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Original Article

Valuation of goods and services produced by coppice and high forest management alternatives in the Pabuçdere Watershed

Pabuçdere Havzasında baltalık ve koru orman yönetim seçeneklerinin ürettiği mal ve hizmetlerin değerinin belirlenmesi

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ABSTRACT

To effectively manage forest resources, consideration of all benefits provided by forests in management decisions is necessarily required. In this study, the value of benefits gained through management approaches such as coppice forest and high forest was estimated using choice experiments. According to this method, 16 different choice sets were created to include the combination of the level of benefits. There are three forest management options-one status quo (current situation) and two different management options in each choice set. This study aimed to determine the effect of possible management options on marketable and nonmarketable benefits produced by different types of forest management regimes in the Pabuçdere watershed. Four ecosystem benefits in form of resources such as timber, water, wildlife, and mushroom were considered. A face-to-face survey was conducted on 384 respondents living in villages inside and near the watershed. Data obtained were analyzed using conditional logit and random parameter logit models with the NLOGIT 5.0 statistical program. Marginal values of the benefits for different parts of the research area and the annual total economic value of each option were calculated. Results revealed that changes in forest management approaches cause a corresponding change in the values added by the society. Considering social preferences as a whole, the more number of "high forests" in the Pabuçdere watershed, the more is the value added by the society to forest services.

Keywords: Choice experiments, environmental valuation, timber, water, wildlife, mushroom

ÖZ

Etkin orman kaynakları yönetim kararları alabilmek için, olası orman yönetim seçeneklerinin üretebildiği tüm faydaları dikkate almak gerekmektedir. Bu çalışmada, baltalık ve koru ormanı şeklindeki iki ayrı orman yönetim seçeneğiyle elde edilen faydaların değerleri, Seçim Deneyleri Yöntemi kullanılarak hesaplanmıştır. Yöntem gereği, fayda seviyelerinin kombinasyonunu içeren, 16 farklı seçim seti oluşturulmuştur. Her bir seçim setinde, bir mevcut durum ve iki farklı yönetim seçeneği içeren, toplamda üç orman yönetimi alternatifi yer almıştır. Çalışmanın amacı, Pabuçdere Havzasında orman yönetim seçenekleri tarafından üretilen, pazarı olan ve olmayan faydalar üzerinde olası yönetim seçeneklerinin etkisini belirlemektir. Bu amaçla çalışmada, odun hammaddesi, su, yaban hayatı ve mantar gibi dört ekosistem faydası ele alınmıştır. Çalışma verileri havza içerisinde ve yakınındaki köylerde yaşayan 384 kişi ile yüz yüze yapılan anketlerden elde edilmiştir. Veriler, NLOGIT 5.0 istatistik programıyla, Koşullu Logit ve Tesadüfi Parametre Logit modelleri kullanılarak analiz edilmiştir. Analizler sonucunda araştırma alanının farklı bölümleri için sağlanan faydaların marjinal değerleri ve her bir yönetim seçeneğinin yıllık toplam ekonomik değeri hesaplanmıştır. Sonuçlar, orman yönetim şekilleri değiştiğinde toplumun atfettiği değerlerin de değiştiğini ortaya koymaktadır. Buna göre, toplumsal tercihler bir bütün olarak ele alındığında, Pabuçdere havzasında koru ormanı arttıkça toplumun orman hizmetlerine verdiği değerin de arttığı görülmüştür.

Anahtar Kelimeler: Seçim deneyleri yöntemi, çevresel değer belirleme, mantar, odun hammaddesi, su, yaban hayatı

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INTRODUCTION

The necessity of the principle of multi-purpose benefits from forests is accepted globally. To effectively manage forest resources, consideration of all values provided by forests (including numerous goods and services such as recreation, wildlife, water production, and soil conservation) is necessary

for making management decisions. Furthermore, the society has varying interests and expectations about forest goods and services. Therefore, use and non-use values have evolved. total economic value (TEV) is usually employed to estimate the full value of environmental resources.

