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Full Length Research Paper

Economic valuation of externalities linked to Turkish forests

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The estimation of economic values for forest externalities that markets may not incorporate plays a key role in formulation of a successful forest policy and determination of the real contributions of forest resources to sustainable development. Both in Turkey and worldwide, determination of negative and positive externalities of forests and forestry is essential for promoting sustainable forestry development. The purpose of this study is to theoretically examine positive and negative externalities related to forest resources and forestry. Then, threshold values for possible externalities in national level of Turkish forests and forestry will be estimated in conservative manner to find out how important are the externalities of forests and forestry in Turkey. Accordingly, we addressed policy measures for sustainable forest management.

Key words: Externalities, total economic value, Turkish forests, sustainable forestry.

INTRODUCTION

Forests are seen in different ways by different groups of people. Many, perhaps the majority in the past, tend to see forests as a source of timber. However, environmental crises of last century together with biological, climatic, economical, ethical and cultural changes resulted in boost of regional, national and global level demands for forest resources. This growing and diversified demands concretized the strategic importance of forest resources (Geray, 1998) in Turkey as well as other countries in the world.

Turkey occupies a unique geographical and cultural position at the crossroads between Europe and Asia. It covers 80 million ha, one-quarter of which is devoted to – or at least designated as – forest (Türker et al., 2005a). Forests are an important feature of the Turkish rural environment and play a vital role in the economy and in social affairs (Anonymous, 2001).

Due to rapid increase in population and necessity, forest resources have been destroyed and the forest areas decreased more and more. Therefore, people are more sensitive about the benefits they get from forests and possible losses in case the forest resources were destroyed. Some of these benefits and losses, especially unpriced with the market price, are identified as the externalities of forestry (Türker et al., 2003).

Today, due to increasing importance of forest resources, the determination of externalities in the forestry practices becomes important for the wellbeing of society. For this purpose, various attempts linked to forest externalities at different levels have been realized (Merlo and Brials, 2000; Cacho, 2001; Bann and Clemens, 2001; Merlo and Croitoru, 2005a; Croitoru, 2007a).

Externalities associated with forest resources create a gap between the value and notional price of forests, either positively or negatively. There are positive externalities when people get various ecological, biological and aesthetic benefits and pay very little price for these benefits. Since, most of the externalities are not accounted for and only timber value is reflected in the contribution of forests in gross domestic product, governments often allocate inadequate funds for maintaining the forests (Mathur and Sachdeva, 2003). Hence, it's generally stated that there is an inadequate recognition of public goods and externalities for forestry (Croitoru, 2007a).

The estimation of economic values for forest externalities that markets may not incorporate plays a key role in formulation of a successful forest policy (Haltia and Keipi, 1997) and determination of the real contributions of forest

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resources to sustainable development. Both in Turkey and worldwide, determination of negative and positive externalities of forests and forestry is essential for promoting sustainable forestry development.

The purpose of this study is to theoretically examine positive and negative externalities related to forest resources and forestry. Then, threshold values for possible externalities in national level of Turkish forests and forestry will be estimated in conservative manner to find out how important are the externalities of forests and forestry in Turkey. Accordingly, we addressed policy measures for sustainable forest management.

FRAMEWORK

Externality concept

Modern textbooks of economics often consider externalities, public goods and market failures together. They are closely related as environment, forests and forestry is concerned (Merlo and Brials, 2000). Although the origin of the externality concept goes to the neo-classical economy periods, this concept were developed by Pigou (1920) who mentioned about the negative externalities (also called external diseconomies or external diseconomies) such as pollution and the positive externalities (also called external economies, beneficial externalities or external benefits) provided by forestry and green areas (Block, 1983; Merlo and Brials, 2000; Vikipedia, 2008).

