

Cavallaro, Fausto; Ciraolo, Luigi

**Working Paper**

## Economic and environmental sustainability: A dynamic approach in insular systems

Nota di Lavoro, No. 21.2002

**Provided in Cooperation with:**

Fondazione Eni Enrico Mattei (FEEM)

*Suggested Citation:* Cavallaro, Fausto; Ciraolo, Luigi (2002) : Economic and environmental sustainability: A dynamic approach in insular systems, Nota di Lavoro, No. 21.2002, Fondazione Eni Enrico Mattei (FEEM), Milano

This Version is available at:

<https://hdl.handle.net/10419/119629>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

Fondazione Eni Enrico Mattei

**Economic and Environmental  
Sustainability:  
A Dynamic Approach in  
Insular Systems**

Fausto Cavallaro and Luigi Ciralo  
NOTA DI LAVORO 21.2002

**APRIL 2002**

SUST – Sustainability Indicators and Environmental Evaluation
--

Fausto Cavallaro *Department of Economy and Territory, University of Catania*  
Luigi Ciralo *Department of R.I.A.M., University of Messina*

This paper can be downloaded without charge at:

The Fondazione Eni Enrico Mattei Note di Lavoro Series Index:  
[http://www.feem.it/web/attiv/\\_attiv.html](http://www.feem.it/web/attiv/_attiv.html)

Social Science Research Network Electronic Paper Collection:  
[http://papers.ssrn.com/abstract\\_id=XXXXXX](http://papers.ssrn.com/abstract_id=XXXXXX)

The opinions expressed in this paper do not necessarily reflect the position of  
Fondazione Eni Enrico Mattei

# **Economic and Environmental Sustainability: A Dynamic Approach in Insular Systems Structures**

## **Summary**

Environmental resources constitute the 'raw materials' for tourism. This sector represents the driving force behind the economy of small islands. The sustainable use and a rational policy of conservation of these resources are prerequisites to enable their full exploitation. However, island systems have low stability, as they are highly sensitive to exogenous stress phenomena caused by economic factors, which exceeding the sustainable threshold may come together to damage the environment. This work systematically examines the effects and the feedbacks that the economy of tourism may generate in small areas like the minor islands of Sicily (Italy). The development of a dynamic model is proposed to supply a key to interpret the phenomena affecting the island of Salina (Aeolian islands-Messina) offering elements for the assessment of future local government policies.

**Keywords:** Sustainable development, dynamic systems, tourism, models

**JEL:** Q01, C89

### *Addresses for correspondence:*

Fausto Cavallaro  
Dip. Economia e Territorio  
Università di Catania  
Corso Italia, 55  
95129 CATANIA  
Phone: 095.375344 (int. 324)  
Fax: 090.6764920  
E-mail: f.cavallaro@mbox.unict.it

Luigi Ciruolo  
Dip. R.I.A.M.  
Università di Messina  
Piazza S. Pugliatti, 1  
98100 MESSINA  
Phone: 090.771548  
Fax: 090.6764920  
E-mail: luigi.ciraolo@unime.it

Fondazione Eni Enrico Mattei

**Economic and Environmental  
Sustainability:  
A Dynamic Approach in  
Insular Systems**

Fausto Cavallaro and Luigi Ciralo  
NOTA DI LAVORO 21.2002

**APRIL 2002**

SUST – Sustainability Indicators and Environmental Evaluation
--

Fausto Cavallaro *Department of Economy and Territory, University of Catania*  
Luigi Ciralo *Department of R.I.A.M., University of Messina*

This paper can be downloaded without charge at:

The Fondazione Eni Enrico Mattei Note di Lavoro Series Index:  
[http://www.feem.it/web/attiv/\\_attiv.html](http://www.feem.it/web/attiv/_attiv.html)

Social Science Research Network Electronic Paper Collection:  
[http://papers.ssrn.com/abstract\\_id=XXXXXX](http://papers.ssrn.com/abstract_id=XXXXXX)

The opinions expressed in this paper do not necessarily reflect the position of  
Fondazione Eni Enrico Mattei

# **Economic and Environmental Sustainability: A Dynamic Approach in Insular Systems Structures**

## **Summary**

Environmental resources constitute the 'raw materials' for tourism. This sector represents the driving force behind the economy of small islands. The sustainable use and a rational policy of conservation of these resources are prerequisites to enable their full exploitation. However, island systems have low stability, as they are highly sensitive to exogenous stress phenomena caused by economic factors, which exceeding the sustainable threshold may come together to damage the environment. This work systematically examines the effects and the feedbacks that the economy of tourism may generate in small areas like the minor islands of Sicily (Italy). The development of a dynamic model is proposed to supply a key to interpret the phenomena affecting the island of Salina (Aeolian islands-Messina) offering elements for the assessment of future local government policies.

**Keywords:** Sustainable development, dynamic systems, tourism, models

**JEL:** Q01, C89

### *Addresses for correspondence:*

Fausto Cavallaro  
Dip. Economia e Territorio  
Università di Catania  
Corso Italia, 55  
95129 CATANIA  
Phone: 095.375344 (int. 324)  
Fax: 090.6764920  
E-mail: f.cavallaro@mbox.unict.it

Luigi Ciruolo  
Dip. R.I.A.M.  
Università di Messina  
Piazza S. Pugliatti, 1  
98100 MESSINA  
Phone: 090.771548  
Fax: 090.6764920  
E-mail: luigi.ciraolo@unime.it

## 1. INTRODUCTION

The Aeolian islands as a whole are certainly, due to their outstanding natural beauty, a huge tourist attraction for Italians and foreigners. The launch of the tourist industry in these islands can be traced back to the scientific and cultural interest arising in the archipelago in the early 1950s. Initially, tourists were attracted by the unusual volcanic activity present on the islands of Stromboli and Vulcano and the natural thermalism on the island of Lipari. Since the 1960s the phenomenon of tourism has become an industry in its own right.

In order to satisfy the increasing demand from tourism a flourishing activity began, centred on the construction of new hotels and other facilities to host tourists. Unfortunately, owing to the lack of regulation, tourist activity in many cases has not translated into opportunity for balanced growth of the local economy. On the contrary it has created significant territorial and environmental imbalances.

The aim of this work is to attempt to develop a model based on a dynamic approach in order to:

- simulate the behaviour and the interaction of the main economic and environmental variables of the islands;
- analyse the resultant levels of stability and fragility of environmental systems on small islands, following exogenous perturbations generated by economic factors such as the presence of tourism.

The model developed, opportunely modified, could also be applied to other areas similar to the one analysed. The next section in this work illustrates the specific problems of the case analysed, the subsequent one goes on to describe methodological aspects and the elements of the model, the fourth analyses the results obtained from the simulation and lastly, conclusions are drawn from these results.

## 2. ECONOMIC ACTIVITY OF THE ISLAND OF SALINA (ITALY)

The Aeolian islands are situated to the north of Sicily in the southern Tyrrhenian sea and comprise the seven main islands as well as some smaller uninhabited ones and rocks of negligible size. In order of size the islands are: Lipari, Salina, Vulcano, Stromboli, Filicudi, Alicudi and Panarea. The islands are administered by the local authority of Lipari apart from Salina, which is divided into three areas that come under the province of Messina.

The economic development of the microinsular Aeolian systems is based almost exclusively on tourism and all the activities associated with this. This development model concentrates

mostly on the island of Salina. There are numerous workers involved who were once employed in farming and fishing. Now however, the local workforce is mainly engaged in construction work during winter and in tourism during the summer season. As a result of this all traditional areas of economic activity have been almost totally abandoned.

For many years agriculture and fishing represented the economy of the local population and was one in which man and environment were in perfect equilibrium. It can easily be deduced that until economic activity mainly consisted of agriculture and fishing, the impacts on the territory were not as significant as those currently generated by tourism. As a consequence of this *non-policy* of tourism, it is clear that during the summer (above all in August) the island of Salina is affected by traffic congestion, production of waste, consumption of natural resources (fresh water, energy, etc.) and an impact on the environment of significant magnitude. Therefore, it can be said that the area is put under pressure by the burden of numbers of tourists that are considered to be too great for the size of the island in the long term. The long-term growth in the number of tourists could compromise the fragile local *carrying capacity* and produce marked instability in the environmental equilibrium through practices that are detrimental to the natural resources. Were the tourist industry to be managed rationally it would certainly represent an opportunity for sustainable growth in the insular systems of the Aeolian Islands. To this end it is held to be necessary and urgent to redesign a model of development for the island of Salina that, through the use of suitable tools, promotes eco-tourism but at the same time revitalizes other areas of production that have now been abandoned.

