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Investigation of relations between forest functions and some socioeconomic variables: The case of Turkey

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Abstract: While human beings first utilized forests as sources of nutrition and shelter, by the industrial age, forests were seen as sources of raw materials. Through variation in forest usage, interactions between forest and society have undergone obvious changes. Thus, to investigate relationships between forest functions and socioeconomic data and, additionally, to estimate related trends, this papermain aim was to present the current situation in forestrelations. In this context, through regression analysis, areal data on forest functions were associated with population, education, and income level. Findings revealed that population and income are variables estimated to have the greatest effect on related areal change. Results also indicated that the area managed for economic and social functions will increase, and that managed for ecological functions will decrease. Therefore, considering these results in the context of policy formulation on sustainable forest management is crucial.

Keywords: Forest, society, forestry, functions of forests, sustainable forest management

Ormanların işlevleriyle bazı sosyo-ekonomik değişkenler arasındaki ilişkinin irdelenmesi: Türkiye örneği

Özet: Önceleri beslenme ve barınma ihtiyacı için ormandan yararlanan insan daha sonra ormanı endüstride kullanılmak üzere bir hammadde kaynağı olarak görmeye başlamıştır. Ormanların işlevlerinin çeşitlenmesi ile orman ve toplum arasındaki etkileşimde farklılaşmalar olmuştur. Çalışmanın amacı söz konusu etkileşimi güncel sayısal verilerle ortaya koymak, ülke genelinde ormanların işlevleri ile sosyo-ekonomik veriler arasındaki ilişkileri irdelemek ve bu kapsamda geleceğe ilişkin tahminlerde bulunmaktır. Bu çerçevede ormanların işlevleriyle ilgili alansal veriler; nüfus, nüfusun eğitim düzeyi ve gelir düzeyi verileri ile ilişkilendirilmiş ve regresyon analizi yönteminden yararlanılmıştır. Elde edilen bulgular ışığında ormanların işlevlerine göre işletilmesindeki alansal değişimi en çok etkilemesi beklenen değişkenler nüfus ve gelir düzeyidir. Özellikle öngörülen değişimlere paralel şekilde alansal olarak ormanların ekonomik ve sosyal işlevlerinin artış göstereceği, ekolojik işlevlerininse azalış göstereceği beklenmektedir. Bu çalışma ile ulaşılan sonuçların sürdürülebilir orman yönetiminin sağlanması yönünde politikaların geliştirilmesi kapsamında dikkate alınması önem taşımaktadır.

Anahtar Kelimeler: Orman, toplum, ormancılık, ormanların işlevleri, sürdürülebilir orman yönetimi

1. INTRODUCTION

Like other living organisms; people also interact with their surroundings. However, human is seen as the living being which mostly damages environment (Ünal et al., 2001). Undoubtedly one of the most effected ecosystems from human and its activities is forest ecosystem. Because of this situation, investigation of forest society relations is one of the prominent issues of forestry.

The way people make use of forests and their point of view of the forest have been determinants in shaping the forestry's phases. In the context of the relationship between the forest and the community, people at first made use of food items in the forest in order to survive, then hunted, and made tools and equipment

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they needed using the wood from the forest (Akesen and Ekizoğlu, 2010). The harm people cause in forest has increased with the invention of fire and people began burning the forest in order to create agricultural land and carry out animal husbandry activities. In Bronze Age and Iron Age, new tools were developed to chop the trees in forest. It is known that the forest has been greatly abused especially after the development of ancient kingdoms (Ekizoğlu and Erdönmez, 2011; FAO, 2012). In the era when people started to live in settlements, irregular tree chopping has begun. In this period, people began making use of wood as a raw material for purposes of constructing ships and buildings. Partially due to the increasing demand for wood as a raw material, human advanced in new territories, which resulted in establishment of many civilizations. This does not only mean destruction of forests, but also forms the very first stage of land deterioration (FAO, 2012).

With the industrialization that started off in 18th century, changes occurred in the way people makes use of the forest and human – forest relationships gained another dimension as the wood was now used as a raw material in the industry as well (Ekizoğlu and Erdönmez, 2011). In the process of industrial revolution, use of wood as a raw material, coupled with diversified agricultural products, development of international trade, colonization in overseas countries, increasing demand for roads, constructions and railroads with the increasing population, urbanization, establishment of new factories and technologic advancement have been the factors that have impact on forests (Kaplan et al., 2009; Janse and Ottitsch, 2005). Removal activities such as clearcutting method, which became prevalent especially in this period, and rapid tree cutting in water basins (Drushka, 2003) resulted in an increase in various environmental problems such as landslides and floods.