The idea of externality is quite complex and many definitions and classifications are found in the literature (Merlo and Croitoru, 2005b). According to Gregory (1987) “when something produced by one economic unit is used by or imposed on another unit without the permission or payment of the recipient we will say that there is an externality”. Smoke from factory chimneys has been the usual example, but automobile exhaust emissions, the noise of jet airplanes, pesticide residuals or blaring radios in campgrounds also serve as illustrations. Pearse (1990) indicated that externalities are the market imperfections that occur whenever such impacts are not compensated through markets.

In the economy literature, the externality concept can be defined in many various ways from production or consumption relations to pricing/can not be priced the products provided by production or environmental economist views. However, basically externality arises from all benefits and also negativities resulted from the interaction process between people and environment or people and natural resources (or forests) (Seyidoğlu, 1992; Kışlalıoğlu and Berkes, 1997; Klemperer, 1996; Perman et al., 1995; Merlo and Croitoru, 2005b).

One of the points in the definition of externality concept is that the goods and services obtained after production period are priced or unpriced (Klemper, 1996). In this sense, the externalities are divided into two groups as unpriced positive effects and unpriced negative effects. Externalities can be either positive or negative (Ver Eecke, 1999). The unpriced negative effects or negative externalities are defined as the costs that cannot be compensated by the producer and directed to other people or organizations. The pollution linked to air, water, noise and visual can be given as example for the negative externalities. Unpriced positive effects or positive externalities may be defined as the benefits obtained by other people or organizations after the production period of a firm without paying any price. The benefits about the climate and natural beauty provided by afforestation of a firm for the society may be accepted as positive externalities.

Externality concept can be related to production and consumption. Namely, one firm’s production or consumption effects vice versa the other firm’s production or consumption. In this case, if production or consumption decisions by a firm has effects on the activities of other firm which has no demand for former firm's goods and services, this creates externalities, positive or negative (Türker et al., 2003).

The externalities are also defined by environmental economists with more general perspective (Kışlalıoğlu and Berkes, 1997), as the effects of a firm over the activities of other people or firm. With specific reference to forests, Price (1989) see externalities as products, either positive or negative, that does not enter the market (Merlo and Brials, 2000).

Distinction of private and public or collective goods and services is often affiliated with the externalities. While the use of private goods and services benefits only the consumer in question, consumption of public or collective goods necessarily affects the welfare of third or "external" parties. For instance, externalities are believed to occur when someone paints his/her house and neighboring householders benefit accordingly. As a contrasting example of house painting, private goods such as bread, contribute to the well-being of only those who purchase and consume it. A scenic beauty long public road is the leading example of a public good in forestry. Firms do not choose to enhance scenery on their lands or to avoid scenic damage that may occur from practices like clear-cutting in certain locations, since you can’t sell units of scenic beauty (Klemper, 1996).

Economists often refer to externalities or external effects to judge whether a good or service is a public good or service which should be provided by govern-ment. External effects are seen in literature such names as “externalities”, “neighborhood effects”, “social costs”, ”third-party effects”, “spillover effects”, and so forth. If a unit which run the economic action that spill over gains or losses onto others, those gains or losses are called externalities. The economic units-firms or households, either exclude the externalities in their decisions, or are not held responsible for them. The government is thought to be responsible for externalities as the collective interest is at risk due to external effects (Hayden, 1989).

After all definitions, the important main characteristics

related to externalities or external economies can be summarized as follow: Firstly, it is necessary to be a production or consumption occurrence or period for arising the externalities. In this process, there should be at least two sides as affecting and affected side in the position of active and passive. However, affected side has no any demand on the process or do not pay a price to opposite side. Lastly, positive results of this influence or beneficial effects on third parties are occurred as positive externalities and negative results of it or costs incurred by third parties are negative externalities.

Externalities associated with forests and forestry

Various externalities, which are not always reflected in conventional market transactions, are associated with forests and other forestry operations (McGaughey and Gregersen, 1988). These were named as positive and negative externalities according to the results of their way of effect.

