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16. Scientific Substantiation Methods of the Ecological Restoration Projects from the Danube Delta Biosphere Reserve

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Abstract: In the period 1994-2007 in the Danube Delta Biosphere Reserve (DDBR) were carried out ecological restoration projects. For the scientific substantiation of the ecological restoration projects, one should use a quantitative and qualitative package of methods to ensure complementarity between their strengths and their limits, aiming at improving the accuracy of the estimation of tangible and intangible costs and benefits, reducing the risk of deferral or cancellation due to lack of financial resources, or to some ecological restoration projects for the sustainable development of the DDBR.
Based on this type of a conclusion, for the scientific substantiation of the ecological restoration projects from the DDBR, we aim to use a mix of methods: the Logical Framework Approach, the multi-criteria analysis, and the cost-benefit analysis. These methods must reflect the diversity of ecosystems and services provided by them, which is specific to the DDBR.
Keywords: ecological restoration projects, Logical Framework Approach, multicriteria analysis, cost-benefit analysis, Danube Delta Biosphere Reserve

INTRODUCTION

In the period 1994-2007 ecological restoration projects were carried out for the agricultural areas of Babina, Cernovca and East-West Furtuna and the fish areas of Holbina-Dunavăţ and Popina from DDBR. These consisted of works to re-connect the areas to the natural flood regime, the hydrological regime guided by the Danube water levels (*****, 2016).

In the last 24 years, 15025 ha of agricultural, pisciculture and forestry land have been restored from the 97408 hectares dammed during the Communist period, of which 39974 ha were used for agricultural purposes, 39567 ha for fish farms and 6442 ha for forestry.

Our research aims to improve the scientific substantiation of the ecological restoration projects in the DDBR. At this stage of the research, the main objective identified is the use of a quantitative-qualitative method package that reflects the specific diversity of ecosystems and ecosystem services provided by the DDBR.

- the Logical Framework Approach (MacArthur, 1993; Baccarini, 1999; Couillard et al., 2009);
- the multi-criteria analysis (Gampera and Turcanuc, 2007; Köksalan et al., 2011);
- the cost-benefit analysis (Pearce and Turner, 1990; Hanley and Spash, 1993; Tietenberg and Lewis, 2012).

The Logical Framework Approach (also regarded as Logframe Approach or simply LFA) is a tool for project design and evaluation as well as a systemic presentation of the project (Practical Concepts, 1978; Sartorius, 1996; Aune, 2000; Baccarini, 1999; Dale, 2003; Earle, 2003; Gasper, 1997, 1999; 2000; Rădulescu et al., 2017).

The use of the LFA brings many benefits to the project cycle management, such as: getting a better understanding of the project context and stakeholder needs, establishing a logical structure, providing a common ground for discussion, and making project-related decisions, encouraging engagement and stakeholder participation, providing a project summary in a standard and condensed format, and identifying any uncertainties and risks that could jeopardize the project's realization, and how the overall objective, specific objectives, outcomes and activities can be evaluated and monitored.
In addition to the analysis (programming, identification) and formulation phases, the LFA is also useful in both the implementation phase and the project evaluation, so the LFA plays a role in each phase of project cycle management.

The LFA must be used from the programming and identification phases, although it cannot be fully completed in these stages. This will be completed gradually in the following phases. Thus, the logic matrix becomes a management tool for each phase of the project cycle and a "directory" for creating other tools, such as the project implementation plan.

Identifying the overall objective, the specific objectives, the results, the activities and the assumptions remains a major challenge for the project team. The difference between objective and purpose is often difficult to understand. Objectively verifiable indicators are hard to establish and therefore the success of the project is not easy to assess. Determining appropriate physical performance indicators is often a challenge to achieve. Responsibilities for project success remain unclear. For example, the LFA could be used to support the selection process and identify a general approach appropriate to project cycle management. All these have created some confusion and many aspects have not yet been elucidated (Aune, 2000; Dale, 2003; Earle, 2003; Gasper, 1997, 1999, 2000).

Multi-Criteria Analysis (MCA) is a complex decision-making tool that uses multiple and often contradictory objectives that stakeholders and decision-makers appreciate differently (Gampera and Turcanuc, 2007; Köksalan et al., 2011). It is made up of a set of techniques designed to establish preferences among stakeholder options. For each of these objectives, measurable criteria are set, so the different options can be compared (CLG, 2009).

