

A regional ecological characterization method for quality and impact assessment

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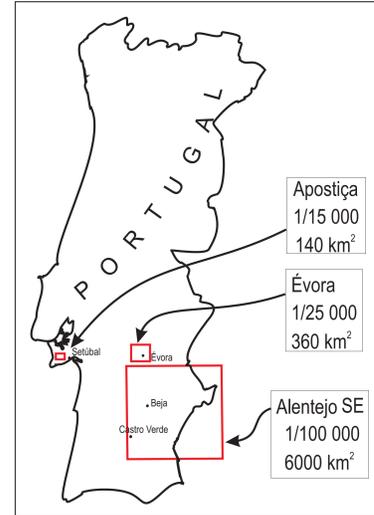
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ABSTRACT

A multidisciplinary, long term project aimed at developing and testing assessment and evaluation instruments for the ecological planning and management of the landscape is being developed in the University of Évora (Portugal). The main project is divided in three sub-projects (Characterization of the conservation value of the SE Alentejo region; Identification of the main ecological processes and functions in Évora; and Analysis of the reality and significance of landscape and ecological characterization indices in Apostiça).



Study Areas

The main objectives to be achieved are to describe the ecological reality and potential of the landscape at different scales; to determine the spatial structure of ecological networks, land use methods and land use intensities necessary to ensure the maintenance and promotion of the conservation value of the landscape, in order to assess the ecological value of a land use structure and evaluate the sustainability of alternative land use patterns.

INTRODUCTION

The Research Project aimed at developing and testing assessment and evaluation instruments for the ecological planning and management of the landscape. That framework has, not only to describe the ecological reality and potential of the landscape at the sub regional scale, but also to determine the spatial structure of ecological networks, land use methods and intensities necessary the ensure the maintenance and promotion of the conservation value of the landscape in a scenario of land use change and evaluate the impacts of land use and landscape changes on that value.

The main objectives of the project are:

- A. Identification of the main ecological processes and functions in an extensively used landscape
- B. Identification of the ecological structures and functions responsible for an increased biodiversity and sustainability of the existing or potential ecosystems
- C. Definition of assessment and evaluation procedures for the planning and management of that landscape balancing its use and its conservation potential

The characterization and evaluation method is based in the knowledge that the ecological value of a landscape depends from the viability of the present ecosystems. This viability is a function not only of their characteristics (dimension, interior/edge ratio, relations with similar ecosystems, diversity, naturalness, degree of external stress) but also from its functional equilibrium in terms of the stability of its nature (the degree of disturbance of the stable long term nature of the site that determines the existence of the ecosystem).

The consideration of this basic conditions forms the core of the assessment and evaluation methods, where equal attention is given to the stable environmental variables and functions and to the circumstantial structures of the present ecological organization of the landscape. The use of the structural classification of Forman and Godron (1986), adapted to characterize both stable and circumstantial ecological structures, has proven very resourceful in describing both informational levels.

METHOD

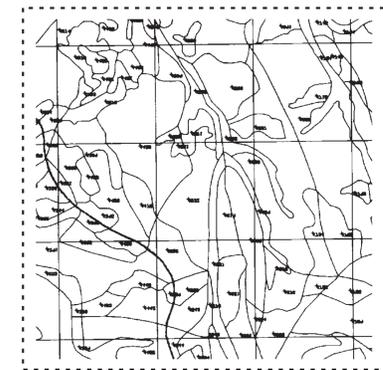
The methodological approach of the project aimed primarily at evaluating the real ecological significance of structural landscape characterization methods (land unit definition) and in calibrating evaluation procedures capable of representing, not only the ecological value of each unit "per se", but mainly its contextual value in the landscape in order to dispose of a framework for the performance of integrated analysis of land use distribution and changes. Following aspects were emphasized in the characterization process:

- I. Land Units
 - A. Structure and characteristics
 - B. Hierarchy
 - C. Functionality
- II. Land Use
 - A. Character and structure
 - B. Complementarity / Permeability
 - C. Functionality
- III. Potentiality and Productivity
 - A. Fauna
 - B. Vegetation
 - C. Pedology
- IV. Particular structures and elements (characteristics, values and potentialities)

