6	3	2, 4	
10	ELECTRE I	1	4, 7	2, 5, 6	3			
	ELECTRE III	1, 7	2, 5	3, 6	4			
	AHP	1	7	6	5	3	2	4
11	ELECTRE I	1	4, 7	2, 5, 6	3			
	ELECTRE III	1, 7	2, 5	3, 6	4			
	AHP	1	7	6	5	3	2	4
12	ELECTRE I	1	4, 7	2, 5, 6	3			
	ELECTRE III	1, 7	2, 5	3, 6	4			
	AHP	1	7	6	5	3	2	4
13	ELECTRE I	1	4, 7	2, 5, 6	3			
	ELECTRE III	1, 7	2, 5	3, 6	4			
	AHP	1	7	6	5	3	2	4
14	ELECTRE I	1	4, 7	2, 5, 6	3			
	ELECTRE III	1, 7	2, 5	3, 6	4			
	AHP	1	7	5	3	6	4	2
15	ELECTRE I	1	4, 7	2, 5	3	6		
	ELECTRE III	1, 7	2, 5	3, 6	4			
	AHP	1	7	6	5	3	2	4
16	ELECTRE I	1	4, 7	2, 5, 6	3			
	ELECTRE III	1, 7	2, 5	3, 6	4			

components of the model, which is known as sensitivity analysis. The computational burden of the decision techniques has been decreased by using computer programs in the information age. The findings of this study show that, sensitivity analysis using different decision techniques may be better than the resolution of the same technique. For this reason, if a fragile or rare ecosystem will be used for ecotourism, a multiple-aim decision-making technique must be employed, but its results have to be tested by another technique. The costs of model development and solutions will never be larger than the costs of losing natural and cultural values.

The structures of the results shown in Tables 5 and 6 are also different. While AHP produces ranks for alternatives successfully, the ELECTRE models generated several groups for the alternatives. In particular, ELECTRE III could not separate priorities among alternatives under the situations designated in the scenarios. By changing the threshold values in the ELECTRE models, groups in the ranks may be separated, and the difference among alternatives may be defined. However, if this is not possible and a restricted rank for alternatives is demanded, decision makers should prefer AHP techniques regarding the number of alternatives and criteria.

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