ISSN 0104-7760
v.24 n.1 2018

CERNE

Ersin Güngör[1+], Gokhan Sen[2]

SELECTING SUITABLE FOREST AREAS FOR HONEY PRODUCTION USING THE AHP: A CASE STUDY IN TURKEY

GÜNGÖR, E.; SEN, G. Selecting suitable forest areas for honey production using the ahp: a case study in Turkey. **CERNE**, v. 24, n. 1, p. 67-79, 2018.

HIGHLIGHTS

Assesed criteria and subcriteria were determined by the participant approach.

Ranking-AHP methods were used to define the most suitable forest are for honey produse.

The most priority socio-cultural sub-criteria is the contribution to employment.

Among the economic sub-criteria, the priority is cost of honey production.

Honey-producing plants stand out in the sub-criteria of ecological–environmental.

Keywords:
Food safety
Participation
Rural development
Sustainable forest management
Decisions making
Turkey

ABSTRACT

Honey production forests (HPFs) are crucial forest areas for the preservation and transfer of biodiversity for future generations, provision of sustainable food safety, supporting rural development, and the rehabilitation of barren forests so that society can benefit from them. The purpose of this study is to prepare a model for conducting planning and prioritizing for HPF areas. For this purpose, using a multidimensional decision support model, we determined the most suitable three areas by way of prioritizing potential HPF areas identified. Bartın in Turkey which was chosen as the area of study, in line with the criteria (ecological–environmental, economic, and socio-cultural) set out using the participatory approach. The ranking and analytic hierarchy process (AHP) methods were employed. The results of the study indicate that public institutions and non-governmental organizations (NGOs) prioritize ecological–environmental criteria (especially the type of honey) in their identification of HPFs, whereas the locals care more about the economic criteria, especially the potential for honey production, when identifying HPFs. Moreover, the fact that the level of demand is at the top among the economy-based sub-criteria indicates that the demands and expectations of interest groups should definitely be taken into consideration in the functional provision of forest resources. If HPF areas are planned and established by paying attention to the priorities, HPFs would contribute to an increase in added value and social welfare in the local area as well as to employment, rural development, and the sustainable management of forest resources.

Historic:
Received 29/01/2018
Accepted 02/04/2018

+Correspondence:
egungor@bartın.edu.tr

DOI:
10.1590/01047760201824012511

[1] Bartın University - Turkey
[2] Kastamonu University - Turkey

INTRODUCTION

Rapid population growth around the world and rapid industrialization generate a heavy pressure on natural resources and forests are severely affected by this adversity (GDF, 2017a). In fact, forests, which cover 31% of the land around the world (FAO, 2017), are the life insurance of the world against decreasing natural living spaces and the effects of global climate change. Moreover, it is not possible to argue that there is an effective understanding of nature protection in most parts of the world (WWF, 2017).

Planned management of forests is not at a satisfactory level around the world yet. There is a need for understanding a management plan, which focuses on versatile utilization, different economic activities, demand and socio-economic utilization, and caring for the needs of people and prioritizes intervention in nature in line with the principle of sustainability (Geray, 1989; GDF, 2017a; FAO, 2017). There are examples of management plans that integrate non-wood forest products and services and are planned and implemented holistically in various countries, mainly in the developed European countries and U.S.A (Leuschner, 1992; Armah, 2011).

In this context, honey production is one of the most important non-wood forest products and services. Forests, where honey is produced, make it possible to protect biodiversity for future generations, to provide sustainable food safety, to support rural development and to rehabilitate barren forests so that society can benefit from them (MFW, 2017). Moreover, while providing a low-cost investment environment for beekeeping activities, honey production forests (HPFs) offer the opportunity to produce high income with their labor input and thus, creating employment. Therefore, they are an important source of income for forest villagers (Gungor; Ayhan, 2016).

Honey is an important resource in worldwide commercial activities. In addition to honey, honey products such as propolis, royal jelly, pollen, and wax, are items traded around the world as well. Today, there are around 59 million beehives in the world, and 1 million 250 thousand tons of honey is being produced. India is the country with the highest number of beehives (12 million beehives). On the other hand, China, which owns 9 million beehives, is the top honey producer (466 thousand tons). In honey production, China is followed by Turkey (95 thousand tons), Ukraine (74 thousand tons), and the Russian Federation (68 thousand tons) respectively (FAO, 2017). As it can be understood from the above statistics, Turkey is the second most important honey producer in the world.

In the world, the average honey production per beehive is 22 kg. The following countries' honey production is more than the global average: Canada (56 kg/beehive), China (52 kg/beehive), Mexico (39 kg/beehive), Argentina (27 kg/beehive), and USA (26 kg/beehive). Turkey is considerably below the global average with a production value of 15 kg/beehive (12th). This is not consistent with the number of beehives and with the amount of honey production in Turkey. India has the lowest value with 4 kg/beehive (FAO, 2017).

Turkey possesses a natural richness in the sense that it hosts 75% of the honey-producing types and species of plants in the world (MFW, 2017). On the other hand, Turkey has a significant genetic diversity of bees. The conducted studies determined five separate bee races in Turkey: Apis mellifera anotoliaca, A.m. caucasica, A.m. carnica, A.m. syriaca, and A .m. meda. This kind of diversity is rare even in countries with high honey productivity. Despite all these, honey productivity per beehive is lower than the global average; therefore, Turkey is not a big actor in the world honey trade yet (OTE, 2017).

Beekeeping in Turkey is a socio-economic activity that has been going on since ancient times. Beekeeping is carried out in all regions of Turkey (TAB, 2012). Beekeeping is an important source of income in countries with a high rural population like Turkey (MFW, 2017). Production of honey traded in Turkey is annually 70 thousand tons and its market value is around $300 million (UTE, 2017). Therefore, honey production is of important economic value for Turkey. Considering the fact that 35% of Turkey's population live in rural areas (Tuik, 2015), it is easier to understand how important honey production in forests is for rural development. On the other hand, Turkey is behind many countries when it comes to honey productivity (FAO, 2017). The main reason for that is unplanned production. More than 100,000 families in Turkey own a bee colony. Only 10% of those families earn their living only from beekeeping, and 30% of families use it as an additional source of income. A large majority of the remaining families practice beekeeping as a hobby (MFW, 2017; Tuik, 2017). Beekeeping in Turkey is estimated to be carried out with more than 4 million colonies at 150 thousand agricultural businesses. Approximately 95 thousand tons of honey, 3–4 thousand tons of wax, a very little amounts of royal jelly, pollen and propolis are being produced. Since the domestic prices of honey products are high due to factors such as insufficient production, unorganized marketing and consumer demand, producers are especially reluctant to export their products (TBA, 2017a).

In Turkey, the annual honey production is around 95 thousand tons and around 20 thousand tons of that, which is 100% of honeydew honey, are produced solely in the forests. Considering chestnut honey, linden honey, locust honey, rhododendron honey and other types of honey produced from trees and plants growing in the forests of Turkey, it is seen that honey is a crucial "non-wood forest product." Moreover, those beekeepers, who produce honey for commercial purposes, generally conduct their activities in forests or in empty areas bordering forests (MFW, 2017).

There is no holistic plan where non-wood forest products (NWFPs) are integrated into the current forest management plans. The reason for this is insufficient studies to generate an inventory and map of NWFPs and to analyze participatory forest management systems.

