Sustainable Forest Management

Socio-economic assessment of goods and services provided by Mediterranean forest ecosystems

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METHODOLOGICAL GUIDE: FACTSHEETS AND TOOLS

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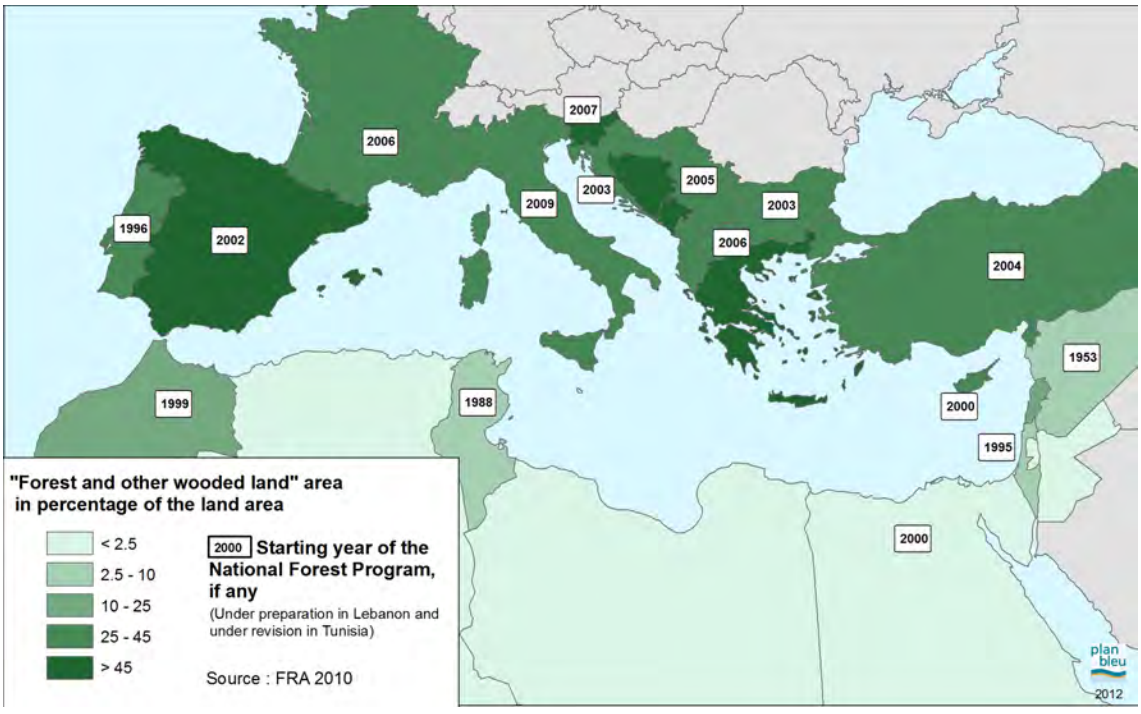
Mediterranean forests under pressure

Although forest ecosystems represent only about 9% of the Mediterranean region's land area (85 million ha) they importantly contribute to poverty alleviation, socio-economic development, food security and the preservation of a healthy environment. Mediterranean forests provide many goods and services sometimes specific to the region: wood products, non-timber forest products (cork, pine nuts, mushrooms, honey, etc.) and environmental services. The ecosystem services provided by these ecosystems are increasingly recognized: protection of water and soil, combat against erosion and desertification, provision of recreational areas, sequestering greenhouse gases, and protecting biodiversity.

Global changes (human pressure and climate change) strongly and quickly affect the Mediterranean forest ecosystems and challenge the sustainable provision of those multiple goods and services for populations. The Mediterranean region already had 507 million inhabitants in 2010 and could reach 625 million in 2050. Increasing human pressure is felt through urbanization, land use changes, firewood collection and grazing. On the other hand the Mediterranean region is highly vulnerable to climate change, the region is expected to warm up at a greater rate than the global average, and undergo a possible severe decrease (up to 30-40%) in precipitation [IPCC, 2013]. The impact of climate change can lead to an increased risk of forest fires and pests, but also growing problems of soil erosion and desertification.

Figure 1: «Forest and other wooded land» area as a percentage of the land area of Medietrranean countries and starting year of NFPs. Source: FAO, 2010



Foreword

Economic valuation to face global changes

To overcome these challenges and secure the sustainable provision of goods and services, policies have to be developed and implemented through adequate forest management strategies and measures. To support decision making processes the estimation of social and economic value of goods and services is essential. The sustainable forest management requires proper consideration of forest ecosystems multifunctionality.

The monetization of damage and environmental benefits is a decision support tool that involves giving a monetary value to the effects of human activities on the environment and the services supplied by the environment. It can also help integrate human and environmental impacts in environmental policy measures.

The economic valuation approach is very important for forest ecosystems and can contribute

- to find adequate budgets to restore forest ecosystems,
- to highlight the importance of forest's goods and services
- to convince owners, politics, etc. to take action to protect forests.

This approach can be used to show that preservation of forests and hence the goods and services rendered by them avoid significant costs for remedial measures to replace these natural services, and it can show how the production of goods and services supplied by forests can be optimized in the context of global changes.