### 3.DEVELOPMENT AND ANALYSIS OF A DYNAMIC MODEL

#### *3.1 Instability and exogenous shock*

As stated above, the effects of tourism exert pressure on the natural environment that can give rise to phenomena harmful to the environment to a greater or lesser extent. But up to what point can the environmental system resist the distress provoked by economic activity? In addition, is the ability of self-preservation of systems to adapt to changes produced tough enough to withstand them? We will seek therefore to illustrate some fundamental concepts to understand how the model works.

The environmental system under pressure from external perturbation, including economic exploitation, may show two types of reaction:

a) a *stability* reaction: this implies a condition in which the system shifts from the state of equilibrium through a state of stress and then tends to return to the initial state; b) a *metastability* reaction: where the system modifies the initial level of equilibrium and subsequently reaches a different stable point of equilibrium<sup>1</sup>. A strong perturbation may instead drive the system into the domain of another stable state of equilibrium, if this exists. This type of stability is known as “global stability”<sup>2</sup>.

The key question is whether the perturbation (exogenous shock due to economic activity) compromises the resilience and resistance of eco-systems. The environmental system may indeed move away from a state of equilibrium and may fluctuate more or less widely around a configuration called *single point attractor*. An attractor binds a system to a precise pattern of behaviour. It may be conceived as a region of limited space towards which every path of a dynamic system tends to direct itself and it may be a stable point, a regular cycle or a highly complex behaviour. When we are in the presence of a single point attractor, the system tends to return towards a state of equilibrium after having been upset.

But if we hypothesise that the oscillations, provoked by an external shock, correspond to another type of field attractor, the *strange attractor*, the system will behave in an unstable and chaotic manner<sup>3</sup>.

When the system finds itself in this state it is structurally unstable and it is impossible to make forecasts. The environmental system, far from equilibrium, because of the presence of non-linearity may show more pronounced disorder. In this specific case the heavy flow of tourists may be the cause of the chaotic behaviour of environmental systems that could translate into irreversible damage.

A dynamic system can be represented as a set of differenzial equations. It is well known that systems of differential equations and systems of non-linear difference equations can generate very complex time-paths that can seem random but instead they are chaotic. We will examine a dynamic system with a simple first-order difference equation:

$$X_{i+1} = aX_i(1 - X_i) \tag{1}$$

This equation in literature is known as “logistic map”<sup>4</sup> and it has been used by May for modelling the dynamic of population. The equation (1) has been largely discussed by May and subsequently by many other authors such as Baker and Gollup (1990), Baumol and Benhabib (1989), Frank and Stengos (1988) and Kelsey(1988). In this equation the parameter “a” is crucial to put in action feed-back behaviours. The equation (1) has two solutions, or



stationary solutions in which  $x(t+1)=x(t)$  so  $x(t)=0$  e  $x(t)=1-(1/a)$  the values of the endogenous variable can fluctuates between 0 and 1. The equation arises a curve known as phase curve and it can to create different dynamic behaviours that may produce complex effects. More precisely we will have:

- If at the beginning, the parameter is  $0 \leq a \leq 1$  the system tends to zero, so a growth of economic development rate does not have any effect on the ecological system.
- If we suppose instead that the parameter is  $0 \leq a \leq 3$  the system tends towards a point of stable equilibrium that in the fig. 1a is represented by the point  $\alpha$ . It is easy to observe that the system moves away from the point  $x_0$  and is attracted to a fixed point  $x_i = 1 - \frac{1}{a}$ , so the dynamic of the system seems to be rather foreseeable. The point  $\alpha$  is an attractor point.

Eventually if “a” is gradually increased till reaching values higher than a *sustainable threshold* the fixed point  $1-1/a$  becomes unstable. The behaviour of the system at the beginning will be oscillatory with periodic cycles (see fig.1 b) and afterwards the cycles will be not identifiable anymore and the path will arise in a chaotic way. Consequently it will became impossible to do any forecast about the pathway of the system.

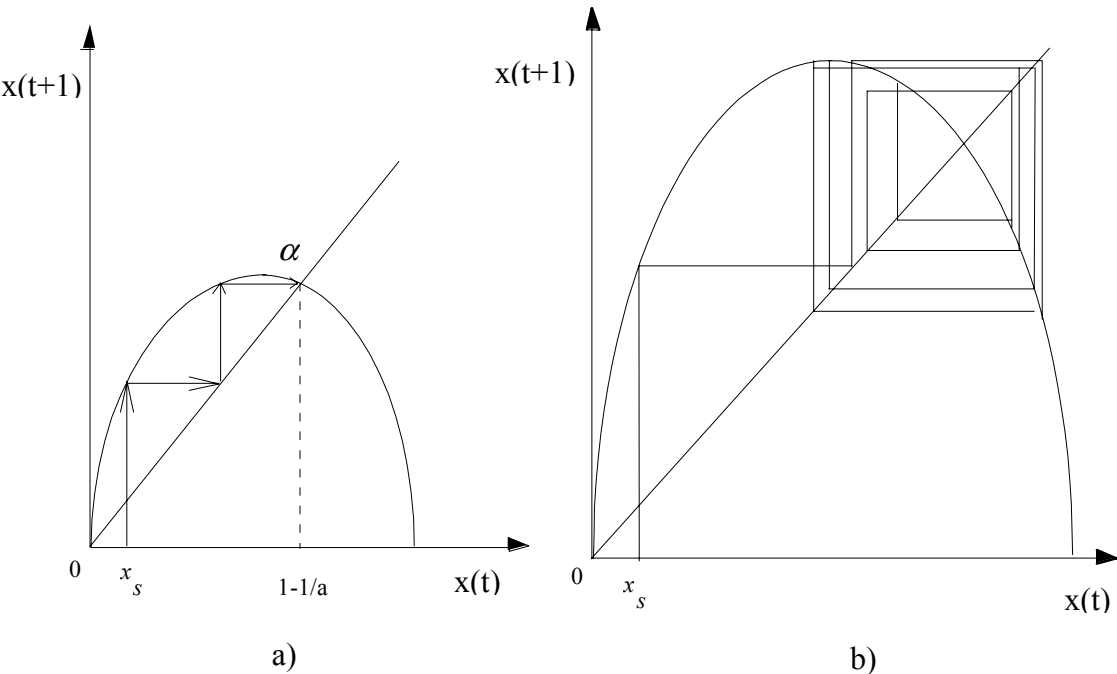


Fig. 1

### 3.2 A systemic approach

In order to globally interpret the existing interrelations in the system *economy-tourism-environment* and above all to verify the degree of stability it seems interesting to adopt an approach that is able to comprehend all the elements produced, i.e., from the dynamics of the interconnections between the vital elements of the whole system. According to a systemic view the interventions occurring in one sector may affect other sectors and the way in which these sectors are interlinked and the possible effects produced are in many cases not at all predictable<sup>5</sup>. Complex systems analysis has been useful in the fields of economics, ecology and others to interpret phenomena when the exact intensities of the interconnections are unknown. Therefore, through the development of this model an attempt is made to interpret the relations and changes over time of the main variables present in the system analysed.

### 3.3 Elements of the model

The model was developed in the STELLA<sup>TM</sup> modelling environment based on system dynamics. The system created was subdivided into three interacting sub-systems: economic, tourist population and environmental resources (see fig. 2).