Forest areas in Turkey constitute 26% of the country's total land area (22,342,935 ha). Areas covered with forest trees and shrubs such as sweet chestnut trees (Castanea sativa Mill.), linden trees (Tilia.), locust trees (Robinia pseudoacacia L.) and rhododendron, which can be used to produce honey, constitute around 4% of the forest area (GDF, 2017a). When clearings inside forests are added to this land, it is evident that the forest areas have sufficient potential for HPFs. HPFs would be beneficial to meet not only our current needs but also the needs of future generations, and thus a participatory approach shall be determined in light of the social demands and resource limitations. Projects, which can address various preferences, needs and expectations of different interest groups in a heterogeneous society (consumers-users, interest groups, pressure groups, etc.) with regard to HPFs, would have a higher chance of success. Therefore, interest groups should be actively involved in planning each stage of the determination process of HPF areas. Moreover, the macroeconomic structure, goals of the national forest policy, industrial and regional characteristics and the qualities of forest resources should be taken into consideration while planning in the light of the principles of sustainability and multipurpose utilization. HPFs planned accordingly would lead to more productive honey production and forests would be able to provide more ecological–environmental, economic, and socio-cultural benefits.

The main problem with this kind of planning is that too many factors are involved in the planning process. Multi-criteria decision-making methods are employed in the planning efforts, where many different criteria are considered.

Many studies have been conducted on how to plan forests (Goushegir at al., 2009; Balana at al., 2010; Nordström at al.,2010; Maxwell;Knapp, 2012; Dzyubenko, 2017). Although, there are many scientific studies in Turkey on NWFPs and their services, ecotourism, wildlife economy, NWFP economy, grass utilization, water production, carbon segregation, etc. (Yilmaz, 2004; Yilmaz at al, 2004; Geray et al., 2007; Cengiz; Akbulak, 2009; Gungor, 2005; Gungor, 2011), these studies, specifically those on NWFPs, have not yet been put into practice at a satisfactory level.

The purpose of this study is to determine potential honey-producing forest areas with differing qualities to serve as HPFs and to select the most suitable area among the potential ones determined using multi-criteria decision-making methods that take ecological–environmental, economic, and socio-cultural values into consideration. The findings of this study would be beneficial to planners and decision makers as well as to individuals who want to establish a HPF for individual or commercial use. Thus, this study would contribute to the relevant literature.

MATERIAL AND METHODS

Study area

The study was conducted in the province of Bartin in the Black Sea region (Figure 1). The province of Bartin is located between 41 ° 53′ northern latitude and 32 ° 45′ eastern longitude. Its surface area is 2,143 km2. Bartin has a mild marine climate (Black Sea climate) with hot summers and cool winters. Its proximity to the sea and the presence of moderately high mountain ranges parallel to the shoreline generally cause a decrease in the temperature differences and an increase in humidity at the shoreline (BG, 2016). Bartin province's total area is 228,576 ha and its forest area is 135,437 ha. Accordingly, approximately 59.3% of the province's area is covered by forests. This figure is above the average of the western Black Sea region (50%) as well as that of the whole country (28%) (GDF, 2017a).

Due to the rich biodiversity (GDF, 2017b), suitable edaphic, climatic conditions and the tree types it accommodates (chestnut, linden, and black locust) Bartin is an important area for honey production potential in the Black Sea region (WWF-TURKEY, 2010; Gungor; Ayhan, 2016).

With a rural population of 63.8%, Bartin province is much above the Turkish average (22.7%) (Tuik, 2015). Table 1 shows the forest areas, overall area, the number of forest villages, the total population and the number of beehives in Bartin province (TBMM, 2017; Mara, 2017; OTE, 2017; GDF, 2017a; Tuik, 2015; Gungor; Ayhan, 2016).

FIGURE 1 Study area in Bartin - Turkey.

TABLE 1 Comparison of the forest areas, overall area, number of forest villages, total population, and number of beehives in Bartin province with the regional and national figures.

	Area Information				Population Information			Honey Production in Numbers		
Region	Forest area	Overall area (Ha)	Forest area/ Overall area (%)	Forest villages (Unit)	Forest villagers (Person)	Total population (Person)	Forest villagers/ Total population (%)	Number of beehives (Unit)	Honey production (Tons)	Honey productivity (%) (Kg·Beehive^{-1})
Bartin	110,227	199,491	55	256	72,260	187,758	38	25,587	352	14
Total in the western Black Sea region	1,494,648	3,015,465	50	2,519	640,040	2,005,689	32	201,929	1,920	10
Total in the Black Sea region	6,727,514	11,483,861	59	6,733	1,830,241	7,539,694	24	1,318,876	22,313	17
Total in Turkey	21,678,134	78,534,470	28	21,238	7,073,020	76,667,864	9	6,348,009	94,694	15

Honey-producing forest areas mapping

Resources such as the Forest Management Plans of the Bartin Forestry Operation Directorate (BFD, 2005) and General Directorate of Forestry (GDF) HPF Action Plan (MFW, 2017) were used to determine the honey-producing forest areas and their potentials as well as to obtain various economic data. Statistical data from various institutions (WBSA, 2017; FAO, 2017; Tuik, 2015) and HPF Projects carried out in other provinces (GENC, 2003; GDF, 2011; GDF, 2015; Misir, 2011; Yalcinkaya; Keskin, 2010; Dumen at al., 2013; Dogaroglu, 2017) were also used. Thus, obtained various figures related to honey production in the Bartin region (the value of honey productivity according to the types of trees, annual numbers of beehives in the region and the amount of production, etc.). Moreover, the records of the Turkish Beekeepers Association (TBA) (TBA, 2017b) and the Bartin Association of Beekeepers (BAM) in addition to the data collected from the employees of the associations and the locals were used.

During the first stage of the study, a preliminary identification of potential HPF areas, which can be used for honey production in the Bartin region, was conducted. Accordingly, the pure and mixed stands including chestnut trees, linden trees, and false locust trees, from among the forest trees, which are used for honey production and mentioned in the management plans of the Directorate of Bartin Forest Enterprises (BFD, 2005), were determined. Afterwards, considering the section and subsection area sizes of the relevant types, the potential HPF areas, where honey can be produced according to the Forest Sub-district Directorate (FSD) and overall DBFE and the area producing the highest amount of honey for each FSD, were determined. Special attention was paid to ensure that the areas were larger than the minimum size (10 ha) specified by the General Directorate of Forestry (MFW, 2017).

In the second stage, potential HPF areas were ranked using the ranking technique by 15 participants in total, five people each from local population, public institutions and non-governmental organizations (NGOs), using a "scale of nine degrees." The criteria used in the ranking process were "Proximity of Beehives to Natural Water Resources" (NWR), "Intensity of Beekeepers' Route" (IBR), and "Distance from Areas Sprayed with Agricultural Pesticides" (DAP). Later, weighted averages of the obtained results were calculated and seven potential HPF areas were determined. Thus, the potential HPF areas (the top three with the highest scores), which would be taken into consideration in the following stage (analytic hierarchy process or AHP), were determined.

Ranking technique organizes the decision units according to their respective importance for the decision makers (Yilmaz, 2006). Within the context of this technique, HPFs were assessed and ranked according to their respective degrees of priority. This ranking process was carried out using a "scale of nine degrees." In this scale, 1 means slightly important, 3 means less important, 5 means moderately important, 7 means more important, and 9 means very important. In addition, middle values such as 2, 4, 6, and 8 can also be used.