TEV is the sum of use, non-use, and option values. While use values are benefits derived from the use of environmental resources, non-use values are benefits that are not related to the current the use of forest resources (Croitoru et al., 2016). In other words, use values are defined as benefits obtained by people resulting from the use of environmental resources by people, whereas non-use values benefits are derived from forest resources even if they is not used by people. Use values are classified as direct use and indirect use values. Non-use values are classified as existence, altruistic, and bequest values. Existence values refer to the values obtained as a result of conservation of environmental resources, and these values will never be directly benefited by people or future generations (Birol et al., 2006; Croitoru and Liagre, 2013; Koshy Mathew et al., 2019; Markandya, 2014). Altruistic value is related to the fact that even if people do not use or intend to use the environmental resources, they may be concerned that the resource will be available to others in the current generation. Bequest value is related to the values that benefits accrued to future generations' use of environmental resources (Croitoru et al., 2016; Guijarro and Tsinaslanidis, 2020). Option value can be recognized as the potential of an environmental resource to provide economic future benefits to the society even if it is not currently used (Birol et al, 2006). Therefore, a component of a forest which cannot be used today can be very valuable for humanity in the future. For this reason, it is not sensible for those who manage today's forests to make possible management decisions by only relying on a limited, usable and market-based value like wood production. Moreover, comparison of forest management regimes in terms of their benefits has created more problems due to the fact that the society's expectations from the forest are increasingly and continually high.

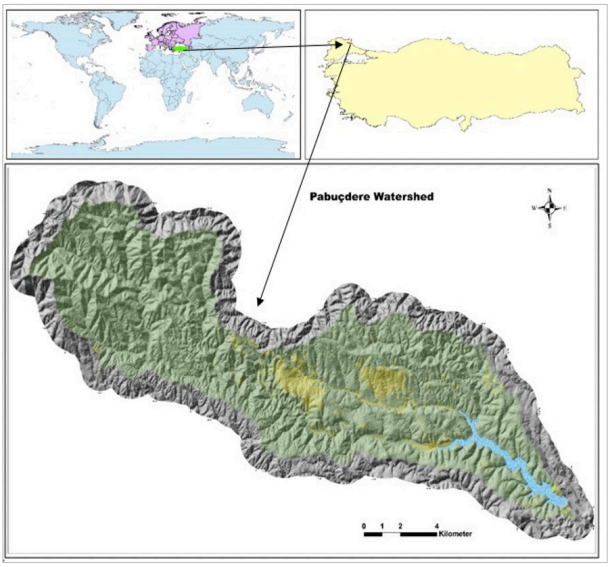

Figure 1. The location of the Pabuçdere watershed

Forest management regimes are divided into three: high forest, coppice forest and coppice-with-standards. While high forest means the forest grown from seed, coppice forest means it is grown from the root, stool or stem shoots. Coppice-with-standards means the forest is grown from the seed and shoots together (IUFRO, 2010). The demand for firewood and fine diameter material in Turkey was supplied by forests managed as coppice forests for many years. However, since 1998, coppice forest management has been restricted following the emanation of alternative fuel resources and, since 2006, it has restricted by the production of good quality timber raw material by high forest management as demanded by industries. In 2015, 19.6 million hectares (88%) of total forest area in Turkey were managed as high forest, while 2.7 million hectares (12%) were managed as coppice forest. The forests categorized as coppice-with-standards are not distinguished in today's forest management plan (GDF, 2017).

Decisions should be rationally made by considering technical and economic issues during the assignments of forest resource to production or during the change of an ongoing mode of production. There are ecological, social and economic outcomes of converting a forest resource managed as coppice forest to high forest or vice versa. The change in management regime does not only alter the forest type, but alters the variety and amount of benefits produced. Therefore, it is necessary to consider the ecological, economic and social dimensions, in addition to scientific findings, before making decisions regarding the conversion of coppice forests to high forests (Bekiroğlu et al., 2013; Odabaşı, 1976).

This study aimed to estimate the values of four benefits including timber, water, wildlife, and mushroom produced by forest management regimes (high forest and coppice forest) of forests in Pabuçdere watershed.

MATERIALS AND METHODS

Pabuçdere watershed in Marmara Region, North-west Turkey was chosen as the research area (Figure 1). Pabuçdere watershed, which has total area of 17613.8 hectares, comprises 16015.6 hectares forested area, with 15760.1 hectares of the forest area productively used for timber and 255.5 hectares of the forest area being unproductive. Furthermore, apart from the forested area, the Pabuçdere watershed also comprises 1 004.5 hectares agriculture area, 140.9 hectares forest soil, 379.2 hectares water and 73.6 hectares settlement area. The watershed is located in Vize district of Kırklareli province but supplies water to Istanbul, which is the most crowded city in Turkey, and serves Tekirdağ city for hunting purposes.