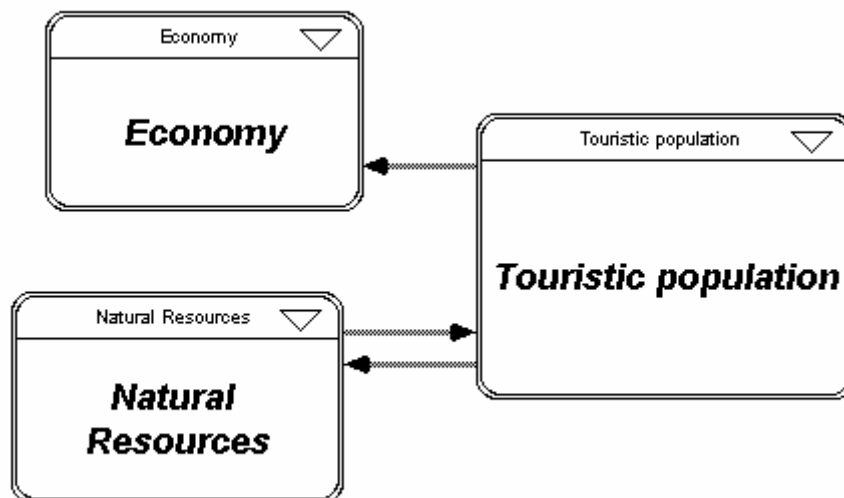


Fig. 2 Interactions of the system

An analysis of all the elements of the three sub-systems making up the model was developed as follows<sup>6</sup> (see fig. 3):

- In **sub-system (a)** the local economy is presented as a stock (**Local Economic**) the growth of which is strongly influenced by the presence of tourists (and all derived from this) and by the rate of local growth (**Lgrowth**), i.e. the ability of the local population to create added value. The hypothesis is considered of introducing a tax (**Tax**) to levy on tourists who decide to go to the island; the yield is calculated on the basis of the rate (**Rate**) set by the authorities (see below).
- The second **sub-system (b)** (population) relates to the size of the tourist population that influences the environmental sub-system. The most important variables, which in this model regulate the size of the tourist population, are represented by<sup>7</sup>: (**E<sub>a</sub>**) *environmental attractions*, this variable takes account of all the aspects linked to the quality of the environment: coastal roads, the sea, parks, cultural and architectural wealth, the landscape, in other words those elements that combine to make a tourist resort an attractive choice; (**P<sub>t</sub>**) *promotion of tourism*, refers to all the initiatives aimed at promoting an influx of tourists (cultural displays, festivals, etc); (**A<sub>t</sub>**), *accessibility*, this is a global measure of the number and frequency of maritime transport to ship people from the mainland to the islands; (**R<sub>t</sub>**) *receptivity* represents the supply of hotels and (**R<sub>h</sub>**) the number of rooms available; and lastly (**C<sub>v</sub>**) is the cost of living that is the price levels of goods and services offered on the island. If we observe fig. 3, the flow which increases the tourist population stock (**Touristic Population**) is governed by the variables  $E_a$ ,  $P_t$ ,  $A_t$ , in other words its increase is strongly influenced by environmental attractions, easier access from the mainland and promotions; on the contrary the outflow is regulated by the local cost of living ( $C_v$ ) and limited availability of accommodation (**R<sub>t</sub>**).
- **Sub-system (c)** represents all the elements relating to natural resources and the main types of environmental damage. There is a stock of natural resources (**Natural Resources**) whose level of is governed by tourist population consumption (**C<sub>tp</sub>**) and environmental load mainly influenced by the amount of wastes produced (**Waste**), and seawater pollution caused by motorboats (**Poll**), and by problems caused by overcrowding (n. cars). The environmental load is however lightened by the *resistance* and *resilience* of the local environment (**R&R**); i.e. by reaction mechanisms and therefore adaptation to external changes with which the system itself is equipped.

### 3.4 Interactions and effects of feedback

As can be seen from the model shown in fig. 2 the main interactions are recorded between system (b) and system (c). Let us try to analyse the strategic points of the model that influence the results of the simulation exercise:

- The tourist population consumes a certain amount of resources (fresh water, energy, etc.), thus it affects, together with the consumption per stock unit ( $C_{us}$ ), the stock level of natural resources.
- The environmental load (**Env Load**), in the most general sense, depends on the level of waste produced, marine pollution caused by motorboats, and by problems of traffic congestion. These correlated elements produce a behaviour (see fig. 3) that is strongly influenced by resilience, (**R&R**), which plays a strategic role in the overall dynamics of the system.
- The stock (Touristic pop) interacts positively with the local economy due to the fact, as mentioned above, that tourism represents the driving force of the local economy. The rate of flow could be influenced by a tax imposed on tourists.

The points of overlap of the elements described generate a complex pattern to be interpreted globally. Therefore, a series of simulated trials of the model were carried out and these produced rather interesting results which are described in the section below.