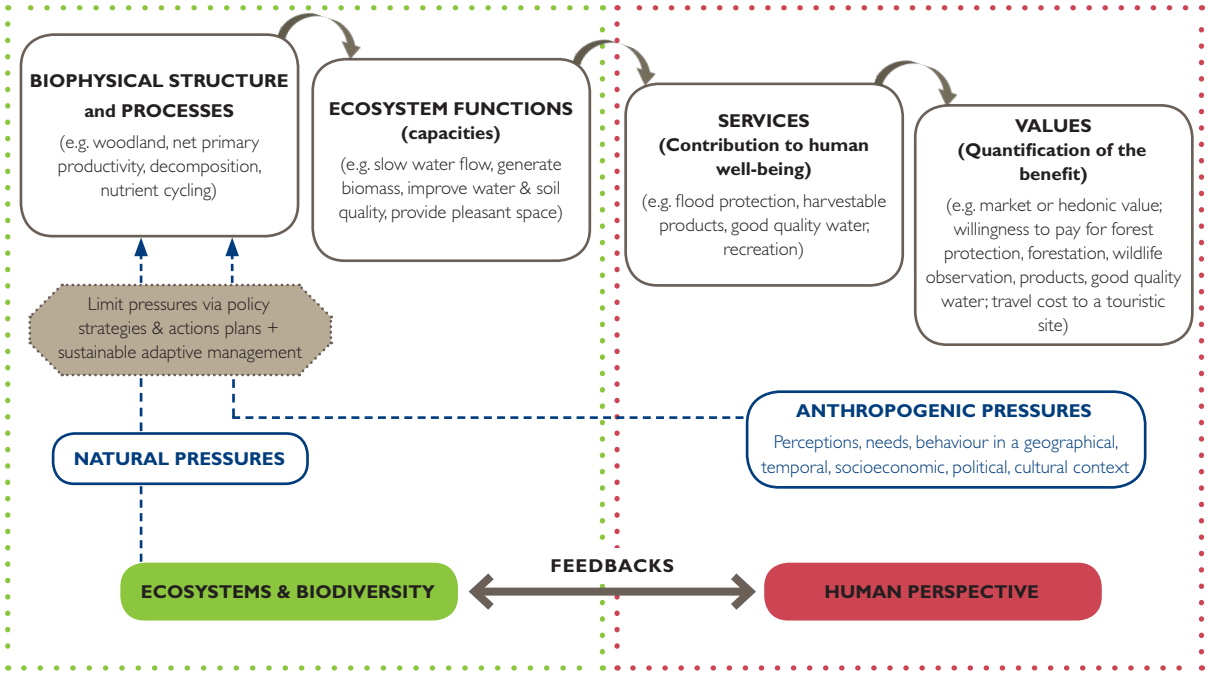


Figure 2: Relationships between ecosystems and human well-being along the «service cascade» (adapted from Haines-Young and Potschin, 2010)

Foreword

Context and Objectives of this methodological guide

In 2014, Plan Bleu has coordinated the production of a synthesis report on state-of-the art methods and tools of economic valuation of forest goods and services*. The report was produced by the Mediterranean office of the European Forest Institute (EFIMED) and the Forest Research Centre of Catalonia (CTFC) as part of the project called «Optimizing the production of goods and services by Mediterranean forests ecosystems in the context of global changes», funded by the French Global Environment Facility (FGEF) and jointly entrusted to Plan Bleu and FAO (Secretariat of Silva Mediterranea).

This report has been completed with the production of factsheets which synthetically cover the various evaluation methods and estimation. Reading the technical report is recommended to illustrate the points presented in these methodological factsheets and deepen the subject.

The objectives of these methodological factsheets are:

- To present an overview of the economic valuation methods that can be applied in the Mediterranean region.
- To describe each economic valuation method and its applications to forest goods and services, with its characteristics and the procedures for implementation, illustrated through concrete examples.
- To describe the characteristics and the application of two methods to help decision making (cost-benefit analysis and multi-criteria analysis) that can be applied to the evaluation of alternative forest management scenarios.

This guide is for everyone concerned and interested in the socio-economic valuation of goods and services provided by Mediterranean woodland areas: managers, public or private owners, companies or individual or collective users in all sectors of activity, including agriculture, water management, protection of fauna and flora, forestry, tourism, leisure, etc.

** The report can be found in French and in English on Plan Bleu website at :*
http://planbleu.org/fr/publications/methodes-et-outils-devaluation-socio-economique-des-biens-et-services-rendus-par-les

Overview of economic valuation methods

There are two main groups of economic valuation methods: revealed preferences methods (RP) and stated preference methods (SP).

Revealed preference methods are based on actual market behaviour of users of ecosystem goods and services. However, their applicability is limited only to a few ecosystem goods and services.

Stated preference methods can be applied to all types of ecosystem goods and services. However, their main disadvantages are that they are based on hypothetical situations and their application is complex and resource consuming.

Method group	Valuation method	Forest good or service valued	Value captured	Affected population captured	Benefits of method	Limitations of method
Revealed preference methods	Market price	Those that are traded in markets, mainly resources (e.g., timber, fuel-wood, cork, non-wood forest products)	Direct and indirect use	Users	Market data available and robust	Limited to market goods and services
	Cost-based *	Mainly ecological services: soil protection, water protection, climate regulation	Direct and indirect use	Users	Market data available and robust	Can potentially overestimate actual value
	Hedonic pricing	Services that contribute to the quality of attributes of a certain market good, e.g., air quality, landscape aesthetics, noise reduction	Direct and indirect use	Users	Based on market data	Very data intensive and limited mainly to data related to property
	Travel cost	All ecosystem services that contribute to recreational activities	Direct and indirect use	Users	Based on observed behaviour	Limited to recreation and problematic for multiple destination trips
Stated preference method	Contingent valuation	All goods and services	Use and non-use	Users and non-users	Able to capture all use and non-use values	Potential bias in response, hypothetical market (not observed behaviour), resource-intensive
	Choice experiment	All goods and services	Use and non-use	Users and non-users	Able to capture all use and non-use values	Potential bias in response, hypothetical market (not observed behaviour), resource-intensive

* *Cost based methods category considers all three approaches (damage costs avoided, replacement costs and substitution costs) which are equally applicable.*

The benefit transfer method is an alternative to RP and SP methods, as it typically requires less resources and time. However, it is not a valuation method, as it only uses values estimated in other valuation studies, which are performed for similar goods or services, and then transfers this values to estimate the value of goods or services on another site by using correction factors or meta-data analysis. However, the method is still relatively new and no widely accepted standards for its application have been adopted yet.

Overview of economic valuation methods

Employing one or the other method will depend on the objectives of the study and of the degree of familiarity with the different methods. The final selection of the method depends on many factors, like: (i) type and number of objects to be valued; (ii) relevant population (e.g. users or non-users or both; geographical scope (local, regional, national, international); (iii) data availability (e.g. restricted data access – data on house values); (iv) available time and financial resources; (v) team (e.g. experience).