Decreased human population due to epidemics and great wars, and the development of alternative products to substitute wood as a raw material have been the factors that helped alleviate the intense human pressure on the forest. Coupled with the population, cultural and political advancements such as adoption of forest laws and legal arrangements pertaining to land use have also been major factors that define the human impact on forests (Ritter, 2011).

In fact, there had been various initiatives aiming to preserve and protect forests even in medieval age, well before the industrial revolution. First arrangements aiming to protect the forest and regulate their use were seen in 13th Century France and Germany (Özdönmez et al., 1996). Later in 18th century, legal arrangements introduced in order to prevent the damages that may be caused by public's overuse of forest resources adopted two distinct approaches. Introduction of protective legal arrangements aiming to prevent the exhaustion of forest resources was the first one while the second approach consisted of protective legal arrangements aiming to ensure efficient use of forest resources (Sieferle, 2010). However, scientific protective activities with regards to forests and other natural resources date back to late 19th and early 20th centuries (Kuvan, 2012).

In this period, forestry technique was developed and a scientific approach was adopted. In this context, certain new arrangements and approaches began emerging also in national forestry policies. While wood production was the only forest utilization method for centuries, now other functions and values began emerging and are prioritized worldwide with regards to forest resources management. Pressure and interest groups from outside of forestry, and especially non-governmental organizations working in the field of environmental protection, have had great helped these developments greatly (Daşdemir 2011, Trosper and Parotta, 2012).

Certainly, the forest, which produces very diverse products and services and have been made use of for various purposes since early days of humanity, is subject to changes in terms of their areas and diversity of their use. Considering the change in forest areas in the recent years, it is seen that there has been a 3% decrease in the period of 1990-2015 (FAO, 2015). Based on the assessment made by Sloan and Sayer (2015), forests are increasing in countries that have higher income levels while forest areas in low income level countries are on decrease. Various driving forces including but not limited to population increase, poverty and state policies as well as controlling powers such as technologic advancements, migration from rural areas in to urban areas, changes in cultural approaches towards forests and protective incentives effect the transformation of forest areas in non-forest areas in terms of land type and land use (Keenan et al.,

2015). Today, 52% of worldwide forest areas are being operated for production, with the rest being under protection (MacDicken et al., 2015). While the annual contribution of wood and products made of wood to world economy is 450 billion $, international trade in this field is worth 150-200 billion $ (Köhl et al., 2015). Without any doubt, forests have an important place worldwide as a means of livelihood. 12.7 million people are being employed worldwide in the field of forestry and forestry accounts for 0.4% of global employment (Whiteman et al., 2015). On the other hand, it is known that public spending in the field of forestry corresponds to approximately 2.5 times the revenues (Whiteman et al., 2015).

While the worldwide forests have been diminishing in the last 25 years, surface area of forests being made use of for purposes of water and soil protection reached 2.51% of overall forest areas. There have also been increases in the surface areas serving functions such as clean water production, flood control, public recreation and cultural uses. Such changes indicate that there is an increasing public awareness regarding multi-dimensional functions of the forest (Miura et al., 2015). Likewise, there is also an increasing trend for protection of forest areas that are ecologically significant. While ecologically significant forest areas under protection accounted for 7.7% of overall forest areas worldwide in 1990, this has increased to 16.3% by year 2015. Assessing the annual data pertaining to the same period in relation to the forests located in protected areas, an increase of 10% to 16% is evident (Morales-Hidalgo et al., 2015).

On the other hand, demography and its dynamics are very important for countries. Because the level of development and welfare have a connection with utilization of economic, social and cultural resources (Akbaş, 2016). In fact, natural resources including forests can be considered in this context and also human effects play an important role on the forests. In this context, it could be useful to examine some socioeconomic data on global scale. The current world population is around 7.3 billion and expected to reach 8.5 billion in 2030 and 9.7 billion in 2050 (UN, 2015). Additionally, the income level of the world has been increasing since 1960. While the GDP (Gross Domestic Product) per capita was 445.8 US$ in 1960 and 10.093,3 in 2015 (World Bank, 2015a). However, there is a great variation among the income levels of countries. While the average GDP per capita is 39939.2 US$ for high-income counties, it is 617.7 for low-income countries (World Bank, 2015a). Moreover, the literacy rate also has increased since 1990. The adult literacy rate was 75.8% in 1990 and increased to 85.3% in 2010 (World Bank, 2015b).

Furthermore, agriculture, stockbreeding, tourism, industry, energy, transportation, building trade and mining activities have direct or indirect effects on forests. Mislanduse and urbanization also have big pressure on the forests. Furthermore, population increase and some socioeconomic properties of the society have impact on shaping the forest-society relations. In this context the main aims of the study were to evaluate the current situation of this interaction by using statistical data, to investigate relations between forest functions and socioeconomic data and to analyze the related trends.