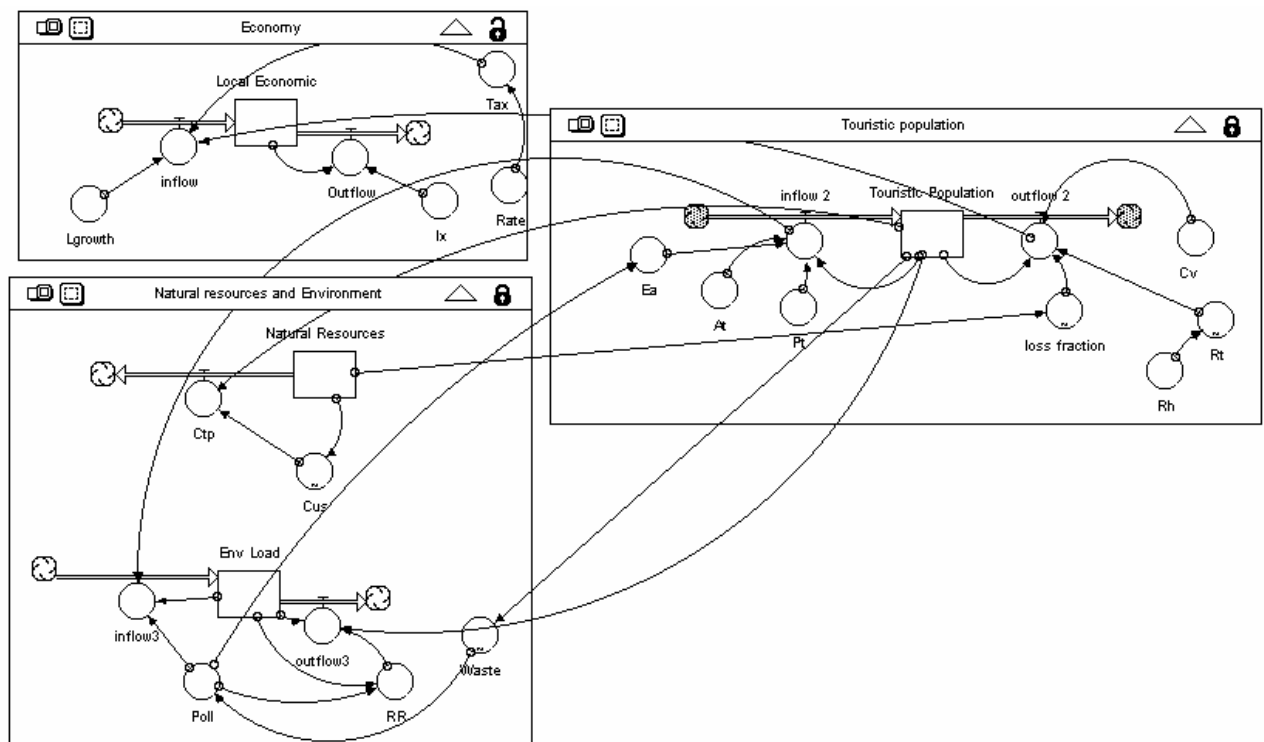


Fig. 3 Tourism-Economy-Environment

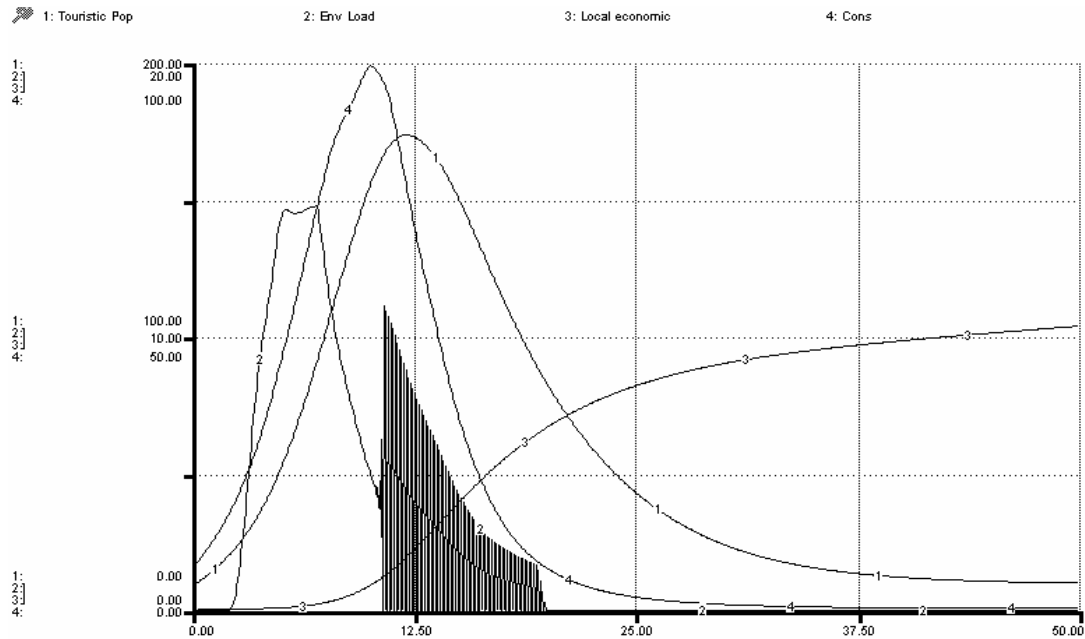
## 4. SIMULATION RESULTS

### *4.1 System dynamics and trajectories*

Fig.4 shows the results obtained from the simulations performed using the model developed. As can be seen from this fig., several curves are plotted to show the patterns of the four different parameters considered. The time period of reference is the typical summer season lasting about three and a half months (June to September). Curve (1) represents tourist population movements and has a typical bell-shape. The number of tourists on Salina (like many other tourist resorts) starts to be recorded towards the middle of June and gradually increases to reach a peak in August. After that the curve gradually falls until it reaches a level of almost nil (winter season). The (4), showing the movements in consumption of natural resources, has a very similar shape to (1) as its plot is highly dependent on the size of the tourist population (consumption of fresh water and energy).

In contrast, the local economy traced in curve (3), first rises, due to the cash inflow directly linked to the tourist presence, and subsequently seems to stabilise at a steady level. This can be explained by the fact that a residual economy remains even when the summer season has finished and there are no longer any tourists. This is basically due to ordinary maintenance work on holidaymakers' second homes. Construction work, together with related activities, is the local population's income source during the winter season. The plot shows a non-linear path and seems to be the parameter that reflects the environmental load level (2). As can be seen from the figure, the (2) shows a sudden rise despite the fact that the tourist population initially grows only gradually; this reflects the fact that at first, the environment does not react promptly to an exogenous perturbation (tourism) and as a result the environmental load curve rises. Subsequently the (2) remains at a constant level very briefly and then plummets. This sharp fall is due to the resilience effect.

Fig. 4 Simulation results (a)



But, just when it seems that the system has *self-regulated*, it suddenly moves towards an unstable equilibrium making the system behave chaotically. This behaviour observed therefore makes it impossible to forecast the evolution of future system behaviour. The instability of (2) is recorded when the tourist population reaches its peak (presumably in August) and then becomes stable when the density of tourists reduces to such a level that it no longer influences environmental balance.

#### 4.2 Simulation with hypotheses of controlled and planned flows

Following the analyses carried out in the previous paragraph we wanted to measure the level of sensitivity and equilibrium of the system when altering some parameters held to be strategic to the model. A number of interventions and planned actions that tend to influence the level of the tourist population were introduced and the consequences of these were studied. Details of the interventions hypothesised are as follows:

- The introduction of an “*entrance tax*” payable by tourists intending to visit the island. This restriction could represent a means to regulate the flow of people in quantitative terms, providing an incentive to environmentally driven quality tourism. In the model the tax yield, indicated by the variable (**Tax**), is determined by the rate set by local authorities. It is obvious that the size of this variable could in some way influence the flow

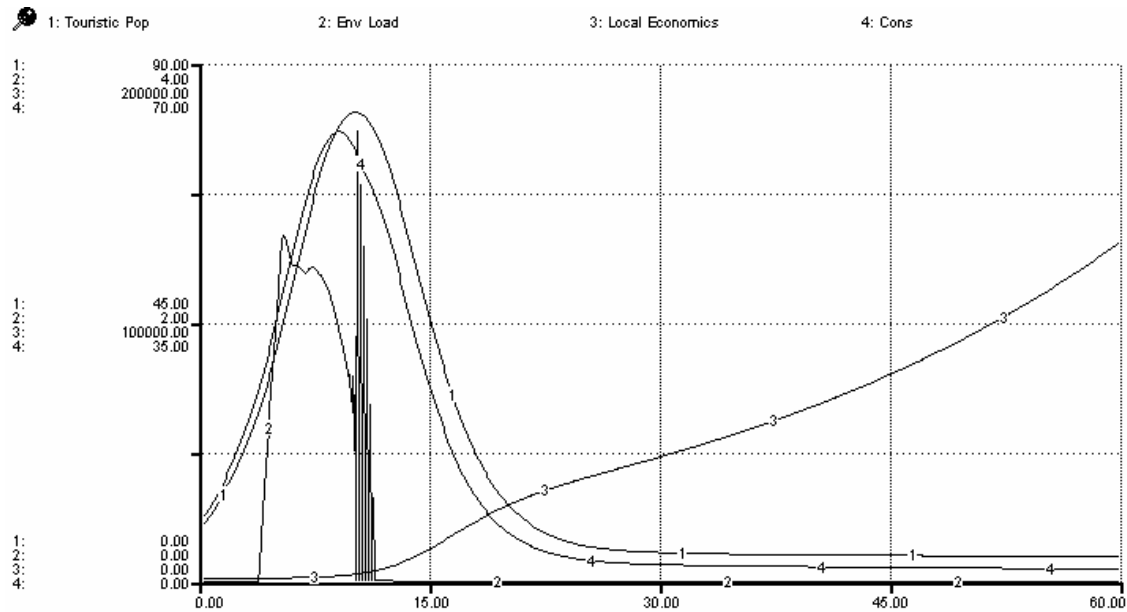
of tourists. It was hypothesised that the entire sum of the tax collected, deposited in the coffers of the local administration, would be used exclusively to diminish the externalities suffered by the local population by the tourist industry. In other words, the total financial sum would be reinvested in environmental recovery activity and to protect eco-systems.

- Reducing *accessibility* (**A<sub>t</sub>**) (reducing the frequency and number of ferries and hydrofoils between the islands and the mainland) in such a way as to limit the number of tourists “just passing through” while improving the quality of transport services;
- Reducing the level of mass *receptivity* (**R<sub>t</sub>**) (big hotels, campsites etc) while favouring the rebuilding of local houses conforming to the original style and architecture but fitted out, however, with various comforts.

As can be seen from figure 5 the pattern of the main variables under scrutiny does not differ substantially from the behaviour described in figure 4. Curves (4) and (1) are typically bell-shaped and, are very similar in both figures, although in simulation (fig. 4) the peak of the (4) was distinctly lower. The most evident differences are to be found when analysing the (2) and (3), i.e. environmental load and economy. Curve (2) shows less chaotic behaviour for a more limited duration, while the (3) climbs rather steeply. The different movement of these variables can be attributed to the manoeuvres hypothesised regarding the introduction of an entry tax and the altered levels of accessibility and receptivity.

The shrinkage caused by the latter two variables certainly modifies and controls the tourist population stock and thus lightens the load on the environment as shown in fig. 5. Curve (4) relating to the economy seems to show rather anomalous behaviour thus leaving a margin of uncertainty. Even considering that collection of taxes paid by tourists benefit local finances (by indirectly creating wealth in the local community) the exponential growth shown by the (4) appears excessive compared to the typical effects arising from the application of a tax on an economic system.

