Analyzing the Impact of Alternative Management Scenarios for Natural Areas using a Local SAM

By

Paola De Agostini,[1]

Stefania Lovo [2]

Francesco Pecci[3]

Federico Perali[4]

and

Michele Baggio[5]

Address for correspondence:

Stefania Lovo
Department of Economics
University of Verona
Via dell'Università
Verona, 37129
Italy

stefanialovo@economia.univr.it
Phone: +39 0458028523

[1] Graduate student in the Department of Economics at the University of Verona: E-mail: pdeago@essex.ac.uk.
[2] Graduate student in the Department of Economics at the University of Verona: E-mail: stefania.lovo@economia.univr.it.
[3] Professor in the Department of Economics Society Institutions, University of Verona; E-mail: francesco.pecci@univr.it.
[4] Professor in the Department of Economics at the University of Verona: E-mail: federico.perali@univr.it.
[5] Graduate student in the Department of Economics at the University of Verona: E-mail: mbaggio@arec.umd.edu.

ABSTRACT

This working paper estimates the impact on the local economy of the High Garda Natural Park of alternative management scenarios for the West Garda Regional Forest. The local economy is specialized in tourist services and strongly linked to the tourist presence and their level of expenditure. We wish to investigate the effects of the participative management strategy, which takes into account users preferences and the non-participative strategy, using the SAM multiplier analysis. The local SAM has been constructed considering three sectors: agriculture, tourism and a third aggregate sector including all the other activities. The resident population has been divided into two categories: residents employed in the tourist sector and the remaining resident population. The SAM analysis shows that the accounting representation of the local economy is meaningful and that the participative program, if chosen by the central regional management, would be the most desirable program also at the local level.

Key Words: Tourism, SAM, Multiplier analysis

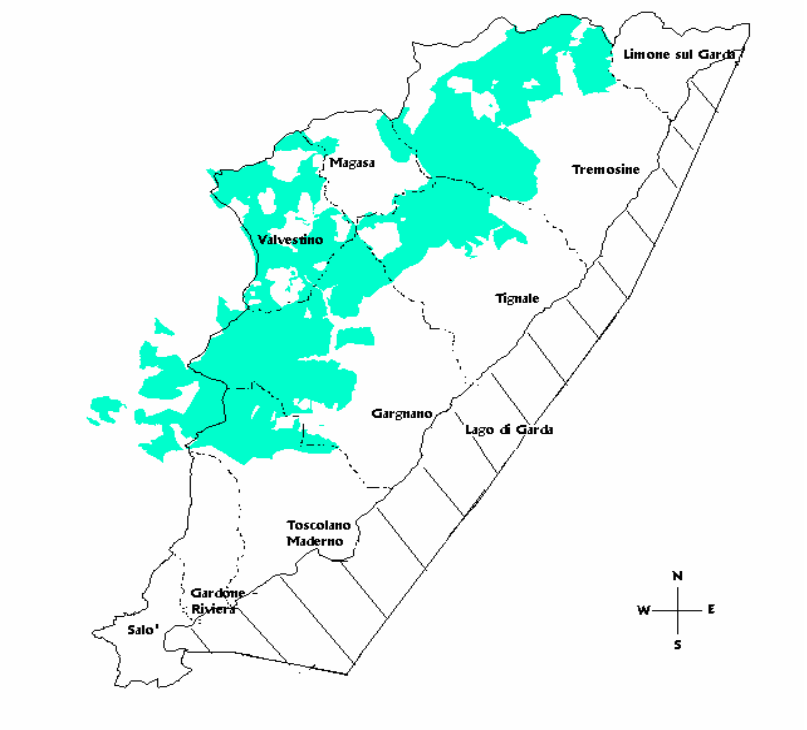
JEL Classification: C63, C67

1. INTRODUCTION

This study estimates the impact on the local economy of alternative management scenarios of the West Garda Regional Forest which is centrally managed by regional authorities located in Milan. Because the forest is part of the High Garda Natural Park[1] (Figure 1), which extends over nine municipalities of the Brescia province and is managed locally, the implementation of the best management program depends critically on the impact on the local economy. The nine municipalities of the High Garda Natural Park are highly specialized in tourist services and strongly linked to the tourist presences and their level of expenditure, therefore the implementation of a new management program of the West Garda Regional Forest, affecting tourist flows, may have a significant impact on the entire economy.

This analysis is part of a multidisciplinary study which integrate the assessment and management aspects of the policy decision process in managing public goods and natural parks. In the first stage, four functions have been identified within the forest area, using territorial information coming from a geographic information system (GIS); these functions are: naturalistic, protective, productive and tourist (De Agostini et al, 2005). Then the multi-criteria analysis, developed in De Agostini (2005), has identified two alternative optimal combinations of the four functions taking into consideration territorial information and information related to the preferences of forest's users, estimated using the contingent valuation method (Cooper et al, 2005a) and the travel cost valuation method (Cooper et al,2005b). One optimal combination is defined as non-participative because it involves only the preferences of central management. The other is the participative strategy which takes into account the users' preferences as revealed by the estimated contingent prices.

We intend to simulate the effects of the participative and non-participative strategies on the entire economy of the park because what is best for the central management may not be best for the local management that is concerned with maximizing the impact on the local economy and the welfare of the local citizens. The convergence of these objectives is desirable to avoid conflicts between the central and the local management.



Note: The shaded part of the figure represents the area covered by the West Garda Regional Forest.

Figure 1. West Garda Regional Forest as a part of the High Garda Natural Park

The tool used in this study to estimate the impact on the local economy of the different management interests in the West Garda Regional Forest is the SAM multiplier analysis applied at the local level of a territory. The social accounting matrices (SAM) are adequate tools to represent the local economy. They define the relationships between local firms and households as well as the physical flows from and to the rest of the economy. They provide a direct and synthetic picture of sector

interdependencies, formation of household income, and the dependence of households on local services and productive activities.