2. MATERIAL AND METHOD

2.1. Study Region

Data used in this study pertaining to the forest and forestry were compiled from the records and website of the General Directorate of Forestry. In ensuring that they reflect the country's true socioeconomic characteristics, data on population, gross national product per capita, education level (graduated person from university) and etc. were obtained from the Turkish Statistical Institute. Information and data obtained from all these sources constitute the material and inputs of this study.

The study region, Turkey, hosts various eco-geographies with its approximately 80-million-hectare surface area. The population of the country is approximately 80 million and 23% of it lives in rural and 77% lives in urban areas. On the other hand, the literacy ratio is 94.4% and with a 9 million university graduates. GNP is over 2 billion TL (1998 current price) and the annual average gross earnings was 27,830 TL in 2016 (TurkStat, 2016).

Besides, the country's forests also have a rich diversity. According to the data made available by the General Directorate of Forestry (GDF) in 2015, 28.6% of the country's surface area is covered by forests. In

addition, 31.1% consists of agricultural lands (Figure / Şekil 1). Majority of Turkey's forest assets is located in Aegean, Mediterranean and Black Sea Regions (Figure / Şekil 2).

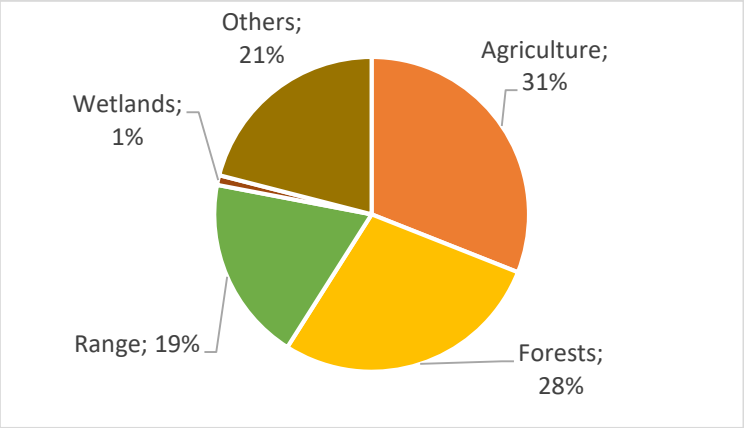

Figure 1. Land usage classes distribution in Turkey (GDF, 2014).
Şekil 1. Türkiye'de arazi kullanım sınıfları dağılımı (OGM, 2014).

All of the country's forests are almost state owned (99.9 %) and managed by General Directorate of Forestry that operates under The Ministry of Forestry and Water Affairs. 19.6 million ha. (88%) of forests has high forest characteristics and 2.7 million ha. (12%) is coppice forest.

Figure 2. Distribution of Turkey's forests (GDF. 2014).
Şekil 2. Türkiye'nin orman dağılımı (OGM, 2014).

In review of the development plans in terms of forest areas, forest areas have increased historically, with 2.1 million ha increase in 50 years, including:

- 20,199,296 ha increase in measurements made in the period of 1963-1972;
- 20,763,248 ha increase in measurements made in year 1997;
- 21,188,747 ha increase in measurements made in year 2004;
- 21,678,134 ha increase in measurements made in year 2012.
- 22,342,935 ha increase in measurements made in year 2015.

As can be seen below, functional planning has become the preferred method in planning and management of forests in Turkey in the last 10 years, which is parallel to international developments. In this context,

results obtained from activities of planning and operating forest areas based on their functions are given in Table / Tablo 1.

Table 1. Functions of forests of Turkey 2006-2015.
Tablo 1. Türkiye'nin orman fonksiyonları 2006-2015.

Basic Functions Areas	2006	2015
Economic Function Areas (ha)	10,138,990	11,243,094
Ecological Function Areas (ha)	10,438,121	9,287,847
Social Function Areas (ha)	667,915	1,811,994

Source: GDF, 2006; GDF, 2014; GDF, 2015

As can be understood from Table / Tablo 1, majority of our country's forests is operated for the purpose of economic function, which is followed by forests operated for their ecological functions. In review of the change that occurred in the period of 2006 – 2015, there had been a 1.1-million-hectare increase in surface area of forests operated for their economic functions while forests operated for ecological function diminished by 1.1 million hectares. Most noteworthy finding from the table above is that forests operated for social function achieved a 1.1 million ha increase, which corresponds to an over 2.5-fold increase.