Fig. 5 Simulation results (b)



## 5.CONCLUSIONS

The first results of the model developed showed that the environmental system is clearly sensitive to the pressures arising from the influx of tourists, above all in small areas like the minor islands. It is necessary to take into account all those signals received from environmental systems that endogenously produce new levels of equilibrium after a series of fluctuations. The model presented provides some data and elements to reflect on. In the case examined these basically affirm the principle that the *uncontrolled* flow of tourism is environmentally unsustainable in the long term and is of limited benefit to the development of the local economy.

## REFERENCES

- Baumol W.L., Benhabib J.,(1992) Chaos: significance, mechanism and economic applications, *Journal of Economic Perspective*, 3;  
 Forrester J.W., *Principles of systems*, (1968) Wright Allen Press, Cambridge, Mass.;  
 Hollings C.S. (1973) Resilience and stability of ecological systems, *Annual Review of Ecology and Systematics*, 4, 1-24;  
 Nijkamp P., Reggiani A., (1992) Non linear evolution of dynamic spatial systems. The relevance of chaos and ecologically-based models, *Regional Science and Urban Economics*, 25;



- Nijkamp P., Reggiani A., (1992)<sup>b</sup> *Interaction, Evolution and Chaos in Space*, Springer-Verlag, Holland, 1992;
- Odum H.T., *Models for national, international and global system policy*, in Braat L.C., Van Lierop W.F.J. (eds) (1987), *Economic-ecological modeling*, Elsevier publisher Netherland;
- Parker d.-Stacey R., *Chaos, management and economics*, Institute of Economic Affairs, London, 1994;
- Puccia C.J., Cavallaro C., Giavelli G., Modelli d'impatto del turismo sull'ambiente e sull'economia delle isole Eolie, *Rassegna di studi turistici* n. 3-4;
- Ruth M., Hannon B., *Modeling Dynamic Economic System*, Springer-Verlag, New york, 1997;
- Smith F., (1996) Biological diversity, ecosystem stability and economic development *Ecological Economics*, 3.

## NOTES

---

<sup>1</sup> See Candela G., Fabbri P., Cardini F., (1995) I programmi di un'economia sostenibile in *Rivista di Politica Economica*, n.2;

<sup>2</sup> The idea of stability in our system is commonly meant as a concept which includes *resistance* and *resilience*. Resistance is the tendency of the values of the parameters of a system to remain within the same bounds when the system is subject to perturbation, resilience is the speed with which a system returns to its original state following perturbation (Hollings C.S., 1973 - Smith F, 1996);

<sup>3</sup> See Baumol W.L., Benhabib J.,(1992), Nijkamp P., Reggiani A., (1992), Nijkamp P., Reggiani A., (1992)<sup>b</sup>, for discussion of this argument;

<sup>4</sup> See Baumol W.L., Benhabib J.,(1992) Parker d.-Stacey R., (1994);

<sup>5</sup> See Forrester J.W. (1968), Ruth M., Hannon B., (1997), Odum H.T., (1987);

<sup>6</sup> The words inside the brackets are reported in the fig. 3 that represents the model;

<sup>7</sup> Some of the variables selected in this model are dealt with by Puccia *et al.* (1988).

**NOTE DI LAVORO DELLA FONDAZIONE ENI ENRICO MATTEI**  
**Fondazione Eni Enrico Mattei Working Papers Series**

**Our working papers are available on the Internet at the following addresses:**

**Server WWW: WWW.FEEM.IT**

**Anonymous FTP: FTP.FEEM.IT**

[http://papers.ssrn.com/abstract\\_id=XXXXXX](http://papers.ssrn.com/abstract_id=XXXXXX)

SUST	1.2001	<i>Inge MAYERES and Stef PROOST: <u>Should Diesel Cars in Europe be Discouraged?</u></i>
SUST	2.2001	<i>Paola DORIA and Davide PETTENELLA: <u>The Decision Making Process in Defining and Protecting Critical Natural Capital</u></i>
CLIM	3.2001	<i>Alberto PENCH: <u>Green Tax Reforms in a Computable General Equilibrium Model for Italy</u></i>
CLIM	4.2001	<i>Maurizio BUSSOLO and Dino PINELLI: <u>Green Taxes: Environment, Employment and Growth</u></i>
CLIM	5.2001	<i>Marco STAMPINI: <u>Tax Reforms and Environmental Policies for Italy</u></i>
ETA	6.2001	<i>Walid OUESLATI: <u>Environmental Fiscal Policy in an Endogenous Growth Model with Human Capital</u></i>
CLIM	7.2001	<i>Umberto CIORBA, Alessandro LANZA and Francesco PAULI: <u>Kyoto Commitment and Emission Trading: a European Union Perspective</u></i>
MGMT	8.2001	<i>Brian SLACK (xlv): <u>Globalisation in Maritime Transportation: Competition, uncertainty and implications for port development strategy</u></i>
VOL	9.2001	<i>Giulia PESARO: <u>Environmental Voluntary Agreements: A New Model of Co-operation Between Public and Economic Actors</u></i>
VOL	10.2001	<i>Cathrine HAGEM: <u>Climate Policy, Asymmetric Information and Firm Survival</u></i>
ETA	11.2001	<i>Sergio CURRARINI and Marco MARINI: <u>A Sequential Approach to the Characteristic Function and the Core in Games with Externalities</u></i>
ETA	12.2001	<i>Gaetano BLOISE, Sergio CURRARINI and Nicholas KIKIDIS: <u>Inflation and Welfare in an OLG Economy with a Privately Provided Public Good</u></i>
KNOW	13.2001	<i>Paolo SURICO: <u>Globalisation and Trade: A "New Economic Geography" Perspective</u></i>
ETA	14.2001	<i>Valentina BOSETTI and Vincenzina MESSINA: <u>Quasi Option Value and Irreversible Choices</u></i>
CLIM	15.2001	<i>Guy ENGELEN (xlii): <u>Desertification and Land Degradation in Mediterranean Areas: from Science to Integrated Policy Making</u></i>
SUST	16.2001	<i>Julie Catherine SORS: <u>Measuring Progress Towards Sustainable Development in Venice: A Comparative Assessment of Methods and Approaches</u></i>
SUST	17.2001	<i>Julie Catherine SORS: <u>Public Participation in Local Agenda 21: A Review of Traditional and Innovative Tools</u></i>
CLIM	18.2001	<i>Johan ALBRECHT and Niko GOBBIN: <u>Schumpeter and the Rise of Modern Environmentalism</u></i>
VOL	19.2001	<i>Rinaldo BRAU, Carlo CARRARO and Giulio GOLFETTO (xliii): <u>Participation Incentives and the Design of Voluntary Agreements</u></i>
ETA	20.2001	<i>Paola ROTA: <u>Dynamic Labour Demand with Lumpy and Kinked Adjustment Costs</u></i>
ETA	21.2001	<i>Paola ROTA: <u>Empirical Representation of Firms' Employment Decisions by an (S,s) Rule</u></i>
ETA	22.2001	<i>Paola ROTA: <u>What Do We Gain by Being Discrete? An Introduction to the Econometrics of Discrete Decision Processes</u></i>
PRIV	23.2001	<i>Stefano BOSI, Guillaume GIRMANS and Michel GUILLARD: <u>Optimal Privatisation Design and Financial Markets</u></i>
KNOW	24.2001	<i>Giorgio BRUNELLO, Claudio LUPI, Patrizia ORDINE, and Maria Luisa PARISI: <u>Beyond National Institutions: Labour Taxes and Regional Unemployment in Italy</u></i>
ETA	25.2001	<i>Klaus CONRAD: <u>Locational Competition under Environmental Regulation when Input Prices and Productivity Differ</u></i>
PRIV	26.2001	<i>Bernardo BORTOLOTTI, Juliet D'SOUZA, Marcella FANTINI and William L. MEGGINSON: <u>Sources of Performance Improvement in Privatised Firms: A Clinical Study of the Global Telecommunications Industry</u></i>
CLIM	27.2001	<i>Frédéric BROCHIER and Emiliano RAMIERI: <u>Climate Change Impacts on the Mediterranean Coastal Zones</u></i>
ETA	28.2001	<i>Nunzio CAPPUCCIO and Michele MORETTO: <u>Comments on the Investment-Uncertainty Relationship in a Real Option Model</u></i>
KNOW	29.2001	<i>Giorgio BRUNELLO: <u>Absolute Risk Aversion and the Returns to Education</u></i>
CLIM	30.2001	<i>ZhongXiang ZHANG: <u>Meeting the Kyoto Targets: The Importance of Developing Country Participation</u></i>
ETA	31.2001	<i>Jonathan D. KAPLAN, Richard E. HOWITT and Y. Hossein FARZIN: <u>An Information-Theoretical Analysis of Budget-Constrained Nonpoint Source Pollution Control</u></i>
MGMT Coalition	32.2001	<i>Roberta SALOMONE and Giulia GALLUCCIO: <u>Environmental Issues and Financial Reporting Trends</u></i>
Theory Network	33.2001	<i>Shlomo WEBER and Hans WIESMETH: <u>From Autarky to Free Trade: The Impact on Environment</u></i>
ETA	34.2001	<i>Margarita GENIUS and Elisabetta STRAZZERA: <u>Model Selection and Tests for Non Nested Contingent Valuation Models: An Assessment of Methods</u></i>