In the third stage, three potential HPF areas with the highest rankings were scaled using AHP. It is quite challenging to rank and prioritize eight areas in AHP unlike in the ranking technique. Likewise, contrary to the ranking technique, of which the calculations are very simple, AHP calculations consist of several very complex stages. Moreover, there might be deviations in the sensitivity analyses made as a result of the calculations. Therefore, it is necessary to prioritize the potential HPF areas that ranked top three to make sure that the calculations are correct. Within the context of AHP, the criteria and sub-criteria were determined. Potential areas were prioritized by the participants in accordance with the criteria and sub-criteria, and thus the most suitable HPF was determined.

The AHP by Saaty (1980; 2005) is one of the most widely used and popular techniques for structuring criteria and indicator sets. More recently, the AHP has been applied in multi-objective forest management and land-use planning due to its flexibility and high effectiveness in analyzing complex decision problems (Yilmaz, 2006; Geray et al, 2007; Chapin, 2009; Govindan et al., 2009; Huang, 2009; Kalayci et al., 2010; Stern et al., 2010; Stern; Predmore, 2011; Gungor, 2011; Bagstad, 2013; Bradford; D'amato, 2012; Brown, 2013). This interactive method allows a decision maker (or a group of decision makers) to express their preferences to the analyst and to support the discussion of the outcomes (Wolfslehner et al., 2005). Generally, the AHP is based on the principle of decomposition, a construction of a series of "pairwise comparisons" (which are used to compare criteria and alternatives with one another) and the principle of additive synthesis of preferences (Saaty, 2005). This method can also be used to assign priorities to the criteria as well as to the indicators (Chapin, 2009; Huang, 2009; Stern at al., 2010).

However, independently from the technique applied, there are several possible ways to aggregate information, when more than one individual judgment is made by individual stakeholders. Treating the group as a new "individual" with aggregating individual judgments requires satisfaction of the reciprocity conditions for judgments (Govindan, 2009) and it is often recommended to use a geometric mean when representing an average ratio (Saaty, 2005). In the fourth stage, different management strategies were developed by different experts and discussions about the performance of the strategies with regard to the criteria and the indicators set were held. Furthermore, the developed strategies were outlined according to their main elements in order to translate the vision and goals for HPFs. Each stakeholder group had the chance to describe and clarify their own strategies in detail which helped to understand the potential impacts of the strategies and allowed an overall assessment. Therefore, in the last stage, the generated strategies were assessed qualitatively and judged according to the selected criteria and indicators with the help of experts. The study combined ecological–environmental, economic, and socio-cultural information and integrated the values of each stakeholder-group participant in order to identify the best performing strategy and potential trade-offs with regard to the different preferences using the AHP.

Creation of the AHP decision hierarchy

The creation of the AHP decision hierarchy starts by placing the general purpose of the problem at the top level. Afterwards, criteria to be used to evaluate the alternatives are determined and these criteria are ranked in a hierarchical order. In this hierarchy, there is a level composed of the criteria and a level or levels for the sub-criteria of each criterion. The process of creating a hierarchy is completed with the placement of the decision alternatives at the bottom level of the hierarchy. In the end, a decision hierarchy, which is composed of a purpose and criteria for each problem as well as potential levels of sub-criteria and options, is created (Figure 2) (Saaty, 1980; 2005).

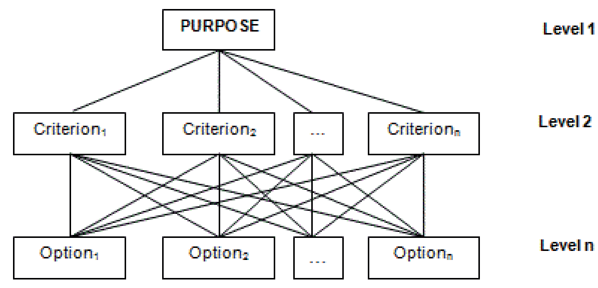

FIGURE 2 A simple AHP decision hierarchy composed of a purpose, criteria, and options.

Determination of the criteria and sub-criteria to be used in the AHP

The criteria and sub-criteria to be used to determine the HPF-area priorities of each interest group were determined by considering the purpose and strategies of the forestry industry, local characteristics, supply opportunities and society's expectation in line with the documents and scientific research related to the topic of this study (Table 2). Accordingly, the criteria to be used at Level 3 of the AHP decision hierarchy were collected under three main headings—ecological–environmental, economic, and socio-cultural—and four sub-criteria for each of these criteria were selected in Level 4. By determining the scopes and definitions of the criteria and sub-criteria, it was made easier to understand, apply and quantify them.

Determination of the number of people to be interviewed for AHP

The following formula [1] (Orhunbilge, 2000), which calculates the sample size in limited societies, was

TABLE 2 The determined criteria and sub-criteria.

Criteria	Ecological–Environmental	Economic	Socio-cultural
Sub-criteria	Honey Productivity	Honey Production Potential	Type of Beekeeping
	Rate of Honey-producing Plants	Cost of Honey Production	Contribution to Rural Development
	Type of Honey	Added Value	Contribution to Employment
	Honey Production Season	Economic Return	Prevention of Migration

used in order to determine how many people would be interviewed at the relevant institutions of the three interest groups (local population, public institutions, and NGOs), to determine the criteria and sub-criteria to be used and to decide the priorities of the HPF areas at Level 3 and Level 4 of the AHP hierarchy, Where: *n*: Sample size; t^2: Confidence level 95% (1.96); *N*: Population (50 people from the local population, 10 people from public institutions and 50 people from NGOs); *P*: Probability of the presence of the aspect aimed to be measured within the main group (taken 50% due to the multi-purpose nature of this study); *Q*: 1-P; d: Sampling error considered 10% (0.1). Thus, it was calculated as *n*= 50 people from the local population, 10 people from public institutions and 50 people from NGOs. The individuals to be interviewed were determined using the stratified simple random sampling method (Kalipsiz, 1994) in the central town, the town of Amasra and the town of Kozcagiz in Bartin.

$$n = \frac{N \cdot t^2 \cdot P \cdot Q}{\left(d^2 (N-1)\right) + \left(t^2 \cdot P \cdot Q\right)} \quad [1]$$

Preparation and completion of the survey forms

Different information and survey forms were prepared for each level in accordance with the AHP and they were conducted by interviewers using the face-to-face interviewing technique. At Level 2, the research team was presented with the scope and definitions of the local population, public institutions, and NGOs as well as the information and survey form consisting of the pairwise comparison scale to determine the importance level of the groups. The scopes and definitions of the ecological–environmental, economic and socio-cultural criteria at Level 3 and their sub-criteria at Level 4 as well as the information and survey form consisting of the pairwise comparison scale were prepared and submitted to each interest group to determine the importance level of the said criteria and sub-criteria. Thus, the alternative HPFs at Level 5 were prioritized and the most suitable honey-producing forest area was determined.

AHP calculations

To explain how sub-criteria, criteria, interest groups, and thus the HPF area priorities were calculated, the theoretical infrastructure of the AHP calculation matrix (Table 3) was created and necessary calculations were made for each level based on this theoretical structure. For this purpose, the AHP survey forms completed by the interviewed interest groups were digitalized. Microsoft Excel spreadsheets were created for each interest group, and thus the data sets to be used in the AHP analysis were formed. In this way, the goal determined at Level 1 of the AHP hierarchy was achieved by multiplying from the bottom level (Level 5) upwards, the importance (priority) level values obtained at each level with the importance values of the level immediately above it.