2.2. Methods

First of the methods that were made use of in this study is interpolation, which was used for identifying the annual changes that occurred in forests' functions. Using interpolation method, data pertaining to years 2006 and 2015 were used to construct data points for the years in between. At this stage, MS Excel software was used and a curve was created, making use of data pertaining to forest functions for years 2006 and 2015. In order to construct data points for the years in between, a function was created using the curve and missing data points for years 2007 to 2014 were constructed based on that function. Data required for regression analysis, which is the main method used in this study, was thus constructed.

Prior to making regression analysis regarding how the forest areas' functions would change in the future, data pertaining to changes of economic ($Y_{Economic}$), ecological ($Y_{Ecological}$) and social (Y_{Social}) functions areas in the period between 2006 – 2016 were produced (Table / Tablo 2) (dependent variables) and independent variables, namely population (number of people) (X_N), education (people number of university graduates) (X_E) and GNP (Gross National Product) per capita (based on 1998 prices) (X_G) were completed using interpolation method (Table / Tablo 3). Data given in Table / Tablo 2 are set up as estimations for the period between 2017-2030 using simple linear regression method (Table / Tablo 3).

Table 2. Dependent and independent variables' data used in this study.
Tablo 2. Bağımsız ve bağımsız değişkenlerin bu çalışmada kullanılan verileri.

Years	Dependent variables			Independent variables		
	Areas of economic function (ha)	Areas of ecological function (ha)	Areas of social function (ha)	Population (number of people)	GNP per capita (1998 prices) (TRY)	Education (number of people)
	$Y_{Economic}$	$Y_{Ecological}$	Y_{Social}	X_N	X_G	X_E
2006	10,138,990	10,438,121	667,915	69,295,000	758,390,785	2,914,942
2007	10,346,574	11,206,853	979,831	70,586,256	843,178,421	3,354,381
2008	10,549,306	10,801,388	1,162,291	71,517,100	950,534,251	3,815,299
2009	10,693,147	10,513,706	1,291,747	72,561,312	952,558,579	4,320,813
2010	10,804,719	10,290,562	1,392,162	73,722,988	1,098,799,348	4,566,049
2011	10,895,880	10,108,241	1,474,207	74,724,269	1,297,713,210	5,495,749
2012	10,972,955	9,954,090	1,543,575	75,627,384	1,416,798,490	5,913,187
2013	11,039,721	9,820,558	1,603,664	76,667,864	1,567,289,238	6,706,780
2014	11,098,612	9,702,775	1,656,666	77,695,904	1,749,782,267	7,447,269
2015	11,151,293	9,597,415	1,704,078	78,741,053	1,900,000,000	8,340,140
2016	11,243,094	9,287,847	1,811,994	81,000,000	2,129,000,000	9,509,448

Source: GDF 2006, GDF 2015, TurkStat 2015.
(X_N): Population; (X_E) : Education; (X_G) : Gross National Product (per capita based on 1998 prices)

Once the data pertaining to forests' functions were completed, attempt was made to identify the correlation of these functions with three socioeconomically significant variables: including population, gross national product per capita and education level. At this stage, equations were developed showing the correlations of forests' functions with individual socioeconomic variables for regional distribution. Using the equations constructed, attempt was made to estimate, again using multiple linear regression method, how the distribution of forests' functions would change in the future.

Table 3. 2017-2030 data points for independent variables using simple regression method.
Tablo 3. Basit regresyon yöntemini kullanarak bağımsız değişkenler için 2017-2030 dönemi veri noktaları.

Years	Population (number of people)	GNP per capita (1998 prices) (TRY)	Education (Number of people)
2017	81,274,363	2,152,669,703	9,485,671
2018	82,363,436	2,289,265,493	10,121,404
2019	83,452,510	2,425,861,283	10,757,136
2020	84,541,584	2,562,457,073	11,392,868
2021	85,630,657	2,699,052,862	12,028,600
2022	86,719,731	2,835,648,652	12,664,333
2023	87,808,805	2,972,244,442	13,300,065
2024	88,897,878	3,108,840,232	13,935,797
2025	89,986,952	3,245,436,022	14,571,529
2026	91,076,025	3,382,031,812	15,207,262
2027	92,165,099	3,518,627,602	15,842,994
2028	93,254,173	3,655,223,392	16,478,726
2029	94,343,246	3,791,819,182	17,114,458
2030	95,432,320	3,928,414,972	17,750,191

All of the independent variables explained in terms of analyzing dependent variables were added to model. The relations between dependent and independent variables were evaluated by multiple regression analysis. The "significance level" (sig) was explained at Alpha Level of 0.01. In this context, the independent variables with 0.01 sig. level were integrated to the regression model. The autocorrelation was analyzed by Durbin Watson test (Kalaycı, 2006). The models that did not have Durbin Watson test statistic values in the range of 1.5 to 2.5 was omitted. On the other hand, Correlation coefficient (R^2) was used to explain variating in the depended variables.