NRM	35.2001	<i>Carlo GIUPPONI</i> : <u>The Substitution of Hazardous Molecules in Production Processes: The Atrazine Case Study in Italian Agriculture</u>
KNOW	36.2001	<i>Raffaele PACI and Francesco PIGLIARU</i> : <u>Technological Diffusion, Spatial Spillovers and Regional Convergence in Europe</u>
PRIV	37.2001	<i>Bernardo BORTOLOTTI</i> : <u>Privatisation, Large Shareholders, and Sequential Auctions of Shares</u>
CLIM	38.2001	<i>Barbara BUCHNER</i> : <u>What Really Happened in The Hague? Report on the COP6, Part I, 13-25 November 2000, The Hague, The Netherlands</u>
PRIV	39.2001	<i>Giacomo CALZOLARI and Carlo SCARPA</i> : <u>Regulation at Home, Competition Abroad: A Theoretical Framework</u>
KNOW	40.2001	<i>Giorgio BRUNELLO</i> : <u>On the Complementarity between Education and Training in Europe</u>
Coalition Theory Network	41.2001	<i>Alain DESDOIGTS and Fabien MOIZEAU</i> (xlvi): <u>Multiple Politico-Economic Regimes, Inequality and Growth</u>
Coalition Theory Network	42.2001	<i>Parkash CHANDER and Henry TULKENS</i> (xlvi): <u>Limits to Climate Change</u>
Coalition Theory Network	43.2001	<i>Michael FINUS and Bianca RUNDSHAGEN</i> (xlvi): <u>Endogenous Coalition Formation in Global Pollution Control</u>
Coalition Theory Network	44.2001	<i>Wietze LISE, Richard S.J. TOL and Bob van der ZWAAN</i> (xlvi): <u>Negotiating Climate Change as a Social Situation</u>
NRM	45.2001	<i>Mohamad R. KHAWLIE</i> (xlvi): <u>The Impacts of Climate Change on Water Resources of Lebanon- Eastern Mediterranean</u>
NRM	46.2001	<i>Mutasem EL-FADEL and E. BOU-ZEID</i> (xlvi): <u>Climate Change and Water Resources in the Middle East: Vulnerability, Socio-Economic Impacts and Adaptation</u>
NRM	47.2001	<i>Eva IGLESIAS, Alberto GARRIDO and Almudena GOMEZ</i> (xlvi): <u>An Economic Drought Management Index to Evaluate Water Institutions' Performance Under Uncertainty and Climate Change</u>
CLIM	48.2001	<i>Wietze LISE and Richard S.J. TOL</i> (xlvi): <u>Impact of Climate on Tourist Demand</u>
CLIM	49.2001	<i>Francesco BOSELLO, Barbara BUCHNER, Carlo CARRARO and Davide RAGGI</i> : <u>Can Equity Enhance Efficiency? Lessons from the Kyoto Protocol</u>
SUST	50.2001	<i>Roberto ROSON</i> (xlvi): <u>Carbon Leakage in a Small Open Economy with Capital Mobility</u>
SUST	51.2001	<i>Edwin WOERDMAN</i> (xlvi): <u>Developing a European Carbon Trading Market: Will Permit Allocation Distort Competition and Lead to State Aid?</u>
SUST	52.2001	<i>Richard N. COOPER</i> (xlvi): <u>The Kyoto Protocol: A Flawed Concept</u>
SUST	53.2001	<i>Kari KANGAS</i> (xlvi): <u>Trade Liberalisation, Changing Forest Management and Roundwood Trade in Europe</u>
SUST	54.2001	<i>Xueqin ZHU and Ekko VAN IERLAND</i> (xlvi): <u>Effects of the Enlargement of EU on Trade and the Environment</u>
SUST	55.2001	<i>M. Ozgur KAYALICA and Sajal LAHIRI</i> (xlvi): <u>Strategic Environmental Policies in the Presence of Foreign Direct Investment</u>
SUST	56.2001	<i>Savas ALPAY</i> (xlvi): <u>Can Environmental Regulations be Compatible with Higher International Competitiveness? Some New Theoretical Insights</u>
SUST	57.2001	<i>Roldan MURADIAN, Martin O'CONNOR, Joan MARTINEZ-ALER</i> (xlvi): <u>Embodied Pollution in Trade: Estimating the "Environmental Load Displacement" of Industrialised Countries</u>
SUST	58.2001	<i>Matthew R. AUER and Rafael REUVENY</i> (xlvi): <u>Foreign Aid and Direct Investment: Key Players in the Environmental Restoration of Central and Eastern Europe</u>
SUST	59.2001	<i>Onno J. KUIK and Frans H. OOSTERHUIS</i> (xlvi): <u>Lessons from the Southern Enlargement of the EU for the Environmental Dimensions of Eastern Enlargement, in particular for Poland</u>
ETA	60.2001	<i>Carlo CARRARO, Alessandra POME and Domenico SINISCALCO</i> (xlix): <u>Science vs. Profit in Research: Lessons from the Human Genome Project</u>
CLIM	61.2001	<i>Efrem CASTELNUOVO, Michele MORETTO and Sergio VERGALLI</i> : <u>Global Warming, Uncertainty and Endogenous Technical Change: Implications for Kyoto</u>
PRIV	62.2001	<i>Gian Luigi ALBANO, Fabrizio GERMANO and Stefano LOVO</i> : <u>On Some Collusive and Signaling Equilibria in Ascending Auctions for Multiple Objects</u>
CLIM	63.2001	<i>Elbert DIJKGRAAF and Herman R.J. VOLLEBERGH</i> : <u>A Note on Testing for Environmental Kuznets Curves with Panel Data</u>
CLIM	64.2001	<i>Paolo BUONANNO, Carlo CARRARO and Marzio GALEOTTI</i> : <u>Endogenous Induced Technical Change and the Costs of Kyoto</u>
CLIM	65.2001	<i>Guido CAZZAVILLAN and Ignazio MUSU</i> (l): <u>Transitional Dynamics and Uniqueness of the Balanced-Growth Path in a Simple Model of Endogenous Growth with an Environmental Asset</u>
CLIM	66.2001	<i>Giovanni BAIOCCHI and Salvatore DI FALCO</i> (l): <u>Investigating the Shape of the EKC: A Nonparametric Approach</u>
CLIM	67.2001	<i>Marzio GALEOTTI, Alessandro LANZA and Francesco PAULI</i> (l): <u>Desperately Seeking (Environmental) Kuznets: A New Look at the Evidence</u>
CLIM	68.2001	<i>Alexey VIKHLYAEV</i> (xlvi): <u>The Use of Trade Measures for Environmental Purposes – Globally and in the EU Context</u>
NRM	69.2001	<i>Gary D. LIBECAP and Zeynep K. HANSEN</i> (li): <u>U.S. Land Policy, Property Rights, and the Dust Bowl of the 1930s</u>