The use of MCA helps to simplify and structure complex issues and it involves many social actors and several criteria to evaluate these results, some of which may or may not be translated into economic terms (Garmendia et al., 2010). Objectives and criteria may be modified by stakeholders if they are considered inappropriate. In addition, the performance of the various options is assessed by social actors to eliminate subjectivity.
The following structure (CLG, 2009) is used to achieve MCA:

1. Definition of objectives. The characteristics of the objectives to be assessed are: specificity, measurability, degree of reach, relevance and duration (SMART) (Doran, 1981);
2. Identification of options for achieving goals;
3. Identification of the criteria for comparing the options considered for each objective. The options are compared in terms of performance in meeting the immediate and final goals. They are selected by experts on the basis of consultation of social actors or other procedures, but in any case, the criteria must be measurable;
4. Analysis of the options, based on a comparison of the performance measures of each option with regard to the selected criteria, taken separately or jointly;
5. Making the choices: The actual decision on the options to be selected is based on the options analysis;
6. Feedback: Making appropriate decisions requires re-evaluations of previous decisions.

Among the methods used by MCA, the most widely used are ELECTRE I, II, III, IV; The process of analytical hierarchy (Saaty, 1980), etc.. They may consist of:

- an alternative to economic evaluation (Vatn, 2009; Wegner and Pascual, 2011; Chan et al., 2012);
- an alternative or a complementary approach to cost-benefit analysis (Vatn, 2009; de Groot et al., 2010; Spangenberg and Settle; 2010; Wegner and Pascual, 2011; Newton et al., 2012; Chan et al., 2012);
- a decision support system that integrates economic and non-economic values (recreation, aesthetic values, cultural values, etc.) (Newton et al., 2012).

The most common limit of MCA is subjectivity. The subjectivity of the analysis may lie in giving relative importance of the criteria with regard to the others. The use of the multi-criteria method also has an involuntary or subjective share of relativity in the process of determining the value of a criterion. In the most common forms of MCA, decision criteria are ranked according to importance, by subjective choice. Some analysts and decision-makers consider that the introduction of such subjectivity influences the analysis, thereby diminishing its value as a tool for supporting the decision (Belton and Stewart, 2002; Henig and Buchanan, 1996). An increasing number of researchers support the idea that MCA should not exclude human decision (Kersten and Noronha, 1996; Olson, 2006; Wenstop, 2005). They use extensive scientific evidence to assert that emotions play a vital role in making reliable decisions, and they argue that decision makers' values and beliefs play a key role in final decisions, regardless of the theoretical objectivity of social actors (Follesdal, 1982; 2004; Wenstop and Seip, 2001).
The cost-benefit analysis (CBA) is an economic valuation method used to compare the costs and benefits of a project (Pearce and Nash 1981; Dixon et al., 1994; Adler and Posner, 2009; Hanley, et al, 2007).

CBA consists in measuring the possibilities, costs and benefits of an action. As the cost of the resources used to concretely promote the action is invariably expressed in monetary terms, the benefits will also have to be expressed in monetary terms in order to ensure comparability (however, it is not necessary that all costs and benefits be expressed in monetary terms).

Most CBA boundaries stem from the fact that it is developed on the basis of the hypotheses and methodologies of neoclassical economic science (travel cost technique, hedonic price technique, contingent method, etc.), which are associated with a vast and still expanding literature on environmental economics. In the neoclassical economy, ecosystem services that are delivered and consumed in the absence of market transactions can be seen as a form of positive externalities. Since these have been classified as a market failure, the environmental economics literature has developed, since the early 1960s, a series of methods to value these 'invisible' benefits from ecosystems, often with the aim of incorporating them into cost-benefit analysis and internalizing externalities. To comprehensively capture the economic value of the environment, different types of economic values neglected by markets have been identified and the evaluation methods have been refined progressively.
CBA is criticized for undermining environmental protection and paving the way for it to change (Gómez-Baggethun and Ruiz Pérez, 2011). Economic assessment fails to capture social and ethical concerns, such as cultural and moral values, because they cannot be measured monetarily (Chan et al., 2012; Kenter et al., 2015).

The CBA analysis is largely based on approximations, working hypotheses and simplifications due to lack of data or due to constraints on evaluator resources.

