

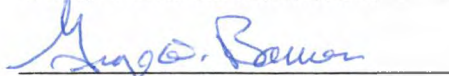
To the Graduate Council:

I am submitting herewith a thesis written by KayAnn Vance entitled "Delineation of Ecologically Sensitive Areas in Parque Natural da Serra da Estrela, Portugal." I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Ecology.

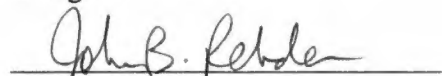


Frank McCormick

We have read this thesis and recommend its acceptance:



George Bowen



John B. Rehder

Accepted for the Council:



Associate Vice Chancellor and
Dean of The Graduate School

**Delineation of Ecologically Sensitive Areas
in Parque Natural da Serra da Estrela, Portugal**

A Thesis Presented for the
Master of Science Degree
The University of Tennessee, Knoxville

KayAnn Vance

May 1999

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ABSTRACT

From their inception, national parks have had two partially conflicting mandates: 1) to conserve and protect nature and 2) to provide for the enjoyment of people to view these areas. Today people are visiting national parks in larger numbers every year. Park budgets nor staff are increasing to accommodate such increased visitation. The decade of the 1990's has seen tourism development touted around the world as the new economic development tool. Tourism is now the world's largest employer and commands 10.9% of world GDP. The goal of this project was to minimize these conflicting mandates in Parque Natural da Serra da Estrela, Portugal. The approach was to guide tourism planning by identifying ecologically sensitive areas deserving of protection.

GIS was used to assimilate data that was made available by the Portuguese government and various researchers. Data that needed to be digitized was entered using Microsoft Microstation software. Gap analysis was used to organize various layers of spatial information with distribution of protected species. A manual assessment based on the Worldmap software approach was used to evaluate species data for areas of richness/rarity. Areas rich in protected animal species were delineated and centers of richness were ranked for conservation priorities. Conclusions and recommendations include:

- 1) The initial use of the 1000 meter contour line to delineate a zone of species protection was reasonably appropriate. However three areas richest in protected species fall outside of this zone.

- 2) Based upon richness of protected animal species, areas most deserving of protection are areas A, B and C totaling 125 Km². For the same reason area E of approximately 40 Km² may be deleted from protection. The tradeoff between addition and deletion represents an addition to the protected zone equal to only .0008% of the total area of the park.

- 3) The use of Gap Analysis is a potentially useful logical framework for integrating and analyzing spatial information. However, the utility of Gap Analysis is heavily dependent upon

integration of multiple compatible data sets. In this study the use of secondary data collected by several different investigators with several different objectives caused Gap Analysis to be of limited value.

In spite of limitations this study resulted in several useful recommendations concerning park management. Recommendations to guide tourism planning include the following.

1) The current protected zone should be expanded in the southwest to include all of areas A and B and in the north to include area C.

2) Reduce the protection zone by eliminating area E.

3) Place high priority upon protecting these additional areas A, B and C which are rich in protected species and further deserve protection because of potential conflicts with expanding tourism development.

4) Special attention should be given to area D with regards to special protection for the breeding area of Ciconia nigra.

5) Detailed resource management plans should be developed for areas with potential conflicts between tourism and biological conservation. Resource management plans should include environmental impact assessments (EIA's) as a requirement for all development projects.

Mitigation procedures should include the training of park personnel to conduct mitigation with developers, local governments and property owners.

6) Construction of roads and tourism facilities within the present and proposed expanded protection zone should be based on careful planning including environmental impact assessments and risk assessment analysis. Construction without careful planning would only further disturb protected species and cause further habitat degradation especially around the glacial lakes surrounding Torre.

7) Further field research in species distributions should be undertaken to enhance the understanding of wildlife - habitat relationships especially in the area of the glacial lakes (UTM coordinates 6154465, 6154460, 6204460, 6154470 and 6204470).