Economic valuation is defined as a process of attributing an economic value to an ecosystem service. The aim of economic valuation is to measure people's preferences for the benefits they receive from ecosystem processes (Masiero et al., 2019). There

are several methods used to measure the expected monetary increases or decreases in welfare as a result of the use of goods or services (Costanza, et al., 2014; Plan Bleu, 2015). The economic valuation methods are examined in three main groups: Revealed Preference, Stated Preference, and Benefit-Transfer Methods (Athukorala and Karunarathna, 2015; Bateman et al., 2002; Plan Bleu, 2015; Riera et al., 2012a). Choice experiments (CE) are among Stated Preference Methods.

Economic valuation aims to estimate the monetary values of ecosystem services. In addition, it produces the necessary information to raise social awareness about the importance of ecosystems in providing social welfare, defines the preferences of the society in providing different ecosystem services, and designs the policy instruments to be used in providing these services (Mavsar and Varela, 2014).

In the past two decades, environmental valuation studies have been increasingly based on random utility maximization (RUM) models. RUM model, which was proposed by McFadden (1974), provides a theoretical base to analyze data obtained through the CE method. The objective of CE method is to estimate the economic values of environmental goods or services comprising several characteristics (Farreras et al., 2017; Holmes et al., 2017). In the CE method, respondents are given a choice set (choice sets/scenarios), each including three or more alternative goods or services. These alternatives (choices, projects, programs) are actually a combination of various theoretically originated attributes and their magnitudes. One of the attributes relates to payment that reflects an individuals' willingness to pay (WTP), and it also shows the value of the alternative. This value represents the amount of payment an individual accepts to make annually for the alternative they chose, and this payment is referred to as "annual payment" in choice sets.

A choice set consists of a status-quo alternative showing the current situation and two or more choices indicating situations that may occur with the implementation of a project and program. The status-quo alternative is common in all choice sets (Birol et al., 2006).

In RUM, utility function has two types of components. One is the deterministic component which includes the factors that may be observed by the researcher. The other one is the random component which includes the unobservable factors (Holmes and Adamowicz 2003; Plan Bleu, 2015; Riera et al., 2012b). Within the scope of RUM, respondents emphasizes the importance of maximum benefit in decision-making process. The utility that an individual (*i*) will take from an alternative (*j*) is represented by Equation (I) (Hoyos et al., 2012):

$$U_{ij}=V_{ij}+\varepsilon_{ij} \quad (1)$$

In Eq (I), U_{ij} refers to the utility that individual *i* gains by choosing alternative *j*; V_{ij} refers to deterministic (observable) component of the benefit; ε_{ij} refers to error component of the benefit.
RUM provides a theoretical basis to integrate the behaviors of individuals using the valuation in CE method. Error component of the benefit reveals that estimations do not have accuracy (Birol et al., 2006). Accordingly, random utility function for respondents or individuals is given in Equation (2) (Athukorala and Karunarathna, 2015; Daly-Hassen et al., 2017; Holmes and Adamowicz, 2003; Hoyos et al., 2012; Hjerpe and Hussain, 2016):

$$U_{ij}=V_{ij}(X_{ij}, Z_{ij})+\varepsilon_{ij} \quad (2)$$

According to RUM, indirect utility function (U_{ij}) of an individual *i* choosing an alternative *j* out of a choice set is represented as the total of deterministic and observable (v_{ij}) and stochastic or error(ε_{ij}) components. (Z_{ij}) *and* (X_{ij}) refer to respondents' socio-economic attributes and goods or services' attributes, respectively. Stochastic or error term, whose average is zero, covers the effects of unobservable factors on the individual's choice. Stochastic component, as a part of the researcher in the model, helps to find the possibilities of the choices in a choice set comprised of alternatives as in the CE method. According to RUM, an individual *i* will choose an alternative *j* from a choice set (C_i) including rivaling alternatives, provided that the benefit of the alternative *j* is higher than that of alternative *k*. Based on this, the possibility of choosing the alternative *j* compared to the alternative *k* is stated in Equation (3) (Adamowicz et al., 1998; Holmes and Adamowicz, 2003):

$$P_{ij}=\text{Prob}\{V_{ij}+\varepsilon_{ij}>V_{ik}+\varepsilon_{ik};\ k \in C, j\neq k\} \quad (3)$$

C covers all alternatives in the choice set. Various choice models based on possibilities may be created depending on specific hypotheses on random error term distribution (Adamowicz et al., 1998; Holmes and Adamowicz, 2003). As in this study, when there is more than one choice in a choice set in which one of them is chosen, models with many terms are formed.