RESULTS

Preliminary identification of the potential HPF areas

To determine the suitable forest areas for honey production in Bartin province, the management plans of the forest sub-district directorate at Bartin OIM were examined and the pure and mixed stands consisting of the trees tagged as chestnut, linden, and black locust, which are among the trees used for honey production and are mentioned in these plans, were determined. Afterwards, considering the section and sub-section area sizes of the relevant types, the areas, where honey can be produced according to the FSD and overall DBFE and as a result, 105 potential HPF areas with a size of at least 10 ha at seven sub-district directorates (Amasra, Bartin Central County, Kozcagiz, Kurucasile, Kumluca, Arit, and Yenihan) of Bartin, which has 12 sub-district directorates in total, were determined (Figure 3).

Eight areas producing the highest amount of honey for each FSD were determined. The relevant areas are shown on the map with numbers placed counterclockwise (Figure 4). These areas were taken into consideration to be organized in accordance with the ranking technique.

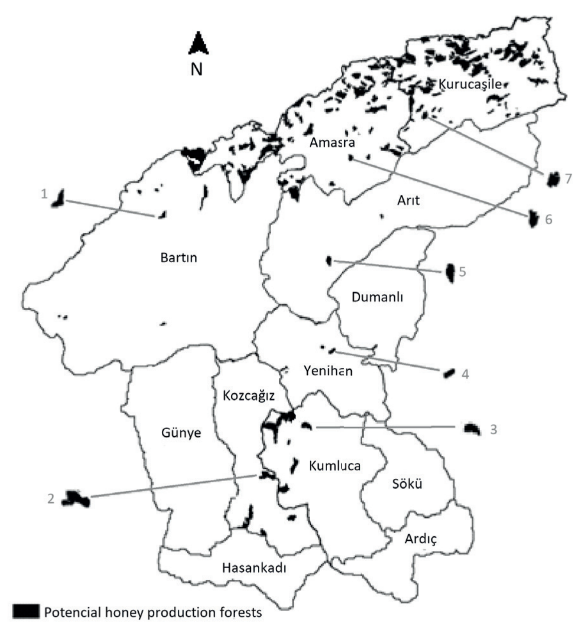

FIGURE 3 Potential honey producing forest areas.

TABLE 3 Theoretical structure of the AHP calculation matrix.

HPF Areas (Options)	Ecological–Environmental Criteria (VÇ)					Economic Criteria (VS)					Socio-cultural Criteria (VE)								
	Honey Productivity	Rate of Honey-producing Plants	Type of Honey	Honey Production Season	Compound Importance 1	Honey Production Potential	Cost of Honey Production	Added Value	Added Value	Compound Importance 2	Type of Beekeeping	Rural Dev. Contribution	Contribution to Employment	Prevention of Immigration	Compound Importance 3	Total Compound Importance (Local Pop.)	Total Compound Importance (Public Institutions)	Total Compound Importance (NGOs)	HPF Area Priorities (Compound Importance) (General)
	V_1	V_2	V_3	V_4		V_1	V_2	V_3	V_4		V_1	V_2	V_3	V_4		V_Y	V_K	V_S	
Kozcağız-Aşağıdere HPF	a_{11}	a_{12}	a_{13}	a_{14}	A_{11}	a_{11}	a_{12}	a_{13}	a_{14}	A_{12}	a_{11}	a_{12}	a_{13}	a_{14}	A_{13}	T_{11}	T_{12}	T_{13}	TAŞAĞIDERE
Arıt-Ören HPF	a_{21}	a_{22}	a_{23}	a_{24}	A_{21}	a_{21}	a_{22}	a_{23}	a_{24}	A_{22}	a_{21}	a_{22}	a_{23}	a_{24}	A_{23}	T_{21}	T_{22}	T_{23}	TÖREN
Bartın-Bedil HPF	a_{31}	a_{32}	a_{33}	a_{34}	A_{31}	a_{31}	a_{32}	a_{33}	a_{34}	A_{32}	a_{31}	a_{32}	a_{33}	a_{34}	A_{33}	T_{31}	T_{32}	T_{33}	TBEDİL

COMPOUND IMPORTANCE 1 ACCORDING TO THE ECOLOGICAL–ENVIRONMENTAL CRITERIA		TOTAL COMPOUND IMPORTANCE FOR THE INTEREST GROUPS (HPF AREA PRIORITIES)		
Compound Importance 1 for Kozcağız-Aşağıdere HPF =	$a_{11} \times V_1 + a_{12} \times V_2 + a_{13} \times V_3 + a_{14} \times V_4$	For Kozcağız-Aşağıdere =	$A_{11} \times V_Ç + A_{12} \times V_S + A_{13} \times V_E = T_{11}$	
Compound Importance 1 for Arıt-Ören HPF =	$a_{21} \times V_1 + a_{22} \times V_2 + a_{23} \times V_3 + a_{24} \times V_4$	For Arıt-Ören Production =	$A_{21} \times V_Ç + A_{22} \times V_S + A_{23} \times V_E = T_{21}$	Local Pop.
Compound Importance 1 for Bartın-Bedil HPF =	$a_{31} \times V_1 + a_{32} \times V_2 + a_{33} \times V_3 + a_{34} \times V_4$	For Bartın-Bedil =	$A_{31} \times V_Ç + A_{32} \times V_S + A_{33} \times V_E = T_{31}$	
COMPOUND IMPORTANCE 2 ACCORDING TO THE SOCIO-CULTURAL CRITERIA		For Kozcağız-Aşağıdere =	$A_{11} \times V_Ç + A_{12} \times V_S + A_{13} \times V_E = T_{12}$	
Compound Importance 2 (A12) for Kozcağız-Aşağıdere HPF =	$a_{11} \times V_1 + a_{12} \times V_2 + a_{13} \times V_3 + a_{14} \times V_4$	For Arıt-Ören Production =	$A_{21} \times V_Ç + A_{22} \times V_S + A_{23} \times V_E = T_{22}$	Public Institutions
Compound Importance 2 (A22) for Arıt-Ören HPF =	$a_{21} \times V_1 + a_{22} \times V_2 + a_{23} \times V_3 + a_{24} \times V_4$	For Bartın-Bedil =	$A_{31} \times V_Ç + A_{32} \times V_S + A_{33} \times V_E = T_{32}$	
Compound Importance 2 (A32) for Bartın-Bedil HPF =	$a_{31} \times V_1 + a_{32} \times V_2 + a_{33} \times V_3 + a_{34} \times V_4$	For Kozcağız-Aşağıdere =	$A_{11} \times V_Ç + A_{12} \times V_S + A_{13} \times V_E = T_{12}$	
COMPOUND IMPORTANCE 3 ACCORDING TO THE ECONOMIC CRITERIA		For Arıt-Ören Production =	$A_{21} \times V_Ç + A_{22} \times V_S + A_{23} \times V_E = T_{22}$	NGOs
Compound Importance 3 (A13) for Kozcağız-Aşağıdere HPF =	$a_{11} \times V_1 + a_{12} \times V_2 + a_{13} \times V_3 + a_{14} \times V_4$	For Bartın-Bedil =	$A_{31} \times V_Ç + A_{32} \times V_S + A_{33} \times V_E = T_{32}$	
Compound Importance 3 (A23) for Arıt-Ören HPF =	$a_{21} \times V_1 + a_{22} \times V_2 + a_{23} \times V_3 + a_{24} \times V_4$	For Kozcağız-Aşağıdere =	$T_{11} \times V_Y + T_{12} \times V_K + T_{13} \times V_S = T_{AŞAĞIDERE}$	
Compound Importance 3 (A33) for Bartın-Bedil HPF =	$a_{31} \times V_1 + a_{32} \times V_2 + a_{33} \times V_3 + a_{34} \times V_4$	For Arıt-Ören Production =	$T_{21} \times V_Y + T_{22} \times V_K + T_{23} \times V_S =$ TÖREN	GENERAL
		For Bartın-Bedil =	$T_{31} \times V_Y + T_{32} \times V_K + T_{33} \times V_S = T_{BEDİL}$	