8) Tourist interviews should be undertaken to determine where tourists use non-paved roads and trails. This should include activities they undertake and estimates of approximate number of visitors.

9) Park management should be made aware of all studies conducted within the park and should receive progress reports and final results. A standard format should be adopted for all park studies involving collection of spatial data so that results may be integrated into a common geographic information system.

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I. INTRODUCTION

Since the inception of national parks they have been given two rather conflicting mandates: 1) to conserve and protect nature and 2) that they be accessible to human beings. (WTO/IUCN 1992). Today national parks are being given credit for playing an important role in the conservation of biological diversity. (Ryan 1992). Globally, in the last twenty years, the number of national protected areas has increased to nearly 7,000. However, many exist only in theory or on paper. With few staff and small budgets it is impossible to protect these areas from damage (Ryan 1992). A 1998 survey of the Organization for American States found that only 16 out of 100 Caribbean marine parks (outside the U.S.) had management plans and adequate staff and funding (Ryan 1992). Within both developed countries and underdeveloped countries, parks encourage destructive but profitable activities such as logging, mining and some recreation with biological conservation a secondary or nonexistent concern. Park managers rely on tourists and other profit making activities to pay the bills, opening themselves up to overcrowding, pollution and habitat degradation (Ryan 1992, Hunter and Green 1996).

In spite of these problems, tourism development is being touted around the world as the new economic development tool, especially in rural areas. Tourism is now the world's largest industry/employer. It contributes 10.9% of world GDP (WTO 1995). Eighty per cent of tourism destination sites are located in rural areas, for the most part, centered around natural areas (USTTA 1994). Many of these natural areas are in fragile ecosystems such as mountains, wetlands and coastal zones which can be severely impacted by tourism development (Hunter and Green 1996, Boo 1990, Brown et.al. 1995).

The idea of protecting whole ecosystems has come under discussion especially in the endangered species debate. According to Ryan (1992), it is the only way to protect the biodiversity of ecosystems at all their levels of organization as well as species which roam large areas; are shy of humans and/or roads; and where disturbance is essential to the viability of the habitat. Ecosystem management is an important piece of the biological conservation/ sustainability puzzle.

The Report of the Ecological Society of America Committee on the Scientific Basis for Ecosystem Management (Christensen 1996) reported that ecosystem management has often focused on maximizing short-term yield and economic gain rather than long-term sustainability. It should instead acknowledge human needs but at the same time confront the reality that our planet has limits and that it depends on functioning ecosystems in which it can meet those human needs (Christensen, 1996).

Because of these issues, this study focuses upon the processes by which we assess biological diversity and plan for species protection within parks using the new techniques afforded by geographic information systems (GIS). Various applications of GIS have been used elsewhere for such assessments. (Castelo-Branco 1997; Pimm and Lawton 1998, Freitag et al. 1997)

The initial objective of this study was to guide tourism planning through integrated assessments of biological diversity within a park setting. Difficulties encountered during this study made it necessary to narrow the initial objective. The modified objective is to use the occurrences and distribution of protected terrestrial vertebrates to identify sites most deserving of protection from impacts of tourism.

This study used the Parque Natural da Serra da Estrela in Portugal as a case study. The study area is unusual in that it contains human habitation and all its amenities. The study area presented many challenges to be considered due to human habitation. Because of the time limit of the study, secondary data was utilized, specifically data regarding species distributions within the park, hydrology, altimetry, satellite landcover data and landuse data. Tourism data was generated by a participatory method involving knowledgeable persons from the park, counties and tourism bureaus.

II. DESCRIPTION OF THE AREA OF STUDY

A. Historical Overview of the Park System in Portugal

The Park System in Portugal was formed after the revolution which brought democracy to the country in July 1976. There are various designations including Total Reserve, Natural Reserve, National Ecological Reserve, National Park, Site of Biological Interest, Natural Park and Protected Landscape. Sustainable development activities range from radical ecocentric for the first three designations to ecocentric for the middle two and intermediate for the last two designations.