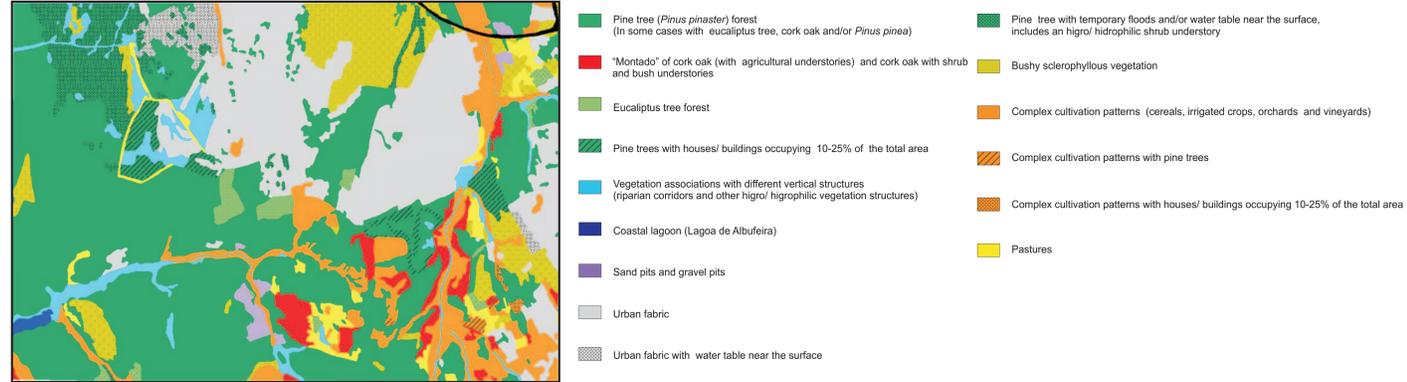
The characterization and evaluation procedure integrated the stable (the land units) and the circumstantial (the land use units) ecological structures in order to build the reference system for the information allowing the identification of dynamic correlation patterns and the evaluation of its character and determining factors.

The variables of quality, capacity and function were considered in the evaluation process in order to determine the following ecological values:

- **Ecotope formation ability (EFA)** - determined by the structural and genetical characteristics of the vegetation formations and the site, expresses the ability of the site to give origin and to sustain viable ecological communities.
- **Heritage value (HV)** - determined by the previous value and the degree of uniqueness and rarity of the site and formations expresses the productivity and genetical value of the ecotope.
- **Conservation Value (CV)** - determined by the previous value and by the expression of the contextual viability and functionality of the site and formation, expresses the ability of the site and formation to contribute to the ecological sustainability of the landscape.



Homogeneous Landscape Units. Extract of the Évora study area.



Apostiça land use in 1995 (12x8 km²)

RESULTS

The results that were obtained proved the interest of the approach and its applicability in the ecological planning and management processes. The simultaneous consideration of two levels of characterization allowed the comparison of two common approaches to the landscape and the evaluation of the ecological information displayed by each method. The main results obtained with this comparison are:

- ✎ The structure of the present land use is constrained by the stable factors and structure. These constraints are, nevertheless, not deterministic but determined by a balance between the environmental demands of the different land uses and the large scale ecological limiting factors: for example the regularity of the landforms and the vicinity of water sources is more important than fertility in the distribution of the agriculture uses.
- ✎ The character of the stable organization of resource corridors and patches and of the matrix is not contradicted by the organization of the land use, where new disturbance patches appear but where the stable structural framework is always identifiable.
- ✎ The hierarchical level of determination of the present structure by the stable structure is higher than the level of determination of the land use/biotope structure: the constraints have a generalized character different from the local variety of ecological features and structures.

The consideration in each level of characterization and evaluation of the nature and the interactive character of each unit, allowed a clear identification of the stability of each matrix, patch and corridor (correspondence of nature in both levels) and the identification of the relative complementarity of each area. The last information proved particular important in the consideration of the results of the intensive field research on the distribution of biological productivity of the different faunal groups and of the genetic interest of the vegetation formations. This characterization aimed at the calibration of characterization and evaluation methods and the identification of the structures and scales determinant for each biological group.

The comparison of these results with the values of relative complementarity and absolute connectivity showed that high complementarity within a low disturbance highly connected matrix are the areas with the highest faunistic value. The importance of connectivity and low fragmentation is well displayed in the urban and peri-urban areas where high complementarity within high disturbed areas determines a low faunistic value. These relations have to be further tested and analyzed in order to determine general patterns applicable in the management of landscapes.

The results also show that, although land use, determining the character, extension, interrelations and degree of disturbance of the present biotopes, builds the major factor in the definition of the biological quality of a site, the existence of particular elements (mainly water points and particular habitats) is the final determinant factor of the final quality of the site.

CONCLUSIONS

The main conclusions that can be drawn at the present state of the research are:

- ✎ The land unit concept is a particular useful instrument in landscape characterization and evaluation. Nevertheless its real value is only fully achieved when replicable methods were used in its definition, and when its articulation with the present structure of the landscape is displayed and made operational.
- ✎ The evaluation of the stability of a landscape by comparing the degree of correspondence of the nature of both levels of characterization is of particular importance in the evaluation of the "naturalness" of the degree of fragmentation of that landscape, and the real disturbance determined by proposed land use changes. It is also of particular importance in the identification of the disturbed patches responsible for the present fragmentation.
- ✎ The consideration of the degree of complementarity within a matrix and of the presence of particular elements is of major importance, together with its connectivity and productivity in the definition of its biological significance.

The first results of the project display a large amount of information of particular interest for the definition of planning and management tools applicable to large landscapes. Nevertheless the particular character of the area (with a combination of relatively extensive used areas, with intensive farmed orchards and irrigated areas and only one large isolated urban area and relatively important barriers), imply that a calibration of the results has to be performed in other landscape types, more intensively used or with a more natural character.

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