The Ecological Land Suitability in the Land-Use Plan

Sintra's Municipality Case Study

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Keywords: Ecological Network, Ecological Land Suitability, Land Use Plan, Sintra's Municipality

Introduction

Landscape Planning in Portugal continues to lean strongly toward urban planning, with a lower incidence in rural areas. The Municipal Master Plans are developed based on a modernist concept of single uses, as a consequence of the interpretation of the Portuguese Decree-Law nº380/99, changed by the Decree-Law nº 316/2007. In planning, the uses for urban settlements, forest, agriculture and nature conservation areas are determined without taking into account the ecological land suitability for human activities.

In order to avoid a mono-functional planning, it is necessary to suggest a Land Use Plan which integrates the principles of ecological and cultural sustainability and acknowledges the real context of economy, energy and production areas. This multifunctional plan includes several uses related to nature conservation; agriculture and grazing; horticulture; forestry areas; leisure and recreational facilities; urban and rural settlements; as well as restrictive uses due to ecological concerns.

The Landscape Planning Model advocated by the CEAP team has its roots on the concept of Ecological Land Suitability. It defines one or several specific kinds of land use to a given area [4], depending on the assessment of the ecological and cultural landscape components. This approach sustains an ideal land-use model for human activities that ensures environmental, economic and social sustainability. This is not the case in the existing land management policies in Portugal.

The concept of land suitability has been used in other studies in Portugal[3][6][10][15], as well as in studies from other countries[1][5][12][13][14].

The assessment of ecological landscape suitability was established within the framework of the Municipal Green Plans[7][8][10], namely the Sintra's Municipal Green Plan [11] as a part of the Municipal Master Plan.

The main goals of this project are: a) to study the correlation between the Ecological and Cultural Networks and the Ecological Land Suitability for Human Activities (ELSHA) that will lead to the Land Use Potential Plan; and b) to develop a Land-Use Plan which includes the potential uses and the existing uses consistent with ecological sustainability.
This methodology identifies the potentialities and the threshold of landscape resilience through its preferential, multiple or restrictive uses[10], in opposition to the single use zoning prescribed by the Portuguese law.
On the one hand, the use of a GIS improves the integration of digital geographic information and the spatial analysis methods, and on the other hand it increases the geographic precision and data quality[2].

Methodology

To achieve the two main goals was applied the follow methodology (Figure):