When the random term of the benefit is presumed to be distributed as independent and identical alternatives, the possibility of an individual *i* choosing an alternative *j* in J number of alternatives in choice set C_i is given in Equation (4) according to Multinomial Logit Model (MNL) (Greene, 2008):

$$P_{ij}=\frac{e^{(X_{ij}\beta)}}{\sum_{j=1}^{J} e^{(X_{ij}\beta)}} \quad (4)$$

β parameters of MNL are estimated by maximizing the log-likelihood function of the model above (Holmes and Adamowicz, 2003). The dependent variable in log-likelihood function is valued at 1 for the alternative preferred in the choice set, and valued at 0 for the others. By doing this, empirical data with several number of alternatives was obtained with several number of respondents and with only one choice set. In this research, conditional logit model and random parameter logit models was used. The explanatory power of the models has been enhanced, and the interactions between the individual features and the benefit of the scenarios have been shown using alternative specific constant (ASC) and variables interacting with alternative specific constant.

Valuation estimations have been done for each attribute/benefit using the parameters derived from analysis of the conditional logit and random parameter logit models. Marginal value of change in attribute level is shown as the ratio of the parameter coefficients [Equation (5)]. This value is called "marginal WTP (mWTP)" or "implicit price." The mean WTP for each environmental attribute is obtained by dividing the parameter coefficient of each attribute by annual payment of the parameter coefficient (Athukorala and Karunarathna, 2015; Daly-Hassen et al., 2017; Holmes and Adamowicz, 2003; Plan Bleu, 2015).

$$mWTP = -\left(\frac{\beta_{attribute}}{\beta_{payment}}\right) \quad (5)$$

According to CE method, 16 sets have been prepared with 3 different management alternatives including one status-quo and two different management alternatives. Table 1 shows four attributes and their determined levels for each alternative. The levels in Table 1 were computed using previous reported relations (Destan, 2011; Bobek et al., 1984).

Status-quo shows the management regimes of the forests in the Pabuçdere watershed prior to 2006. As at that time, the cover area of coppice forest was 50% of all forest area, and it was accepted as the status-quo. Alternative *I* refers to the management of half of the coppice forest land included in the coppice forest management category by direct conversion into high forest, while the management regimes of high forests in the Pabuçdere watershed remain the same. In other words, the forests in the watershed are managed as 75% high forest and 25% coppice forest, as first alternative management regime. Alternative II, accepted as the second management regime, refers to the management of all the coppice forest lands included in high forest by direct conversion into high forest without changing the type. In other words, all forests in the watershed were converted to high forest (100%) as coppice forests (0%) are totally removed. Bayesian efficient design was used as experimental design for determination of the combinations of attribute levels in this study. The computer software N-Gene (1.0) was used to create this design. In Figure 2 shows a sample of the choice sets used in this study. With the questionnaires, respondents were asked to state their most preferred choice out of the sets.

Table 1. Attributes and their levels used in choice experiments

Attribute	Description	Attribute levels
Timber	Annual cut	80 000 m³ 72 000 m³ 64 000 m³ (status-quo)
Water	Annual water yield	80 million m³ 70 million m³ 60 million m³ (status-quo)
Wildlife	Number of deer in the watershed)	330-deers 220-deers 110-deers (status-quo)
Mushroom	Amount of mushroom gathered from the watershed)	23 tons 20 tons 26 tons(status-quo)
Annual payment*	Household annual payment to change forest management regime	260 Turkish liras (₺) 195 Turkish liras 130 Turkish liras 65 Turkish liras 0 Turkish liras (status-quo)