3. RESULTS

Result of the multiple linear regression analysis relating the functions of forest areas and the results showing the coefficients of independent variables fed to the model are given in Table / Tablo 4. In review of the Table 4, it is understood that the change in dependent variables pertaining to the functions of forests areas is explained by average of 93% by the independent variables added to the model. Remaining 7% is explained by variables that were not added to the model via error term. In addition, it is evident that the smallest (R^2) value is that of ecological functions. On the other hand, Durbin Watson test values are between 1.5-2.5, which indicates that autocorrelation is not relevant in the models that were created. Again, F statistics value and Significant (Sig) value pertaining to the model in Table 4 are noteworthy. In review of the aforementioned values, it is seen that models pertaining to all functions are significant as a whole at significance levels of 0.001 and 0.05.

Moreover, "t statistics" values pertaining to parameters show individual significances of all variables added in the model and all variables are significant. Findings outlined above are individually discussed in terms of forests' functions and estimation values are listed below.

Table 4. Regression analysis results.
Tablo 4.Regresyon analizi sonuçları.

Dependent Variable	(R^2)	F	Sig.	Durbin Watson (DW) Test	Independent Variable and Parameters			
					Independent Variables	Value	t-Test	Sig.
Economic Function ($Y_{economic}$)	0.967	94.769	0.000	2.005	Fixed	-7095827.03	-2.418	0.046
					Population (X_N)	0.26190	5.819	0.001
					GNPpC (X_G)	-0.00021	-0.355	0.733
					Education (X_E)	-0.24464	-1.667	0.139
Ecological Function ($Y_{ecological}$)	0.850	13.208	0.003	2.003	Fixed	14946181.20	1.264	0.247
					Population (X_N)	-0.05064	-0.279	0.788
					GNPpC (X_G)	-0.00097	-0.408	0.695
					Education (X_E)	0.05090	0.086	0.934
Social Function (Y_{social})	0.971	77.059	0.000	1.861	Fixed	-17771271.33	-5.581	0.001
					Population (X_N)	0.28198	5.773	0.001
					GNPpC (X_G)	-0.00042	-0.656	0.533
					Education (X_E)	-0.23878	-1.499	0.177

In review of the values in Table / Tablo 4 for the economic function dependent variable ($Y_{economic}$), it is understood that the dependent variable is explained by 96.7% by the independent variables added to the model while remaining 3.3% is explained by the variables that are not added to the model via error term. In this case, it is safe to assert that the variables chosen for the model are highly effective. Based on the DW test value ranging between 1.5 and 2.5 (DW=2.005) it is understood that the economic function model does not have autocorrelation. Moreover, we can assert that the model as a whole is significant at all levels (F=94.769, Sig=0.000). Model pertaining to economic function can be expressed as what follows based on the coefficients constructed using multiple linear regression analysis:

$$Y_{economic} = -7{,}095{,}827.03 + (0.26190 * X_N) - (0.00021 * X_G) - (0.24464 * X_E) \quad (1)$$

As can be seen in the formula above, calculated fixed term is -7,095,827.03. This means that there will be a decrease of -7,095,827.03 units in the surface area of forests that are operated for their economic function if the listed independent variables are zero. Again, using the model, parameter values and their explanations can be made as follows pertaining to the independent variables: firstly, the population variable coefficient is 0.26190 and it is understood that one-unit increase in population will cause 0.26190-unit increase in economic function. However, coefficients of GNP per capita and education independent variables are negative and are 0.00021 and 0.24464 in respective order. This means that a one-unit increase in GNP per capita or education will result in decrease of 0.00021 or 0.24464 in respective order.

Estimated data of Table / Tablo 3 were inserted in the regression formula given in Table / Tablo 4 and estimated economic function values are listed for the period of 2017-2030. Using the model that was constructed, surface area of Turkey's economic function areas is calculated to be 11,417,293 ha for 2017. 2020 estimation is 11,720,346 ha, 2025 estimation is 12,225,435 ha while 2030 estimation is 12,730,524 ha. All estimations regarding economic functions of Turkey's forests are given in Figure / Şekil 3 below.