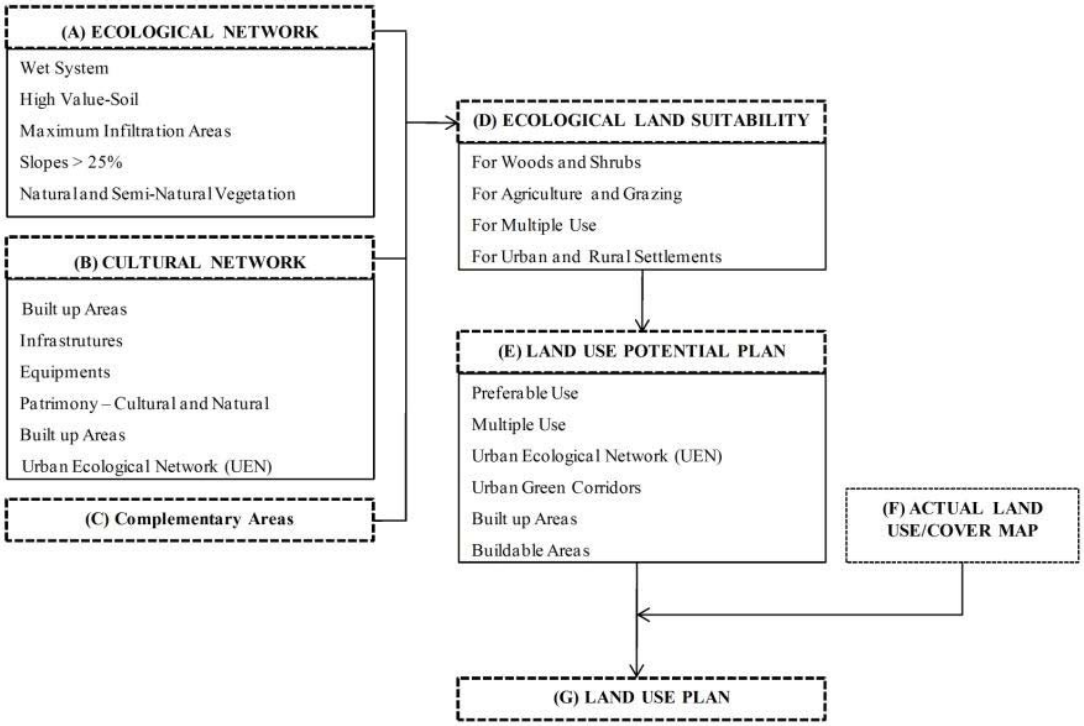


Figure1: Schematic presentation of the methodology [11]

1) The first step in the methodology is the determination of ELSHA (D) which results from analysis of the Ecological Network - EN (A), Cultural Network (B) and Complementary Areas (C).
ELSHA integrates less flexible uses, where ecological concerns are major, with more flexible uses, where ecological concerns are minor. The ecological suitability is considered pertaining to: nature conservation areas – woods and shrubs; agriculture and grazing; forestry; and urban and rural settlements, according to multi-uses, preferential and restrictive uses.

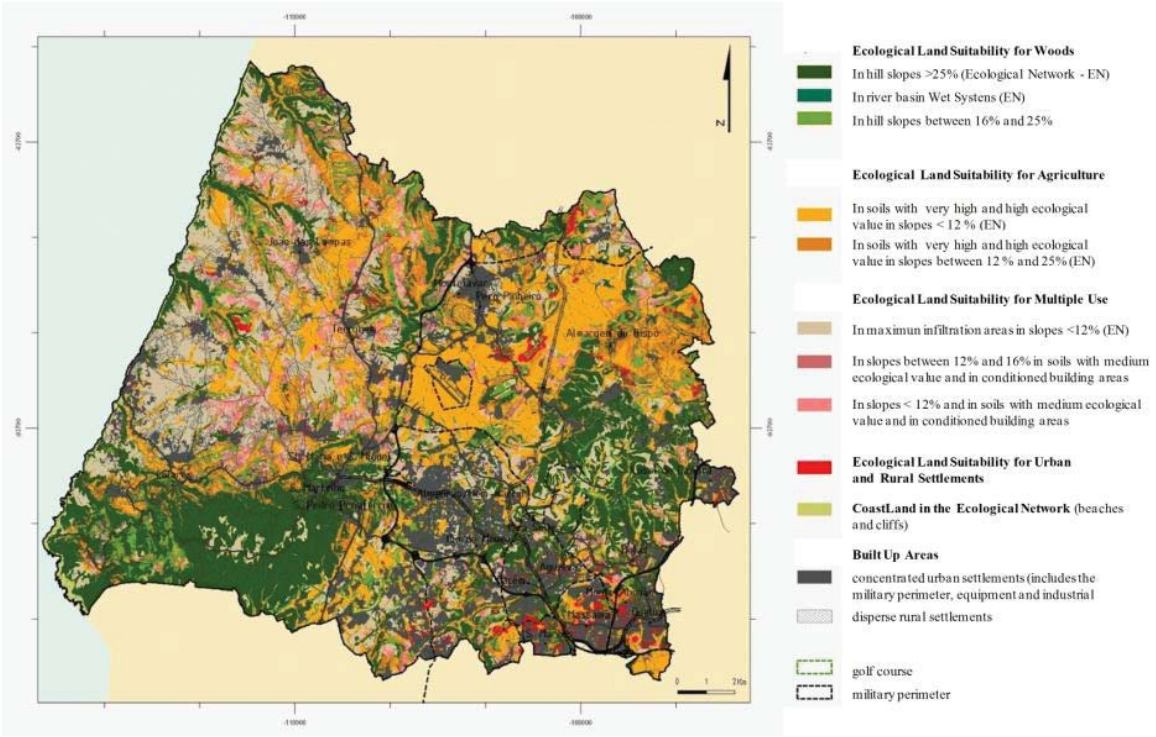
ELSHA will lead to a Land Use Potential Plan (E) relating the ecological and cultural systems with appropriated land uses.
The less flexible uses in the Land Use Potential Plan are linked to the areas which make part of the EN (A). Nature conservation must be the main goal in these areas, especially at the level of the soil, the water and the vegetation protection. The EN (A) is composed by: river basin wet systems; ecological high-value soil; geological erosion risk areas; maximum infiltration areas; etc. It supports fundamental ecological systems, where the land must be protected from human interventions, which can lead to irreversible degradation[10]. Activities as building and intensive agricultural practices, concerning machinery and agro-chemicals, should not be allowed.
Furthermore, the more flexible uses related to ELSHA (D) are linked to areas where it is allowed to build. However, this does not mean that all areas should be considered for building projects. The possibility of building should depends on:

- delimitation of urban perimeters discussed in the scope of the city Master Plan model (in urban areas);
- specific legislation of the National Agricultural (in rural areas) and National Ecological Reserve;
- specific legislation of the new touristic developments and industrial areas.

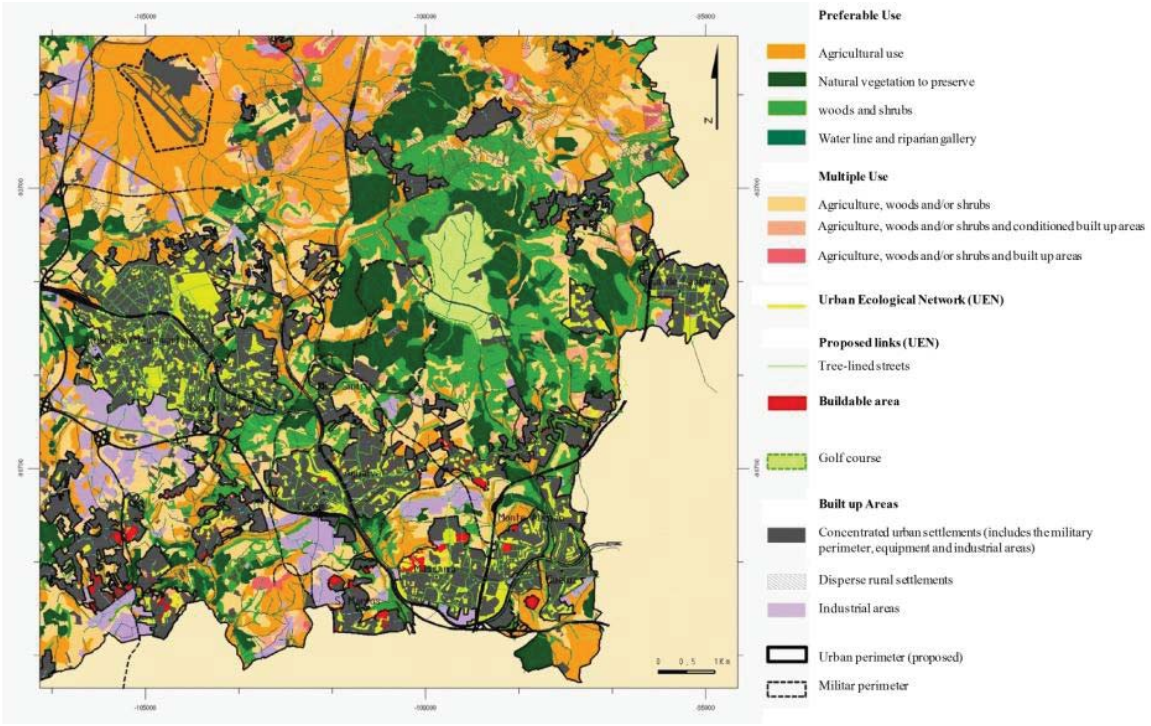
The intermediate ecological suitability uses focus the Complementary Areas (C) of the Landscape-System Methodology used in the CEAP projects[10][11]. These areas are targeted with flexible uses because they are not ecologically concerning. Therefore, they are suitable for a wider range of uses. However, in some cases, due to major aquifers and north exposure, these areas do not present bioclimatic comfort for human settlements and consequently should not be considered for building.
2) The second step is the combination the Land Use Potential Plan (E) and the Actual Land Use/Cover Map (F) in order to obtain the Land Use Plan (G).
Therefore, this Plan will gather the exiting land uses which are consistent with ecological suitability and consequently are appropriate, with those which need to be converted in other uses according to ESLHA.