1 US dollar equal to 352 Turkish Liras according to the exchange rate in 2017.

Three types of questionnaire were used: pilot questionnaire, annual payment determination questionnaire, and the main questionnaire. Within the scope of pre-field study, 21 pilot questionnaires were administered in villages (Sergen and Kışlacık) in Vize town in Kırklareli in June 2016. Questionnaires were administered to 9 forest villagers in the villages (Kızılağaç and Hamidiye), and 21 forest villagers in the villages (Sergen and Kışlacık) within the watershed borders in order to determine the annual payments to be included in the choice sets. 30 questionnaires were also administered in Vize and Demirköy town centers in Kırklareli; Saray town center in Tekirdağ, Çatalca town center in Istanbul, as well as in neighboring villages (including those outside the watershed borders) to the Pabuçdere watershed were included in the study.

In the annual payment determination questionnaire, the respondents were shown a choice card demonstrating the best and worst situation related to the benefits of the watershed. Respondents were then asked about their WTP for this change. Average value was 132 ₺ for the annual payment, which was estimated by calculating the average money they are willing to pay. Annual payment amounts were determined as 0 – 65–130–195-260 ₺ by calculating the lower and upper quantities of a specific amount of this value. The 0 ₺ status-quo alternative was

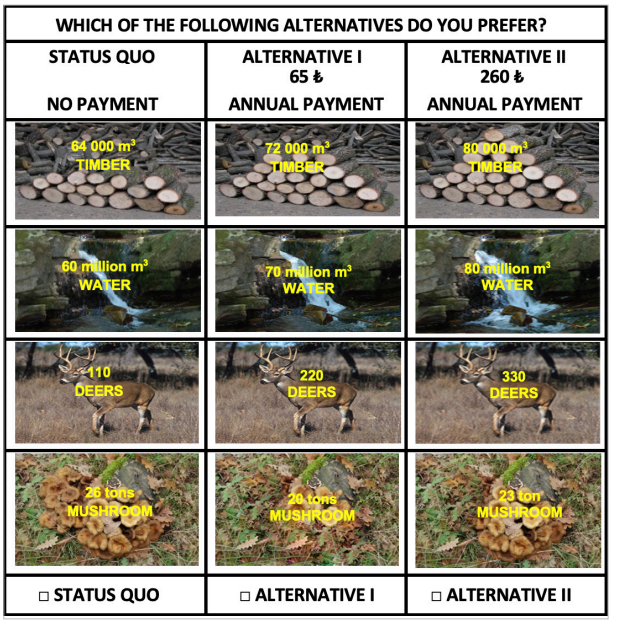

Figure 2. A sample of choice sets used in the study

fixed for each choice set. The payment amounts calculated were used as annual payments in the choice sets.

Although the Pabuçdere watershed was chosen as the study area, the benefits produced by forest management alternatives have been a concern for many people within or outside of the watershed, and it does not enable a sample only in the watershed. The values produced by two different management alternatives of coppice and high forest in the Pabuçdere watershed are enormous, as communities living within and outside the watershed can benefit from them. For this reason, questionnaires and choice sets were categorized into three settlement units: *in the watershed, near the watershed* and *outside the watershed*.

The sample size of the study was calculated as 384, and the respondents were administered the questionnaires via face-to-face. 155 of these respondents were from the villages in the watershed, 103 were from the villages near the watershed, and 126 were from villages outside the watershed. The questionnaires were administered in 2016 and 2017. People living in the watershed usually work for the forestry implementations, except during vegetation period. Therefore, questionnaires administration was spread across all periods in a year, with forestry harvests period having a higher amount.

RESULTS AND DISCUSSION

The main questionnaire of the study begins with an introductory part which summarizes the subject. It also includes parts in which attributes and their levels are explained through visual materials (choice sets). The questions to find out the most preferred choice out of 16 choice sets was included in addition to information about the levels of each attribute in status-quo, as well as information about when the other management regimes are implemented.

Attitude questions addressed the attributes, and the questions on socioeconomic characteristics (age, education, income, etc.) of the respondents were included in the last part of the questionnaire. Information about the socioeconomic characteristics of the respondents are summarized in Table 2.