In CBA applications, project specialists must measure the net benefits of the project. This leads to greater complexity of the comparison between earnings and losses since the monetary value of costs or benefits over a certain period of time is not directly comparable to the value of today's costs and benefits. CBA uses a process called update to express all future costs and benefits in the equivalent of their present value. This is done by updating the costs and benefits of each future timeframe and summing them to reach a present value.

Using the update leads to the appearance of one of the CBA weaknesses. Firstly, in the process of upgrading future benefits or costs, the decision is made by assessing from the perspective of a present generation. In the upgrading process, the costs incurred for the next generation are lower in relation to the costs incurred for the current generation, which raises a number of questions about intergenerational equity. Secondly, the upgrade process can often favor those projects that lead to short-term gains, not long-term sustainable earnings. In particular, the benefits that materialize later, in the long and very long term, receive lower values following the update process. To update the costs and benefits, you need to set the discount rate. A higher upgrade rate will result in lower current costs and benefits. Alternatively, a lower discount rate will increase the current value of future cost and benefit flows.

Choosing the time to achieve CBA can have an important effect on the results as the time horizon affects the calculation of the main costs and benefits. The longer the time interval, the farther the interval for which the costs and benefits are valued.

Because the CBA involves analyzing the structure of future costs and benefits, there is also a need to formulate a hypothesis about possible changes in the external environment. When measuring benefit levels, future benefit values depend on assumptions about the future. For example, the benefits of public policies specific to sustainable development depend on the future profile of population growth, their needs, and economic growth. Thus, the socio-economic environment is characterized by the formulation of reasonable assumptions regarding the preservation of natural capital and the economic support of the population's needs.

The effect of the general price increase may have an impact on cost or benefit calculations. It is therefore recommended to use current prices (nominal prices actually observed year after year) to measure benefits or costs. However, for an analysis with a higher time horizon, it is not always possible to estimate the current nominal prices for each year. In these cases, constant prices, which are the fixed prices set for a base year, are used.

RESULTS AND DISCUSSIONS

Using the logic matrix for the scientific substantiation of ecological restoration projects in the DDBR can help to restoration processes, by faster identifying the objectives, the measurement indicators of the achievement of the objectives, the risk factors and resources allocated, which leads to increased success probability of these processes.

The logic matrix represents the basis of a number of components of the project, such as the project budget, the process of setting responsivities, the design of the implementation process, the monitoring process. This approach also facilitates communication among stakeholders; it helps to clarify the purpose of the project, and to formulate ideas about the project in a standardized, but dynamic form.

Designing the logic matrix of the project is performed in two stages:

1. Analysis

This phase deals with analyzing the current situation, on multiple levels (skateholders, issues, objectives, and strategies) as a basis for choosing the best strategies which will lead to the successful implementation of the restoration process.

1.1 Stakeholders’ analysis

Ideally, stakeholders need to take an active part in the renaturation process. By stakeholders we refer to all the people, groups and institutions which can be affected (in a positive or negative way) by the implementation of the project. After identifying them, and how they can be affected, the stakeholders are subject to a detailed analysis about social, cultural, economic, organizational characteristics, as well as their attitude towards the project, their sensitivity regarding the environmental protection, their needs and goals, their interests and expectations from the project, their potential contribution to the project.

I.2 Problem analysis

Problem analysis aims at identifying and establishing cause-effect relationships between existing problems.

When designing the problem tree (Fig. 1), the authors started from the chain of causes (the disconnection of the area from the Danube flooding regime by damming, thus altering the ecological profile) and this has led to the degradation of the wetlands in the Danube Delta and the effects of it, both in the natural environment (reduction of biodiversity, bad alteration of the landscape), and the socio-economic environment (the disappearance of the traditional activities in the area).

