Socio-economic Benefits of Natura 2000 in Azores Islands – a Case Study approach on ecosystem services provided by a Special Protected Area

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ABSTRACT

This paper intends to evaluate the socio-economic benefits and assess the ecosystem services associated with the creation and existence of a Protected Area, but also with the development of a conservation project: LIFE-Priolo (2003-2008). Methods used ranged from qualitative ones to monetary valuation and valuation methods were defined for each service. The most important services in the SPA are those related to water provision, quality and regulation. Regulation provides a reduction in the occurrence of floods and landslides (29 deaths and around €20,000,000 in damages, in 1997, in a village close to the SPA). This regulation of the water cycle also provides water worth more than €600,000. Other important services were: Genetic/species diversity maintenance; Carbon storage estimated at around 465,000 tC plus 223,667,84 tC/year sequestered in the peat area; Ecotourism and Recreation estimated at around €60,000/year plus €16,500/year expenses on active tourism activities and Landscape and amenity values estimated at €3,000,000 for the Povoação region alone. Management of the SPA, had also an important socioeconomic impact by the creation of an average of 21.6 Full Time Jobs directly and support of another 4 Full Time Jobs every year, but this project also had impacts in terms of infrastructures and training of specialized workers. The results obtained by this study show that nature conservation and biodiversity protection support policies are fundamental for the sustainable development of these areas and can drastically improve quality of life and economic self-sufficiency of local populations by the diversification and creation of new skills, products and business opportunities.

ADITIONAL INDEX WORDS: Nature conservation, Valuation methodologies, Sustainability

INTRODUCTION

Actual rate of degradation of ecosystems is strongly reducing their functionality and as a consequence, their capacity to supply goods and services to human populations (Millennium Ecosystem Assessment, 2005).

In many cases it requires a considerable investment to recover the functionality of the ecosystem and therefore its supply of goods and services to human populations (Kettunen et al., 2009). When it comes to allocation of financial resources by governments and international organizations, that are limited, it is essential to be able to measure the welfare produced by the expense (Bockstael et al., 2000). With this objective, the main international institutions related to nature conservation, consider that valuation of Socioeconomic Impact and value of ecosystem services is a practical tool in order to justify allocation of resources for biodiversity conservation (Pangiola et al., 2004).

Valuation of Ecosystem Services is still nowadays controversial. Two different theories emerged in order to include the consideration of environment and natural resources into the economic analysis, differing basically in the philosophy behind them. Some approaches intended to quantify in monetary terms the value of ecosystems for communities; this is the case of the study conducted by Constanza (1997) that estimated world’s ecosystem services provision to be in the range of US$16-54 trillion (1012) per year, one to three times the World’s Gross Product. This study recognized its limitations, but was expected to be a starting point for further investigation on ecosystem services.

In general, most authors agree with the definition of ecosystems services as the contribution of these ecosystems to human welfare (Costanza and Farber, 2002). But this contribution is not always measurable in monetary terms due to absence of “price” since many benefits are not paid for or imply an indirect cost. Monetary terms have a great advantage in terms of addition, and also in political terms; but since this approach is not always possible, many authors suggest valuation on qualitative, quantitative and when possible monetary terms and the use of multicriterial assessment to introduce them into decision-making (Martínez Alier, 1999).
Main valuation disciplines (Environmental Economy and Ecological Economics) differ on philosophical issues. These disciplines propose methodologies to try to value Ecosystem Services in monetary terms, each of them apply to different types of services (Nunes et al., 2001).

The aim of this study is to apply these methodologies to our local information, trying to get a monetary value for the service, expressed in Euro (€), using benefit transfer trying (whenever possible) to use function transfer or meta-analysis instead of direct unit transfer; which leads to a bigger error (Rosenberg and Stanley, 2006). Therefore, it will not always be possible to get to a monetary valuation, due to lack of data available, in this cases we will try to define a non-monetary quantification, expressing value in other units different than Euro, or a qualitative valuation, where we would underline value, but will not be able to translate it to a number in any unit.

A secondary objective is to analyze used methodologies in order to identify gaps and methodologies that could provide a more accurate result.

METHODS

The objective of the study carried in SPA Pico da Vara was to try to identify, characterize and valuate the most important ecosystem services provided by the habitats present in the area as accurate as possible, being very conservative in the chosen values in order not to over-value and avoiding double counting. In this study we presented qualitative, quantitative and monetary values of the ecosystem services provided by the SPA.

But nature conservation doesn’t only provide benefits to human populations by preserving ecosystems; management of nature for conservation implies expenses that can be relatively important to the populations living close to these important protected areas (Kettunen et al., 2009). For this reason, it was considered in a second stage the study of socio economic-benefits derived from the LIFE Priolo Project that took place in the SPA between 2003 and 2008 being the main financial source for the SPA management.

