Development of an information system for the environmental and economic management of the Dehesa/Montado ecosystem in Extremadura and Alentejo

Espejo Díaz M., Martín Bellido M., Espejo Gutiérrez de Tena A., Matos C.

in

Olaizola A. (ed.), Boutonnet J.P. (ed.), Bernués A. (ed.).
Mediterranean livestock production: uncertainties and opportunities

Zaragoza : CIHEAM / CITA / CITA
Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 78

2008
pages 91-96

Development of an information system for the environmental and economic management of the *Dehesa/Montado* ecosystem in Extremadura and Alentejo

M. Espejo Díaz*, M. Martín Bellido*, A. Espejo Gutiérrez de Tena* and C. Matos**
*Centro de Investigación Agraria "La Orden", Junta de Extremadura, Apartado 22, Badajoz, Spain
**CEBA Abobada, DRAAL, Vila Nova de S. Bento Portugal, Present address: ACOS, Beja, Portugal

SUMMARY – This paper presents the first results of the project Interreg-IIIA SPA4.E13 to develop an information system for the environmental and economic management of the *dehesa/montado* ecosystem. The dehesa and the most important of their quality products (PDO and PGI) are described. There are two partners in the project, which coordinate the 15 research teams participating in the work. The research was planned around six activities: Coordination, Physical Factors, Biological Factors, Production systems, Social and Economic Characterisation and Geographic Information System (GIS) and Decision Support System (DSS) The most significant of the project's achievements up to the moment are: creation of extensive information of the *dehesa* and transfer of the project results: (i) Creation of a website and a digital library of the *dehesa*; and (ii) Transfer of results through conferences on the *dehesa*. To complete the GIS with new data obtained and finalise and test the models and the DSS, a second phase of the project has been approved by the European Union.

Keywords: *Dehesa*, *Montado*, PDO, PGI, GIS, DSS, environment, management.

RESUME – *"Développement d'un système d'information pour la gestion environnementale et économique de l'écosystème de* dehesa/montado *dans l'Extrémadure et l'Alentejo". Cet article présente les premiers résultats du projet Interreg-IIIA SPA4.E13 pour développer un système d'information pour la gestion économique et environnementale de l'écosystème* dehesa/montado*. On décrit la* dehesa *et ses principaux produits de qualité (DOP et IGP). Il y a deux organismes responsables du projet qui coordonnent 15 Équipes de Recherche. La recherche a été planifiée dans 6 activités : Coordination, Facteurs physiques, Facteurs biologiques, Systèmes de production, Caractérisation sociale et économique, et Caractérisation et Systèmes d'Information Géographique (SIG) et Systèmes d'Appui à la Décision (SAD). Les réalisations les plus significatives du projet sont : (i) Création d'une information étendue sur la* dehesa *; et (ii) Transfert des résultats du projet : création d'une page Web et d'une bibliothèque numérique sur la* dehesa, *organisation de symposiums sur la* dehesa*. Une seconde phase du projet a été approuvée par l'Union Européenne pour compléter le GIS avec de nouvelles données, et finir et tester les modèles et le SAD.*

Mots-clés : Dehesa*,* Montado*, DOP, IGP, GIS, SAD, environnement, gestion.*

Introduction

The *dehesa* ecosystem (called *montado* in Portugal), has arisen from the Mediterranean forest where man has eliminated undergrowth. Its characteristic vegetation is the *Quercus* ssp. (holm oak and cork oak) together with grasses and pulses (graminea and leguminae), which form the basic feedstock for free range livestock comprised of local breeds of pigs, cattle, sheep and goats. These are very important due to the quality of the derived products.

This ecosystem, which covers an extension of more than five million hectares in the Southwest of the Iberian Peninsula, is also of great interest because of its environmental values (rich flora and fauna), landscape and leisure activities (rural tourism, hunting).

The high quality of the *dehesa's* animal products, derived from their special characteristics, means demand is high, despite being slightly more expensive than mass produced products. This has led to many of them being protected by quality protocols approved by the European Union, the most outstanding of which are the PDO (Protected Designation of Origin) and PGI (Protected Geographical Indication):

(i) Iberian cured ham products such as: PDO "Dehesa de Extremadura", PGI "Jamón de Guijuelo" (Salamanca), PDO "Jamón de Huelva", PDO "Carne de Porco Alentejano", PDO "Presunto de Barrancos", PGI "Presunto e Paleta de Campo Maior e Elvas", PDO" Presunto e Paleta do Alentejo".