To apply the impact analysis at a local level, we need to know with an acceptable level of precision the economic structure of the territory (Dorward et al., 2003; Bendavid-Val, 1983). The data available from official sources are not organized with the purpose of building tables of sector interdependencies and social accounting matrices at a territorial level. Therefore, the information is often not available at the level of aggregation desirable for the efficient planning of local development activities. This was the most evident constraint faced during the SAM construction.

The SAM analysis shows that the accounting representation of the local economy carries weight and that the participative program, if chosen by the central regional management, would be the most desirable program also at the local level.

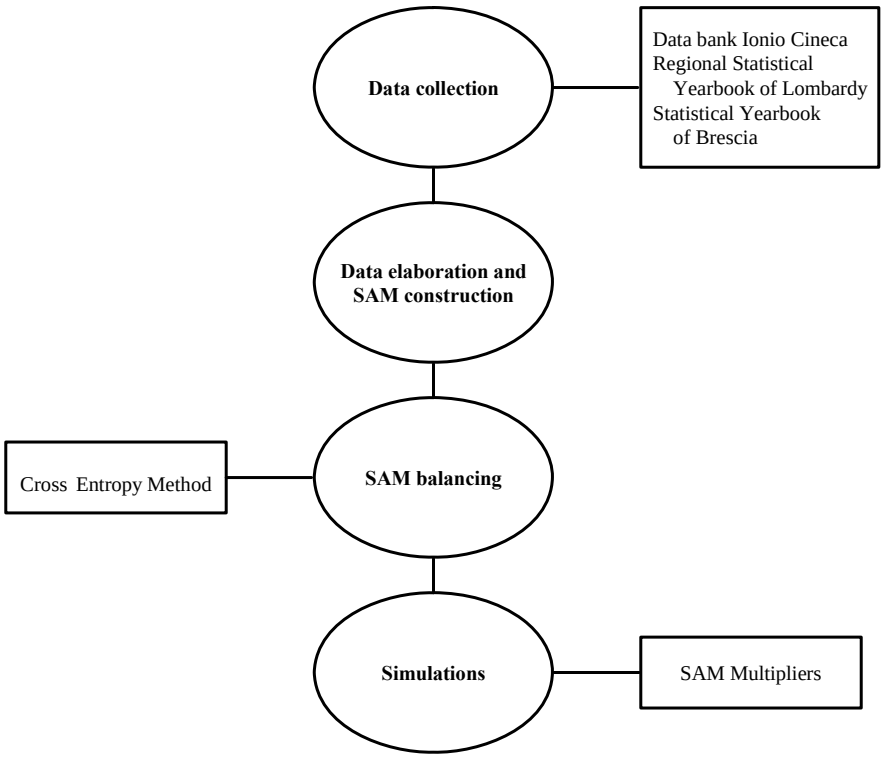


Figure 2 - Stages of the impact analysis

As described in Figure 2, the impact analysis develops in four phases: data collection and elaboration, construction of the SAM, its balancing, and simulations. This study follows the same sequence. Section 2 describes the data required for constructing and balancing the local SAM. Section 3 describes the SAM multiplier analysis. Section 4 presents simulations and results of the impact on the local economic system of the managerial alternatives described above. Section 5 draws some conclusions.

2. THE LOCAL SOCIAL ACCOUNTING MATRIX FOR THE WEST GARDA AREA: DESIGN AND DATA REQUIREMENTS

A SAM is a tool of regional analysis providing useful guidelines for the development of a regional economy (Fannin, 2001). It is a system of social accounts which reproduces the economic flows in a particular area. The SAM describes the relevant features of the socio-economic structure and the relationships between the structure of production and the distribution of income and expenditure among households in a particular area. An estimation of the impact of public policies and the examination of the links between social and economic development is useful to support the local policy-making decision process.

A SAM is the natural extension of the input-output model. It includes inter-industry transactions, payments of productive factors, household expenditure, income transfers, government expenditure and transactions with the rest of the economy, defining the circular flows of income within the economic area of interest.

The most evident limitation of this powerful instrument is represented by the scarcity of available information at the regional and local level that is necessary to build a SAM. To describe the High Garda Natural Park's economy we used a simplified SAM which

still reflects the structural characteristics of the local economy necessary to estimate the impact of a change of the forest management strategies on the local economy.

Three sectors have been considered: agriculture, tourism and a third aggregate sector including all the other sectors such as industry, construction, commerce and other relatively less important economic activities. Our SAM considers only one social institution, the household, and gives less importance to savings and capital. The structure is reproduced in Figure 3 while Box 1 describes the SAM contents.

	Agriculture	Tourism	Other sectors	Labor	Capital	Resident population	Resident pop. (tourist Sector)	Rest of the economy	Total
Agriculture	Inter- sector transactions					Domestic consumption of local agricultural products		Final and intermediate agricultural exported products	**Total sales of the agriculture sector**
Tourism						Expenditure within the park area by resident tourists		Tourist expenditure within the park area by non- resident tourists	**Total sales of the tourist sector**
Other sectors								"Exported" intermediate and final products and local services	**Total sales of other sectors**
Labor	Labor employed in agriculture	Labor employed in tourism	Labor employed in other sectors					Income of residents employed in non local firms, in health and education sectors	**Total labor of residents + labor of non-residents employed in local firms**
Capital	Capital employed	Capital employed	Capital employed						**Total employed capital in local firms**
Residents population				Labor income				Other income	**Resident households incomes**
Resident pop. (tourist Sector)									
Rest of the economy	"Imported" intermediate goods	"Imported" intermediate goods	"Imported" intermediate goods	Non resident workers employed in local firms	Capital supply	Domestic consumption of "imported" goods and services and savings			**Balancing account**
Total	**Total agriculture production**	**Total tourist production**	**Total production of other sectors**	**Labor supply**	**Capital supply**	**Total residents' consumption**		**Balancing account**	

Figure 3 – The local SAM for the High Garda Natural Park

Box 1 - Description of the SAM contents:

Agriculture: includes cereals, permanent cultivations and livestock. The other productive activities and resident and non-resident consumers, demand for intermediate and final consumption of agricultural goods (in the row). The value of intermediate goods sold to firms located outside the territory of interest is included in the column 'rest of the economy'. The column includes the consumption of intermediate goods by the agricultural sector and the value of the productive factors, labor and capital, used in the production process. Intermediate goods purchased by firms located outside the territory are listed in the column 'rest of the economy'.