Overview of the use valuation methods in relation to valued goods and services

Group	Forest Good/Service	Valuation method*					
		MP	CB**	HP	TC	CV	CE
Resources	Industrial wood	+	o	-	-	-	-
	Fuelwood	+	o	-	-	-	-
	Cork	+	o	-	-	-	-
	Food products	+	o	-	-	-	-
	Fodder and forage	+		-	-	-	-
	Decorative material	+	o	-	-	-	-
	Hunting and game products	+	o	-	-	-	-
	Pharmaceuticals, Cosmetics and other raw materials for industrial application	+	o	-	-	-	-
Biospheric	Biodiversity protection	-	o	-	-	+	+
	Climate regulation	-	+	-	-	+	+
	Air quality regulation	-	+		-	+	+
	Carbon sequestration		+	-	-	+	+
Ecological	Health protection	-	+	-	-	+	+
	Water regulation	-	+	-	-	+	+
	Water purification	o	+	-	-	+	+
	Soil protection	o	+	-	-	+	+
Social	Recreation	o	o	-	+	+	+
	Tourism	o	o	-	o	+	+
Amenities	Spiritual and cultural services	-	-	-	-	+	+
	Historical and educational services	-	-		-		+
	Aesthetic services	-	o	+	o	+	+

**MP – market price based method; CB – cost based methods; HP – hedonic pricing method; TC – travel cost method; CV – contingent valuation method; CE – choice experiment method*

*** Cost based method category considers all three approaches (damage costs avoided, replacement costs and substitution costs), which are equally applicable. +- typically used; o – sometimes used; - not applicable*

1. Market price method

General description:

The market price method estimates the economic value of ecosystem goods or services that are bought and sold in markets. The market price method can be used to value changes in either the quantity or quality of a good or service. It uses standard economic techniques for measuring the economic benefits from marketed goods and services, based on the quantity people purchase at different prices, and the quantity supplied at different prices. Market price represents the value of an additional unit of that good or service, assuming the good or service is sold through a perfectly competitive market (that is, a market where there is full information, identical products being sold and no taxes or subsidies).

Goods and services valued:

The market price method uses prevailing prices for goods and services traded in markets, such as timber, fuelwood, non-wood forest products (e.g., mushrooms, berries, aromatic and medicinal plants, etc.).

Main steps of application:

1. Estimate of demand function before the change in provision - use market data to estimate the market demand function and consumer surplus for the valued good or service before the change in the provision.
2. Estimate of demand function after the change in provision - estimate the market demand function and consumer surplus for the good or service after the change in provision has occurred.
3. Estimate of the change in economic benefits to consumers - calculating the difference in benefits before and after the change in provision.
4. Estimate of supply function before the change in economic benefits to producers
5. Estimate of supply function after the change in economic benefits to producers
6. Estimate of the change in economic benefits to producers - calculate the difference in producer surplus due to the change in the provision of the valued good or service
7. Estimate of the total economic change - sum of changed consumer surplus and changed producer surplus.

Strengths	Weaknesses
• People's values are likely to be well-defined as it reflects an individual willingness to pay for costs and benefits of goods or services that are bought and sold in markets. • Data are relatively easy to obtain. • Uses observed data of actual consumer preferences • Uses standard, accepted economic techniques.	• Market data only are available for a limited number of goods and services. • True economic value of goods or services may not be fully reflected in market transactions. • Seasonal variations and other effects on price must be considered. • Cannot be easily used to measure the value of larger scale changes that are likely to affect the supply of or demand for a good or service. • Usually, the market price method does not deduct the market value of other resources used to bring ecosystem products to market, and thus may overstate benefits.

Revealed Preferences

Application example:

Daly et al. (2012) estimated the value of annual wood production for the forests in the Barbra watershed basin. Forest covers around 31% of the total area of this watershed basin. One of the benefits these forests provide is wood. It was estimated that in 2010 the annual wood increment for the total area was 4,516 m3. However, a survey conducted in the area showed that households consume on average 1.48 m3 of fire wood and 155 kg of charcoal per year. Multiplying these amounts by the number of households in the area this means that the total consumption was 10,351 m3 of wood (6,650 m3 of fire wood and 3,701 m3 wood for charcoal production), which is much higher than the estimated annual production capacity of the forests in the Barbra watershed basin. This clearly indicates the importance of the consideration of self-consumption of forest products by the population.

To estimate the annual benefit of wood production for the local population the market price for fire wood was used, which was in 2010 around 4.35 €/m3. Thus, estimated the total annual benefit was 45,026 €.

Source : Daly, H., Croitoru, L., Tounsi, K., Ali, A., Sihem, J., 2012. *Evaluation économique des biens et services des forêts tunisiennes - Rapport final,* Société des Sciences Naturelles de Tunisie (SSNT).

More information:

Mavsar R., Varela E., Gouriveau, F., Herreros, F. 2013. Methods and tools for socio-economic assessment of goods and services provided by Mediterranean forest ecosystems. Project Report for Component 2 of the project "Optimized production of goods and services by Mediterranean forest ecosystems in the context of global changes", pages 53-57.

Further reading:

Pearce, D. (2001) Valuing biological diversity: issues and overview. In: OECD: Valuation of Biodiversity Benefits. Selected studies. Paris, OECD, pp. 27-44.
http://www.oecd-ilibrary.org/environment/valuation-of-biodiversity-benefits_9789264195844-en

2. Cost based methods

General description:

The cost based methods (damage cost avoided, replacement cost, and substitute cost methods) are related methods that estimate values of ecosystem goods and services based on either the costs of avoiding damages due to lost services, the cost of replacing environmental assets, or the cost of providing substitute goods or services. The damage cost avoided method uses either the value of property protected, or the cost of actions taken to avoid damages, as a measure of the benefits provided by an ecosystem. The replacement cost method uses the cost of replacing an ecosystem or its goods and services as an estimate of the value of the ecosystem or its goods and services. Similarly, the substitute cost method uses the cost of providing substitutes for an ecosystem or its goods and services as an estimate of the value of the ecosystem or its goods and services.

Goods and services valued:

These methods might be applied for valuing improved water quality, erosion protection services, water purification services, storm protection services, and habitat and nursery services.