General average age of respondents was 50 years. In addition, it was revealed that the respondents in 45–54 years age group (29.4%) participated most in the questionnaire administration exercise. The least participants were 75 years old and above (2.3%) followed by 18–24 years age group (3.9%). Primary school graduates account for half of the participants (207 respondents). The lowest household income of the respondents living in the watershed was 1200 ₺/year, while the highest was 120000 ₺/year. The lowest household income of the respondents living near the watershed was 1000 ₺/year, while and the highest was 84000 ₺/year. The lowest household income of the respondents living in town centers outside the watershed was 6000 ₺/year, while the highest was 240000 ₺/year.

The analysis of data generated from this study was done using NLOGIT 5.0 statistical program. Conditional Logit (CL) and Random Parameter Logit (RPL) models were used according to the attributes of the data. 23 different CL and 3 different RPL regression models were tested for the target settlement categories. In these models, effects of the four attributes mainly addressed in this study and the change in annual payment levels on individual preferences were utilized. Also, the analysis on interaction of variables related to the features of the respondents who chose the status-quo alternative was also conducted. While RPL analysis was done solely for all the target society in all models, CL analysis was exclusively done on data gathered from sample communities settled within the watershed, near the watershed, in the town centers outside the watershed, as well as all the societies (in some models).

The results of CL analysis for the different parts of the survey area based on their living areas are summarized in Table 3. All the three CL models were significant at 0.01 level of significance. Table 3 shows that all model variables (except "wildlife" in the CL1 model and "water" in the CL2 model) are statistically significant in explaining variations in the respondents' choices. All variables in the three CL models have the expected outcomes.

Table 2. Socioeconomic variables of respondents

Socioeconomic variables	The number of respondents	The percentage of respondents
Age (years)		
18–24	15	3.9
25–34	41	10.7
35–44	65	16.9
45–54	113	29.4
55–64	92	24.0
65–74	49	12.8
>75	9	2.3
Level of education		
No education	6	1.6
Primary school	207	53.9
Secondary school	63	16.4
High school	76	19.8
Vocational school	25	6.5
Master/PhD	7	1.8
Income* (Turkish Lira)		
0–10.000	46	12.0
10.001–20.000	169	44.0
20.001–30.000	81	21.1
30.001–50.000	64	16.7
>50.000	24	6.3

*household income, annual

Log-Likelihood (Log-L), χ^2, McFadden ρ^2 (McFadden pseudo- R^2), Akaike information criteria (AIC), information about observation and respondent number were given in the models. Significance of the models was shown with χ^2. AIC values were used to determine how the variables added to the models fitted well into the explanatory power of the model. While McFadden ρ^2 value increased with each independent variable added, the models with decreasing AIC levels were preferred. McFadden ρ^2 values indicate the explanatory power and they correspond to R^2 value in multiple regression. However, McFadden ρ^2 is much lower than R^2 generated for multiple regression, and the values between 0.20–0.40 for this coefficient may be considered quite high (Hensher and Johnson 1981; Tabachnick and Fidell, 2015). In some studies McFadden ρ^2 values below 0.10 or even 0.20 are often found in the MNL analysis (Audibert et al., 2017; Bachok, 2008; Bhat ve Sardesai, 2006; Holmes and Adamowicz, 2003; Zanni et al., 2008).

CL4 and RPL models increased to prominence as the most explanatory for the complete survey area in this study. Both models were significant at the 0.01 level of significance, and all variables in these models have the expected outcomes (Table 4). Also, almost all variables were statistically significant, at least, at 0.05 level of significance. The negative sign of the ASC_{SQ} variable indicates that respondents believe that the alternatives other than the status quo will improve their well-being and that there is no status-quo bias.

Table 3. Results of CL analyses for the different parts of the survey area

	CL1	CL2	CL3
	In the watershed	Near the watershed	Out of the watershed
Variable	Coefficient	Coefficient	Coefficient
Annual payment	–0,00618*** (0,00042)	–0,00764*** (0,00052)	–0,00425*** (0,00043)
Timber	$0{,}4624.10^{-4}$*** (0,00938)	$0{,}3453.10^{-4}$*** (0,01178)	$0{,}2828.10^{-4}$*** (0,01031)
Water	$0{,}1742.10^{-7}$*** (0,00625)	$0{,}1087.10^{-7}$ (0,00770)	$0{,}6661.10^{-7}$*** (0,00672)
Wildlife	–0,00047 (0,00058)	0,00199*** (0,00073)	0,00264*** (0,00062)
Mushroom	$0{,}9243.10^{-4}$*** (0,02194)	$0{,}16391.10^{-3}$*** (0,02711)	$0{,}7477.10^{-4}$*** (0,02327)
ASCSQ	–0,67481*** (0,21015)	–1,45671*** (0,26150)	0,08891 (0,22413)
Log-L	–2486,32	–1529,38	–1952,62
χ^2	311,36***	381,54**	192,25***
Pseudo-R^2	0,0578	0,1093	0,0455
AIC	4984,6	3070,8	3917,2
Observations	2480	1648	2016
Respondents	155	103	126