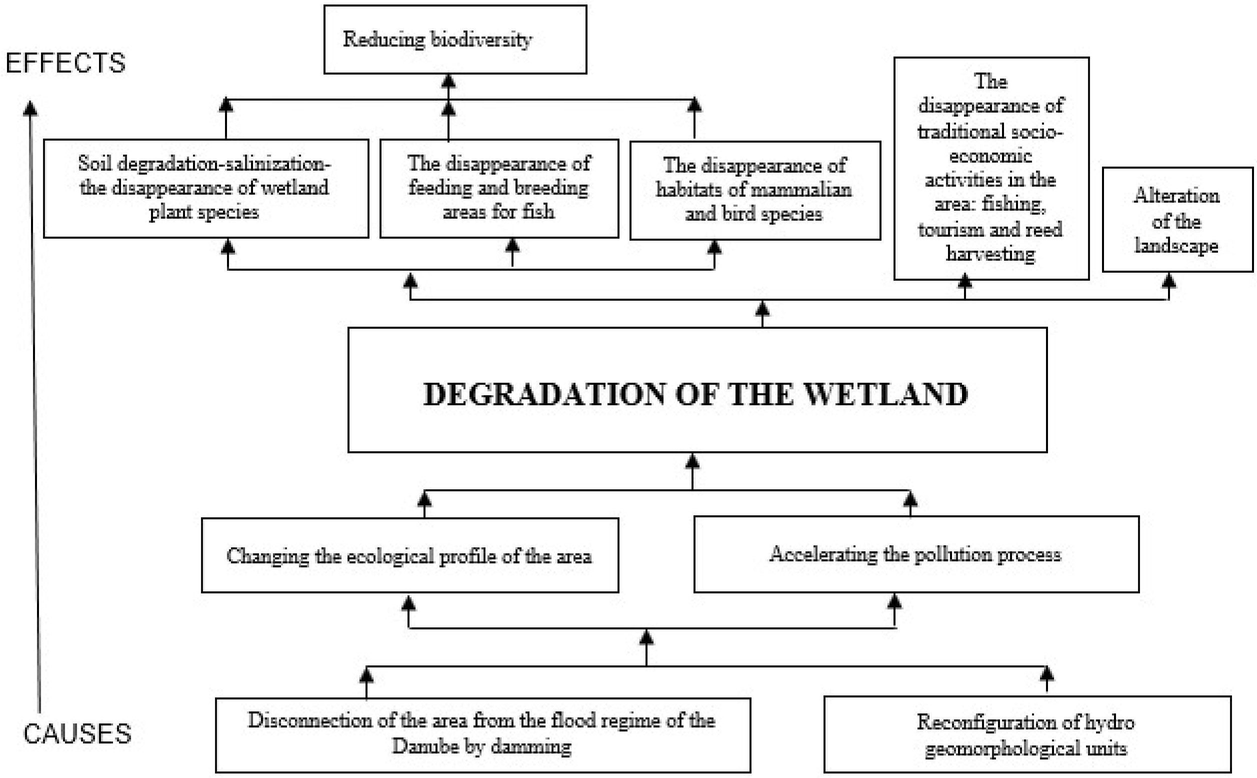

Figure 1. Problem tree of a degraded area of the DDBR (Source: Own representation, 2018)

I.3 Objectives Analysis

By analyzing the objectives and identifying solutions to existing problems, the problem tree becomes a tree of objectives in the form of a diagram that highlights objectives in a context of measures-results.

The way of solving aspects of the state of the anthropically degraded areas presented in the problem tree is transposed into a proposal for its improvement by positively formulating the identified problems (Fig. 2).

At the basis of the objective tree of a rectangular area in the Danube Delta (Fig. 2) are the restoring measures consisting in the reversal of the actions that led to the degradation of the wetland, with an aim to restore this area. In its turn, this goal is reflected in a number of impacts (increased biodiversity, development of traditional activities, improved quality of the landscapes).