Tourism: includes services offered to the park tourists such as hotels and restaurant, food, drinks, recreational and cultural activities. Hotels and restaurants are included in the tourist sector because their returns are assumed to come entirely from tourism. The other items are partially counted because tourists are only present in some periods of the year and part of the revenue comes from local consumption.

Other sectors: includes all the other sectors in the territory like industry, construction, commercial activities, transport and so on. The main activities are commerce (wholesale and retail), construction and other professional services such as legal consulting, financial consulting, architectural, engineering and other technical activities.

Labor: includes all the professional categories of employees and self-employed. The quantity of labor employed in agriculture, tourism and other sectors is reported in the row. Resident workers employed in firms outside the territory and in the health and education sectors, which represent 5.4 per cent of the total employed population, are included in the account 'rest of the economy'. This share of value-added is distributed among resident and non-resident households (in the column).

Capital: the total return to capital factor from the three productive activities is indicated in the row. This component of value-added is not redistributed because this factor is not relevant for the analysis (in the column). It is then included in the 'rest of the economy' row for the balancing of the SAM.

Residents: includes income and consumption of the inhabitants of the park area. The resident population has been divided into two categories: residents employed in the tourist sector and the remaining resident population. In the SAM, the row indicates the income composition. It consists of labor and other income, including transfers, interest, etc. Considering that other income is not relevant for this analysis, it is indicated in the column 'rest of the economy'. Expenditure on consumption goods is indicated in the column. It is subdivided into consumption of domestic agricultural goods, tourist consumption within the park area and consumption of goods and services provided by other local firms. Savings, taxes and expenditure on consumption goods produced by non-local firms are in the row 'rest of the economy'.

Rest of the economy: includes what is purchased and sold outside the economic area of interest, and those values which are relatively less relevant to the study but necessary for the final balancing of the SAM such as other income, savings and capital supply. The 'rest of the economy' row includes the amount of intermediate 'imported' goods, income of the non-residents employed in local firms, savings, taxes and the consumption of 'imported' goods and services. Intermediate and final goods consumed by non resident households and demanded by non local firms are indicated in the column. Non-resident tourists' expenditure, other income and labor income of residents employed in firms outside the territory and in the health and education sectors are also reported.

2.1 SAM construction and balancing

The construction of a local social accounting matrix is a difficult task, mostly because of the scarcity of local statistical information organized at a local level. As a consequence the researcher is forced to use alternative and indirect sources to make hypotheses and get information about the local economic entities (Bendavid-Val, 1983).

Within the park, the national statistical office (ISTAT) identifies two local labor systems (LLS) gravitating around the municipalities of Limone and Toscolano Maderno. A local labor system is an area composed by several adjacent municipalities defined on the basis of the maximization of commuters' flows within the same area and the minimization of commuters' flows across different areas. The Limone LLS includes also the Tremosine municipality. The Toscolano Maderno LLS includes the municipalities of Gardone Riviera, Gargnano, Magasa, Tignale, Toscolano Maderno and Valvestino. The Salò municipality is at the center of a third LLS which includes other municipalities all outside the park. For the Limone and Toscolano Maderno LLS, we assume that most inhabitants live and work within the territory. This assumption was not extended to the Salò municipality because there is a relevant movement of workers going in and out. Statistical information on the local labor systems is not fully developed and data cannot be disaggregated either by sectors or by municipality (Faramondi and Paris, 2002). As a consequence, we use the information about local

labor systems as a comparison framework in order to evaluate the quality and consistency of the information gathered for constructing the SAM.

The productive structure of the area is mainly composed by small firms with fewer than 10 employees (96 per cent of the total firms). The employees mostly work in the tourist and commercial sectors. Their distribution within the territory shows the economic importance of Salò and Toscolano Maderno.

The economy of small municipalities which are near or belong to natural parks is often strongly linked to the tourist presence and their level of expenditure. In Limone for instance, which has about 1000 inhabitants, 70 per cent of the employees work in the tourist sector. Tourism is in fact the most important sector. It is of high quality because hotels with three or more stars are about 65 percent of the total**.**

Figure 4 describes data and sources used in this study for building the local SAM for the High Garda Natural Park.