*,**, and *** indicate significance levels at 10%, 5%, and 1%, respectively. Standard deviations are in the brackets.

As a result of the analysis, marginal WTPs for the benefits addressed were calculated using Eq. (5) with coefficients of variables of the CL1, CL2 and CL3 models developed for the different parts of the survey area (Table 5). While the participants settling in the watershed referred $7{,}48.10^{-3}$ ₺ value per household for a unit increase in timber production, this value decreased to $4{,}52.10^{-3}$ ₺ near the watershed. The respondents near the watershed referred $1{,}42.10^{-6}$ ₺ value per household to management alternatives, causing a unit increase in water. However, the value per household increased to $1{,}57.10^{-5}$ ₺ for out-of-watershed respondents who are more sensitive to water scarcity. While out-of-watershed respondents were the ones who most valued the change in the wildlife, with $6{,}21.10^{-1}$ ₺ per household, the community living near the watershed was the ones who most valued the mushroom production, with $2{,}15.10^{-2}$ ₺ per household.

CL4 and RPL models were both used for estimating marginal values of forest benefits for the complete survey area, and RPL model was used for the calculation of values of the management regime options (alternatives). Marginal values of forest benefits in both models and TEVs of management regime options are summarized in Table 6.

Furthermore, the annual total economic value of each choice was calculated using production amounts in economic values and choice sets. As a result of the calculations, if the forests in the watershed were managed as 50% coppice and 50% high forest, it was found that the society would attributed 53 969 495 ₺ to contributions made by timber, water, wildlife, and mushroom. If these forests were managed as 75% high forest and 25% coppice forest, this value level would increase to 56 930 655 ₺. If these forests were managed as 100% high forest, the value would rise to 59 891 815 ₺.

The study does not certainly reveal that economic value generated would rise due to high forest rate increase in all conditions. The forest structure of the Pabuçdere watershed and value approaches of the societies involved gave more prominence to the high forests. Furthermore, it may be thought that the General Directorate of Forestry leaves a small amount of coppice forest due to employment and social pressure, among others reasons. It is not possible to claim that this approach is not applicable as a result of these findings. The approaches implemented in this study must be benefited from in the determination of "alternative cost" or "social cost" of the land managed as coppice forest.

These findings are not the values calculated based on the market prices of neither the timber nor mushroom gathered. A marketization approach was not used in this research, instead, the values the society would sacrifice were selected as baseline. For this reason, findings of the research were affected by market conditions. However, as the social interests and

preferences change, these findings may also change. When the societal preferences are dealt with as a whole, the high forests the Pabuçdere watershed had the most value of forest benefits as indicated by society. Czajkowski et al. (2017) investigated the

Table 4. Results of CL and RPL analysis for the complete survey area

Variable	CL4		RPL	
	Coefficient	St. Dev.	Coefficient	St. Dev.
Annual payment	0.00584***	0.0002	–0.00698***	0.0005
Timber	$0.3641.10^{-4}$***	0.0060	$0.3656.10^{-4}$***	0.0071
Water	$0.3378.10^{-7}$***	0.0039	$0.3690.10^{-7}$***	0.0048
Wildlife	0.00134***	0.0003	0.00109**	0.0004
Mushroom	$0.10407.10^{-3}$***	0.0137	$0.11859.10^{-3}$***	0.0167
ASCSQ	–0.67999**	0.3162	1.31368***	0.4471
Derived standard deviations of parameter distributions				
NsPAYMENT			0.00185	0.0020
NsTIMBER			$0.4857.10^{-4}$*	0.0261
NsWATER			$0.5504.10^{-7}$***	0.0153
NsWILD			$0.633.10^{-5}$***	0.0013
NsMUSHROOM			0.04934	0.0604
Log-L	–5786,62	–5775,21		
χ^2	1338,51***	1949,32***		
Pseudo-R^2	0.1015	0.1443		
AIC	11631,2	11618,4		
Observation	6144	6144		
Respondents	384	384		