Organization of the potential HPF areas using the ranking technique

Eight potential HPF areas with the highest honey productivity were organized using the ranking technique by 15 participants in total, five people each from the local population, public institutions and NGOs, using a "scale of nine degrees." The criteria used in the ranking process were "Proximity of Beehives to Natural Water Resources" (NWR), "Intensity of Beekeepers' Route" (IBR), and "Distance from Areas Sprayed with Agricultural Pesticides" (DAP). Later, weighted averages of the obtained results were calculated and seven potential HPF areas were ranked (Table 4).

TABLE 4 Ranking of the potential HPF areas in Bartin OİM.

Area No.	Potential HPF Areas Criteria	NWR	IBR	DAP	Weighted Value	Ranking
1	Bartın-Bedil	6.30	6.80	6.40	6.50	2
2	Kozcağız-Aşağıdere	7.11	7.44	7.11	7.22	1
3	Kumluca-Döngeller	5.65	4.16	5.01	4.94	7
4	Yenihan-Kuzluk	5.01	5.75	4.30	5.02	6
6	Arıt-Ören	5.12	6.11	6.14	5.79	3
7	Amasra-Uğurlar	5.44	5.11	4.96	5.17	5
8	Kurucaşile-Paşalılar	6.66	5.55	4.68	5.63	4

According to the ranking, Kozcagiz-Asagidere HPF with the area no. (2) ranked first with 7.22 points; Bartin-Bedil HPF with the area no. (1) ranked second with 6.50 points, and Arit-Oren HPF with the area no. (6) ranked third with 5.79 points. Thus, the potential HPF areas (the top three with the highest values), which would be taken into consideration in the following stage (AHP), were determined.

Prioritization of the HPF areas with the AHP and determination of the most suitable area

An AHP hierarchy composed of five levels to collect data and to evaluate, prioritize and determine the most suitable area for this research was created. The top level of this hierarchy (Level 1) is the goal of "Determination of the Most Suitable HPF Area." There are three interest groups at Level 2: the local population, public institutions and NGO representatives. Levels 3 and 4 consist of the criteria and sub-criteria to be used to determine HPF areas. Level 5, which is the bottom level of the AHP hierarchy, consists of the three potential HPF areas (Figure 4).

Priorities for the interest groups

Importance and priority value of the interest groups, which were taken as a basis to determine the priorities of the potential HPF areas mentioned in Level 2 of the AHP, were calculated by the researchers according to pairwise comparison matrices and the obtained results are shown in Table 5.

TABLE 5 Priority values of the interest groups.

Interest Groups	Priority Value	Ranking
Local Population	0.411	1
Public Institutions	0.312	2
NGOs	0.277	3

Priorities regarding the criteria

Priority values for the said criteria mentioned at Level 3 of the AHP are shown in Table 6.

TABLE 6 Priority values regarding the criteria.

Criteria	Interest Groups			General	Ranking
	Local Population	Public Institutions	NGOs		
Ecological–Environmental	0.278	0.396*	0.461*	0.376*	1
Economic	0.362*	0.327	0.316	0.336	2
Socio-cultural	0.216	0.277	0.223	0.288	3

* The highest weight grades.

As it can be seen in Table 7, whereas the local population pays more attention to the "Economic" criteria, the public institutions and NGOs care more about the "Ecological–Environmental" criteria.

Priorities regarding the sub-criteria

Table 7 shows the results of prioritization according to the sub-criteria (Level 4). As it can be seen in Table 8, "Rate of Honey-producing Plants" got the highest score of 0.257 in the "Ecological–Environmental" sub-criteria in the general average. Among the interest groups, the local population care about "Honey Productivity," whereas public institutions and NGOs care about the "Type of Honey." Among the "Economic" sub-criteria, "Cost of Honey Production" received the highest value of 0.260. Among the interest groups, the local population care about the "Honey Production Potential" the most, whereas public institutions and NGOs mostly care about the "Added Value." Among the "Socio-cultural" sub-criteria, "Contribution to Employment" received the highest value of 0.256 among all the interest groups.

Priorities regarding the potential HPF areas

Three potential HPF areas (decision criteria) according to the ecological–environmental, economic and socio-cultural sub-criteria at AHP Level 5 were ranked (Table 8).

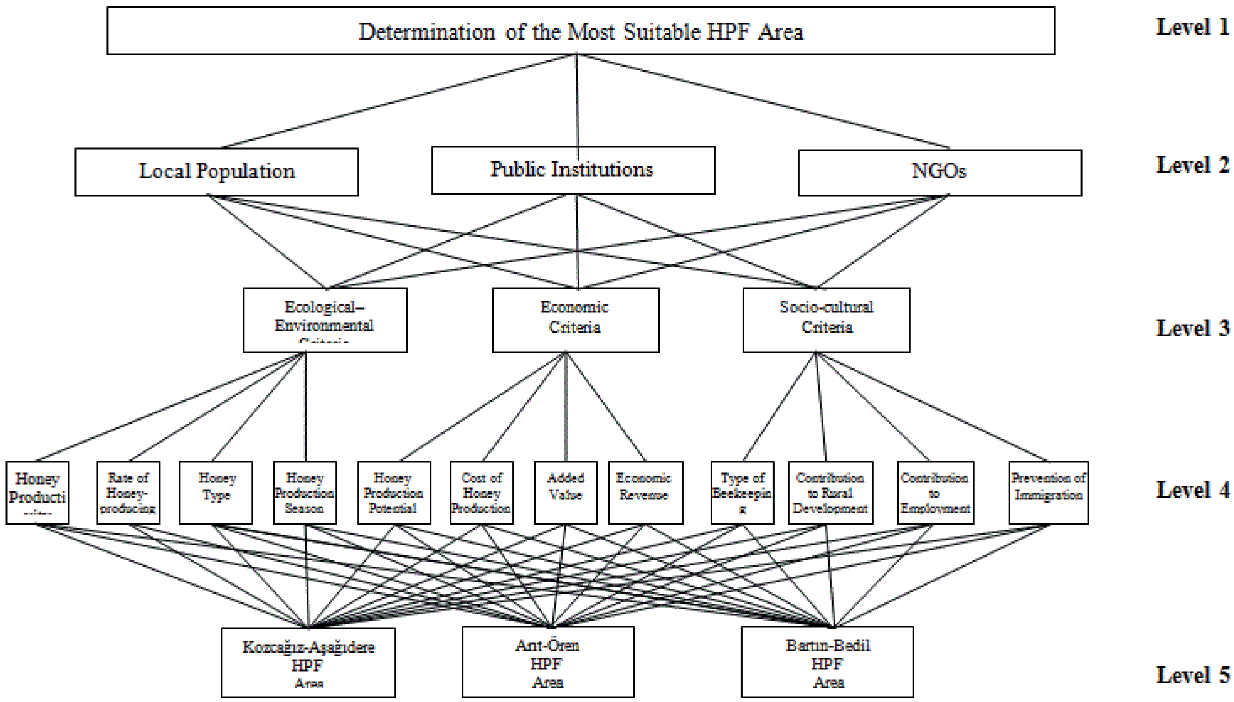

FIGURE 4 AHP decision hierarchy to determine the most suitable HPF area.