(ii) Beef products such as: PGI "Ternera de Extremadura", PGI "Carne de Avila", PGI "Morucha de Salamanca" and "Carne de Retinta de Extremadura y Andalucía" (PGI pending). The last three comprise the "Vacuno Extensivo de Calidad" Federation. In the Portuguese *montados* we find the following: PDO "Carnalentejana", PDO "Carne Mertolenga" and PDO "Carne de Charneca", which are included in the provisional TSG (Traditional Speciality Guaranteed) known as "Carne de Bovino Tradicional".

(iii) In lamb and mutton products we have: PGI "Carne de Merina", PGI "Cordero de Extremadura (CORDEREX) ", and in Alentejo there is lamb PGI "Borrego do Nordeste Alentejano", "Borrego do Montemor-O-Novo" and "Borrego do Baixo Alentejo".

(iv) With regard to high quality cheese we find the PDO "Queso de la Serena" and PDO "Torta del Casar" (made with sheep's milk), PDO "Queso de los Ibores" (made with goat milk), and in the Portuguese *montados* the PDOs "Queijo Serpa", "Queijo de Évora", "Queijo de Nisa" y "Queijo de Castelo Branco" are produced.

(v) Honey is also a high quality product obtained in the *dehesas*. The PDO "Miel Villuercas-Ibores" and the PDO "Mel do Alentejo" have been recognised.

(vi) Organic products, appreciated for their nutritional and health qualities as well as their optimum organoleptic properties, for which there is a growing demand can also be produced in the *dehesas*, where free range farming systems predominate.

Summarising, the importance of the *dehesa/montado* ecosystem in the Alentejo and Extremadura regions is fundamental in the social, economic and environmental areas. The vulnerability of this ecosystem has led to efforts to guarantee its preservation and to monitor it at local and regional levels. It has also led to the development of systems for supporting decision making in the sustainable use of the ecosystem. To this end, an R+D project is being carried out, which is included in the initiative INTERREG IIIA, a programme of the EU (Martín Bellido *et al.,* 2000). This paper presents the first results.

The *Dehesa* / *Montado* project

The objective of the Interreg-IIIA project SPA4.E13: *"Development of an information system for the environmental and economic management of the dehesa/montado ecosystem in Extremadura and Alentejo"* is to create models and technology to resolve the problems encountered by that the agents involved in the management of the *dehesa/montado*.

Project objectives

The final objective is to develop an *integral model* for the monitoring, management, conservation and sustainable development of the *dehesa* ecosystem.

The specific objectives of this project are:

(i) Complete a diagnostic of the physical environment in which the *dehesa* is established.

(ii) Characterise the ecosystem in terms of its biological factors.

(iii) Determine and evaluate the productive system's vulnerability factors.

(iv) Create a model for managing this ecosystem that permits its conservation and sustainable development.

(v) Develop information systems to support the decision-making process, based on strategies for sustaining this ecosystem. Develop technology on which to base policies for the use of natural resources on a regional scale.

Methodology

An innovative methodology has been adopted for this project, based on its multi-disciplinary character. This methodology allows us to relate physical, biological, social and economic variables, using the new technologies of the information society.

The research was planned around six activities, with the following purposes:

(i) *Coordination:* Global project management in financial, technical and scientific terms, and the transfer of the results obtained.

(ii) *Physical Factors:* Creation of a digital database and maps of physical factors and determination of the state of deterioration of the *dehesas*.

(iii) *Biological Factors:* Characterisation of the bio-diversity of the *dehesa*, determination of bio-indicators, and creation of the corresponding cartographic maps.

(iv) *Productive Systems:* Determination of the quantity and quality of grazing pastures in the *dehesas*. Characterisation and regional mapping of the livestock and hunting production systems. Taking of an inventory of and mapping the *dehesas'* forests and classifying them according to age.