NRM	70.2001	<i>Lee J. ALSTON, Gary D. LIBECAP and Bernardo MUELLER</i> (li): <u>Land Reform Policies. The Sources of Violent Conflict and Implications for Deforestation in the Brazilian Amazon</u>
CLIM	71.2001	<i>Claudia KEMFERT</i> : <u>Economy-Energy-Climate Interaction – The Model WIAGEM -</u>
SUST	72.2001	<i>Paulo A.L.D. NUNES and Yohanes E. RIYANTO</i> : <u>Policy Instruments for Creating Markets for Biodiversity: Certification and Ecolabeling</u>
SUST	73.2001	<i>Paulo A.L.D. NUNES and Erik SCHOKKAERT</i> (lii): <u>Warm Glow and Embedding in Contingent Valuation</u>
SUST	74.2001	<i>Paulo A.L.D. NUNES, Jeroen C.J.M. van den BERGH and Peter NIJKAMP</i> (lii): <u>Ecological-Economic Analysis and Valuation of Biodiversity</u>
VOL	75.2001	<i>Johan EYCKMANS and Henry TULKENS</i> (li): <u>Simulating Coalitionally Stable Burden Sharing Agreements for the Climate Change Problem</u>
PRIV	76.2001	<i>Axel GAUTIER and Florian HEIDER</i> : <u>What Do Internal Capital Markets Do? Redistribution vs. Incentives</u>
PRIV	77.2001	<i>Bernardo BORTOLOTTI, Marcella FANTINI and Domenico SINISCALCO</i> : <u>Privatisation around the World: New Evidence from Panel Data</u>
ETA	78.2001	<i>Toke S. AIDT and Jayasri DUTTA</i> (li): <u>Transitional Politics. Emerging Incentive-based Instruments in Environmental Regulation</u>
ETA	79.2001	<i>Alberto PETRUCCI</i> : <u>Consumption Taxation and Endogenous Growth in a Model with New Generations</u>
ETA	80.2001	<i>Pierre LASSERRE and Antoine SOUBEYRAN</i> (li): <u>A Ricardian Model of the Tragedy of the Commons</u>
ETA	81.2001	<i>Pierre COURTOIS, Jean Christophe PÉREAU and Tarik TAZDAÏT</i> : <u>An Evolutionary Approach to the Climate Change Negotiation Game</u>
NRM	82.2001	<i>Christophe BONTEMPS, Stéphane COUTURE and Pascal FAVARD</i> : <u>Is the Irrigation Water Demand Really Convex?</u>
NRM	83.2001	<i>Unai PASCUAL and Edward BARBIER</i> : <u>A Model of Optimal Labour and Soil Use with Shifting Cultivation</u>
CLIM	84.2001	<i>Jesper JENSEN and Martin Hvidt THELLE</i> : <u>What are the Gains from a Multi-Gas Strategy?</u>
CLIM	85.2001	<i>Maurizio MICHELINI</i> (liii): IPCC “Summary for Policymakers” in TAR. <u>Do its results give a scientific support always adequate to the urgencies of Kyoto negotiations?</u>
CLIM	86.2001	<i>Claudia KEMFERT</i> (liii): <u>Economic Impact Assessment of Alternative Climate Policy Strategies</u>
CLIM	87.2001	<i>Cesare DOSI and Michele MORETTO</i> : <u>Global Warming and Financial Umbrellas</u>
ETA	88.2001	<i>Elena BONTEMPI, Alessandra DEL BOCA, Alessandra FRANZOSI, Marzio GALEOTTI and Paola ROTA</i> : <u>Capital Heterogeneity: Does it Matter? Fundamental Q and Investment on a Panel of Italian Firms</u>
ETA	89.2001	<i>Efrem CASTELNUOVO and Paolo SURICO</i> : <u>Model Uncertainty, Optimal Monetary Policy and the Preferences of the Fed</u>
CLIM	90.2001	<i>Umberto CIORBA, Alessandro LANZA and Francesco PAULI</i> : <u>Kyoto Protocol and Emission Trading: Does the US Make a Difference?</u>
CLIM	91.2001	<i>ZhongXiang ZHANG and Lucas ASSUNCAO</i> : <u>Domestic Climate Policies and the WTO</u>
SUST	92.2001	<i>Anna ALBERINI, Alan KRUPNICK, Maureen CROPPER, Nathalie SIMON and Joseph COOK</i> (lii): <u>The Willingness to Pay for Mortality Risk Reductions: A Comparison of the United States and Canada</u>
SUST	93.2001	<i>Riccardo SCARPA, Guy D. GARROD and Kenneth G. WILLIS</i> (lii): <u>Valuing Local Public Goods with Advanced Stated Preference Models: Traffic Calming Schemes in Northern England</u>
CLIM	94.2001	<i>Ming CHEN and Larry KARP</i> : <u>Environmental Indices for the Chinese Grain Sector</u>
CLIM	95.2001	<i>Larry KARP and Jiangfeng ZHANG</i> : <u>Controlling a Stock Pollutant with Endogenous Investment and Asymmetric Information</u>
ETA	96.2001	<i>Michele MORETTO and Gianpaolo ROSSINI</i> : <u>On the Opportunity Cost of Nontradable Stock Options</u>
SUST	97.2001	<i>Elisabetta STRAZZERA, Margarita GENIUS, Riccardo SCARPA and George HUTCHINSON</i> : <u>The Effect of Protest Votes on the Estimates of Willingness to Pay for Use Values of Recreational Sites</u>
NRM	98.2001	<i>Frédéric BROCHIER, Carlo GIUPPONI and Alberto LONGO</i> : <u>Integrated Coastal Zone Management in the Venice Area – Perspectives of Development for the Rural Island of Sant’Erasmus</u>
NRM	99.2001	<i>Frédéric BROCHIER, Carlo GIUPPONI and Julie SORS</i> : <u>Integrated Coastal Management in the Venice Area – Potentials of the Integrated Participatory Management Approach</u>
NRM	100.2001	<i>Frédéric BROCHIER and Carlo GIUPPONI</i> : <u>Integrated Coastal Zone Management in the Venice Area – A Methodological Framework</u>
PRIV	101.2001	<i>Enrico C. PEROTTI and Luc LAEVEN</i> : <u>Confidence Building in Emerging Stock Markets</u>
CLIM	102.2001	<i>Barbara BUCHNER, Carlo CARRARO and Igor CERSOSIMO</i> : <u>On the Consequences of the U.S. Withdrawal from the Kyoto/Bonn Protocol</u>
SUST	103.2001	<i>Riccardo SCARPA, Adam DRUCKER, Simon ANDERSON, Nancy FERRAES-EHUAN, Veronica GOMEZ, Carlos R. RISOPATRON and Olga RUBIO-LEONEL</i> : <u>Valuing Animal Genetic Resources in Peasant Economies: The Case of the Box Keken Creole Pig in Yucatan</u>
SUST	104.2001	<i>R. SCARPA, P. KRISTJANSON, A. DRUCKER, M. RADENY, E.S.K. RUTO, and J.E.O. REGE</i> : <u>Valuing Indigenous Cattle Breeds in Kenya: An Empirical Comparison of Stated and Revealed Preference Value Estimates</u>
SUST	105.2001	<i>Clemens B.A. WOLLNY</i> : <u>The Need to Conserve Farm Animal Genetic Resources Through Community-Based Management in Africa: Should Policy Makers be Concerned?</u>
SUST	106.2001	<i>J.T. KARUGIA, O.A. MWAI, R. KAITHO, Adam G. DRUCKER, C.B.A. WOLLNY and J.E.O. REGE</i> : <u>Economic Analysis of Crossbreeding Programmes in Sub-Saharan Africa: A Conceptual Framework and Kenyan Case Study</u>
SUST	107.2001	<i>W. AYALEW, J.M. KING, E. BRUNS and B. RISCHKOWSKY</i> : <u>Economic Evaluation of Smallholder Subsistence Livestock Production: Lessons from an Ethiopian Goat Development Program</u>