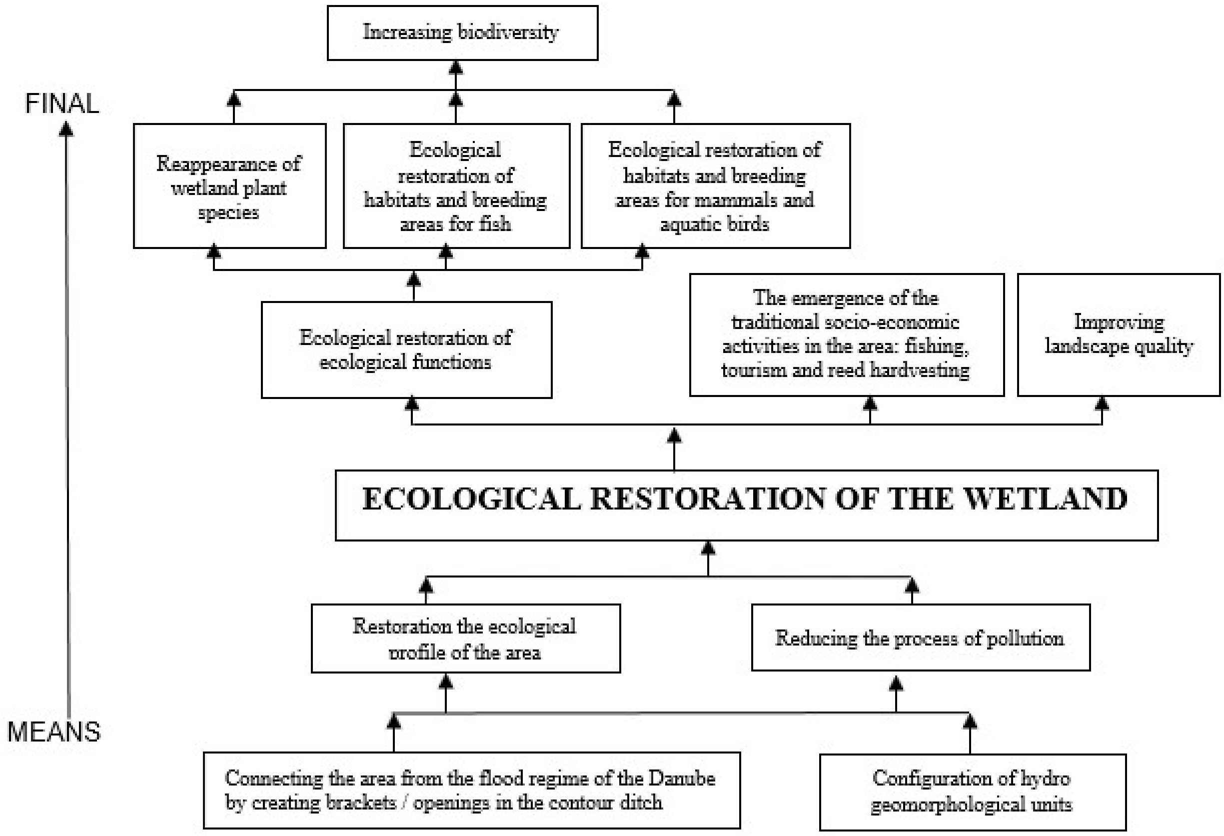

Figure 2. Objective tree of an area subject restoration from DDBR (Source: Own representation, 2018)

I.4 Analysis of strategies

At first, the objectives of the project are filtered and separated from those that will be left out of the restoration project (those undesirable, irrelevant or intangible). Further, it is necessary to: a) clarify the criteria for the selection of strategies; b) identify and assess the feasibility of different strategic alternatives for achieving the objectives; c) choose the project strategy according to certain criteria, such as: the priorities of the social actors involved, the probability of project success, costs and cost effectiveness, implementation deadline, sustainability after funding, environmental issues, social risks, etc.

II. Planning

Within this phase, the project idea is developed as a practical, operational plan to be implemented, the activities and resources being clearly defined and planned over time.

MCA can be used for the scientific foundation of projects, starting from the acknowledgement of the fact that ecosystem services generated by ecological restoration areas can be defined from the social point of view. The value of ecosystem services is relative, because both the whole of the socially recognized services and their value depend on the attitude of the social actors assessing them.

The MCA identifies how ecosystem services and their value vary over time and space according to the degree of information on the beneficiaries of ecosystems as well as on how they are socially defined. Thus, the MCA based on survey can result in that the same resource acquires totally different values for the local community, on the one hand, and the research community or people outside the local communities on the other.
Mechanisms and operational approaches for the return of ecosystem services in the Danube Delta into policy-making practices are still poorly developed.

Restored areas (previously anthropically degraded, economically inefficient areas) provide ecosystem services that were not provided in the pre-retention period.
The ecosystem services generated by the redeveloped areas of the Danube Delta are essential for human well-being, the importance of these services being recognized at local, regional and national level.

The diversity of ecosystem services provided by the Danube Delta corresponds to a large variety of users, which means multiplying the professional categories of stakeholders in the realization of ecological restoration projects: production services (providing resources such as fish, reed, fiber woods) are of particular interest to fishermen, reed growers, folk craftsmen, and cultural services are important for tourism workers.

CBA is an effective method in the scientific substantiation of ecological restoration projects by estimating costs, identifying and quantifying the benefits in terms of the benefit to the environment and society as a whole.