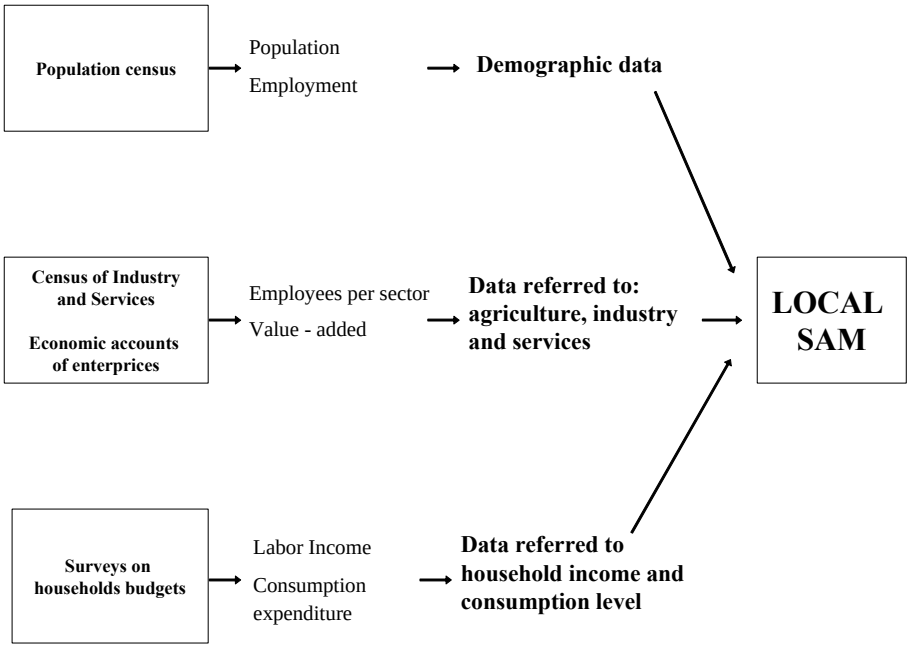


Figure 4 - Sources and data used for the SAM construction

Table 1 reports the aggregate values at the sector level generated following the procedure specified in the Appendix. As expected, tourism plays a relevant role in the local economy within the park boundary.

Table 1-Main aggregates of the park productive sectors

Sectors	Employed	Value-added	Sales	Wages and salaries
Tourism	1837	33 179	81 926	12 185
Other sectors	4203	123 939	398 422	33 245

Considering that the data come from many sources at different points in time, the West Garda SAM is not balanced. Table 2 presents the initial unbalanced SAM, computed using the procedure illustrated in the Appendix.

Table 2 – The local SAM before balancing (in thousands of euros)

	Agriculture	Tourism	Other sectors	Labor	Capital	Resident population	Rest of the economy	Total
Agriculture	382	281	1135			1545	1255	4597
Tourism	51	1194	744			164	47 111	49 265
Other sectors	567	3400	25 569			159 012	209 874	398 422
Labor	1246	28 905	78 866				39 199	148 216
Capital	1350	4274	45 074					50 698
Resident population				180 665			93070	273 734
Rest of the economy	1000	43 746	247 034	4526	50 698	113 014		460 019
Total	4597	81 800	398 422	185 191	50 698	273 735	390 509	

We use the cross entropy method (CE) to correct for this problem as illustrated in detail in the following section.

2.2. SAM balancing using the cross entropy method

The *cross entropy method* estimates a balanced and consistent matrix starting from an original unbalanced social accounting matrix using information available both at micro and macroeconomic levels (Robilliard and Robinson, 1999 and Robinson et al, 1998). This approach is based on Shannon's *information theory* (1948) lately applied to statistical inference by Jaynes (1957). In 1994 Golan, Judge and Robinson used this approach to estimate the coefficients of an input-output table. The objective is to obtain a new set of coefficients close to those previously available but incorporating updated or additional information about economic aggregates such as value-added or consumption.

Two types of information are considered. The first type of information comes from the observed samples, where weights (coefficients) are computed embodying several demographic information. Weights represent the starting point of the estimating process. The second type of information comes from aggregate sources, such as national accounts. They are provided as aggregate values or weighted averages of the distribution of observed variables among observed households.

The High Garda Natural Park SAM has been balanced fixing the rows and columns sums, except for the tourist account, to their initial average value. The tourist row sum has been fixed to the column sum value because of insufficient information on the tourist expenditure reported in the row. The total value-added produced by the industry and services sectors has been fixed to that found in the survey on the local labor systems. We could not use this information for the SAM construction because it refers only to aggregate values (Faramondi and Paris, 2002). However we adjust the content of the value-added cells using the aggregate data available at the local labor system level.

From the initial SAM we obtain the column coefficients $A_{i,j}$:

$$A_{i,j} = \frac{t_{i,j}}{y_j}$$

where $t_{i,j}$ represents the cell in the i-th row and the j-th column and y_i is the total sum of the j-th column.

The estimation process minimizes the cross-entropy distance between the new estimated coefficients and the previous ones:

$$\min I = \left[\sum_i \sum_j A_{i,j} \ln \frac{A_{i,j}}{\overline{A}_{i,j}} \right]$$

subject to the following constraints:

$$\sum_j A_{i,j} y_j^* = \frac{y_j^* + y_i^*}{2}, \quad i = 1,...,n-1$$

$$\sum_j A_{t,j} y_j^* = y_t^*, \qquad t = \text{tourist}$$

$$\sum_i \sum_j G_{i,j} T_{i,j} = VA$$

$$0 \le A_{i,j} \le 1$$

where $\overline{A}_{i,j}$ and $A_{i,j}$ are respectively the prior and the new estimated SAM coefficients, y^* are rows and columns sums of the n accounts, **T** is the initial SAM which is multiplied by matrix **G** which has 1 in the value-added cells (labor and capital) of each sector (agriculture, tourism and other sectors) and 0 elsewhere. *VA* represents the value-added produced by industry and services sectors found in the survey on the local labor systems. An analytic description of the complete model, where row and column sums involve errors in measurement, is presented in Robilliard and Robinson (1999) and Robinson and El-Said (2000). The balanced SAM for the High Garda Natural Park is reported in Table 3.

Table 3 – The local SAM balanced (in thousands of euros)

	Agriculture	Tourism	Other sectors	Labor	Capital	Resident population	Resident pop (tourist Sector)	Rest of the economy	Total
Agriculture	382	268	905			1369	258	1415	4597
Tourism	52	1222	858			191	36	79442	81801
Other sectors	566	3180	18888			133626	25217	216428	397905
Labor	1246	30829	110487					42419	184981
Capital	1351	4610	66621						72582
Resident population				151587				84990	236577
Resident pop (tourist Sector)				28764				15882	44645
Rest of the economy	1001	41691	200146	4631	72582	101390	19134		440575
Total	4597	81801	397905	184981	72582	236577	44645	440575	

The balanced values in Table 3 are similar to the original values and the resulting balanced SAM is now ready for the impact analysis.