Study area

SPA Pico da Vara / Ribeira do Guilherme was classified as Special Protected Area (SPA) in 1999 (Decreto-Lei n.º 140/99 de 24 de Abril). Afterwards in 2005, its area was increased along (Decreto Regulamentar Regional 9/2005/A, de 19 de Abril) on the behalf of the SPA’s Management Plan publication (Gil, 2007).

This SPA is located in São Miguel Island, the biggest island on the Azores archipelago, and it comprises the councils of Nordeste and Povoação. In the present the SPA covers an area of 6,067.27 ha. that represents 28.3% of the total area of the two councils.

This area comprises the last big area of altitudinal Laurel Forest in São Miguel, which is being seriously compromised by the appearance of invasive species that cover an important area of the SPA and threaten an even bigger area. The SPA also includes a small area of a bigger peat area close to it. This peat area is also threatened by desiccation for pastures and the presence of invasive alien species. For this reason, despite the peat area comprised in the SPA is small; we also included the peat area in this study (Cruz et al., 2009).

This area is also the habitat of Priolo (Pyrrhula murina) an endemic bird from São Miguel Island, which was critically endangered with less than 400 individuals left. Main threats to this bird is the destruction of its habitat by the proliferation of invasive species. LIFE Priolo Project was developed to preserve Priolo’s habitat creating conditions for its survival. After the end of this Project in 2008 Priolo’s population had increased to 1000-1600 individuals (Teodósio et al., 2008) being downgraded to endangered status. At the present moment LIFE Sustainable Laurel Forest Project takes place in this area continuing the conservation practices in LIFE Priolo and implementing new actions in order to preserve ecosystems and their benefits for the population.

Methodology

The methodology used in this study is based in that proposed by Troy and Wilson (2006) that uses spatial explicit valuation in order to take advantage of the cartographic information already available from the SPA, defining Service Providing Units for each ecosystem service. The scheme of this methodology is in figure 2.

This methodology implies an iterative research on available information and best valuation methodologies for each ecosystem, until the most accurate value in regard of available information can be set. Before this iterative process, all ecosystem services were analyzed and valuated in a gross mode, in order to determine

Figure 2. Scheme for valuation of Ecosystem Services attempt
their contribution to global area value. Only the most significant ones were included into further research. Afterwards, Service Providing Units (Luck et al., 2003) were defined for each service; this SPU’s varied between the services. Definition of SPU’s allowed geographical plotting of results. Chosen methodologies and bibliography used are shown on Table 1.

RESULTS

The most important services in the SPA are those related to water, its provision, quality and regulation. Ecosystems preserved in the SPA regulate the water cycle providing a reduction in the occurrence of floods and landslides, which are very habitual events in this area having caused 29 deaths and around €20,000,000 in damages, in 1997, in a village close to the SPA. This water cycle regulation also provides water for almost all the parishes in Nordeste and Povoação councils whose total water demand is 1,408,273 m³/year. This water supply is worth more than €600,000, based on the prevailing price of water. The real value should be higher, since agricultural use was not considered in this calculation because there is no price established for this use. The SPA is a guarantor of water quality. Medium expense by a family in 2001 in bottled water was €46.5 per year (Regional Water Plan in the Azores). The total benefits from water quality impacts of the SPA are estimated at over €110,000.

Carbon storage in the SPA was quantified approximately. The total amount of carbon stored in the SPA was estimated at around 465,000 tC plus 223,667.84 tC/year sequestered in the peat area. Further research is needed to obtain improved estimates of this potentially valuable service.

Home of the rare Priolo and unique Laurel Forest area, the SPA has also the potential for developing Ecotourism activities. At present, this potential has not been developed significantly. A value for tourism, calculated by the Travel-Cost method for visitors staying in rural houses in Nordeste council, was estimated at around 60,000 €. Expenses on active tourism by visitors of the SPA were calculated at 16,500 €. These values are conservative; since accommodation in the Nordeste region is not very developed and currently active tourism activities are limited to trekking activities.

Inspirational services of the area are also very important; the SPA received a mean of 10 school groups every year, as hosts 8 graduates, 0.25 PhD students and 1 MSc student every year. Scientific research within this area is also reasonably important,

Table 1: Methodologies applied to valuate Ecosystem Services in the SPA Pico da Vara/ Ribeira do Guilherme.