Main steps of application:

1. Ecological assessment of the provided good or service - determine the current level of the ecosystem good or service, and the expected level if any change in the ecosystem would occur.
2. Cost assessment - The damage cost avoided method estimates potential damages or expenditures on damage avoidance or protection. The replacement cost method estimates costs of replacing the affected ecosystem goods or services. The substitute cost method is applied by estimating the costs of providing a substitute for the affected goods or services.

Strengths	Weaknesses
• Rough indicator of economic value, subject to data constraints and the degree of similarity or substitutability between related goods or services. • Easier to measure the costs of producing benefits than the benefits themselves, when goods, services, and benefits are non-marketed. • Less data- and resource-intensive. • Provide surrogate measures of value that are as consistent with the economic concept of use value, for goods or services which may be difficult to value by other means.	• Expenditures to repair damages or to replace ecosystem goods and services are not always measures of the benefits provided. • Do not consider social preferences for ecosystem goods and services. • In certain cases, the cost of a protective action may actually exceed the benefits to society. • Substitute goods or services are unlikely to provide the same types of benefits as the natural resource. • Goods or services being replaced probably represent only a portion of the full range of goods and services provided by the natural resource.

Revealed Preferences

Application example:

In the Tazekka national park a study was conducted to estimate of the total economic value of the goods and services provided by the park. The Tazekka national park is located in the Middle Atlas, near the city of Taza, in Morocco. The park provides a wide range of ecosystem goods and services, in particular to the local population, as it significantly contributes to the local economic development, (e.g., income from tourism, agricultural and forest products).

The ecosystem goods and services provided by the park were grouped into: economic (agricultural production, forest products, fodder, water provision), ecological (soil conservation, water reserves and quality, carbon sequestration, biodiversity conservation), and social (recreation, tourism, cultural, education, and spiritual).

The forest fodder production value was estimated by using the substitute cost method. In the valuation approach the quantities of the forest fodder and costs of substituting it by barley were estimated.

Using this approach, it was estimated that 11,006 ha of forests provide approximately 4 million fodder units. Considering a barely price of 0.31 €/kg, the total economic value obtained for the fodder production was 1.26 million euros. Further, the authors also considered the degradation caused by overgrazing. Thus, they reduced the total benefit of fodder provision by the cost of overgrazing. Finally, the benefit of fodder production was estimated at 902,775 € or approximately 82 €/ha.

Source: Jorio, A., *Evaluation économique de la biodiversité et des services écosystèmiques du parc national de Tazekka et impact des changements climatiques sur ces services*, Haut Commissariat aux Eaux et Forêts et à la Lutte contre la Désertification, Royaume du Maroc, July 2011.

More information:

Mavsar R., Varela E., Gouriveau, F., Herreros, F. 2013. Methods and tools for socio-economic assessment of goods and services provided by Mediterranean forest ecosystems. Project Report for Component 2 of the project "Optimized production of goods and services by Mediterranean forest ecosystems in the context of global changes", pages 57-60.

Further reading:

Pearce, D. (2001) Valuing biological diversity: issues and overview. In: OECD: Valuation of Biodiversity Benefits. Selected studies. Paris, OECD, pp. 27-44.
http://www.oecd-ilibrary.org/environment/valuation-of-biodiversity-benefits_9789264195844-en

3. Hedonic pricing method

General description:

The hedonic pricing method (HP) relies on market transactions for differentiated goods to estimate the economic benefits or costs associated with environmental quality. The basic premise of the HP method is that the price of a marketed good is related to its characteristics, or the services it provides.

For example, the price of a house is related to the characteristics of the house and property itself, the characteristics of the neighbourhood and community, and environmental characteristics. Thus, if non-environmental factors are controlled for, then any remaining differences in price can be attributed to differences in environmental quality. For example, if all characteristics of houses and neighbourhoods throughout an area were the same, except for the level of air pollution, then houses with better air quality would cost more. This higher price reflects the value of cleaner air to people who purchase houses in the area.

Goods and services valued:

The hedonic prizing method is mainly used to estimate economic values for economic benefits or costs associated with environmental quality (e.g., air pollution, water pollution, or noise) and environmental amenities (e.g., aesthetic views or proximity to recreational sites).

Main steps of application:

1. Collection of data on property value and attributes, and environmental quality attributes - to estimate a hedonic price function in order to calculate implicit prices, that is the marginal willingness to pay for the evaluated attributes of the property.
2. Sampling - the size of area and the period for which the data is collected have to be determined.
3. Model estimation and welfare estimates - the choice of the functional form is a crucial issue as it can substantially impact results.

Strengths	Weaknesses
• Can be used to estimate values based on actual choices. • Property markets are relatively efficient in responding to information, so can be good indications of value. • The method is versatile, and can be adapted to consider several possible interactions between market goods and environmental quality. • Property records are typically very reliable.	• Scope of environmental benefits that can be measured is mainly limited to things that are related to housing prices. • Only captures people willingness to pay for perceived differences in environmental attributes, and their direct consequences. • Assumes that people have the opportunity to select the combination of features they prefer, given their income. • Results depend heavily on model specification. • Large amounts of data must be gathered and manipulated. • Relatively complex to implement and interpret, requiring a high degree of statistical expertise. • Time and expense to carry out an application depends on the availability and accessibility of data.

Revealed Preferences

Application example:

Tyrväinen (1997) studied whether and how urban forests benefits are capitalized in property prices in Joensuu (Finland). As the dependent variable the author used real estate prices (Finish Marks/m2) from 14 different housing areas (a total of 1006 observations) and as independent variables different housing characteristics, like size, age, location, proximity of schools and other urban services, proximity of wooded area and watercourses.

The author applied a linear and semi-log regression models to estimate the impact on housing, location and environmental characteristics on the housing price. The obtained results indicate that the proximity to different environmental amenities positively affects housing prices. For example, a 100 m increase in distance to a watercourse decreased the housing price by 25.9 €/m2. In the same way, an 100 m increase of distance to forest recreation site decreases the housing price by 7.06€/m2.