3. THE MULTIPLIER ANALYSIS

We use the SAM multiplier analysis for simulating the impact on the local economic system of changes in relevant exogenous policy variables as a result of the interrelations existing among revenue, income and expenditure flows of households and firms. The matrix of multipliers obtained from the SAM captures both the direct and indirect effects on production and income and also the circular effects that are the result of the circular flow of income within the local economy.

The SAM multiplier analysis considers prices as exogenously fixed and implies the following behavioral assumptions:

1. since prices are given, it is not possible to estimate the impact of price variations and the conclusions must be drawn in terms of quantities;

2. functional relations use fixed technical coefficients of Leontief technologies and it is therefore not possible to consider changes in the productivity of labor and capital;
3. there are no bounds on goods supply because supply satisfies demand by assumption.

In developing a SAM multiplier model, the first step is to decide which accounts should be exogenous and which are endogenous on the basis of the specific aim of the analysis (De Janvry and Sadoulet, 1995, Pyatt and Round, 1979). Given that in our case the study evaluates the impact of environmental policies on the local economy, the account 'rest of the economy' is considered exogenous.

<table>
<tr><td></td><td colspan="7">Endogenous accounts</td><td rowspan="2">Total</td><td>Exogenous accounts</td><td rowspan="2">TOTAL</td></tr>
<tr><td>(1)</td><td>(2)</td><td>(3)</td><td>(4)</td><td>(5)</td><td>(6)</td><td>(7)</td><td>(8)</td></tr>
<tr><td>(1)Agriculture</td><td colspan="3" rowspan="3">T_{ij}</td><td colspan="2" rowspan="4"></td><td colspan="2" rowspan="3">T_i</td><td>N_1</td><td>X_1</td><td>Y_1</td></tr>
<tr><td>(2)Tourism</td><td>N_2</td><td>X_2</td><td>Y_2</td></tr>
<tr><td>(3)Other sectors</td><td>N_3</td><td>X_3</td><td>Y_3</td></tr>
<tr><td>(4)Labor</td><td colspan="3" rowspan="2">T_{fj}</td><td>N_4</td><td>X_4</td><td>Y_4</td></tr>
<tr><td>(5)Capital</td><td>N_5</td><td>X_5</td><td>Y_5</td></tr>
<tr><td>(6)Residents employed in the tourist sector</td><td colspan="3" rowspan="2"></td><td colspan="2" rowspan="2">T_f</td><td colspan="2" rowspan="2"></td><td>N_6</td><td>X_6</td><td>Y_6</td></tr>
<tr><td>(7)Rest of the resident population</td><td>N_7</td><td>X_7</td><td>Y_7</td></tr>
<tr><td>(8)Exogenous accounts</td><td colspan="7">E</td><td rowspan="2"></td><td>L</td><td>Y_X</td></tr>
<tr><td>TOTAL EXPENDITURE</td><td>Y_1</td><td>Y_2</td><td>Y_3</td><td>Y_4</td><td>Y_5</td><td>Y_6</td><td>Y_7</td><td>Y_X</td><td></td></tr>
</table>

Figure 5 - Representation of the SAM model

The matrix of the endogenous transactions, **T**, can be divided into four sub-matrices. In Figure 5, the matrix $\mathbf{T_{ij}}$ is the matrix of transactions which is presented also in the input - output model. The matrix $\mathbf{T_{fj}}$ represents the composition of the value-added in different sectors of the economy; the matrix $\mathbf{T_f}$ represents the distribution of the value-

added to the endogenous institutions and the matrix $\mathbf{T_i}$ corresponds to the expenditures of the endogenous institutions. The column vector **X** represents the injections from exogenous to endogenous accounts. We can simulate shocks on the endogenous variables by modifying the elements of vector **X**. **L** corresponds to the transactions between exogenous accounts and the row vector **E** shows the leakages from the endogenous to the exogenous accounts. The column vector **Y** and $\mathbf{Y_X}$ represents the total income and the total expenditure of endogenous and exogenous accounts respectively. Considering the matrix of endogenous accounts **T**, we divide the elements in each column by its column total. We obtain the matrix of coefficients **A** and inverting the matrix (**I - A**), where **I** is the identity matrix, we obtain the SAM multiplier matrix, **M**. Similarly we divide each element of the row vector **E** by its column total to obtain the vector of coefficients **B**. Impacts on total output and income are derived using the following expressions:

The vector of impacts: $\Delta\mathbf{Y} = (\mathbf{I} - \mathbf{A})^{-1}\Delta\mathbf{X}$;

The leakages from endogenous to exogenous accounts: $\Delta\mathbf{L} = \mathbf{B}\ \Delta\mathbf{Y}$;

The SAM multiplier matrix: $\mathbf{M} = (\mathbf{I} - \mathbf{A})^{-1}$;

The vector of exogenous shock: **ΔX.**

In the High Garda Natural Park case **X** is the account ‘rest of the economy’ and **ΔX** corresponds to changes in the final demand for agricultural products and the tourists’ expenditure of non residents. The expression describing the impact on leakages **ΔL** must hold with equality because in a SAM framework total injections from exogenous accounts must be equal to total leakages from the endogenous to the exogenous

accounts. In this expression **B** is the vector of coefficients which represents what the exogenous accounts receive from the endogenous ones.

4 SIMULATIONS AND RESULTS

This section estimates the impact of both the participative and non-participative management policies of the West Garda Regional Forest on the local economic system. In line with the analysis developed in the previous study, Table 4 describes the following three scenarios:

- benchmark – the actual forest plan;
- scenario A – non-participative regional management program;
- scenario B – participative regional management program.

Note that in scenario B, the public manager based in Milan takes formally into consideration the preferences of the users as revealed by the estimated contingent prices.