Externalities are related uncompensated costs and or benefits arising from economic activity. For example, as a result of the well-management of forest resources in a watershed, forestry practices contribute the soil conservation. This is a positive externality for the owner of agricultural lands and communities in lower part of watershed, who usually don't share the cost of soil conservation. In this example, soil erosion due to deforestation and over grazing would be a negative externality for same group of people (Merlo and Croitoru, 2005b). Due to the increased pressures on the natural resources, the increased demand for non-market resources and society's strong desire to preserve the natural heritage for future generations, it is becoming increasingly important to identify and assess non-market benefits or externalities of forest resources (Condon, 1998). Because central task of forest policy is to satisfy society's needs and desires, it is imperative to understand the nature of forest externalities (Nascimento, 2005).

There are many positive externalities or external economies provided by forests to society such as increasing landscape quality, regulation of climate, recreation, carbon storage, regulating climate, increasing water quality and purification, biodiversity preservation and providing sustainability of local ecosystems. In the coverage of watershed management, the benefits such as erosion prevention or soil conservation, hydrological regulation, preventing floods and avalanche may be also expressed among the positive externalities of forests. Most of these benefits are obtained from the losses prevented by forests (EFI, 2000; Riera, 2007). These benefits, which are also called as externalities or environmental services of forests, are quite important especially for the sustainability of natural ecosystem balances and for preserving continuously physical and psychological health of individuals in the society (Türker et al., 2003).

Forest benefits are a combination of marketable and non-marketable goods and services together (Türker et al., 2005b). Especially, non-marketable ones involving the public goods and externalities make difficult to assess the value of forests accurately. However, it is not impossible to estimate the value in question.

In the fruition process of the externality, if some costs are unwillingly imposed to individual or institutions affected from the production or consumption activities or being in a passive position, or causing some negative results on these, this situation is named as negative externality. For example, there are these kinds of activities such as mis-management of forest resources, events such as erosion, avalanche or some biotic and abiotic events like forest fires. All these threaten the sustainability of forest ecosystem and prevent the production of various wood and non-wood outputs of forests. That is to say, these factors endanger the effective and productive management of forest resources. Existences of all these factors or precautionary measures to evacuate them are called as negative externalities of forest resources (Türker et al., 2001a; Türker et al., 2003).

On the other hand, the negative externalities occurred by the interferences to forests can be summarized as follow: erosion, floods and avalanche events due to poor or no forest management and the losses in the landscape quality due to increasing the intensive use of forest lands may be accepted as negative externalities. Forest fires arisen from many different reasons, the losses such as biodiversity and landscape value occurred due to plantation forestry, the losses of recreational value arisen from poor management and intensive plantation forestry may also be accepted as negative externalities of forests (EFI, 2000; Türker et al., 2001a; Türker et al., 2003).

Effect of the forest externalities is not limited to the country they happened. Positive externalities like the environmental services might reach into many other countries other than the country in which that forest actually stands. As to the costs, on the other hand, for example costs of preventing the forest degradation and deforestation is not shared with the other countries that enjoy the positive externalities. This is true for negative externalities (such as global warming) due to deforestation, where the damage would be felt outside the borders of the country being deforested. Externalities are felt by many other countries either negatively or positively. There is a need for payment and /or compensation mechanisms to assure externalities to be taken into account (Joshi, 1999).

Externalities as a component of the Total Economic Value

Total Economic Value (TEV) has been used in recent years to identify and to certain extent, quantify full value of the different components having the tangible and intangible characteristics of natural resources such as