Source: Tyrväinen, L., The amenity value of the urban forest: an application of the hedonic pricing method, *Landscape and Urban Planning,* 37, 1997, 21 -222

More information:

Mavsar R., Varela E., Gouriveau, F., Herreros, F. 2013. Methods and tools for socio-economic assessment of goods and services provided by Mediterranean forest ecosystems. Project Report for Component 2 of the project "Optimized production of goods and services by Mediterranean forest ecosystems in the context of global changes", pages 60-64.

Further reading:

Mavsar R., Varela E., Gouriveau, F., Herreros, F. 2013. Methods and tools for socio-economic assessment of goods and services provided by Mediterranean forest ecosystems. Project Report for Component 2 of the project "Optimized production of goods and services by Mediterranean forest ecosystems in the context of global changes", pages 60-64.

4. Travel cost method

General description:

The travel cost method is used to estimate the value of recreational benefits generated by ecosystems. It assumes that the value of the site or its recreational services is reflected in how much people are willing to pay to get there. There are several varieties of the travel cost method: simple zonal travel cost method (using mostly secondary data), individual travel cost method (using a more detailed survey of visitors and statistical analysis), and random utility travel cost method (using survey and other data, and statistical techniques).

The basic premise of the travel cost method is that the time and travel cost expenses that people incur to visit a site represent the value of access to the site. Thus, peoples' willingness to pay to visit the site can be estimated based on the number of trips that they make at different travel costs. This is analogous to estimating peoples' willingness to pay for a marketed good based on the quantity demanded at different prices.

Goods and services valued:

The travel cost method is used to estimate use values associated with the recreational services that ecosystems or sites provide. The method can be used to estimate the economic benefits or costs resulting from (i) changes in access costs for a recreational site, (ii) elimination of an existing recreational site, (iii) addition of a new recreational site or (iv) changes in environmental quality at a recreational site.

Main steps of application:

1. Definition of the site – defining the boundaries and attributes of the valued site.
2. Definition of the target population – the population of interest mainly includes current and potential visitors of the valued site.
3. Definition of the sampling strategy – manly deciding between on-site and off-site sampling or a combination.
4. Survey implementation – the type of questions will depend on the aim of the study and needed data.
5. Calculation of travel costs and other costs – specifying which type of costs will be considered to calculate travel cost.
6. Model estimation and welfare estimates - depends on study objective and data: single-site travel cost regression models or random utility travel cost regression models.

Strengths	Weaknesses
• Similar to more conventional approaches to estimate economic values based on market prices. • Based on actual behaviour, and therefore more reliable that methods based on hypothetical behaviour of the respondents. • On-site surveys provide opportunities for large sample sizes. • Results are relatively easy to interpret and explain. • Relatively inexpensive to apply.	• Similar to more conventional approaches to estimate economic values based on market prices. • Based on actual behaviour, and therefore more reliable that methods based on hypothetical behaviour of the respondents. • On-site surveys provide opportunities for large sample sizes. • Results are relatively easy to interpret and explain. • Relatively inexpensive to apply. • Measuring the opportunity cost of time can be problematic. • It cannot be used to measure non-use values.

Revealed Preferences

Application example:

Among the environmental goods and services provided by Mediterranean forests, wild mushroom picking is particularly appreciated. Where access to the forests is free, and when the property rights to the products are not clearly assigned, forest owners receive no benefits. Therefore, they have little incentive to provide forests with improved mushroom production, regardless of how socially desirable this would be. If the value of this environmental service to society was known, an appropriate policy could be applied to correct this situation.

To estimate the recreational benefit of mushroom picking in Solsonès county (Catalonia, Spain) a travel cost method was applied. A questionnaire was drawn up to survey a sample of mushroom pickers in Solsonès. To calculate the number of mushroom pickers, the vehicles parked at forest entrances were counted on selected days. The quantities of mushrooms picked were estimated by appraising the success of the mushroom pickers surveyed. Finally, mushroom prices in the market were recorded. The study was conducted in September, October, November and December 2001, 2002 and 2003. A sample of 300 people was surveyed in the three years period. Mushroom pickers were randomly selected on exit from different forest locations.

The survey showed that mushroom pickers made an average of 4.56 trips to the forests of Solsonès County during the mycological autumn season. The econometric analysis showed that the average consumers surplus was 39.26€ per trip. Considering that for the Solsonès County about 18,000 mushroom picking visits were estimated per year the total net benefit was about 710,000€.

Source: Martínez de Aragón, J., et al., Value of wild mushroom picking as an environmental service, *Forest Policy and Economics* (2011), doi:10.1016/j.forpol.2011.05.003.

More information:

Mavsar R., Varela E., Gouriveau, F., Herreros, F. 2013. Methods and tools for socio-economic assessment of goods and services provided by Mediterranean forest ecosystems. Project Report for Component 2 of the project "Optimized production of goods and services by Mediterranean forest ecosystems in the context of global changes", pages 64-70.

Further reading:

Riera, P., Signorello, G., (Eds.) 2012. Good Practice Guidelines for the Non-Market Valuation of Forest Goods and Services. University of Catania.
http://www.efi.int/files/attachments/e45/publications/1cost_e45_guidelines.pdf

5. Contingent valuation method

General description:

The contingent valuation method is a questionnaire based technique that seeks to discover individual preferences for an environmental change. These are the only methods that can assess non-use values of ecosystems but can also be used to estimate use values generated by the ecosystems. In addition, due to their hypothetical nature, these methods can be used to assess social preferences ex-ante, i.e., for changes that have already not taken place.

The basic premise of the contingent valuation method is that individuals are sensitive to a given environmental change and that their preferences could be measured in terms of their willingness to pay to undergo (or their willingness to accept a compensation to avoid) this change. Therefore, the given change is presented to individuals through a survey where the environmental change is presented and where people are asked to state their willingness to pay or their willingness to accept the given environmental change.

Goods and services valued:

The contingent valuation method is used to estimate non-use values that ecosystems provide, but can simultaneously estimate use values such as recreational values associated with these ecosystems. The method can be used to estimate the economic benefits or costs resulting from an environmental change that has an impact on (i) non-use values, such as existence values people hold for biodiversity, (ii) use-values such as recreational values or landscape values people hold for a given natural site.