*, **, and *** indicate significance levels at 10 %, 5 %, and 1 %, respectively

Table 5. Marginal WTPs of the forest benefits for the settlement categories

Attribute	Unit	In the watershed	Near the watershed	Out of the watershed
Timber	₺/m^3/household	$7,48.10^{-3}$	$4,52.10^{-3}$	$6,65.10^{-3}$
Water	₺/m^3/household	$2,82.10^{-6}$	$1,42.10^{-6}$*	$1,57.10^{-5}$
Wildlife	₺/unit/household	$-7,61.10^{-2}$*	$2,60.10^{-1}$	$6,21.10^{-1}$*
Mushroom	₺/kg/household	$1,50.10^{-2}$	$2,15.10^{-2}$	$1,76.10^{-2}$

Table 6. The economic value of management options with marginal values of forest benefits for the society

Attributes	Marginal Values		Economic Values of Forest Management Options		
	CL4	RPL	Status-quo	Alternative I	Alternative II
Timber	$6,23.10^{-3}$	$5,24.10^{-3}$	335,22	377,12	419,03
Water	$5,78.10^{-6}$	$5,29.10^{-6}$	317,19	370,06	422,92
Wildlife	$2,29.10^{-1}$	$1,56.10^{-1}$	17,18	34,36	51,53
Mushroom	$1,78.10^{-2}$	$1,70.10^{-2}$	441,74	390,77	339,80
Economic value of management options per household (₺)			1 111,33	1 172,31	1 233,28
Total economic value of management options (₺)			53 969 495	56 930 655	59 891 815

spatial heterogeneity of public's preferences for a new forest management and protection program in Poland. They found that respondents'WTPs were higher when they live closer to the forest. In addition, the socio-demographic variables had highly significant effects on WTP. For example, individual's age had a highly significant and negative effect on WTP, while their income had a positive effect on WTP. It was observed that people who frequently use the forests for recreational purposes have more WTP for improvements in their management. Also, individuals who live near old-growth forests have substantially different preferences with respect to the desirability of enhancements in national forest management and protection practices.

It is not possible to think that a finding based on subjective values is obtained by highlighting choice sets and questionnaire used for this study in addition to lack of an economic analysis based on market values. With the change of management alternatives, subjectivity has decreased by giving respondents the chance to make a choice out of attribute levels based on scientific findings on the changes in the benefit levels. As a matter of fact, differences have evolved between the opinions of the respondents and economic values based on their choices and payment decisions. While the respondents who stated that change into high forest was negative and that coppice management affected all the benefits positively (Bekiroğlu et al., 2013) were more, the economic value calculated with the data collected from the same respondents were higher for the high forests. Therefore, decisions are to be made based on methods like the CE method which considers effective implicit variables on society preferences rather than direct declarations.

CONCLUSION

This study reveals that changes in forest management regimes cause a corresponding change in the values added by the society. When social preferences are addressed as a whole and high forests are observed in the Pabuçdere watershed, more values would be added by the society in terms of forest benefits. In this study conducted in the Pabuçdere watershed, it should be taken into consideration that the TEVs calculated for the study population are limited to the sample society. In this study, it was revealed that societal needs and expectations from forests as well as socio-economic and demographic factors affect the TEVs. Therefore, the planning of further similar studies should consider these factors mentioned as this will enable researchers to obtain more reliable results. It has been investigated that forest management regimes can provide greater benefits in the Pabuçdere watershed with the valuation of different management regimes. Thus, a guiding approach has been presented to resource managers for decision making among alternative management regimes and effective management of forest resources. For the implementation of such methods, research findings revealing the assessment of and interest in the benefits derived from forests are not sufficient. Indeed, further research must be conducted to identify the relationship between possible management regimes and benefits in order to optimize the most effective results in areas providing increasing values in terms of water, wildlife, recreational impact, climate change, and biodiversity.

Ethics Committee Approval: Ethics committee approval was not required in this study, as no plant or animal species were collected and no experiments or analyzes were conducted on them. In the study, the data of forest management and forestry practices were used.

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