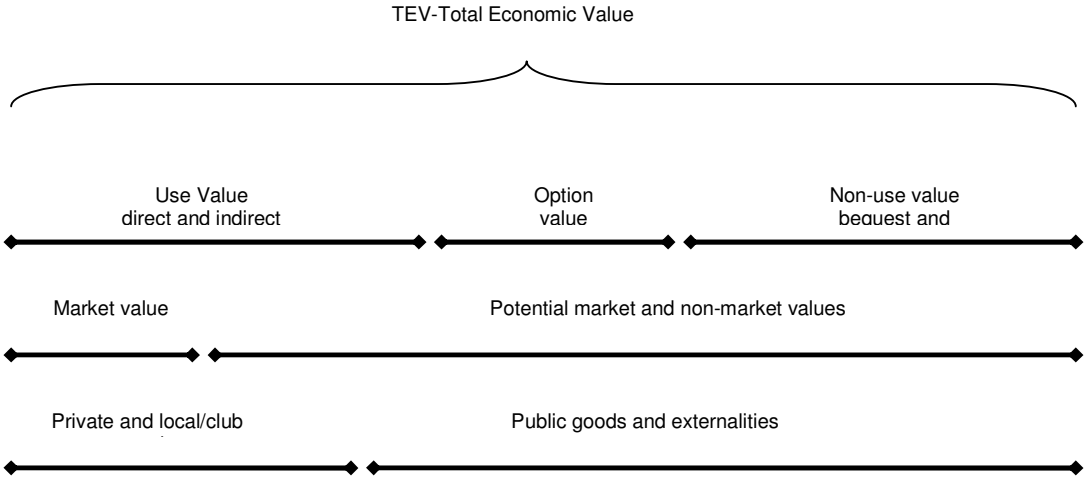

Figure 1. Possible value types within total economic value (Merlo and Croitoru, 2005b).

forests (Mathur and Sachdeva, 2003; Merlo and Croitoru, 2005b). Positive and negative externalities as well as the other forest outputs are related to the TEV of forests (Croitoru et al., 2001).

Acording Merlo and Croitoru (2005) (Figure 1), forest outputs are also classified seen as market, potential market and non-market values) or private and local/club goods and public goods and externalities. Most direct use values are market private goods, while moving along to the right, the various use and non-use values become potential market and non market public goods and externalities (Croitoru et al., 2001; Merlo and Croitoru, 2005b).

The TEV is the sum of benefits including positive outputs classified as use values (direct and indirect), option value and non-use values (bequest and existence) and social costs including negative outputs (Figure 2) Some of the positive outputs such as carbon sequestration and conservation of biodiversity are named as positive externalities, while all social costs such as damages by forest fires and erosion, floods and avalanches due to poor or no forest management that negatively affect the TEV are negative externalities (Merlo and Brials, 2000; Merlo and Croitoru, 2005b; Croitoru, 2007a).

METHODS USED FOR VALUATION OF THE FOREST EXTERNALITIES

The most important positive externalities of Turkish forests are carbon storage, climate regulation, watershed protection, enhancing water quality and purification, preventing erosion, floods and avalanches, decreasing the air pollution and noise, preserving the biodiversity etc. The other important issue for the Turkish forest resources is negative externalities. Especially in Turkey, wrong behavior of people directed to forest resources and illegal utilizations, wrong applications in the forest management and forest fires are the most important negative externalities. Although there are many positive and negative externalities for Turkish forests and forestry, only six types of externalities or outputs are taken into account in valuation due to the difficulties in terms of data availability, as mentioned by Croitoru (2007b).

A wide range of methods was also used in this paper in order to estimate threshold values for externalities related forests in Turkey. Externality types and methods used in valuation are summarized in Table 1.

A wide range of methods previously used in similar studies (Bann and Clemens, 2001; Türker et al., 2005a) was used in this paper in order to estimate threshold values for externalities related forests and forestry in Turkey. These values were obtained from the Turkish case study (Türker et al., 2005a) in MEDFOREX project prepared by the research group, who are authors of this paper.

Externality types and methods used in valuation are summarized in Table 1.

Positive externalities

The major positive externalities estimated in this study are grazing, carbon sequestration, pharmaceuticals and biodiversity conservation.

Grazing

Fodder is usually consumed by animals grazing in forests and a tangible output, but it is generally unpriced (Merlo and Croitoru, 2005b; Croitoru, 2007b). Grazing in Turkish forests can be seen as free public right and significant activity for rural communities. Thus, it can be considered that the grazing also is a type of the positive externalities for forest villagers.