Main steps of application:

1. Definition of the valuation objective – defining the objective of the valuation study.
2. Selection of the survey type - defining the way the survey will be implemented (e.g., in person, mail, phone, web).
3. Questionnaire elaboration – preparation of a draft questionnaire, which includes the definition of the elicitation response format.
4. Definition of the target population – who will be surveyed.
5. Definition of the sampling – the sampling strategy is selected (e.g., random sampling or stratified sampling).
6. Test the questionnaire in focus groups and in pilot surveys – to test the consistency and respondents' perception.
7. Launch the survey and collect the data from your sample.
8. Statistical analysis – including the definition of the bid and the probability functions and the estimation model parameters.

Stated Preferences

Strengths	Weaknesses
• They are the only available methods to estimate non-use values. • They can also be employed to estimate use values. • The use of surveys allows to collect relevant socioeconomic and attitudinal data on the respondents that could be relevant for understanding the variables influencing social preferences and choices. • The use of surveys allows to estimate hypothetical changes and their impact before they have taken place. • Participative/deliberative approaches before valuing the good or service at stake seem to provide with more stable results.	• Preferences for non-use values tend to be less stable. • Complex questionnaire development and data analysis. • Budget and time demands are high. • High risk of biases that may lead to inaccurate WTP estimations. • If the surveyed population has a low level of literacy it would pose significant constraints for the implementation of a questionnaire where respondents have to read. In such cases, face-to-face interviews, use of local language and local enumerators are suggested.

Application example:

To estimate the values French population hold for their forest ecosystems, a questionnaire was drawn up to survey a sample of a representative sample of 4,500 French households through telephone interviews.

The main goods and services valued were both use (e.g., resistance to catastrophes, food provision, medicines, raw materials, water supply, carbon storage, leisure, tourism) and non use values (existence, legacy). The households were asked if they had visited any forests during the time surveyed, and more generally about their different activities in the forests.

The valuation scenario was the hypothetic implementation of different protection and maintenance measures to conserve the biodiversity of forests. The survey used a referendum format and respondents were asked on the amount of money they would be willing to pay in order to finance conservation measures. The prices offered in the referendum ranged between 6 € and 90 €.

The values obtained vary according the revenues and regions. The main willingness to pay for the whole country fluctuated between 45€ and 64€ per household per year, while the results showed significant differences between the North (including Paris) with a mean of around 64€, the East (between 50 € and 55€) and the South-West of France (45€).

Source: Garcia et. al. *Valuing forest biodiversity from a National Survey in France: A Dichotomous Choice Contingent Valuation*. Document de travail du Laboratoire d'Economie Forestière (LEF), INRA, n°2007-08 (2007).

More information:

Mavsar R., Varela E., Gouriveau, F., Herreros, F. 2013. Methods and tools for socio-economic assessment of goods and services provided by Mediterranean forest ecosystems. Project Report for Component 2 of the project "Optimized production of goods and services by Mediterranean forest ecosystems in the context of global changes", pages 70-80.

Further reading:

Riera, P., Signorello, G., (Eds.) 2012. Good Practice Guidelines for the Non-Market Valuation of Forest Goods and Services. University of Catania. http://www.efi.int/files/attachments/e45/publications/1cost_e45_guidelines.pdf

6. Choice experiment method

General description:

The choice experiment method is a questionnaire based technique that seeks to discover individual preferences for simultaneous changes in the attributes that compose an environmental good or service. States preference methods are the only methods that can assess non-use values of ecosystems but can also be used to estimate use values generated by the ecosystems. In addition, due to their hypothetical nature, these methods can be used to assess social preferences ex-ante, i.e., for changes that have already not taken place.

The basic premise of the choice experiment is that a forest good or service can be decomposed in a bundle of attributes or features and that individuals are sensitive to changes in these attributes. Therefore, individuals are asked through a survey to state their willingness to pay to undergo these changes.

Goods and services valued:

The choice experiment method is used to estimate non-use values that ecosystems provide, but can simultaneously estimate use values such as recreational values associated with these ecosystems. The method can be used to estimate the economic benefits or costs resulting from an environmental change that has an impact on (i) non-use values, such as existence values people hold for biodiversity, (ii) use-values such as recreational values or landscape values people hold for a given natural site.

Main steps of application:

1. Define the valuation objective – defining the objective of the valuation study
2. Select the survey type - defining the way the survey will be implemented (e.g., in person, mail, phone, web)
3. Questionnaire elaboration – preparation of a draft questionnaire, which includes the definition of the attributes, their levels and structuring of the choice sets
4. Define the target population – who will be surveyed
5. Define the sampling – the sampling strategy is selected (e.g., random sampling or stratified sampling)
6. Test the questionnaire in focus groups and in pilot surveys – to teste the consistency and respondents' perception
7. Launch the survey and collect the data from your sample
8. Statistical analysis – calculating the attributes' coefficients and implicit prices

Strengths	Weaknesses
• They are the only available methods to estimate non-use values. • They can also be employed to estimate use values. • The use of surveys allows to collect relevant socioeconomic and attitudinal data on the respondents that could be relevant for understanding the variables influencing social preferences and choices. • The use of surveys allows to estimate hypothetical changes and their impact before they have taken place. • Participative/deliberative approaches before valuing the good or service at stake seem to provide with more stable results.	• Preferences for non-use values tend to be less stable • Complex questionnaire development and data analysis. • Budget and time demands are high • High risk of biases that may lead to inaccurate WTP estimations. • If the surveyed population has a low level of literacy it would pose significant constraints for the implementation of a questionnaire where respondents have to read. In such cases, face-to-face interviews, use of local language and local enumerators are suggested

Stated Preferences

Application example:

An application of the choice experiment was carried out to assess the preferences of the Moroccan society for different management options, aimed to improve or conserve different ecosystem goods and services provided by the forest of Bouhachem, in Northern Morocco. The main forest goods and services valued on the study are food and forage production, soil protection, water cycle regulation, biodiversity conservation, recreation and tourism.