SUST	108.2001	<i>Gianni CICIA, Elisabetta D'ERCOLE and Davide MARINO: <u>Valuing Farm Animal Genetic Resources by Means of Contingent Valuation and a Bio-Economic Model: The Case of the Pentro Horse</u></i>
SUST	109.2001	<i>Clem TISDELL: <u>Socioeconomic Causes of Loss of Animal Genetic Diversity: Analysis and Assessment</u></i>
SUST	110.2001	<i>M.A. JABBAR and M.L. DIEDHOU: <u>Does Breed Matter to Cattle Farmers and Buyers? Evidence from West Africa</u></i>
SUST	1.2002	<i>K. TANO, M.D. FAMINOW, M. KAMUANGA and B. SWALLOW: <u>Using Conjoint Analysis to Estimate Farmers' Preferences for Cattle Traits in West Africa</u></i>
ETA	2.2002	<i>Efrem CASTELNUOVO and Paolo SURICO: <u>What Does Monetary Policy Reveal about Central Bank's Preferences?</u></i>
WAT	3.2002	<i>Duncan KNOWLER and Edward BARBIER: <u>The Economics of a "Mixed Blessing" Effect: A Case Study of the Black Sea</u></i>
CLIM	4.2002	<i>Andreas LÖSCHEL: <u>Technological Change in Economic Models of Environmental Policy: A Survey</u></i>
VOL	5.2002	<i>Carlo CARRARO and Carmen MARCHIORI: <u>Stable Coalitions</u></i>
CLIM	6.2002	<i>Marzio GALEOTTI, Alessandro LANZA and Matteo MANERA: <u>Rockets and Feathers Revisited: An International Comparison on European Gasoline Markets</u></i>
ETA	7.2002	<i>Effrosyni DIAMANTOUDI and Eftichios S. SARTZETAKIS: <u>Stable International Environmental Agreements: An Analytical Approach</u></i>
KNOW	8.2002	<i>Alain DESDOIGTS: <u>Neoclassical Convergence Versus Technological Catch-up: A Contribution for Reaching a Consensus</u></i>
NRM	9.2002	<i>Giuseppe DI VITA: <u>Renewable Resources and Waste Recycling</u></i>
KNOW	10.2002	<i>Giorgio BRUNELLO: <u>Is Training More Frequent when Wage Compression is Higher? Evidence from 11 European Countries</u></i>
ETA	11.2002	<i>Mordecai KURZ, Hehui JIN and Maurizio MOTOLESE: <u>Endogenous Fluctuations and the Role of Monetary Policy</u></i>
KNOW	12.2002	<i>Reyer GERLAGH and Marjan W. HOFKES: <u>Escaping Lock-in: The Scope for a Transition towards Sustainable Growth?</u></i>
NRM	13.2002	<i>Michele MORETTO and Paolo ROSATO: <u>The Use of Common Property Resources: A Dynamic Model</u></i>
CLIM	14.2002	<i>Philippe QUIRION: <u>Macroeconomic Effects of an Energy Saving Policy in the Public Sector</u></i>
CLIM	15.2002	<i>Roberto ROSON: <u>Dynamic and Distributional Effects of Environmental Revenue Recycling Schemes: Simulations with a General Equilibrium Model of the Italian Economy</u></i>
CLIM	16.2002	<i>Francesco RICCI (I): <u>Environmental Policy Growth when Inputs are Differentiated in Pollution Intensity</u></i>
ETA	17.2002	<i>Alberto PETRUCCI: <u>Devaluation (Levels versus Rates) and Balance of Payments in a Cash-in-Advance Economy</u></i>
Coalition Theory Network	18.2002	<i>László Á. KÓCZY (liv): <u>The Core in the Presence of Externalities</u></i>
Coalition Theory Network	19.2002	<i>Steven J. BRAMS, Michael A. JONES and D. Marc KILGOUR (liv): <u>Single-Peakedness and Disconnected Coalitions</u></i>
Coalition Theory Network	20.2002	<i>Guillaume HAERINGER (liv): <u>On the Stability of Cooperation Structures</u></i>
NRM	21.2002	<i>Fausto CAVALLARO and Luigi CIRAOLO: <u>Economic and Environmental Sustainability: A Dynamic Approach in Insular Systems</u></i>

- (xlii) This paper was presented at the International Workshop on "Climate Change and Mediterranean Coastal Systems: Regional Scenarios and Vulnerability Assessment" organised by the Fondazione Eni Enrico Mattei in co-operation with the Istituto Veneto di Scienze, Lettere ed Arti, Venice, December 9-10, 1999.
- (xliii) This paper was presented at the International Workshop on "Voluntary Approaches, Competition and Competitiveness" organised by the Fondazione Eni Enrico Mattei within the research activities of the CAVA Network, Milan, May 25-26, 2000.
- (xliv) This paper was presented at the International Workshop on "Green National Accounting in Europe: Comparison of Methods and Experiences" organised by the Fondazione Eni Enrico Mattei within the Concerted Action of Environmental Valuation in Europe (EVE), Milan, March 4-7, 2000
- (xlv) This paper was presented at the International Workshop on "New Ports and Urban and Regional Development. The Dynamics of Sustainability" organised by the Fondazione Eni Enrico Mattei, Venice, May 5-6, 2000.
- (xlvi) This paper was presented at the Sixth Meeting of the Coalition Theory Network organised by the Fondazione Eni Enrico Mattei and the CORE, Université Catholique de Louvain, Louvain-la-Neuve, Belgium, January 26-27, 2001
- (xlvii) This paper was presented at the RICAMARE Workshop "Socioeconomic Assessments of Climate Change in the Mediterranean: Impact, Adaptation and Mitigation Co-benefits", organised by the Fondazione Eni Enrico Mattei, Milan, February 9-10, 2001
- (xlviii) This paper was presented at the International Workshop "Trade and the Environment in the Perspective of the EU Enlargement", organised by the Fondazione Eni Enrico Mattei, Milan, May 17-18, 2001
- (xlix) This paper was presented at the International Conference "Knowledge as an Economic Good", organised by Fondazione Eni Enrico Mattei and The Beijer International Institute of Environmental Economics, Palermo, April 20-21, 2001
- (l) This paper was presented at the Workshop "Growth, Environmental Policies and Sustainability" organised by the Fondazione Eni Enrico Mattei, Venice, June 1, 2001
- (li) This paper was presented at the Fourth Toulouse Conference on Environment and Resource Economics on "Property Rights, Institutions and Management of Environmental and Natural Resources", organised by Fondazione Eni Enrico Mattei, IDEI and INRA and sponsored by MATE, Toulouse, May 3-4, 2001
- (lii) This paper was presented at the International Conference on "Economic Valuation of Environmental Goods", organised by Fondazione Eni Enrico Mattei in cooperation with CORILA, Venice, May 11, 2001
- (liii) This paper was circulated at the International Conference on "Climate Policy – Do We Need a New Approach?", jointly organised by Fondazione Eni Enrico Mattei, Stanford University and Venice International University, Isola di San Servolo, Venice, September 6-8, 2001
- (liv) This paper was presented at the Seventh Meeting of the Coalition Theory Network organised by the Fondazione Eni Enrico Mattei and the CORE, Université Catholique de Louvain, Venice, Italy, January 11-12, 2002

## 2002 SERIES

<b>MGMT</b>	<i>Corporate Sustainable Management</i> (Editor: Andrea Marsanich)
<b>CLIM</b>	<i>Climate Change Modelling and Policy</i> (Editor: Marzio Galeotti )
<b>PRIV</b>	<i>Privatisation, Antitrust, Regulation</i> (Editor: Bernardo Bortolotti)
<b>KNOW</b>	<i>Knowledge, Technology, Human Capital</i> (Editor: Dino Pinelli)
<b>NRM</b>	<i>Natural Resources Management</i> (Editor: Carlo Giupponi)
<b>SUST</b>	<i>Sustainability Indicators and Environmental Evaluation</i> (Editor: Carlo Carraro)
<b>VOL</b>	<i>Voluntary and International Agreements</i> (Editor: Carlo Carraro)
<b>ETA</b>	<i>Economic Theory and Applications</i> (Editor: Carlo Carraro)