Grazing is generally practiced for free in forests, while sometime it is done with defined payment. It is not simple to value grazing because of the absence of a market price. Thus, substitute goods approach is mostly used (Croitoru, 2007a). We estimated the grazing value in Turkey using substitute goods (hay) and their average price in the market. Livestock is commonly grazed for free in Turkish forests for 8 month of the year, that is, roughly from April to November. 5.8 Mha of Turkish forests is used for grazing and about 2.3 Mt fodder is annually consumed from these forest lands. Ministry of Forestry sets a market price of hay cut from meadows around US$0.23/kg. We used a conservative estimate that hay from forest pastures is of less than half value of hay from meadows, that is, US$0.98/kg (Bann and Clemens, 2001; Türker et al., 2005a). At last, we estimated the fodder value based on this conservative

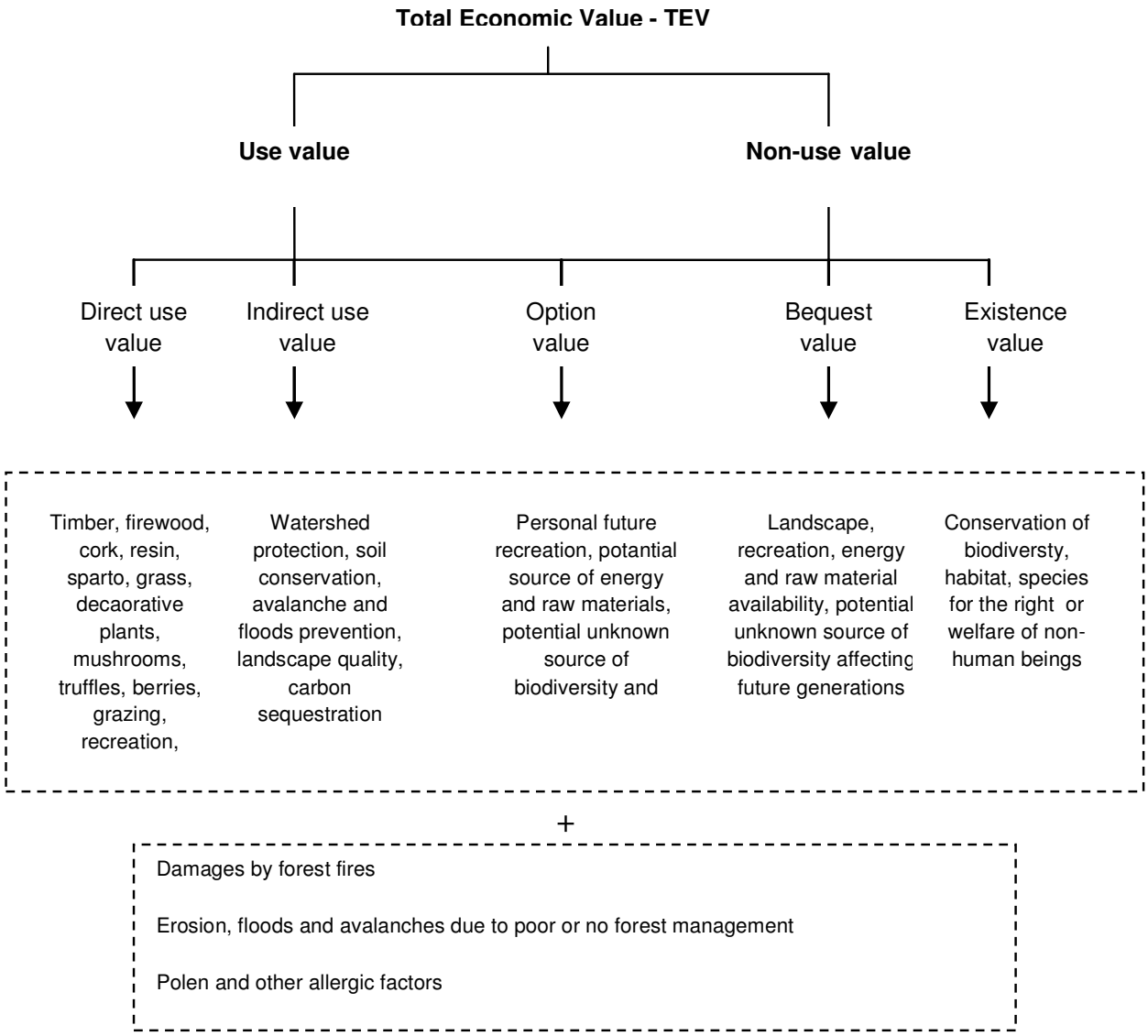

Figure 2. Total Economic Value of Forests. From Croitoru (2007a).

approach, by multiplying quantity of fodder consumed annually with conservative price of hay.

Carbon sequestration

Carbon sequestration is a component of the indirect use value and a type of the positive externality related to Turkish Forests. The value of carbon sequestration is estimated using the shadow price. This valuation is based on the annual net forest increment as proposed by the United Nations Economic Commission for Europe-Food and Agriculture Organization (2000). The annual amount of sequestrated carbon in Turkish forests is estimated at 7.92 MtC. By applying a shadow price of US$20/tC, proposed by Fankhauser (1995), we derived the economic value of carbon sequestration.

Pharmaceuticals

In Turkish forests, pharmaceutical products have always been an output that mainly used for human health. They are considered an option value and also positive externality component of the TEV.
We used the rent capture approach developed by Pearce and Puroshothaman (1992) to estimate the option value of pharmaceuticals out of Turkish forests' genetic materials. Here is the illustration of model we used for valuation (Bann and Clemens, 2001):