The assessed attributes were: conservation (reducing the loss of biodiversity and the perturbations in the cycle of water), soil protection (presented as erosion), restrictions to wood and forage provision, recreational and touristic activities. These were combined to create alternative management scenarios that people had to value.

A questionnaire was distributed to a sample of 396 individuals representative of the Moroccan society (terms of age, residence and gender diversity). A latent class model with four classes was estimated. These models assume that the population is divided in a finite number of groups within which the preferences of the individuals are homogenous and different from these of other groups or classes.

The results show that the WTP of the Group 1 for the conservation, erosion and recreation attributes are not significant, which means that for this group changes in erosion and recreation attributes have no impact on the welfare. On the other hand, they would pay 0.40€ for restricting the use of the forest. The WTP of Group 2 for the conservation attribute is the value is 0.28€, which is the amount of money that the respondents would be willing to pay to conserve biodiversity. On the other hand, they would experience a loss of welfare of -0.61€ per each extra unit (ha) of eroded forest area, and of -0.38€ if the use of the forest is restricted. The WTP of Group 3 for the conservation attribute is 0.44€ (they would pay for conserving biodiversity). They would experience a loss of welfare of -0.61€ for each extra unit of eroded surface. Their WTP for the restriction of the use of the forest is 0.17€, and their WTP for the recreational attribute is 1.06€. The WTP of the Group 4 for the conservation, erosion and restriction attributes is not significant. They would experience a welfare increase of 2.47€ if the forest would be contributing to an increase of tourism.

Source: Mavsar, R., Farreras, V. (2010). *Gestion durable du capital naturel de la forêt de Bouhachem (Chefchaouen, Maroc) : garantie des bénéfices sociaux, économiques et environnementaux*. Centre Tecnològic Forestal de Catalunya.

More information:

Mavsar R., Varela E., Gouriveau, F., Herreros, F. 2013. Methods and tools for socio-economic assessment of goods and services provided by Mediterranean forest ecosystems. Project Report for Component 2 of the project "Optimized production of goods and services by Mediterranean forest ecosystems in the context of global changes", pages 70-80.

Further reading:

Riera, P., Signorello, G., (Eds.) 2012. Good Practice Guidelines for the Non-Market Valuation of Forest Goods and Services. University of Catania. http://www.efi.int/files/attachments/e45/publications/1cost_e45_guidelines.pdf

7. Benefit transfer method

General description:

Benefit transfer method is not a valuation method as such, but it is a method that involves transferring economic estimates from previous studies of similar changes in environmental quality to value the environmental change at the policy site. Thus, the basic goal of benefit transfer is to estimate benefits for one context by adapting an estimate of benefits from some other context.

Benefit transfer is often used when it is too expensive and/or there is too little time available to conduct an original valuation study, yet some measure of benefits is needed. It is important to note that benefit transfers can only be as accurate as the initial study.

There are two main forms of the benefit transfer method:

- Unit transfer method is the simplest method to transferring benefit estimates from a study site, or as a mean from several study sites, to the policy site.
- Function transfer method transfers a benefit function from another study. The benefit function statistically relates people willingness to pay to ecosystem characteristics and the people whose values were elicited.

Goods and services valued:

The benefit transfer method can be applied for all ecosystem goods and services. However, it was showed that it is more reliable for transferring use values (e.g., recreation).

Main steps of application:

1. Identify the change in the environmental goods and services to be valued at the policy site.
2. Identify the affected population at the policy site - including size and socioeconomic characteristics.
3. Conduct a literature search to identify relevant primary studies - preferably based on a database; but supplemented by journal and general web searches.
4. Assessing the relevance/similarity and quality of study site values for possible transfer.
5. Select and summarize the data available from the study site(s).
6. Transfer value estimate from study site(s) to policy site.
7. Calculate total benefits or costs.
8. Assess of the uncertainty and transfer error / Conduct a sensitivity analysis.

Benefit transfer

Strengths	Weaknesses
• Benefit transfer is typically less costly than conducting an original valuation study. • Economic benefits can be estimated more quickly than when undertaking an original valuation study. • The method can be used as a screening technique to determine if a more detailed, original valuation study should be conducted. • The method can easily and quickly be applied for making gross estimates of recreational values. The more similar the sites and the recreational experiences, the fewer biases will result.	• Benefit transfer may not be accurate, except for making gross estimates of recreational values, unless the sites share all of the site, location, and user specific characteristics. • Good studies for the policy or issue in question may not be available. • It may be difficult to track down appropriate studies, since many are not published. • Reporting of existing studies may be inadequate to make the needed adjustments.

Application example:

Zandersen and Tol (2009) conducted a function transfer method to study recreational values in Europe. This study systematically analysed the variation in data from different sources, to identify the extent to which methods, design and data affect reported forest recreation values. Only studies conducted in Europe that have applied the travel cost method had been considered. A total of 26 studies from nine European countries published between 1977 and 2001 were used.

The data indicates that there is a substantial variance in forest recreation values across studies, ranging from 0.66 to 112€ per trip with a median of 4.52€. Despite the similarities in valuation methods applied (all studies were conducted with travel cost method) and environmental service valued, the summarised benefit estimates reflect methodological, geographical and temporary differences. Namely, the values are influenced by the measurement of value (e.g., value per trip, per day or per season), by the travel cost approach (i.e., zonal versus individual travel cost method), by the definition of costs (i.e., inclusion and level of opportunity cost of time, composition of car-borne travel costs) and other methodological issues (e.g., inclusion of substitute sites, postal or face to face interviews, or specification of functional form of the meta-analysis). Also, the inclusion of exogenous data on location and site characteristics reveals that site-specific characteristics such as size, age diversity, area of open land within a forest site have distinctive effects on benefits summarised in a meta-analysis.

Source: Zandersen, M., Tol, R., A meta-analysis of forest recreation values in Europe, *Journal of Forest Economics*, Volume 15, Issues 1–2, p. 109-130.

More information:

Mavsar R., Varela E., Gouriveau, F., Herreros, F. 2013. Methods and tools for socio-economic assessment of goods and services provided by Mediterranean forest ecosystems. Project Report for Component 2 of the project "Optimized production of goods and services by Mediterranean forest ecosystems in the context of global changes", pages 80-88.