<table>
<thead>
<tr>
<th>Ecosystem Service</th>
<th>Valuation</th>
<th>Method</th>
<th>Formula/ Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td>Qualitative</td>
<td>Identification of potential edible plants</td>
<td></td>
</tr>
<tr>
<td>Ornamental Resources</td>
<td>Qualitative</td>
<td>Identification of potential ornamental resources</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>Monetary</td>
<td>Price of water</td>
<td>[ Y_s = \sum P_s Q_{ia} ]</td>
</tr>
<tr>
<td>Recreation and Tourism</td>
<td>Monetary</td>
<td>Travel-Cost Method</td>
<td>Building of demand curve from the costs of travel of tourist staying in three rural lodges in Nordeste and calculation of total welfare regarding the zero cost of this benefit.</td>
</tr>
<tr>
<td>Educational value</td>
<td>Monetary</td>
<td>Travel-Cost Method</td>
<td>Building of demand curve from the costs of schools visiting the SPA and calculation of total welfare regarding the zero cost of this benefit.</td>
</tr>
<tr>
<td>Scientific value</td>
<td>Quantitative</td>
<td>Scientific production</td>
<td>Identification of scientific papers produced.</td>
</tr>
<tr>
<td>Landscape and amenities value</td>
<td>Monetary</td>
<td>WTP survey</td>
<td>Building of demand curve from expressed Willingness to Pay in 67 inquiries in the council of Povoação and calculation of total welfare regarding the zero cost of this benefit.</td>
</tr>
<tr>
<td>Stored Carbon</td>
<td>Quantitative</td>
<td>Biomass calculation with value transfer</td>
<td></td>
</tr>
<tr>
<td>Water regulation</td>
<td>Qualitative/Quantitative</td>
<td>Value transfer from close case</td>
<td>Flooding and landslide disaster at Ribeira Quente economic effects (Valadão, 2002).</td>
</tr>
<tr>
<td>Water purification</td>
<td>Quantitative</td>
<td>Replacement cost</td>
<td>Bottled water consumption expenses (Regional Water Plan of the Azores)</td>
</tr>
<tr>
<td>Genetic / species diversity</td>
<td>Qualitative</td>
<td>Biodiversity and endemism rates</td>
<td>Biodiversity Database of the Azores (<a href="http://www.azoresbioportal.angra.uac.pt/">http://www.azoresbioportal.angra.uac.pt/</a>) Management Plan of SPA Pico da Vara/ Ribeira do Guilherme (Gil, 2007)</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Qualitative</td>
<td>Connectivity indexes</td>
<td>Heleno et al., 2009</td>
</tr>
</tbody>
</table>

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since 1968, a total of 10 scientific papers have been written directly related to the area, and many others used this area as one of their study sites.

Landscape, amenity and existence values (value of Priolo and Laurel forest themselves) of the site were valued by a willingness to pay inquiry for the protection of the SPA. This survey found that the Povoação community values the conservation of the SPA at between €500 to 800 per person. Taking the lower estimate, this gives a benefit of over €3,000,000 for the Povoação region alone.

Other potential ecosystem services that for the moment remain unexploited include the use of Azorean Blueberries (Vaccinium cylindraceum) for cultivation as well as in manufacturing of jams and cakes, and ornamental use of endemic species for gardening. These two services should be encouraged in order to benefit from their value; despite for their implementation it would even be necessary to change legislation.

Invasive species were identified as reducing biodiversity and provision of certain ecosystem services, such as risk protection and amenities, but it was not possible to determine to which extent they negatively influenced the ecosystem services production. As to the socioeconomic benefits, the LIFE Priolo Project created an average of 21.6 Full Time Jobs every year directly, divided between a technical team, a group of national and international interns and a fieldwork team of local people. Indirectly, this project also supported another 4 Full Time Jobs through expenditure of around €300,000 per year and expenses of workers and volunteers of the project of around €50,000 a year.

The LIFE Priolo Project as a manager entity of the site created infrastructure that will remain after the project. This infrastructure will assist the delivery of recreation related services and include an Environmental Awareness Centre, 14 km of trails in the SPA and the planting of 3 orchards with traditional and endemic fruits. The Project also eradicated exotic species in more than 100 hectares and cultivated endemic planting techniques, an average of 40 workers were trained on these techniques every year.

ANALYSIS

The methodologies applied for each of the ecosystem services (Table 1) analyzed, were widely recognized as good techniques for their valuation.

Due to reduced time and resources to conduct this research, most of the values were obtained by benefits transfer technique. This technique allows transferring values from similar situations, when not able to research for in situ data. This Benefit transfer was used to transfer value of Canary Laurel Forest Biomass to our case, since no information on Azorean Laurel Forest Biomass was available at that time.

When some data were available, the benefit transfer technique was used to transfer equations used for calculation of this services in other situation and apply our local data to them. This was done, for example in water provisioning and quality services.

These benefit transfer techniques incur in some bias of the data that should carefully be identified and justified (Wilson and Hoehn, 2006).

