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METHODS AND TECHNIQUES FOR EVALUATING NON-MARKETABLE ECOSYSTEM SERVICES

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Abstract: *Ecosystems provide a range of goods and services vital to the well-being of humans and other living things, as well as to the development of society. Along with natural resources, tangible and tradable in the market, they provide a series of intangible, non-marketable services that translate into health, cultural, social and scientific benefits. Human activities, especially after industrialization, have created unprecedented pressures on natural ecosystems and led to their constant degradation, resource depletion, global warming and loss of biodiversity. This is also because non-marketable services are underestimated by the majority of the population, being perceived as inexhaustible and free. The health of ecosystems has a direct impact on the quality of life of people and other living things, a fact that has led to the development of a series of methods and techniques for evaluating all services, including non-marketable ones, so that their value can be taken into account at all relevant levels of the decision-making process. In this paper, a state-of-the-art of methods and techniques for evaluating non-marketable services provided by ecosystems is presented, the results of studies to calculate the Total Economic Value of ecosystem services are presented, as well as their importance in the process of public policy development.*

Keywords: *ecosystem services, global warming, biodiversity, evaluation methods, public policies.*

JEL classification: Q51.

INTRODUCTION

Currently, part of these resources, such as UNESCO heritage sites, Natura 2000, natural areas or protected species, benefit from protection, by legislating restrictions on human activities that can be carried out in the respective areas. One such example is the granting of financial compensation for loss of income, as is the case with forest land owners who enter into voluntary commitments. For example, in Romania, through NPRD 2014-2020, under Measure 15 – Agri-environmental services, compensatory payment packages were provided for forest owners who enter into commitments for at least 5 years, in the amount of €25/ha/ year for the areas dedicated to the provision of quiet areas, respectively €103/ha/year for the use of hitches for the collection of wood from thinnings, in the case of forest areas between 100-500 ha. For areas larger than 500 ha, a degressive financial support is applied, motivated by the fact that, in this case, the amount of income ensured by the utilization of the harvestable wood mass increases progressively, and the profitability of the forest exploitation is also improved (NPRD, 2014).

MATERIAL AND METHOD

The objective of the research is to present methods and techniques for evaluating non-marketable services provided by ecosystems, their advantages or disadvantages and limitations, identified in the specialized literature, as well as in specific national and international legislation. Also, as an example, the results of some studies will be presented that have focused on the calculation of VET in the USA, Spain, Italy and the Republic of Moldova. For this purpose, scientific articles published on the scientific platforms researchgate and google academic were analyzed, as well as national and international specialized legislation such as: resolutions, regulations, decisions, directives, PNDR 2014-2020, guides related to the specified measures. The research methods used in carrying out the work were the following: the desk-research method through the study of previous research carried out by different authors and their systematic and comparative analysis, as well as of the studied legislation.

RESULTS AND DISCUSSION

In the last 70 years, especially after industrialization, human activities have created unprecedented pressures on natural ecosystems that have caused changes within them faster and more than in any other period of mankind, and led to their constant degradation, global warming and biodiversity loss. Between 1960 and 2000, the demand for ecosystem services increased exponentially as the world population doubled to 6 billion people and the global economy grew more than sixfold (MEA, 2005).

At the global level, the importance of protecting ecosystems and their sustainable management has been recognized through a series of documents adopted by the UN, such as the Framework Convention on Climate Change (2016), the Convention on Biological Diversity (1992), or the Convention to Combat Desertification (2019). Also, at the European level, a series of European conventions or regulations have been adopted by which the member countries undertake to promote appropriate legislative and administrative measures for the protection and conservation of natural habitats. Among them we list: Bern Convention on the Conservation of Wild Life and Natural Habitats in Europe (1979), Bonn Convention on the Conservation of Migratory Species of Wild Animals (1979), EU Council Directive 92/43/EEC on the Conservation of Natural Habitats and species of wild fauna and flora (1992), Directive 2009/147/EC on the conservation of wild birds (Birds Directive, 2009) or the EU Biodiversity Strategy for 2030 (2020). The UN Millennium Ecosystem Assessment report classifies ecosystem services into: supply services (food, water, wood, etc.); regulation services (which regulate the climate, water quality, provide control of floods, epizootics and zoonoses, ensure the absorption of carbon emissions and other gases); cultural services (recreational, aesthetic, cultural, spiritual benefits), and support services (soil formation, photosynthesis, nutrient cycle).

VET assessment of ecosystem services has been and still is a challenge for scientists, specialists, experts, promoters and decision-makers of public policies globally.

Concerns in the field have led over time to the development of various techniques and methods for conducting these assessments, from mapping and modeling the demand and supply of ecosystem services to determine their economic and non-economic value, to social and ecological assessment techniques.

If for the evaluation of marketable ecosystem goods and services there are already associated values related to their use, resulting from trading on the market, the challenges arise when the question arises of the evaluation of non-marketable services, associated with non-use values, such as benefits in terms of health, biodiversity, society, science, expectations about the future.

The natural resources provided by ecosystems are unique and limited, and their depreciation or degradation entails costs to society. From an economic point of view, when a resource is limited, the opportunity cost appears, representing the value of the best of the sacrificed chances, i.e. the one that is given up when a choice is made. However, the difficulty of carrying out a VET evaluation of ecosystems is given by the fact that the changes produced on them are irreversible or reversible but at a prohibitive cost.

The VET assessment methodology developed in 2010 in the TEEB Report (TEEB, 2010) identifies two main components of the VET of ecosystem services: use value and non-use value.