(v) *Social and Economic Characterisation:* Characterisation of the *dehesa* ecosystem from a social and economic point of view, evaluating the profitability and sustainability of the system, determining the effect of the different institutional support policies on the *dehesa* systems, and the definition of the final model for efficient management.

(vi) *Geographic Information System and Decision-making Support System:* Centralisation and processing of the available geographic information, definition and use of cartographic criteria, development of the Geographic Information System (GIS), creation of social/economic and regional strategic decision-making models and the *dehesa* Decision-making Support System (SAD).

To carry out the work, data has been collected from existing published sources in different institutions: official Statistic Services, regional agricultural, animal husbandry, forestry and environmental services, national meteorological services and land conservation and regional planning Institutions of both countries.

On the other hand, 85 farms are cooperating in the study. These are situated in all the areas where data referring to each of the objectives is being collected (Espejo Díaz *et al.,* 2006a) (Fig. 1).

Fig. 1. Farms studied in Alentejo (Portugal) and Extremadura (Spain).

Also, remote sensing parameters like NDVI (Normalized Difference Vegetation Index) or ST (Surface Temperature), have been calculated from information of the resource satellites images on the areas being studied in the project. In this way we can relate variables collected in the fieldwork with those from the satellite to build predictive models. In the Alentejo region an inventory of natural resources was taken on 650 pieces of land to develop predictive models, particularly in relation to cork production.

Research teams

There are two partners in this project, one in Extremadura and the other in Alentejo, which coordinate the 15 research teams participating in the work, included in these Centres.

The Regional Ministry of Infrastructure and Technological Development of Junta de Extremadura, coordinates the work of the following Institutions:

(i) Agricultural Research Centre of La Orden and Valdesequera.

(ii) Regional Agriculture and Environment Ministry: Animal and Vegetable Health Services and the Forestry, Hunting and Fishing Service.

(iii) University of Extremadura: Areas of Physical and Human Geography of the Geography and Regional Planning Department, School of Agricultural Engineering and the Veterinary Faculty.

The following bodies cooperate with the Alentejo Regional Agriculture Directorate:

(i) University of Évora: Research and Advanced Management Training Centre and the Macro-ecological and Conservation unit.

(ii) New University of Lisbon: Geography and Regional Planning Research Centre, Faculty of Social and Human Sciences.

(iii) Superior Institute of Agriculture: Forestry Engineering Department.

(iv) Portuguese National Agricultural Research Institute: National Plant Improvement Station of Elvas.

(v) University of Algarve: Engineering and Natural Resources Faculty.

Results

The most important results of the project are (Martín Bellido *et al.,* 2004):

Creation of extensive information on the dehesa

(i) Physical Factors:

- Maps at an individual farm level (climate, hydrology, altitude, slope of the land, geomorphology, etc.).
- Identification of areas environmentally sensitive to soil deterioration.
- Characterisation of soil quality and state of deterioration.

(ii) Biological factors and environmental conservation:

- Identification of the diversity of flora and fauna in the pilot farms.
- Listing of the vegetal diversity in the *dehesa*.
- Spatial distribution models for plants and birds in Alentejo using the databases of UNIBA.

- identification of insect diversity in 18 pilot farms in Alentejo.
- Studies of the physiology of the cork tree and the detection of *Phytophtora* spp. in Alentejo.

(iii) Characterisation of production systems:

- Characterisation of agricultural, grazing land, livestock, hunting and forestry production systems.
- Data collection in the pilot farms regarding the production, composition and quality of grazing.
- Inventory of forestry resources in Alentejo based on 650 pieces of land.

(iv) Social/economic characterisation:

- Social/economic Inventory of the pilot farms. Social/economic characterisation of Alentejo.
- Microeconomic analysis and study of the profitability of farms in the *dehesa.*
- Development of economic models of different scenarios.

(v) Information system and generation of GIS applications and decision-making support applications (DSS):

- Methodology about selection of 85 cooperating farms in the two regions.
- Average monthly vegetation index and the average thermal index for the whole of Extremadura, based on satellite information (NOAA-AVHRRR) (Fig. 2).
- Mapping of land use in Extremadura based on images from the Landsat ETM+ satellite.
- Conception of the Geographical Information System (GIS).
- Programming of interfaces for the introduction of all the information collected in the project.
- Introduction of information in the GIS.