Case Study - Sintra Municipality's

This case study focuses Sintra Municipality's. Its area is 317 km^2 and it is located in the North part of the Lisbon Metropolitan Area in Portugal. The south area of this municipality is a dense build up area with a high urban pressure due to the proximity to Lisbon. Despite being in a metropolitan area, the Sintra Municipality's has an extended rural landscape at North.
The previous methodology was applied to the case study using a GIS, ArcGis 9.3 software from ESRI©, in order to obtain the Ecological Land Suitability Map (Map 1) synthesized in a Land Use Potential Plan (Map 2).
The Sintra Ecological Land Suitability Map was determined according to different ecological situations, for example river basins wet systems or steeper slopes. This allows a proposal of potential land uses more or less flexible for woods, agriculture, multiple uses, urban and rural settlements.



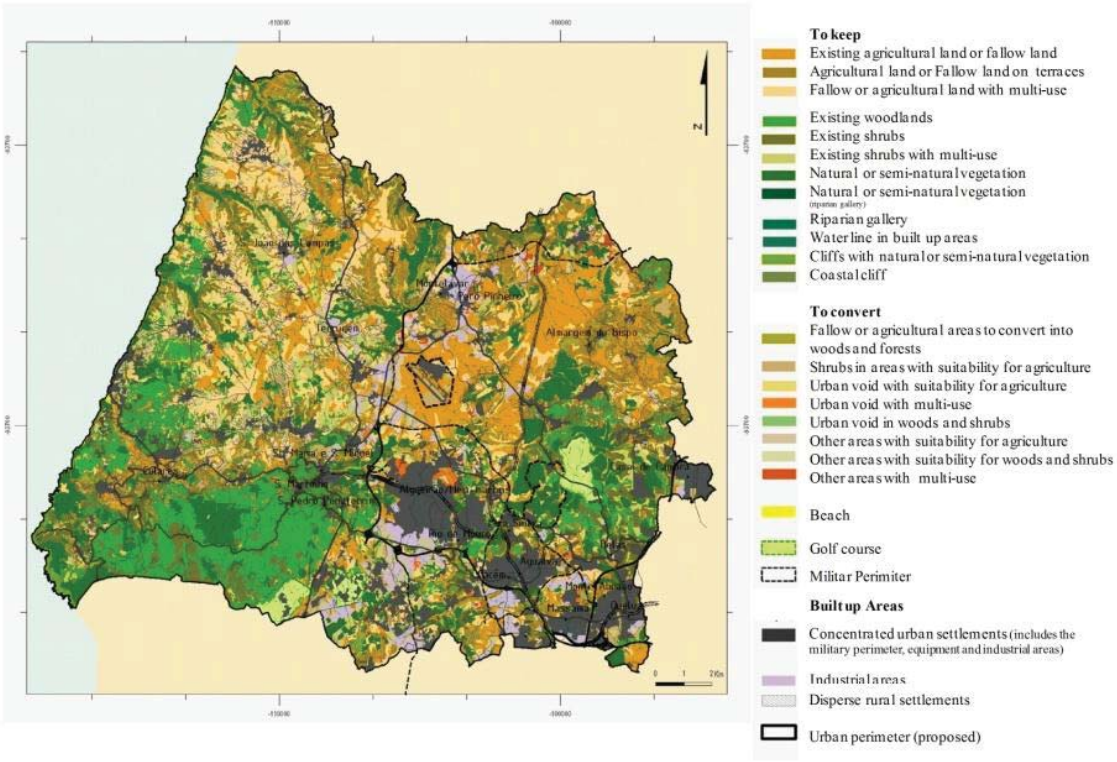
Map 1: Ecological Land Suitability Map [11]



Map 2: Land Use Potential Plan – Zoom [11]

The Land Use Plan (Map 3) focuses on the uses of rural land. This map acknowledges to opposite land uses: a) those which are consistent with ecological suitability and consequently are appropriate; b) those which are in conflict with ecological suitability and consequently should be converted. This assessment allows

a better understanding of ecological evolution uses, which should be taken into account by the decision makers.



Map 3: Proposed Land Use Plan – in the Rural Areas [11]

Conclusion

This integrative methodology contributes to sustainable management of the Ecological and Cultural Networks through landscape structures and ecological suitability land uses.
This ELSHA will allow the development of several scenarios, disputable by stakeholders and likely to inform public policies that safeguard natural resources while simultaneously support rural business owners.

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