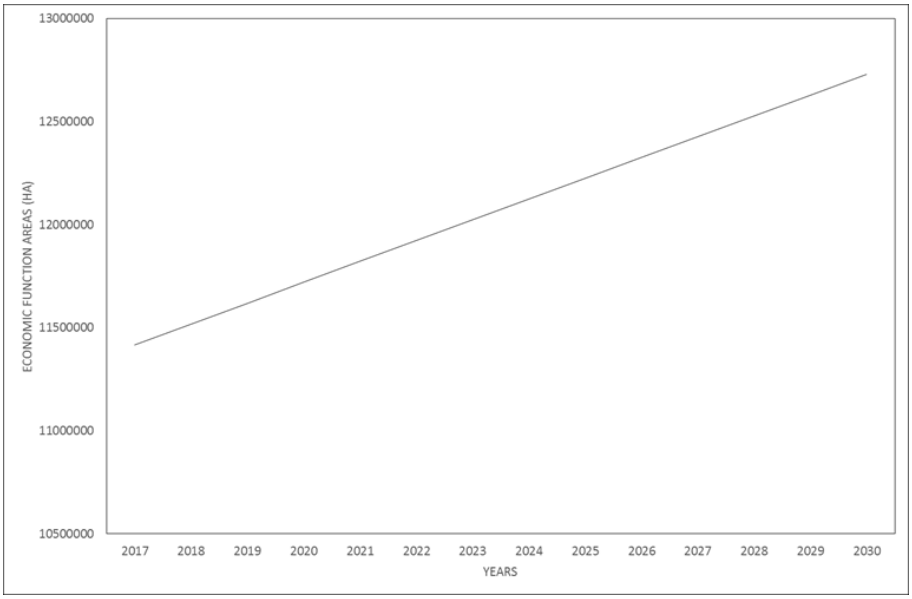

Figure 3. Estimations of economic function areas for the period of 2017-2030.
Şekil 3. 2017-2030 dönemi için ekonomik fonksiyon alanlarının tahmini.

Again, in review of the values in Table / Tablo 4 for ecological function dependent variable ($Y_{ecological}$), it is understood that the dependent variable is explained by 85% by the independent variables added to the model. Remaining 15% is explained by the variables that are not added to the model via error term. In this case, it is safe to assert that the variables chosen for the model are largely effective. We understand that there is not autocorrelation in ecological function model based on the DW test value ranging between 1.5-2.5 (DW=2.003). Moreover, we can assert that the model as a whole is significant at all levels (F=13.208, Sig=0.003). Ecological function model can be expressed as what follows based on the coefficients constructed using multiple linear regression analysis:

$$Y_{ecological} = 14{,}946{,}181.20 - (0.05064 * X_N) - (0.00097 * X_G) + (0.05090 * X_E) \quad (2)$$

As can be seen in the formula above, fixed term is calculated to be 14,946,181.20. This means that there will be an increase of 14,946,181.20-unit increase in the surface area of forests with ecological function if the listed independent variables are zero. Again, parameter values and explanations pertaining to the relevant independent variables can be made as follows using the model: firstly, population variable coefficient is -0.05064 and it is understood that a one-unit increase in population will cause a 0.05064-unit decrease in ecological functions. Likewise, GNP per capita coefficient is negative, i.e. -0.00097, and one-unit increase in GNP per capita will cause a decrease of 0.00097 in ecological functions. On the other hand, education independent variable coefficient is 0.05090, which indicates that a one-unit increase in education will cause 0.05090-unit increase in ecological function.

In estimations of areas with ecological function for the period of 2017-2030, results in Table / Tablo 3 and 4 were used, and estimations are listed. Based on the model that was constructed, estimated surface area of Turkey's forests of ecological function for 2017 were calculated to be 9,225,179 ha. While the estimation for 2020 was calculated to be 8,759,309, estimations made for 2025 and 2030 are 7,982,860 ha and 7,206,411 ha in respective order. All estimations regarding the ecological functions of forests in Turkey for the period of 2017-2030 are given in Figure / Şekil 4.