Further reading:

Riera, P., Signorello, G., (Eds.) 2012. Good Practice Guidelines for the Non-Market Valuation of Forest Goods and Services. University of Catania. http://www.efi.int/files/attachments/e45/publications/1cost_e45_guidelines.pdf

A. Cost-benefit analysis

General description:

Cost-benefit analysis (CBA) is a technique for the assessment of the relative desirability of competing alternatives (events, project, management or policy measures). The assessment involves the comparison of the current (base case) situation to one or more alternatives considering the differences between the base case and the alternatives. The analysis would focus on the differences in costs (negative impacts) and benefits (positive impacts), in the situations with and without the management measure. The CBA compares the costs and benefits measured in monetary terms.

Private CBA considers only those costs and benefits from the analysed alternative, which are imposed onto or accrue to a private agent (e.g. individual or firm). This approach is also often called financial appraisal. Social CBA in turn attempts to assess the overall impact of an alternative on the welfare of the society as a whole, rather than of the agent that implements the project. Social analysis differs from the private analysis in terms of (i) the breadth of the identification and evaluation of inputs and outputs, and (ii) the measure of costs and benefits. Social CBA considers the costs and benefits which accrue to the society as a whole.

Main steps of application:

1. Event, project or policy definition - describe the event, project or policy in sufficient detail in order to be able to determine the relevant benefits and costs.
2. Identification of relevant project impacts - tangible and intangible impacts.
3. Physical quantification of relevant impacts - physical amounts impacts (e.g. in man-days of labour, tons of CO2, etc.), and identifying when they will occur.
4. Monetary valuation of relevant impacts – valuing all costs and the benefits in monetary units.
5. Discounting of costs and benefits - convert them into their present value.
6. Calculating the CBA performance indicators – main indicators are net-present value, benefit-cost ratio, internal-rate of return.
7. Performing sensitivity analysis - examining how the outcome of the cost-benefit analysis changes with variations in inputs, assumptions or the setup of the analysis.

Strengths	Weaknesses
• Based on well-understood theoretical foundations • Has a built-in standard for value (in monetary terms) • Only includes benefits that are corresponding to beneficiaries, which actually value the impact • Because all CBA studies share a common methodology, lessons learned in one study can be easy transferred to other studies. • Better adopted to be used in benefit transfer - to estimate benefits in one situation by extrapolation or interpolation from previous studies of similar situations	• Limited only to impacts that can be measured in monetary terms • Strong influence on the results of the selected CBA parameters (e.g., discount rate, project duration, costs and benefits considered)

Decision-Making support methods

More information:

Mavsar R., Varela E., Gouriveau, F., Herreros, F. 2013. Methods and tools for socio-economic assessment of goods and services provided by Mediterranean forest ecosystems. Project Report for Component 2 of the project "Optimized production of goods and services by Mediterranean forest ecosystems in the context of global changes", pages 35-46.

Further reading:

EC 2002. Guide to cost-benefit analysis of investment projects. http://ec.europa.eu/regional_policy/sources/docgener/guides/cost/guide02_en.pdf

B. Multi-criteria analysis

General description:

Multi-criteria analysis (MCA) is a decision support method that can be used to evaluate different alternatives. These alternatives may be very broad (e.g. different policy options) or concrete cases of applied instruments. Applying MCA helps to compare alternatives according to their performance with regard to a selected set of evaluation criteria. These performances are presented in a so called performance matrix, or consequence table. In this matrix each column represents an alternative (case) and each row describes the performance of the alternative against each criterion. In a basic form of MCA this performance matrix may be the final product and each user can use this matrix to make his own judgement.

Main steps of application:

1. Establish the aims of the MCA, identify the decision maker and other stakeholders – define why is it done and who (which stakeholders) should be involved in the process.
2. Identify alternatives – list the alternatives to be evaluated (e.g., different management approaches)
3. Define the criteria (and the corresponding objectives) that reflect the relevant consequences of each option - the criteria are measures of performance applied to evaluate the alternatives (e.g., effectives, economic efficiency, flexibility).
4. Describe the performance of each alternative against the criteria in the performance matrix and determine the score matrix (scoring) - the scoring reflects the subjective judgment of each user.
5. Assign weights to each of the criteria to reflect their relative importance (weighting) – end users define the relative importance of the evaluation criteria.
6. Combine the weights and scores for each of the options to derive overall values - the performance scores for each criterion are combined with the respective importance weights.
7. Analyse the results - comparing the overall scores or by comparing scores on single criterion.

Strengths	Weaknesses
• Enables taking into account project impacts that are not easily given monetary values. • Facilitates stakeholder involvement. • Makes the appraisal and decision-making process more transparent.	• No built-in standard value, as it applies project specific values (criteria and weights). • Comparisons between studies with different valuation criteria and weights are very limited. • Requires well developed participation processes and strongly depends on stakeholder willingness to participate.

Decision-Making support methods

More information:

Mavsar R., Varela E., Gouriveau, F., Herreros, F. 2013. Methods and tools for socio-economic assessment of goods and services provided by Mediterranean forest ecosystems. Project Report for Component 2 of the project "Optimized production of goods and services by Mediterranean forest ecosystems in the context of global changes", pages 30-35.

Further reading:

Department for Communities and Local Government, 2009. Multi-criteria analysis: a manual.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/7612/1132618.pdf

Plan Bleu: let the Mediterranean be an area of cooperation for sustainable development

The objective of the Plan Bleu/RAC is to contribute to raising awareness of Mediterranean stakeholders and decision makers concerning environment and sustainable development issues in the region, by providing future scenarios to assist in decision-making. In this respect and through its dual functions as an observatory of the environment and sustainable development and a centre for systemic and prospective analysis, the PB/RAC's mission is to provide the Contracting Parties with assessments of the state of the environment and development of the Mediterranean and a solid basis of environmental and sustainable development data, statistics, and indicators to support their action and decision making process.

Decision IG.19/5 of the 16th Meeting of the Contracting Parties to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Marrakesh, 2009)

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