TABLE 7 Priority values regarding the criteria.

Criteria and Sub-criteria		Interest Groups: Local Population	Interest Groups: Public Institutions	Interest Groups: NGOs	General Average	Ranking
Ecological–Environmental	Honey Productivity	0.272*	0.247	0.230	0.250	2
	Rate of Honey-producing Plants	0.262	0.259	0.251	0.257*	1
	Type of Honey	0.211	0.260*	0.280*	0.248	3
	Honey Production Season	0.255	0.234	0.239	0.245	4
Economic	Honey Production Potential	0.272*	0.249	0.232	0.248	2
	Cost of Honey Production	0.241	0.242	0.250	0.260*	1
	Added Value	0.217	0.271*	0.270*	0.247	3
	Economic Return	0.270	0.258	0.248	0.245	4
Socio-cultural	Type of Beekeeping	0.238	0.241	0.242	0.240	4
	Contribution to Rural Development	0.251	0.247	0.243	0.247	3
	Contribution to Employment	0.255*	0.252*	0.261*	0.256*	1
	Prevention of Migration	0.252	0.250	0.252	0.257	2

* The highest weight grades.

According to Table 9, Kozcagiz-Asagidere HPF area is in the foreground regarding the ecological–environmental and economic sub-criteria and Arit-Oren HPF is in the foreground regarding the socio-cultural sub-criteria.

Priorities of the HPF areas regarding the interest groups

According to the AHP theoretical calculation matrix (Table 3), the priority matrix of the HPF areas (Table 9) according to the sub-criteria at the bottom level is multiplied by the sub-criteria (Table 8) and criteria priorities column vectors (Table 7) of the interest groups at the upper level and with the column vectors of the subsequent interest groups (Table 6) and these values are added, and thus the priorities of the forest function based on the interest groups are found (Table 8).

According to Table 8, it is clear that the representatives of NGOs prioritize the Arit-Oren HPF area, whereas the local population and public institutions prioritize the Kozcagiz-Asagidere HPF area. An overall evaluation of all the interest groups showed that the Kozcagiz-Asagidere HPF area is the number one priority.

DISCUSSION

The local population also has a close relation with the natural environment, and thus it is economically, socially and culturally involved with forests. Forests not only

TABLE 8 Priority values of the HPF areas regarding the interest groups.

Potential HPF Area	Local Population		Public institutions		NGOs		General (All Interest Groups)	
	Priority Value	Rank	Priority Value	Rank	Priority Value	Rank	Priority Value	Rank
Kozcağız- Aşağıdere	0.371*	1	0.367*	1	0.364	2	0.368*	1
Arıt- Ören	0.342	2	0.344	2	0.372*	1	0.351	2
Bartın- Bedil	0.287	3	0.289	3	0.264	3	0.281	3

* The highest weight grades

TABLE 9 Priority values of the HPF areas according to the criteria and sub-criteria.

Potential HPF Area	Ecological–Environmental Criteria				Economic Criteria				Socio-cultural Criteria			
	Honey Productivity	Rate of Honey-producing Plants	Honey Type	Honey Production Season	Honey Production Potential	Cost of Honey Production	Added Value	Economic Return	Type of Beekeeping	Contribution to Rural Development	Contribution to Employment	Prevention of Migration
Kozcağız-Aşağıdere	0.349*	0.367*	0.312*	0.360*	0.341*	0.351*	0.346*	0.343*	0.320	0.338	0.348	0.354
Arıt-Ören	0.332	0.324	0.349	0.346	0.336	0.331	0.331	0.334	0.401*	0.404*	0.409*	0.407*
Bartın-Bedil	0.349	0.309	0.339	0.294	0.323	0.318	0.323	0.323	0.279	0.276	0.243	0.239

* The highest weight grades

assure biodiversity for honey production but also provide an opportunity to earn more income. Therefore, the establishment of HPFs would meet the financial and spiritual needs of the people, and thus having a positive effect on the socio-economic life in addition to assuring protection and the development of the balance of natural systems as an invisible hand. It is crucial for rural development for various areas being opened up to use as HPF areas, since HPF areas have the potential to ensure the protection of nature and the continuation of public health.

When the relation between forest villagers and honey productivity is examined, it is seen that the number of forest villagers increases while the productivity value of honey decreases (Gungor; Ayhan, 2016). Forest villagers, who already have a much lower level of income than the national average, neither have the necessary equipment for honey production nor the necessary knowledge and skills. Therefore, epically state-based institutions such as Provincial Directorates of Agriculture provide adequate support to the forest villagers.

In this research, to prioritize the potential HPF areas and to determine the most important suitable participatory approach with multiple criteria, the AHP technique with hierarchical weighing was adopted. In the study, not only the weight of the potential HPF areas was determined using the AHP, but also the weight of the ecological–environmental, economic and socio-cultural criteria and sub-criteria were determined in addition to the weight of the interest groups. Thus, an AHP model, which can be used in the regions where the establishment of a honey production forest is desired, was developed.

The local population has a weight of 41.1% in the determination of the relevant areas using the AHP. This is followed by public institutions (31.2%) and NGOs (27.7%). A similar research concluded that industrial public institutions have the top priority (Geray et al., 2007; Jalilova et al., 2009). It is obvious that these priorities would vary according to the region, time, industry and the characteristics of the decision group.

Public institutions and NGOs consider the ecological–environmental criteria as the most important (*especially the type of honey) ones in the determination of the HPF areas, whereas the local population considers the economic criteria, especially the honey production potential, to be more important. Moreover, the economic criteria have top priority for the local population because of the economic bottlenecks it faces as well as the social and cultural structures. The fact that the level of demand is of top priority among the economy-based sub-criteria indicates that the demands and expectations of the interest groups, especially those of the local population, should definitely be taken into consideration in the functional allocation of forest resources.

In general, giving top priority to the ecological–environmental criteria in the AHP does not mean that the economic and socio-cultural importance of forest resources are decreasing. A similar study conducted in the province of Izmir concluded that the interest groups paid more attention to the environmental functions due to environmental destruction. However, the study results showed that the real destruction would result from the social and economic negligence of forest resources (Geray et al., 2007). Likewise, in efforts concerning functional forest resource planning (Yilmaz, 2004; Jalilova et al., 2009; Gungor, 2011), there is a ranking of importance of the criteria as ecological–environmental, economic and social at the determining stage of the most appropriate management strategy.

According to the priority values of the ecological–environmental sub-criteria, public institutions and NGOs prioritize the type of honey, whereas the local population prioritizes honey productivity. The local population, unlike the public institutions and NGOs, which care about the type of honey, considers honey productivity to be more important. Considering the general average, wit is seen that the sub-criterion showing the rate of honey-producing plants has gained importance.

Among the priority values related to the economic sub-criteria honey production potential has priority for the local population, whereas added value has priority for public institutions and NGO representatives. The cost of honey production has priority in the general average. The Kozcagiz-Asagidere HPF area is more in the foreground, since it provides more economic returns. Therefore, this area should have priority in the planning and allocation efforts.