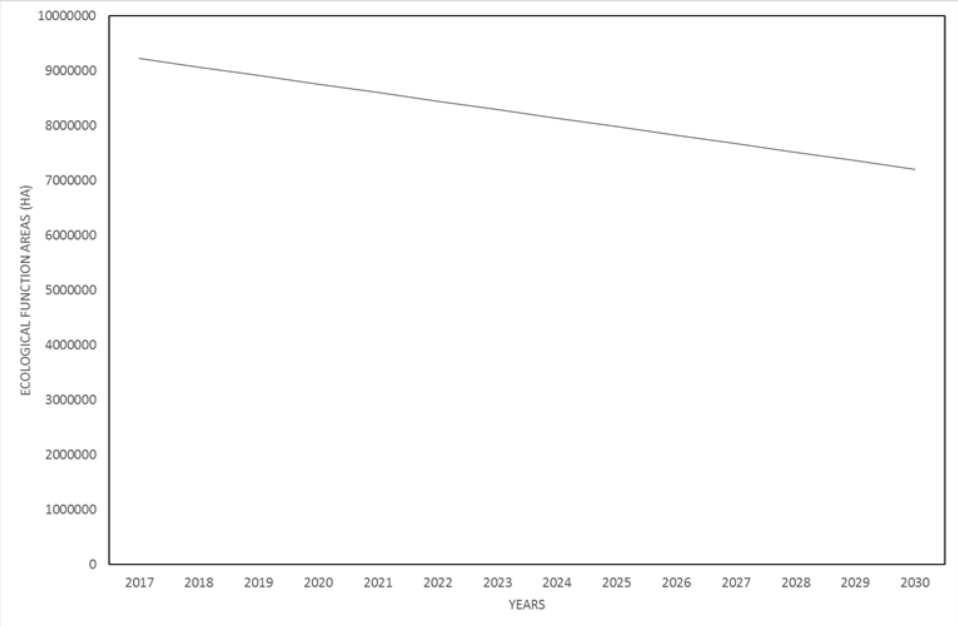

Figure 4. Estimations of ecological function areas for the period of 2017-2030.
Şekil 4. 2017-2030 dönemi için ekolojik fonksiyon alanlarının tahmini.

In review of the values in Table / Tablo 4 regarding social function dependent variable (Y_{social}), it is understood that the dependent variable is explained by 97.1% by the independent variables added to the model while the remaining 2.9% is explained by the variables that are not added to the model via error term. In this case, it is safe to assert that variables chosen for the model are largely effective. Based on the DW test value ranging between 1.5-2.5 (DW=1.861) it is understood that social function surface area model does not have autocorrelation. Moreover, we can assert that the model as a whole is significant at all levels (F=77.059, Sig=0.000). Social function surface area model can be expressed as what follows based on the coefficients constructed using the multiple linear regression analysis:

$$Y_{social} = -17,771,271.33 + (0.28198 * X_N) - (0.00042 * X_G) - (0.23878 * X_E) \quad (3)$$

As can be seen in the formula above, fixed term is calculated to be -17,771,271.33. This means, there will be a 17,771,271.33-unit decrease in the surface area of forests with social function if the listed independent variables are zero. Again using the model, parameter values and explanations pertaining to the relevant independent variables can be made as follows: firstly, public variable coefficient is 0.28198 and it is understood that a one-unit increase in population will cause a 0.28198 unit increase in social functions. On the other hand, GNP per capita coefficient is negative 0.00042, which means a one-unit increase in GNP per capita will cause a decrease of 0.00042 unit in social functions. Likewise, education independent variable coefficient is also negative, i.e. -0.23878, which indicates that a one-unit increase in education will cause 0.23878 decrease in social function.

Surface area estimations for areas of social function in the period of 2017-2030 were also made using the results given in Table / Tablo 3 and 4. Using the model that was created, Estimation for social function areas of Turkey in 2017 was calculated to be 1,977,364 ha. Estimation for 2020 was calculated to be 2,271,143 while estimations for 2025 and 2030 are 2,760,776 ha and 3,250,409 ha respectively. All estimations for surface areas of Turkey's forests with social function in the period of 2017-2030 are given in Figure / Şekil 5 below.

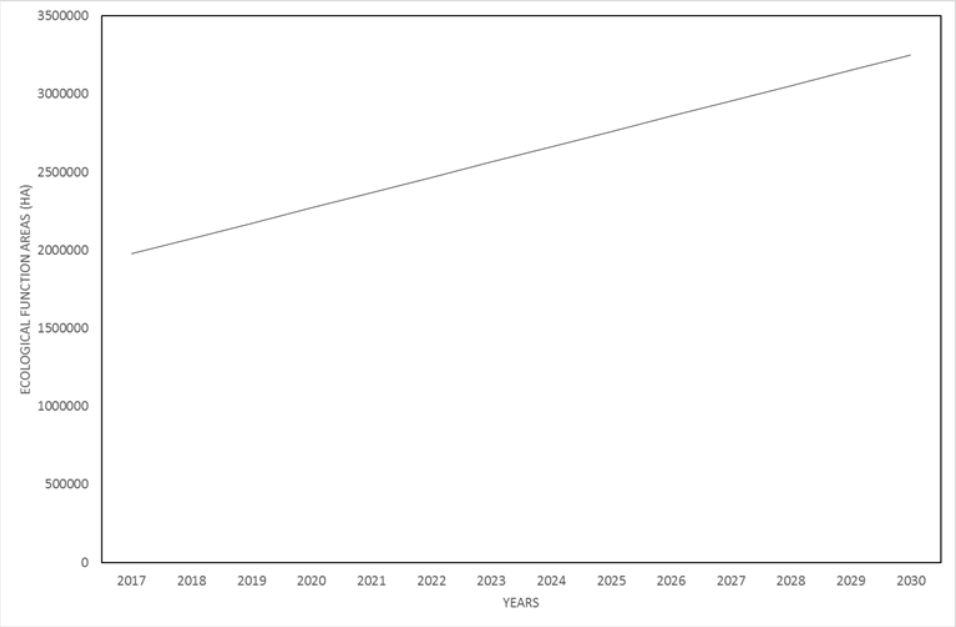

Figure 5. Estimations of social function areas for the period of 2017-2030.
Şekil 5. 2017-2030 dönemi için sosyal işlev alanlarının tahmini.