Only in a few cases, we could compare our data with existent studies, for example, in the case of carbon storage, we had the possibility of comparing our results with those of Olson et al., (1985) they were consistent. Olson calculated a revised medium carbon density for “Southern taiga” of 80 tC/ha, which matches with results obtained for Cryptomeria trees, and of 120 tC/ha for Tropical and Subtropical Broad-leaved Humid forest, that could correspond with Laurel and Pittosporum Forests.

Looking more closely at some of our results, we identify a considerable loss of value when trying to translate into monetary terms (Howarth and Farber, 2002). For example, the results show an underestimation of water supply value for the area because of two main reasons. First of all, there is no price for agricultural use of water, being this use the most important one in both councils, secondly water price is subsidized and doesn’t represent real value of water not even extraction and treatment costs of it.

Travel-cost methodologies, although scientifically accepted and useful on defining monetary values, should be carefully relied, since information introduced in them is very variable from year to year, carrying to important changes in global results (Eberle and Hayden, 1991). This methodology is strongly dependent on actual exploitation of the resource, and does not reflect potential value. For example on educative valuation, if the calculation had been done after Priolo’s Environmental Center’s opening, this value would have been much higher since school visits doubled.

Contingent valuation is probably the most subjective of all the valuation techniques used in this study. This technique relies on enquiries that can present with many biases (Eberle and Hayden, 1991). In our study interviews were carried personally by students of the Professional School of Povoação, which gives them more subjectivity. Although 1% of population was considered in the interviews, also extrapolation to all population may be considered carefully. Differences in valuation depending on payment media are an example of this subjectivity.

DISCUSSION

The main objective of this study was to give an approach to ecosystem services provided by the SPA Pico da Vara/ Ribeira do Guilherme but also to analyze uncertainties and information needs in order to provide more accurate results.

Thus, all services were analyzed in order to obtain a monetary valuation. In most of the cases it was not possible to achieve a monetary value; just being able to provide a quantitative or qualitative value of the service (Table 1).

The reasons for not achieving monetary value varied from service to service. In general, main problems found to give monetary valuation were:

- Lack of in-site reliable information
- Lack of put in value of potential benefits
- Lack of price or cost of goods and services

Anyway, the type of analysis applied in this study proved to be very useful in defining sustainable development strategies for the Protected Area, even more than a simple monetary analysis would do. Although not able to provide a global monetary value for the SPA Pico da Vara/ Ribeira do Guilherme, the results show the importance of maintaining or increasing conservation and restoration action in the area in order to guarantee the provision of ecosystem services to the populations.

Therefore this methodology also provided the opportunity of identifying key actions in order to assure not only conservation but also sustainable development of the populations adjacent to the SPA. Key actions identified were:
Management field actions and maintenance of expenses policy, assuring that most of the expenses of the reserve revert into the region.

Promotion of Eco-tourism in the area regarding strategies defined in the European Charter for Sustainable Tourism.

Promotion of other sustainable activities in the area such as Azorean Blueberry orchards, endemic wood or endemic plants as ornamentals.

Promotion of scientific research in the area.

Promotion of Educational value of the area.

Awareness campaigns among population on services provided by the SPA and on the importance of preservation of the SPA.

Local, regional, national and international disclosure of Laurel Forest and the Priolo.

This study also proved its interest in defining especially important preservation areas. Defining Service Providing Units and mapping results are especially useful since they allow us identifying the most important restoration areas in order to maximize benefits for the populations.

Many of the key actions identified by this study are actually being put in practice in LIFE Sustainable Laurel Forest Project (2009-2012).

CONCLUSION

Although we can identify some strategies in order to improve the accuracy of results, like more in-site information and research on monetary exchange rates in order to provide monetary results for each service, we must conclude from this case study that we will never be able to capture all value of the ecosystem services in monetary terms.

Anyway these studies provide other benefits, probably more relevant than a simple monetary value for the area. Identification of socioeconomic benefits of nature conservation is important for definition of development strategies for communities living close to Protected Areas.

Valuation of Ecosystem Services, although not completely accurate, is a great tool to identify priority conservation areas in terms of provision of services for populations, this should be considered in land planning in order to guarantee sustainability.

LITERATURE CITED


ACKNOWLEDGEMENT

This publication includes some material prepared for an EC project ‘Financing Natura 2000: Cost estimate and benefits of Natura 2000’ (2009).

We would like to thank SPEA - Portuguese Society for the Study of Birds and the Royal Society for the Protection of Birds for their support during the development of this research. Special thanks to Ian Dickie and Paul Morling for their contributions on methodology and calculations developed in this study.

Journal of Coastal Research, Special Issue 64, 2011 1959