Considering the priority values related to the socio-cultural sub-criteria, it is seen that the criterion contribution to employment is found important by all the interest groups. When these results are correlated with the rural population, it is seen that the Arit-Oren HPF area and the surrounding area have the highest rural population and the highest rate of migration. Moreover, the forest villagers in this area have a low level of income. Therefore, creating employment in and preventing migration from this area are more important comparing to other HPF areas. In general terms, since the HPF would provide crucial returns for the rural population, it would be a good thing to use these areas as tools for rural development.

Honey production potential is an important criterion in selecting HPF areas, the points on which all the interest groups agree are as follows: the type of honey, added value, contribution to employment and supporting the local population as well as rural development.

When the criteria, sub-criteria and interest groups are assessed in the AHP with the results, it is seen that the top three areas are prioritized as Kozcagiz-Asagidere HPF (0.368), Arit-Oren HPF (0.351) and Gunye-Bedil HPF (0.281).

CONCLUSIONS

The method and approaches adopted in this research will be useful for the efforts to determine and prioritize alternative HPF areas in other provinces. However, it is possible that the solutions and results will vary according to the region, participants, time criteria and sub-criteria. Therefore, new solutions should be developed according to the changing conditions and times even in the same region. This research provided an objective ranking with multiple criteria instead of a subjective ranking. HPFs provide an assurance for honey production and guarantee biodiversity at the same time. On the other hand, the establishment of HPFs would ensure the protection and development of natural systems as an invisible hand. Thus, effective planning and management of the determined areas will increase pollination and accordingly, it will make significant contributions to the protection of nature. If allocation, planning and management efforts toward honey-producing forests are conducted by considering the results of this research, it will provide an efficient use of not only the forest resources but also all limited resources (personnel, tools and equipment etc.) in line with social welfare. Prioritization of the potential HPF areas is also important because it shows where and for what purpose resources will be allocated in the future and what kind of R&D studies are required. HPFs, which is to be established in the region, will provide added value, help increase social welfare and contribute to employment as well as rural development and the sustainable management of forest resources.

REFERENCES

ARMAH, F.A. GIS-based assessment of short term shorline changes in the coastal erosion-sensitive zone of accra, Ghana. **Research Journal of Environmental Sciences**, v. 5, p. 643-654, 2011.

BAGSTAD, K. J.; JOHNSON, G. W.; VOIGT, B.; VILLA, F. Spatial dynamics of ecosystem service flows: a comprehensive approach to quantifying actual services. **Ecosystem Services**, v. 4, p. 117–125, 2013.

BALANA, B.B.; MATHIJS, E.; MUYS, B. Assessing the sustainability of forest management:an application of multi-criteria analysis to community forests in northern Ethiopia. **Journal of Environmental Management**, v. 91, p. 1294–1304, 2010.

BARTIN FORESTRY DIRECTORATE (BFD), **Forestry management plan (2006-2025 cutting planning)**, Bartın, Turkey. 2005.

BARTIN GOVERNORSHIP (BG). Bartın İstatistikleri, Available at: http://www.bartin.gov.tr/kurumlar/bartin.gov.tr/Dosyalar/Il_Planlama_Koordinasyon_Md/Yayinlar/BARTIN_ISTATISTKLERI_2015.pdf Accessed in: 10 may 2017.

BRADFORD, J.B.; D'AMATO, A.W. Recognizing trade-offs in multi-objective land management. **Frontiers in Ecology and the Environment**, v. 10, p. 210–216, 2012.

BROWN, G. The relationship between social values for ecosystem services and global land cover: an empirical analysis. **Ecosystem Services**, v. 5, p. 58–68, 2013.

CENGIZ, T.; ALBULAK, C. Application of analytical hierarchy process and geographic information systems in land-use suitability evaluation: a case study of Dümrek village (Çanakkale, Turkey). **International Journal of Sustainable Development & World Ecology**, v. 16, n. 4, p. 286–294, 2009.

CHAPIN, T. "**Large Landowners as Plan-Makers: St. Joe and the Future of the Florida Panhandle.**" In Large Landowners and Land Markets, R. Bostic and R. Greenstein (Eds.). Cambridge, MA: Lincoln Press. 2009. 22 p.

DOĞAROĞLU, M. **Modern Beekeeping Techniques**. Anadolu Matbaası, 2017, 111 p.

DÜMEN E.; AKKAYA H.; ÖZ GM.; SEZGIN FH. Microbiological and parasitological quality of honey produced in İstanbul. **Turkish Journal of Veterinary and Animal Sciences**, v. 37, p. 602-607, 2013.

DZYUBENKO O. M. Investment and innovation support for forestry practices of permanent forest users under conditions of deepening the institutional transformations, **Problemi Ekonomiki**, v. 3, p. 283-291, 2017.

FOOD AND AGRICULTURAL ORGANISATION. **Honey Inf**. Available at: http://www.fao.org/statistics/databases/en/. Accessed in: 10 nowember 2017.

GENÇ, Y. **Pollen analysis in İskalan region (Bartın) ballads**. 2003. 78 p. Msc. Thesis. Zonguldak Karaelmas University, Institute of Science and Technology, Bartın, Turkey.

GERAY, A. U. Contemporary frame of forestry, **Istanbul University Forest Faculty Journal**, Series B, v. 39, n. 4, p. 17-27, 1989.

GENERAL DIRECTORATE OF FORESTRY (GDF) (a). **Turkey Forest Assets**. Available at: https://www.ogm.gov.tr/ekutuphane/Yayinlar/T%C3%BCrkiye%20Orman%20Varl%C4%B1%C4%9F%C4%B1-2016-2017.pdf Access: 29 december 2017.

GENERAL DIRECTORATE OF FORESTRY (GDF) (b). Pollen and nectar potential spreads of important honey plants. Available at: https://www.ogm.gov.tr/ekutuphane/Dokumanlar/%C3%96nemli%20Bal%C4%B1%20Bitkilerin%20Polen%20ve%20Nektar%20Potansiyelleri%20ile%20Yay%C4%B1l%C4%B1m%20Alanlar%C4%B1.pdf. Accessed in: 17 nowember 2017.

Geray, A.U.; Şafak, İ.; Yılmaz, E.; Kiracıoğlu, Ö.; Başar, H. Determination of Function Priorities Related to Forest Resources. **EGE Forestry Research Directorate Technical Bulletin**, 35, 137 p.

GOUSHEGIR, S. Z.; FEGHHI, J.; MOHAJER, M. R. M.; MAKHDOUM, M. Criteria and indicators of monitoring the sustainable wood production and forest conservation using AHP (Case study: Kheyrud Educational and Research Forest). **African Journal of Agricultural Research**, v. 4, n. 10, p. 1041-1048, 2009.

GOVINDAN, K.; DIABAT, A.; MADAN SHANKAR, K. Analyzing the drivers of green manufacturing with fuzzy approach. **Journal of Cleaner Production**, v. 96, p. 182-193, 2009.

GÜNGÖR, E. **Development of optimum management strategy of Kastamonu-Bartın Küre Mountains National Park**. 2005. 136 p. Msc. thesis. Zonguldak Karaelmas University, Institute of Natural and Applied Sciences, Bartın, Turkey.

GÜNGÖR, E. **Integrated functional management planning of forest resources**. 2011. 310 p. PhD thesis. Bartın University, Institute of Natural and Applied Sciences, Bartın. Turkey.