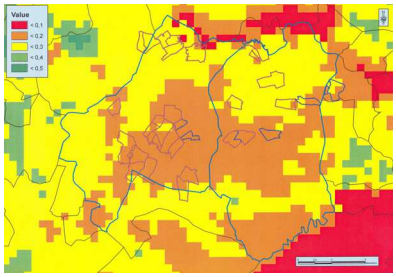

Fig. 2. La Serena NDVI, June 2003.

Transfer of the project results

(i) Creation of a Web page. A webpage has been created: http://dehesa.juntaextremadura.net. In it we have brought together information on legislation, news of the *dehesa*, flora and fauna, environment, breeds, the variety of quality poducts whose origins are in the agricultural production systems associated with the *dehesa*, etc.

(ii) Set up a digital library on the dehesa. To disseminate and promote this ecosystem in its many functions.Through the same Web page access can be had to the digital library, which contains complete publications on the *dehesa*, (currently there are more than 300 publications). These can be consulted by the public and authors who wish can add their articles on the theme (see Junta de Extremadura, 2005).

(iii) Transfer of results through conferences on the Dehesa. During the project, various activities were held to disseminate the results (Pomarinho, Fregenal, Beja). The most important was the Conference on the Management of the Montados and Dehesas of the Iberian Peninsula recently held at the Finca La Orden (General Directorate of Research, Technological Development and Innovation). The provisional results of the project have been published in the Proceedings of the conference (Espejo Díaz *et al*., 2006b).

Future plan

In order to complete the GIS with new data obtained and finalise and test the models and the SAD, an application to the European Union for a second phase of the project has been approved. The scheme of Activities and Teams described for the first project is considered valid for the second one.

The principal results anticipated at the close of this project are:

(i) Characterisation of the whole region in agricultural, social, economic and environmental terms relating to the state of the *dehesa*, in order to recommend measures and actions that will contribute to its sustainability.

(ii) Identification of areas with different states of deterioration at a regional level, as well as areas in danger of becoming desert and their cartographic representation for Regional Planning purposes.

(iii) Construction of an Information Management System for Alentejo and Extremadura, which provides ongoing regional information on the variables studied as an input to the Decision Support System (SAD).

(iv) Development of management support models for the *dehesa/montado* and the writing of software for applying the models.

In conclusion, this project seeks to offer the institutions the capacity to acquire information and implement actions in reforming the common agriculture policy that have an impact on the production systems of the *dehesa*.

Acknowledgements

This article presents the results of the project Montado/Dehesa SP4.E13. The project is co-financed by the European Union through INTERREG III A Programme.

References

Espejo Díaz, M., Espejo Gutiérrez de Tena, A.M., Matos, C. and Pereira, P.M. (2006a). Elección de fincas piloto para el desarrollo del Proyecto INTERREG-IIIA Dehesa-Montado SP4.E13. In: Espejo, M. *et al*. (eds), *Gestión ambiental y económica del ecosistema dehesa en la Península Ibérica.* Junta de Extremadura, Consejería de Infraestructuras y Desarrollo Tecnológico, Mérida, pp. 249-258.

Espejo Díaz, M., Martín Bellido, M., Matos, C. and Mesias Díaz, F.J. (eds) (2006b). *Gestión ambiental y económica de la Dehesa en la Península Ibérica.* Ponencias y comunicaciones presentadas a las Jornadas Técnicas celebradas en el Centro de Investigación Agraria Finca La Orden, Guadajira, Badajoz (Spain), 9-11 November 2005. Consejería de Infraestructuras y Desarrollo Tecnológico, Junta de Extremadura, Mérida, 410 pp.

Junta de Extremadura [on line] [Mérida]. Available at: http://dehesa.juntaextremadura.net. [visited 25 April 2006].

Martín Bellido, M. *et al*. (2000). Project SPA4.E13 Interreg-IIIA: *"Development of an information system for the environmental and economic management of the dehesa/montado ecosystem in Extremadura and Alentejo".*

Martín Bellido et al. (2004). Final Report of the Project SPA4.E13 Interreg-IIIA: *"Development of an information system for the environmental and economic management of the dehesa/montado ecosystem in Extremadura and Alentejo".*