$V_p = (N \times p \times r \times a \times V/n)/H$

Where; V_p = the pharmaceutical value of 1 ha of forest (US$/ha/yr), N = the number of plant species in the forest, p = the probability of a hit, r = the royalty rate, a = the appropriation rate, or rent capture, V/n = the average value of drugs developed (US$/year) and H = the area of forest (ha).

We created three scenarios for estimation of potential valuation of pharmaceuticals based on best guest factors for Turkey (Table 2). We included the medium scenario valuation for Turkish forests

Table 1. The use of valuation techniques in Turkey.

Externality-Value type		Outputs	Valuation techniques	Physical indicators	Monetary indicators used (€)
Positive externality	Direct use value	Grazing	Substitute goods	Quantity of forage grazed (FU)	Price of hay
	Indirect use value	Carbon sequestration	Shadow price	Net change of carbon sequestrated in forest biomass (tC)	Shadow price of carbon
	Option value	Pharmaceuticals	Rent capture	Plant species (no.)	Market price of pharmaceuticals
	Bequest-Existence value	Biodiversity conservation	Cost-based approach	Protected area (ha)	Annual expenses for preserving biodiversity
Negative externality		Erosion, floods and landslides	Change in production function (quantitative valuation) and replacement cost (monetary valuation)	Loss of soil nutrients (t)	Cost of fertilizers
		Damage caused by forest fires	Restoration cost/or value of damage	Area burnt by fires (ha)	Cost of restoration/or value of wood

Source: Adapted from Merlo and Croitoru (2005b).

Table 2. The value of pharmaceuticals derived from Turkey's forest resources.

	Values (US$)		
Scenario	**Unit value (US$/ha/year)**	**Total value (million US$)**	**Assumptions**
Low	0.05	0.9	Appropriation rate:0.1;drug value = US$0.39 million
Medium	6.30	112.5	Appropriation rate:0.5;drug value = US$1 million
High	87.0	1575.0	Appropriation rate:1.0;drug value = US$7 million
General assumptions: n = 9000; probability of a hit = 0.0005[a]; royalty rate:0.05; H = 17.8 Mha.			