GÜNGÖR, E.; AYHAN, A. B. Potential and economic value of honey production in Bartın Region Forest resources, **Turkish Journal of Forestry**, v. 17, n. 1, p. 108-116.

HUANG, C. Q.; KIM, S.; SONG, K.; TOWNSHEND, J. R. G.; DAVIS, P.; ALTSTATT, A.; RODAS, O.; YANOSKY, A.; CLAY, R.; TUCKER, C. J.; MUSINSKY, J. Assessment of Paraguay's forest cover change using Landsat observations. **Global and Planetary Change**, v. 67, n. 1-2, p. 1-12, 2009.

JALILOVA, G. **Impact of different forest management strategies on the diversity of birds in the walnut fruit forest in Kyrgyzstan**. 2009. 52 p. MSc thesis. University of Natural Resources and Applied Life Sciences (BOKU), Vienna. Austria.

KALIPSIZ, A. **Statistical Methods**. IU Forestry Faculty Publication No: 294, Istanbul, 1994, 211 p.

LEUSCHNER, W. A. **Introduction to Forest Resource Management**, ISBN:978-0471086680, Krieger Publishing Company, Malabar, Florida, 1992. 304 p.

MAXWELL, J.T.; KNAPP, P. A. Reconstructed tupelo-honey yield in northwest Florida inferred from *Nyssa Ogeche* tree-ring data: 1850–2009. **Agriculture, Ecosystems & Environment**, v. 149, p. 100-108, 2012.

MINISTRY OF AGRICULTURE AND RURAL AFFAIRS (MARA). **Rural Development Plan (2010-2013)**. Available at: http://kkp.tarim.gov.tr/sp/Kirsal_Kalkinma_Plani%20(2010-2013).pdf. Accessed in: 21 nowember 2017.

MINISTRY OF FORESTRY AND WATER (MFW). **Honey forest action plan (2013-2017)**. Available at: https://www.ogm.gov.tr/ekutuphane/Yayinlar. Accessed in: 13 december 2017.

MINISTRY OF AGRICULTURE AND RURAL AFFAIRS (TKDK), **Rural Development Plan (2010-2013)**, Ankara, Turkey, 2011.

MISIR, M. **Arıt bölgesi (Bartın) ballarında polen analizi**. 2011. 47 p. Msc. Thesis. Zonguldak Karaelmas University, Institute of Science and Technology, Bartın, Turkey.

NORDSTRÖM, E.M.; ERIKSSON, L.O.; ÖHMAN, K. Integrating multiple criteria decision analysis in participatory forest planning: experience from a case study in northern Sweden. **Forest Policy and Economics,** v. 12, p. 562–574, 2010.

ORDU TRADE EXCHANGE (OTE). **Beekeeping**. Ordu Trade Exchange Publications, Available at: http://www.ordutb.org.tr/admin/dosya/aricilik_son(_2013)(1).pdf. Accessed in: 15 october 2017.

ORHUNBILGE, N. **Sampling Methods and Hypothesis Testing**. Review and Expanded Second Edition, ISBN-**13:** 978-9758345045, Avcıol Publishing and Publication, Istanbul, 2000, 420 p.

SAATY, T.L. **The Analytic Hierarchy Process**. New York: McGraw-Hill. New York. International, 1980. Translated to Russian, Portuguese, and Chinese, Revised editions, Paperback (1996, 2000), Pittsburgh: RWS Publications, 2000, 14 p.

SAATY, T. L. **Theory and Applications of the Analytic Network Process: decision making with benefits, opportunities, costs, and risks**. RWS, Pittsburgh, PA: RWS Publications, 2005, 124 p.

STERN, M.J.; PREDMORE, S.A.; MORTIMER, M.J.; SEESHOLTZ, D.N. The meaning of the national environmental policy act in the U.S. forest Service. **Journal of Environmental Management,** p. 91, n. 6, p. 1371-1379, 2010.

STERN, M.J.; PREDMORE, S.A. Decision making, procedural compliance, and outcomes definition in U.S. forest Service planning processes. **Environmental Impact Assessment Review,** v. 31, n. 3, p. 271-278, 2011.

UNYE TRADE EXCHANGE (UTE). **Beekeeping**. Unye Trade Exchange Publications, Available at: http://www.ünyerutb.org.tr/admin/dosya/aricilik_son(_205 2)(3).pdf. Accessed in: 22 nowember 2017.

THE GRAND NATIONAL ASSEMBLY OF TURKEY (TBMM). **2010 Population Census Results and Forestry Villages**. Available at: http://www2.tbmm.gov.tr/d23/7/7-14296c. Accessed in: 19 september 2017.

TURKEY BEEKEEPERS ASSOCIATION (TBA) (a). **Beekeeping Information**. Available at: http://www.tab.org.tr/wp-content/uploads/2016/11/Mu%C4%9Fla-Kongresi-Sonu%C3%A7-Raporu.pdf., Accessed in: 12 december 2017.

TURKEY BEEKEEPERS ASSOCIATION (TBA) (b). **2015 Honey Production Values**. Available at: http://www.tab.org.tr/wp-content/uploads/2016/11/Mu%C4%9Fla-Kongresi-Islah-%C3%87al%C4%B1%C5%9Ftay%C4%B1-Raporu.pdf Accessed in: 12 december 2017.

TURKISH STATISTICAL INSTITUE (TÜİK), **Beekeeping Statistics**. Available at: http://www.tuik.gov.tr, Accessed in: 11 october 2017.

WESTERN BLACK SEA DEVELOPMENT AGENCY (WBSA). TR81 Regional Statistics (2011). Western Black Sea Development Agency Publications, Available at: https://www.tarim.gov.tr/SGB/TARYAT/Belgeler/kalkinma_ajansi_bolg_plan/TR81.pdf. Accessed in: 30 december 2017.

WOLFSLEHNER, B.; VACIK, H.; LEXER, M.J. Application of the analytic network process in multi-criteria analysis of sustainable forest management. **Forest Ecology and Management, v.** 207, n. 1-2, p. 157-170, 2005.

WORLD WIDE FUND FOR NATURE (WWF). 2016 **Annual Report**. Available at: http://assets.worldwildlife.org/financial_reports/27/reports/original/WWF_AR_2016.pdf. Accessed in: 13 december 2017.

WORLD WIDE FUND FOR NATURE–TURKEY (WWF-TURKEY) (2010). **Sürdürülebilir Turizm Gelişim Stratejisi (KDMP)**, Report: Andrei Blumer, WWF-Turkey.

YALÇINKAYA A.; KESKIN N. The Investigation of honey bee diseases after colony losses in Hatay and Adana provinces of Turkey. **Mellifera**, v. 10, n. 20, p. 24-31, 2010.

YILMAZ, E. **Resolutions on the functional segmentation of forest resources.** 2004. 385 p. PhD Thesis, IU Graduate School of Natural and Applied Sciences, Istanbul, Turkey.

YILMAZ, E.; OK, K.; OKAN, T. Activity selection with participatory approach in ecotourism planning: example of Cehennemdere valley. **East Mediterranean Forestry Research Directorate Publication**, v. 30, p. 56, 2004.

YILMAZ, E. R'WOT Technique; An Example Application with Participatory Approach in Beekeeping Industry, **Ministry of Environment and Forestry Publication**, 274, 86 p. 2006. Available at: https://yayin.ogm.gov.tr/yaydepo/t730.pdf. Accessed in: 30 december 2017.