Table 4 - Combinations of functions and their description

Functions	**Description**	**Combinations of functions (%)**		
		Benchmark Scenario Actual forest plan	**Scenario A Non-participative**	**Scenario B Participative**
Naturalistic function	Conserving nature, wildlife and ecosystem	26	65	94
Productive function	Providing market with timber and non-timber products: fodder, mushrooms, resins, etc.	21	2	2
Protective function	Preserving structural features of the canopy and territory	26	2	2
Tourist function	Providing tourist-recreational services: sports, outdoor activities (hunting and fishing, horse riding, biking, etc.)	27	31	2

In the benchmark scenario, 27 per cent of the forest is devoted to the tourist function while 26 per cent is devoted to the naturalistic function. If the adopted management

policy follows scenario A, then the importance of the naturalistic function increases to 65 per cent while the tourist function does not change significantly. On the other hand, if the adopted policy follows scenario B then the importance of the tourist function reduces to 2 per cent and the forest mainly offers the naturalistic function in up to 94 per cent of the total area. In both scenarios, protective and productive functions declines to 2 per cent.

As it is reasonable to expect, these scenarios attract different flows of tourist and have a differential impact on agriculture as they imply different uses of land. With respect to the participative program, the non-participative management plan places more importance on the tourist function. Note that more hectares allocated to the tourist function do not necessarily mean higher levels of tourist flows. The tourist function embodies recreational services, sports and natural activities such as fishing, biking and horse riding. These are all anthropic interventions which according to the contingent evaluation analysis seem to be little desired by visitors. Tourists prefer this area to be allocated at naturalistic aims where human interventions are reduced to vegetation and fauna habitat maintenance. For this reason, we simulate that scenario B induces a higher number of visitors than scenario A. In simulating a change in tourist flows, we must also consider that the West Garda Regional Forest is a part of the West Garda Park where most tourists are attracted by cultural and sports events, historical places, monuments and so on. Changes in tourist flows depend also on the efficiency of the future developments in the parks potentialities. Therefore we simulate three possible changes in tourist flows, affecting tourists' expenditure for each scenario.

Agricultural activities within the park area are partly linked to the productive function of the West Garda forest. Both scenarios devote only 2 per cent of the territory

for productive ends implying a reduction in the land used for agricultural purposes. As a consequence, agricultural activities decline. In the participative scenario (A) the impact is smaller because a larger area is allocated to the naturalistic function. Note that while in tourist areas there is negligible agricultural activity, in naturalistic areas a certain level of agricultural activities is maintained. Therefore we simulate a negative change in the agriculture sector of about 10 per cent in scenario A and of about 5 per cent in scenario B.

Table 5 reports the SAM multipliers for the High Garda Natural Park corresponding to changes in the non-resident final demand for agriculture products and tourist services.

Table 5 – The SAM multipliers

	Agriculture	**Tourism**
Agriculture	1.094	0.007
Tourism	0.014	1.016
Other sectors	0.377	0.316
Labor	0.406	0.473
Capital	0.385	0.112
Resident population	0.396	0.461

The Multipliers show the changes in output and income of the local sectors and resident population as a result of exogenous shocks. Looking at the tourism column each value can be interpreted as the additional output or income generated in the row account due to a one unit increase in non-resident tourist expenditure. The Multipliers show a negligible link between tourism and other local activities (0.007, 0.316) with respect to agriculture (0.014, 0.377). On the other hand, changes in the tourist sector have a larger impact on the resident population income level (0.416).

In the simulation analysis an increase in tourist flows is expected to have a greater direct impact on the tourist sector and smaller indirect effects on other local activities,

because of the high share of non-resident tourists' expenditure on the total output of the tourist sector (Table 3). Tables 6 and 7 respectively show the simulations result expected in terms of changes in production, labor demand and incomes of the resident population

Table 6 – Simulation results, variations in production and labor demand (in thousands of euros)

	BENCHMARK SCENARIO Actual forest plan		**SCENARIO A Non-participative**			**SCENARIO B Participative**		
Change in the agriculture sector (%)			-10	-10	-10	-5	-5	-5
Change in tourists' expenditure (%)			0	+5	+10	0	+10	+20
	Production	Labor	**Results**					
Agricultural sector	4.597	1.246	-3.36	-2.74	-2.11	-1.67	-0.43	+0.80
Tourist sector	81 800	30 829	-	+4.93	+9.86	-	+9.87	+19.73
Other sectors	402 502	111 732	-1.16	-0.85	-0.55	-1.14	-0.54	+0.54
Total sectors	484 303	142 562	-0.03	+1.05	+2.13	-0.02	+2.16	+4.33

If there is no change in tourist flows, both strategies have a negative impact on the local economy caused by the shock on the agriculture sector (Table 6). However, if the adopted management policy is scenario B, the negative impact is smaller. An increase in tourist expenditure affects positively both the tourist sector and the other activities due to indirect and circular effects. The impact on the local economy generated by the adoption of scenario A is positive given the relevance of tourist sector to the local economy. On the other hand, the impact is negative for agriculture (2 per cent) and the other sectors. If the management policy is participative, in the case of a 10 per cent increase in tourist expenditure, the results are similar to those of scenario B but the negative effects on agriculture and other sectors are smaller. If the forest is developed incorporating the users' preferences, the increase in tourists' expenditure can be even

higher. In the case of a 20 per cent increase, the effects on the local economy are markedly positive. The negative impact on agriculture is offset by the positive indirect and circular effects caused by the change in tourist expenditure.