Use value is composed of actual use value and potential use value while non-use value is made up of preservation value and intrinsic value. Specifically, use value comes from direct services provided by ecosystems: animals, fish, plant products, recreation, well-being, spiritual fulfillment, education, research, or indirect: clean air, purified water, soil fertility, pollination, pest control, And so on

Non-use value includes philanthropic and altruistic values, namely the desire that the services offered by ecosystems can be enjoyed by other people and future generations, as well as the desire that the species that make up the ecosystem continue to exist. These values are the most difficult to evaluate in financial terms, considering that they refer to moral, aesthetic, religious principles, for which there is no proper trading market.

The TEEB report identifies and classifies VET assessment methods into 3 categories:

I. Direct market valuation approaches: price-based method, cost-based method, production function-based method.

I.1) The price-based method is most often used to calculate the value of goods and services provided. These being traded on the market, their value is relatively easy to calculate: for example, the value of selling wood, honey, the value of tourist services.

I.2) Cost-based methods. Within this category there are several techniques, such as: the method of avoided costs (which evaluates the costs that would have occurred in the absence of the existence ecosystem), the replacement cost method (estimates the costs of replacing ecosystem services with artificial technologies), the restoration cost method (which evaluates the costs of counteracting the effects of ecosystem loss or restoring them).

I.3) The method based on production functions estimates how much of the non-market services provided by an ecosystem contribute to another service or good traded on the market, respectively how much it contributes to the increase in productivity or the price of that good or service.

II. Approaches to consumer preferences: Travel cost method, Hedonic pricing method.

II.1) Travel cost method – the method mainly relevant for determining the value of recreational services associated with biodiversity and ecosystem services. The method is based on the principle that recreational experiences can be associated with a cost, consisting of direct costs and opportunity cost. In the case of tourism, changing ecosystem biodiversity can influence the demand to visit that location.

II.2) The hedonic price method – it is based on the added value that a landscape, or the location near a forest can bring to the real estate market, for example. In this case, the change in the biodiversity of an ecosystem can lead to a change in the market value of the respective property.

The limitations of these approaches are given by the fact that a large amount of data and complex statistics are needed, the methods being expensive and time-consuming. In addition, being methods that are based on direct observation of buyers, they can provide a picture of the current moment.

III. Value simulation approaches: Contingent valuation method, Deliberative choice method, Group valuation method. III. 1) The contingent valuation method consists in the use of questionnaires through which the respondents provide information regarding the amount they would be willing to pay to protect ecosystem services, respectively how much they would be willing to pay to accept their loss or degradation.

III. 2) The deliberative choice method focuses on trying to model human behavior in a given context, starting from the premise that, as a rule, people have to choose from two or more alternatives when making a decision, one of which is the money.

III. 3) The group evaluation method combines the techniques of gathering information through questionnaires, with elements of the deliberative process from political sciences, this being increasingly used to collect values such as: the uniqueness of ecosystems, social justice, altruism towards other people, face by future generations, compared to the species that are part of the ecosystem,

One of the first significant economic evaluations of VET was carried out in 1997 by Robert Costanza in the work entitled "The value of the world's ecosystem services and natural capital" (Costanza, 1997). The premises from which the evaluation of eco-systemic services was started were those that they provide, through their functions and components, benefits to the population, i.e. services. Ecosystems are unique, irreplaceable, which makes their value inestimable. Starting from these premises, the author grouped ecosystem services into categories and calculated their unit value, using evaluation techniques based mainly on "people's willingness to pay". The resulting values were then multiplied by the area occupied by all ecosystems in the US, calculating a total of \$33 billion per year, more than double the annual GDP, estimated at \$16 billion, at the time.

The study entitled Socio-Cultural and Economic Valuation of Ecosystem Services Provided by Mediterranean Mountain Agroecosystems (Bernués, 2014), carried out in the Natural Park "Sierra y Cañones de Guara" from Spain, in which deliberative methods were applied to evaluate the services provided by Mediterranean mountain ecosystems, leading to the conclusion that a level of compensatory payments three times higher than that applicable at the time of the study (121 euros/person/year, compared to 45 euros/person/year) would correctly reflect the VET of the studied area.

In the framework of the study Socio-economic valuation of abandonment and intensification of Alpine agroecosystems and associated ecosystem services (Faccioni, 2018), carried out in the Italian Alps - Provincia Trento, a VET of 150.30 euros/person/year resulted.

The study Practical considerations in the complex economic evaluation of forest resources managed by the "Moldsilva" agency (Țurcanu, 2014), concluded that about 83.65% of VET is represented by regulatory, cultural and assistance services.

The results obtained from the study will be presented in a logical order to enable the reader to interpret the data correctly.

CONCLUSIONS

Ecosystems provide a range of marketable and non-marketable services, such as food, genetic material, medicinal plants, pollination, air filtration and cleaning, soil and carbon dioxide absorption. People's perception of ecosystem services is different and often underestimated.

Calculating VET in a comprehensive and relevant manner is challenging due to the fact that natural, historical and cultural resources are not traded like any other goods and services and do not have an explicit monetary value, making them difficult to quantify monetarily. Biodiversity is one of the non-use values for which society and people must decide whether they want to pay to maintain and preserve it.

Despite the increase in the number of scientific communications presenting the valuation of ecosystem services and valuation methods and techniques based on non-monetary methods, it has not been possible to formalize a relatively unified methodology to date.

Challenges identified in the methodologies developed to date are: broad, confusing and contested terminology, unclear boundaries/boundaries and contextual specificities.

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