[a]A hit rate of 0.0005 has been estimated for tropical forest ecosystems and is applied here on the assumption that Turkey's biodiversity is comparable in richness.
Source: Bann and Clemens (2001).

that is, an option value of US$6.3/ha.

Biodiversity conservation

Biodiversity conservation is a bequest-existence value and a positive externality component of the TEV. We used cost based approach in valuation of biodiversity conservation. Biodiversity conservation value is US$0.70/ha of forest based on the annual payments of international organizations for biodiversity conservation in protected forest areas- the total is almost US$14 million. This is financially equal to perpetual recurring payment of US$1.38 million/year, annualized at a discount rate of 10% (Bann and Clemens, 2001). This is of course a minimum estimate of biodiversity conservation values: (i) the overall sum (US$14 million) does not refer to all forests but only to the protected forests; and (ii) the willingly transfers of international organizations are very conservative appraise of biodiversity conservation (Türker et al., 2005a).

Negative externalities

The major negative externalities estimated in this study are erosion, floods and landslides and damage caused by forest fires.

Erosion, floods and landslides

We employed the replacement cost approach to estimate the value of soil protection. As a rough replacement of soil nutrients vanished as a result of erosion, we estimated the erosion costs with amount of the fertilizers needed for replacement (Bann and Clemens, 2001).

There are various estimates of soil loss in Turkey ranging from 500 million to 1 billion t. The least loss estimate means the vanishing of 2.2 Mt of plant nutrients supposing that the soil contains on average 0.1% N, 0.15% P_2O_5 and 0.154% K_2O. The market prices of fertilizers vary from US$0.45 to US$2/kg. If we choose a price of US$1.25/kg within this price range to assess the

Table 3. Some positive and negative externalities of Turkish forests and their values.

Type of Externality		Quantity	Value (000 US$)	Value (000 €) 2001 prices	Value/ha (€/ha)	%
Positive externalities	Grazing (t of fodder)	2 300 000	225 000	218 250	10.5	45.2
	Carbon storage (tC)	7 920 000	158 400	153 648	7.4	31.9
	Pharmaceuticals (no. of plant species)	9 000	112 500	109 125	5.3	22.6
	Biodiversity conservation	-	1 380	1 339	0.1	0.3
Total			497 280	482 362	23.3	100.0
Negative externalities	Erosion, floods and landslides (t of nutrients)	110 000	- 125 000	- 121 250	-5.9	93.6
	Damage caused by forest fires (ha)	5 804	- 8 607	- 8 349	-0.4	6.4
Total			- 133 607	- 129 599	-6.3	100.0

Adjusment to 2001 prices based on US$ inlation and exchange rate.

replacement costs for erosion, the substituent fertilizers' charge would be US$2.75 billion. This amount can not be directed to the forest degradation or deforestation due to the lack of data or information on the actual share of forestry sector in contributing erosion as a result of poor forest management. Nonetheless, assuming the poor forest management induces the just 5% of the total erosion in Turkey, once more in a conservative manner, replacement costs still would be over US$125 million annually. The replacement cost, of course, is not equal to real damage values, since this approach only considers the vanishing nutrients and we do not really know the exact amount of nutrient loss. Thus, this cost estimation is very minimal compared with the real losses, because: (i) assumption of 5% of erosion is attributed to the forestry is very beyond the range of real share considering that half of the forests degraded; (ii) irreversible losses of soil is not taken into account with this assessment.

Damage caused by forest fires

In Turkey, an average forest area of 5804 ha is under direct effect of forest fires annually in accord with General Directorate of Forests (GDF) statistics. We here calculated the forest fire damages by three items: (i) the market value of timber lost in forest fires (US$2.2 million); (ii) increased afforestation costs because of the forest fires (US$4.5 million), and (iii) extinguishing costs (US$4.5 million). With an economists view, there are more items to include this estimation of forest fire damage such as (i) the value of damages on non-wood forest products which are more sensitive to fire; (ii) the value of endemic species destroyed completely; (iii) opportunity cost of labor used in forest fire suppression; (iv) devoid of land revenue due to fire; (v) extra administration costs for burnt out forests etc (Türker, 2000; Türker et al., 2001b).