4. DISCUSSIONS

Based on the findings of the study, socioeconomic variables are effective on the change of surface areas allocated for forests' functions. Especially population and education among the aforementioned variables have greater effect compared to GNP per capita. Similarly, Atmış and Günşen (2016), in their study, set forth that generally demographic variables (principally population) affected the changes in ways of making use of forests and determining their functions. In the referenced study, it was also pointed out that forests' service production has also increased recently along with the population. Kuvan et al (2011) pointed out in their study that production functions of forests were currently important, but in the future social functions would take over priority. Daşdemir and Güngör (2010) manifested the relevance of socioeconomic variables in terms of determining and prioritizing the functions of forests. Yılmaz et al (2006) pointed out that forests' especially recreation and urban characteristics were prioritized in metropolitan areas, and therefore priority of social functions of forests would increase day by day. From the studies referenced above, it is especially understood that forests' social functions began having priority. Similar to the referenced studies, basic findings of this study are listed below.

Based on the findings pertaining to Turkey, population has the effect of increasing the amount of forest areas that have economic function while education causes a decrease in the amount of forest areas that have economic function. GNP per capita also has decreasing effect on the aforementioned areas but its effect is much more limited in comparison to those of the other two variables. In the light of the findings of this study and in parallel to estimated changes in population, GNP per capita and education level, it is expected that surface area of forests with economic function will grow. It is foreseen that population and GNP per capita will have a decreasing effect while education has an increasing effect on amounts of forest areas operated for ecological function. Considering the tendencies pertaining to the aforementioned variables, it is estimated that the amount of forests operated for ecological purposes will decrease in the next 15 years. In review of the variables that effect the changes in forests operated for their social function, it is understood that only population will have an increasing effect on these areas. It is expected that GNP per capita and education will have a decreasing effect on forests operated for social functions. In parallel to the estimated changes, it is expected that social functions of forests will increase in terms of area.

It is certain that the balance between forests' economic, social and ecological functions must be maintained and the relations between the community and forest resources must be regulated in order to ensure sustainable forest management. It is important that the findings of this study are taken in consideration while developing policies and determining strategies for ensuring sustainable forest management. The foresight that forests being operated for ecological function will likely decrease, which is one of the especially noteworthy findings hereof, is one of the most important points that must be especially emphasized by the country's decision makers in parallel to the future-oriented approaches.

5. CONCLUSION

In the light of the findings of this study, population is the most important factor that effects the change of forest areas based on their functions. In fact, the overall population increase alone has great effect, but individual increases in urban population or rural population also have effects because expectations from forests of urban population and those of rural population differ. Such difference is also relevant in determining the functions of forests. It is also evident that, higher the education and income levels, greater the priority of social and ecological functions of forests.

It is generally thought that the demands on economic function of forests decrease, social and ecological demands increase with the increase of income and education level of society. However, the relations between income level and areal distribution of ecological functions have different characteristics in Turkey. As it is assumed that the consumption attitude of Turkey as a developing country could be considered as a factor of this difference. As it is known increase in economic income of developing countries cause also increases in consumption trend. On the other hand, the developing counties have supported some economic activities associated with environmental deterioration as the main sources of economic growth (Chew, 2009). Undoubtedly, change of this trend has a social and multi-dimensional fact. However, this trend should be taken under control to manage sustainable forests in a sustainable manner. Moreover, the results showed that education has a greater impact than economic variable on ecological functions of forests. In the light of these findings the education level has important influence on increase of ecological functions of forests. Some previous studies also showed that education was the most efficient factor on human-nature interaction (Çabuk ve Karacaoğlu, 2003; Gürlük ve Karaer, 2003; Gürlük, 2010).

Therefore, social changes must be closely monitored in plans for the future and purposes, aims and policies in the field of forestry must be determined accordingly. In this perspective, it is understood that forestry decisions must be integrated in to other social policies in order to ensure true sustainability of forest resources. Without doubt, analyzing these relationships in a broader perspective and using different types of data would be beneficial for this purpose.

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