Table 7- Simulations results, variations in resident population income level (in thousands of euros)

	BENCHMARK SCENARIO Actual forest plan	**SCENARIO A Non-participative**			**SCENARIO B Participative**		
Change in the agriculture sector (%)		-10	-10	-10	-5	-5	-5
Change in tourists' expenditure (%)		0	+5	+10	0	+10	+20
		Results					
Income level of residents employed in tourist sector	44 645	-	+3.18	+6.35	-	+6.36	+12.71
Income level of residents employed in agricultural and the other sectors	236 576	-0.02	+0.12	+0.26	-0.01	+0.28	+0.56
Income level of total resident population	281 221	-0.02	+0.60	+1.23	-0.009	+1.24	+2.49

Inspection of Table 7 reveals that the impacts on the income level of residents employed in the non-tourist sector are not economically significant. If there is no change in tourist expenditure, residents face a negative but small impact in both scenarios. On the other hand, in the case of a 10 per cent increase, both scenarios have positive effects on the local population. If the participative scenario is adopted, a 20 per cent increase in tourist expenditure causes a positive impact of about 12 per cent on the income level of the resident population employed in the tourist sector.

5. CONCLUSIONS

This study analyzed the impact of the participative and the non-participative managerial alternatives of the West Garda Regional Forest on the local economy of the High Garda Natural Park, where the forest is located, using a social accounting matrix framework

developed at the local level. This approach provides a comprehensive view of the local economic scenario and its basic structural characteristics. The territorial analysis allows us to understand better the social economic and environmental interactions at the local level and to verify the potential sources of conflict between the central management, having jurisdiction over the West Garda Regional Forest, and the peripherical management commanding the High Garda Natural Park.

Although the data available for the area of interest were scattered, the resulting SAM adequately represents the interactions between local economic activities and the resident population. However more and better quality data would permit a more efficient use of the model potentialities.

We simulated the impact of both the participative and non-participative optimal combinations of functions using the SAM multiplier approach that gives an immediate representation of direct, indirect and circular effects. The participative program is obtained by maximizing the manager's revenues, taking formally into consideration the preferences of users and residents by including the prices that visitors are willing to pay for each function as weights of the objective function. The simulation analysis showed that the participative program is preferable to the non-participative program for the impact both on production and income level. It follows that the participative regional management program matches both the preferences of users and the interests of local institutions because the territory receives a larger benefit from its implementation. However the presence of vested interests among local institutions, associations and actors may be a further source of conflict among the stakeholders. This issue will be analyzed in Baggio (2005).

APPENDIX - DATA SOURCES

In this appendix we describe the data sources used to estimate the values content in the SAM. We collected data mainly from the data bank Ionio Cineca. Local information was provided by the population census (Istat, 1991) and the intermediate census of industry and services (Istat, 1996a). From the regional statistical yearbook of Lombardy we collected data related to households' incomes and expenditure and employers' professional positions per each observed municipality. Information about value-added and sales of each sector was found in the economic accounts of enterprises yearbook (Istat, 1996b). The value-added produced in agriculture referred to the census of agriculture of 1991 while the agricultural standard gross incomes comes from the Inea yearbook of Italian Agriculture of 1996. Data used to determine value-added, inter-sector transactions, production, income, consumption and labor income are illustrated in sequence.

1. Value-added

   The procedure used for determining the value-added at factor costs produced by local firms includes two phases. First, the number of employees by local economic activity, derived from the intermediate census of industry and services, is multiplied by the average value-added per employee, assuming that the West Garda's firms produce a value-added similar to the average values of the Lombardy Region. The Italian national statistical office (Istat) distinguishes between firms with less than 19 employees and firms with more than 19 employees. We also adopt this classification because within the area considered there are mostly small firms (less than 19 employees). This allows us to be more precise in the estimation. During the SAM

balancing process these values have been compared with the data at the Local Labor System level. The obtained value-added is divided into labor and capital remuneration using regional average values. After having determined the amount of labor expenditure, we subtract social contributions, using percentage values calculated at a national level, in order to obtain values as close as possible to the local labor income levels. We verified the congruence between the obtained labor income and the values determined by multiplying the number of employees as derived from the population census of 1991, by the average annual income reported in the statistical yearbook of the Lombardy region. Considering that dependent employees (managers, employees and workers) represent only a part of the total number of employees, we needed to determine the income level of self-employed people. We assumed that the self-employed workers are equally distributed among sectors. Finally, we estimated the value-added produced by the agriculture sector using data from two sources: the census of agriculture and the Standard Gross Margin provided by the yearbook of Italian agriculture (Inea, 1996). For the agriculture sector the value-added is derived from the information available on gross incomes, which are close to the value-added produced by the agricultural sector (European Commission, 2002). The value-added have then been divided into labor and capital remuneration on the basis of the information on farm budgets collected by Inea and reported in the 1996 yearbook.

2. Inter-sector transactions

Given that local input-output tables are not available, the national input-output table has been used in order to define the size of inter-sector transactions under the

assumption of constant proportions between the national, regional and local level. After obtaining the total transactions of agriculture, tourism and other sectors we derived the coefficients matrix referred to the intermediate transactions among the three accounts. Since firms are rather small and heterogeneous we assumed that most of the intermediate goods come from firms located outside the area of interest.

3. Production

In order to determine the total production of the three sectors considered in this study (agriculture, tourist and other sectors) we consider that the local sales per employee are a reasonable approximation of the average regional values, therefore we multiply average sales per employed by the number of employed, in each sector. The total production of agriculture derives from average regional values. We identified that the value-added produced by agriculture sector represents the 56 per cent of the total. These values were then compared to those obtained from the input-output table following the procedure described above.

4. Income

In determining the income and consumption levels of the resident population we need to make further assumptions. Since there is no local information on income and household consumption we assumed that they are similar to the regional and provincial average values. Therefore we derived the average per capita income, labor income and the distribution of consumption expenditure. The resident population was divided into two categories: residents employed in the tourist sector and the remaining resident population.