RESULTS

Two major categories of externalities, positive and negative, have been identified and estimated in monetary values. Estimates realized in this study summarized in Table 3.

Conservatively value estimates of positive externalities related Turkey forests and forestry averages about € 482.4 million (€23.3/ha), while the value of negative ones is € -129 599 (- €6.3/ha).

The contributions of grazing, carbon sequestration, pharmaceuticals and biodiversity conservation to the positive externalities of Turkey forests and forestry are 45.2, 31.9, 22.6 and 0.3% respectively. In this case, the biggest share in the positive externalities is grazing provided Turkish forests to forest communities.

Relatively high positive externality values, of €10.5/ha, are found in Turkey, where grazing provides a large and valuable free input to the economic life of forest villagers (Türker et al., 2005a).

The shares of erosion, floods and landslides and damage caused by forest fires, which are the negative externalities linked to Turkish forests are 93.6% and 6.4% respectively. The biggest share in the negative externalities is the cost of erosion, floods and landslides. While it was considered that the value of positive externalities together with the negative ones, the net value of externalities is about € 352 763.

Conclusion

The results of this study revealed that Turkish forests and forestry practices involve many positive and negative externalities. However, monetary valuation was carried out for only six externality items, because of the data constraints in national level. These constraints are related to current forest management mentality. It often seeks to produce goods and services, which are pertinent to production of the wood and non-wood forest products. Thus, externalities or non-marketed outputs are not sufficiently taken into consideration by decision makers. They are, therefore, to ignore externalities in their decisions and planning activities. This study is a tool guiding and encouraging for improving current forest management understanding, as it was estimated the value of externalities or forest outputs except that the wood and non-wood forest products. Such these studies also provide an aid that externalities can be internalized.

It can be seen that the total value of positive externalities is greater than € 482 million/year, while the value of timber and other WFPs such as firewood estimated by Türker et al. (2005a) for the year of 2001 totalled less than € 476 million. This shows that the contribution of Turkish forests to the national economy depends on not

only in wood products, but also elsewhere. However, the values of positive forest externality can be considered substantial underestimates, as important externalities such as climate regulation, watershed protection, decreasing the air pollution and noise etc are not valued in this study.

On the other hand, the value of externalities can not be reflected to the balance sheets of Turkish forest sector. Thus, the share of forestry sector in GDP is only 0.05% (Türker, 1999), this rate arises mainly WFPs, partly from NWFPs and very little from hunting and recreation and it is considerable low for the sector, which cause the forestry sector cannot get financial support for its investments.

The value of externalities remains external to forestry planning that focuses intensively upon timber, leaving open the possibility of large negative externalities when non-wood resources are significantly affected by forestry planning decisions. This can cast doubt on the degree to which those decisions provide benefit to Turkish society. It is therefore desirable that forestry planners take certain actions. These can be broadly classified according to tree items: (i) multi-functional management, (ii) joint management of the State Forest, and (iii) improvement management of the protected areas (Bann and Clemens, 2001).

Furthermore externalities as component of the TEV play an important role in Turkish forestry, especially improving forest accounting and forest policy. Sustainable strategies are needed to increase TEV of Turkish forests through raising positive externalities with the other forest outputs or marketable forest products while reducing negative ones. Due to the values of externalities estimated at the minimum bounds, it is expected that the real value of positive externalities would be higher. On the other hand, it is necessary to minimize the values of negative externalities, arisen from soil loss and forest fires, causing to decrease of TEV.

Necessity for the considering these non-market forest externalities has emerged in Turkish forestry to pursue sustainable management of the forests. In this context, forest management and administrative activities should involve these externalities. Furthermore, sustainability and multiple-use principles should be pursued. Comprehensive management plans should be prepared instead of existing management plans which are timber production dominant. New plans should include externalities or non-market forest products value.

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