In the CBA of ecological restoration projects, we have to consider the following categories of costs:

• Direct costs, which delimit the costs attributed to the activities undertaken (consultancy costs, management costs, cost of technology, cost of financing, etc.);

• Indirect costs, represented by environmental externalities that are social costs or benefits found beyond the ecological restoration projects itself, influencing the well-being of third parties without any monetary compensation.

In order to diagnose the effectiveness of ecological restoration projects in the DDBR, the social cost, ie the private cost plus the external costs of the natural environment (negative externalities of the natural environment: soil, water, landscape, etc.), must be considered.

The benefits of ecological restoration projects in the DDBR can be divided into two categories: direct and indirect benefits.
Direct benefits are grouped into:

• financial benefits - resulting from the sale of ecosystem products (fish, meat, medicinal plants, wood, reeds);

• economic benefits - development of the economic sector: establishment / expansion of trading companies for the production of fish and fish products, sale of agricultural, animal, agro-tourism products through the development of guest houses and farms;

• social benefits - improving the living conditions of the population (creating and / increasing the number of jobs and raising the standard of living);

Indirect benefits are those that are not directly related to the ecological restoration projects but are secondary products;

• market prices - increase of the productivity of some sectors such as: fish farming, tourism, rural tourism, etc;

• shadow prices - protecting and preserving ecosystems and biodiversity, improving / restoring the landscape, increasing the quality of public and private services, etc.

Taking into account the social dimension of ecosystem services generated by restored areas, the three types of approach to assessing ecosystem services are presented:

1. Participatory approach. The identification and appreciation of the importance of ecosystem services take into account the mosaic of local communities' value systems and the perception of all local, regional and national social actors;

2. Inclusive approach. It is based on the mobilization of representatives of all interest groups at local, regional and national level. The assessment of ecosystem services therefore, requires a process of prior segmentation of stakeholders and their co-optation in the process of identifying and ranking social services;

3. Deliberative approach. It is centered on group discussion of ecosystem services. Deliberative action has a multiple effect at individual and group level, contributing to:

- awareness of the perceived differences in the number and importance of ecosystem services;
- deepening the individual understanding of the multitude of ecosystem services and their importance;
- building a common understanding negotiated on the most important ecosystem services.

The way of identifying and evaluating ecosystem services through the participatory process of stakeholders, user groups of natural and semi-natural ecosystems and aggregating perceptions of social actors on the ecosystem capacity to provide different services can also be applied to ecosystem services in the DDBR.

Local actors are defined as those who have direct interests in the area, such as fishermen, tour operators, representatives of civil society in the area or local government. Often, their interests are related to access to production services and how access to these services is made (who limits access, access, etc.).

Regional or secondary level actors are those for whom access to production services is no longer as important but for whom regulation, support and cultural services are becoming more and more important. They are mainly representatives of regional authorities, civil society and other stakeholders.
National actors are representatives of national authorities. They have the role of coordinating the implementation of national programs and strategies for the use of ecosystem services in line with EU Directives on Biodiversity Conservation.

CONCLUSIONS

The use of scientific substantiation methods of the ecological restoration projects requires a complex analysis of economic, social and natural effects. This analysis includes the ability to explain the multiple dimensions of welfare, economic, social and natural aspects, including the distribution of gains and losses by the beneficiaries of ecosystem services (Pascual et al., 2014; Gomez-Baggethun and Muradian, 2015).

Among the methods used, MCA generally performs better than CBAs in assessing ecosystem services generated by restored areas. MCA's ability to determine the values resulting from ecosystem services depends on the specific methods used in the benefit assessment process. However, the decisive factor in the MCA is how the analysis and involvement of social actors are organized. MCA methods can support for and against proposals and it is best suited to help discussion and debate between a limited number of stakeholders, usually in a conflict situation.

If the ecosystem service has the characteristics of private goods such as recreational services, it is well justified to use the declared preference methods and the use of information within a CBA framework to highlight whether investment in recreational opportunities is cost-effective.

The CBA, through the monetary assessment it includes, is useful in the context of the awareness process, especially by the political factors, with regard to the economic importance of ecosystem services. (Gómez-Baggethun and Barton, 2013; Barton et al., 2015).

In the case of implementing renaturation projects resulting in a high degree of complexity of ecosystem services, it is preferable to use both the LFA, the MCA and the CBA to cover all the components of the ecological impact (economic, social and natural environment). This situation occurs in most of the restored areas in the DDBR.

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