5. Consumption

Intermediate consumption of local firms' products have been determined assuming that the small and heterogeneous local firms purchase mostly from firms located outside the territory of interest. The share of production assigned to final local consumption has been calculated by dividing final consumption by total production derived from the national input - output table. By distinguishing among two typologies of visitors, we calculate resident and non-resident tourist expenditure using information on daily personal expenditure obtained from the travel cost section of the West Garda Regional Forest survey. Moreover, using data on arrivals and the number of nights spent in hotels and supplementary accommodation provided by the Province of Brescia, we determine the average yearly flow of tourists.

6. Labor

Estimation of labor income follows the procedure described in the 'Value-added' section of this appendix. The number of resident and non-resident workers in firms is calculated by comparing data from the population census and the intermediate census of industry and services. Note that the comparison is difficult because they differ both in terms of heterogeneity of units studied and also for the period they refer to. While the population census refers to households, the intermediate census of industry and services collects information on people employed using local units as a basis.

NOTES

[1] The High Garda Natural Park extends for about 38 000 hectares, half of which are covered by woods. It embraces the municipalities of Salò, Gardone Riviera, Toscolano Maderno, Valvestino, Magasa, Gargnano, Limone, Tignale and Tremosine. The territory has heterogeneous morphological characteristics. It ranges from a height of 65m to 2000m above the sea level. It presents also very different climatic conditions, typical of a Mediterranean system in the land surrounding the lake shores and the 'alpine systems' on the north-west side of Garda Lake.

REFERENCES

Baggio, M., (2005), 'Resolution of Conflicts in a Natural Area', in *Integrated assessment and management of public resources*, eds. Cooper, Perali and Veronesi, Edward Elgar (forthcoming).

Bendavid-Val, A. (1983), *Regional and Local Economic Analysis for Practitioners*, Praeger Publishers, New York.

Cooper,J., F. Perali, Tommasi, N. and M. Veronesi,(2005a), 'A contingent valuation method incorporating fairness and citizen participation', working paper of the Department of Economics of the University of Verona.

Cooper,J., F. Perali, Tommasi, N. and M. Veronesi,(2005b), 'Travel cost estimation conditional on leisure consumption', in *Integrated assessment and management of public resources*, eds. Cooper, Perali and Veronesi, Edward Elgar (forthcoming).

De Agostini, P., (2005) 'Identification of the best combination of environmental functions using multi-criteria analysis', in *Integrated assessment and management of public resources*, eds. Cooper, Perali and Veronesi, Edward Elgar (forthcoming).

De Agostini, P., V. Cicogna and Perali, F.,(2005) 'The supply of functions by homogeneous areas using cluster analysis', in *Integrated assessment and management of public resources*, eds. Cooper, Perali and Veronesi, Edward Elgar (forthcoming).

De Janvry, A. and E. Sadoulet, (1995), *Quantitative Development Policy Analysis*, The Johns Hopkins University Press, Baltimore.

Dorward, A., J. Morrison, C. Poulton and T. Hardwick (2003), *Disaggregated Impacts of Agricultural Policy Reform on Rural Households in Malawi*, First Meeting OECD Global Forum Pro-Poor Agricultural Policies, Paris.

European Commission, (2002), *Definitions of Variable Used in FADN Standard Results*, RI/CC 8882 Rev. 7.0, Brussels.

Fannin M. (2001), *Construction of a Social Accounting Matrix for Country Fermanagh, Northern Ireland*, Southern Regional Science Association, USA.

Faramondi, A. and M. G. Paris (2002), *Le nuove stime di aggregati socio-economici per i Sistemi Locali del Lavoro*, Sixth Conference of Statistics, Rome.

Golan, A., G. Judge, and S. Robinson. (1994), 'Recovering information from incomplete or partial multisectoral economic data', *Review of Economics and Statistics*, **76**, 541 – 49.

Inea (1996*), Agricoltura Italiana Conta*, INEA, Rome.

Istat (1991), 'Censimento della popolazione e delle abitazioni', Istat, Rome; at IONIO Servizio Banche Dati Cineca, http://ionio.cineca.it/

Istat (1996a), 'Censimento intermedio dell'industria e dei servizi', Istat, Rome; at IONIO Servizio Banche Dati Cineca, http://ionio.cineca.it/.

Istat (1996b), 'Conti Economici delle Imprese', Istat, Rome.

Istat (1996c), 'Distribuzione quantitativa del reddito nelle indagini sui redditi delle famiglie agricole', Istat, Rome.

Istat, (2000), 'Tavola intersettoriale dell'economia italiana' – Anno 1992, Istat, Rome; at IONIO Servizio Banche Dati Cineca, http://ionio.cineca.it/.

Jaynes, E.T (1957), 'Information Theory and Statistical Mechanics', *Physical Review*, **106**, Issue 4, 620 – 30.

Province of Brescia, Ufficio promozione e statistica at: http://www.provincia.brescia.it/turismo/turismo-uffici.php

Pyatt, G. and J. I. Round (1979), 'Accounting and Fixed Price Multipliers in a Social Accounting Matrix Framework', *The Economic Journal*, **89**(356), 850-73.

Regional Statistical Yearbook of Lombardy in http://www.ring.lombardia.it/.

Robilliard, A. S. and S. Robinson (1999), 'Reconciling Household Survey and National Accounts Data Using a Cross Entropy Estimation Method', IFPRI. Discussion Paper No. 50.

Robinson, S., A. Cattaneo and M. El-Said (1998), 'Estimate a Social Accounting Matrix Using Cross Entropy Methods', International Food Policy Research Institute, TMD Discussion Paper No. 33.

Robinson, S. and M. El-Said (2000), 'GAMS Code for estimate a Social Accounting Matrix (SAM) Using Cross Entropy (CE) Methods', International Food Policy Research Institute, TDM Discussion Paper No. 64.

Shannon, C. E. (1948) 'A mathematical theory of communication', *Bell System Technical Journal*, **27**, 379 – 423.