(Table 1.) In all there are 39 designated areas within continental Portugal and its two protectorates the Acores and Madeira. Only one park, Parque Nacional da Peneda-Geres has a management

TABLE 1. - Classification and Management Goals in Protected Areas in Portugal

	Guiding Concepts	Operational Objectives	Type of Sustainable Development
Total Reserve	zones of total protection included in protected areas	maintenance of natural processes in untouchable state, conservation of ecologically representative examples in a dynamic and evolutionary state where human presence is only admitted for scientific research or environmental monitoring	radical ecocentric
National Park	area with one or more ecosystem non or hardly altered by human intervention, including samples of natural regions, characteristic of natural and humanised landscapes, of flora and fauna species and geomorphologic places or habitats with scientific interest	adoption of measures to enable the conservation of ecological integrity of ecosystems and to avoid intensive exploitation or occupation of natural resources	ecocentric
Natural Reserve	area for the protection of habitats, flora and fauna	adoption of measures to guarantee the conservation of natural conditions necessary for the stabilisation of species, groups or biotic communities, physical aspects of the environment when these require human intervention for their survival	radical ecocentric
Natural Park	areas with natural, semi-natural or humanised landscapes with national interest, being example of the harmonious integration of human intervention and nature, presenting samples of natural regions	adoption of measures to guarantee the maintenance and improvement of natural and semi-natural landscape features and ecological diversity	intermediate
Protected Landscape	areas with natural, semi-natural and humanised landscapes with regional or local significance, resulting from the harmonious interaction between man and nature, with aesthetic or natural value	adoption of measures at regional or local level to maintain and improve the features of landscapes and ecological diversity	intermediate
Sites of Biological Interest	private protected areas	protection of species and wild flora fauna and related habitats with ecological and scientific value	ecocentric
National Ecological Reserve	diversified biophysical structure of environmental value	to constrain the use of these areas in order to maintain their function in the global environmental balance	radical ecocentric

Source: Nogueira and Pinho 1997.

plan. All the others operate from a document established in their individual enabling legislation the Plano Ordomento.

Parks in Portugal are very different from most parks in the United States in that they contain cities, towns, villages, people and all their accompanying industries and services. In addition they have at least three federal government agencies operating within park limits: Instituto Conservacao e Natureza (park service), Ministerio de Floresta (forest service) and Ministerio da Agricultura plus six county governments and local governments. Additionally, lands within parks are both publicly and privately owned.

B. Parque Natural da Serra da Estrela

Parque Natural da Serra da Estrela is located in the northeast of the central region of Portugal between 40°17' and 40°25' latitude north and 07°33' and 07°40' longitude west in UTM coordinates and is approximately 100,000 ha. in area (Pires 1996). Of the six Concelhos (counties) that make up the park, Manteigas is completely encapsulated in the park whereas the others, Seia, Gouveia, Celorico de Beira, Guarda, and Covilha are only partially contained within the park limits. According to Pires (1996) the 1991 census estimated the population of the park to be 44,162 inhabitants with 43.7 hab/km² but the published hiking map of the park cites 70,000 inhabitants (ICN 1993). Park officials estimate that about 80 per cent of the park is privately owned (Matos 1997) (Figures 1 and 2).

Geologically, schist underlies the southern portion and granite the northern portion. The Zezere river valley, the Alva and the Loriga valleys were formed by glaciers. There are also small glacial lakes, namely Comprida, Escura and Canaros. They occur at the higher elevations, which for the most part, have almost all been damned to provide water to various communities throughout the park (PO 1987). Soil types are rankers which are derived from granite and cambisols derived from schist. Due to erosion and weathering the weathering layer is thin or absent. Accumulation is found in valleys and depressions. (Jansen et al. 1997) The Serra da Estrela is a mountainous

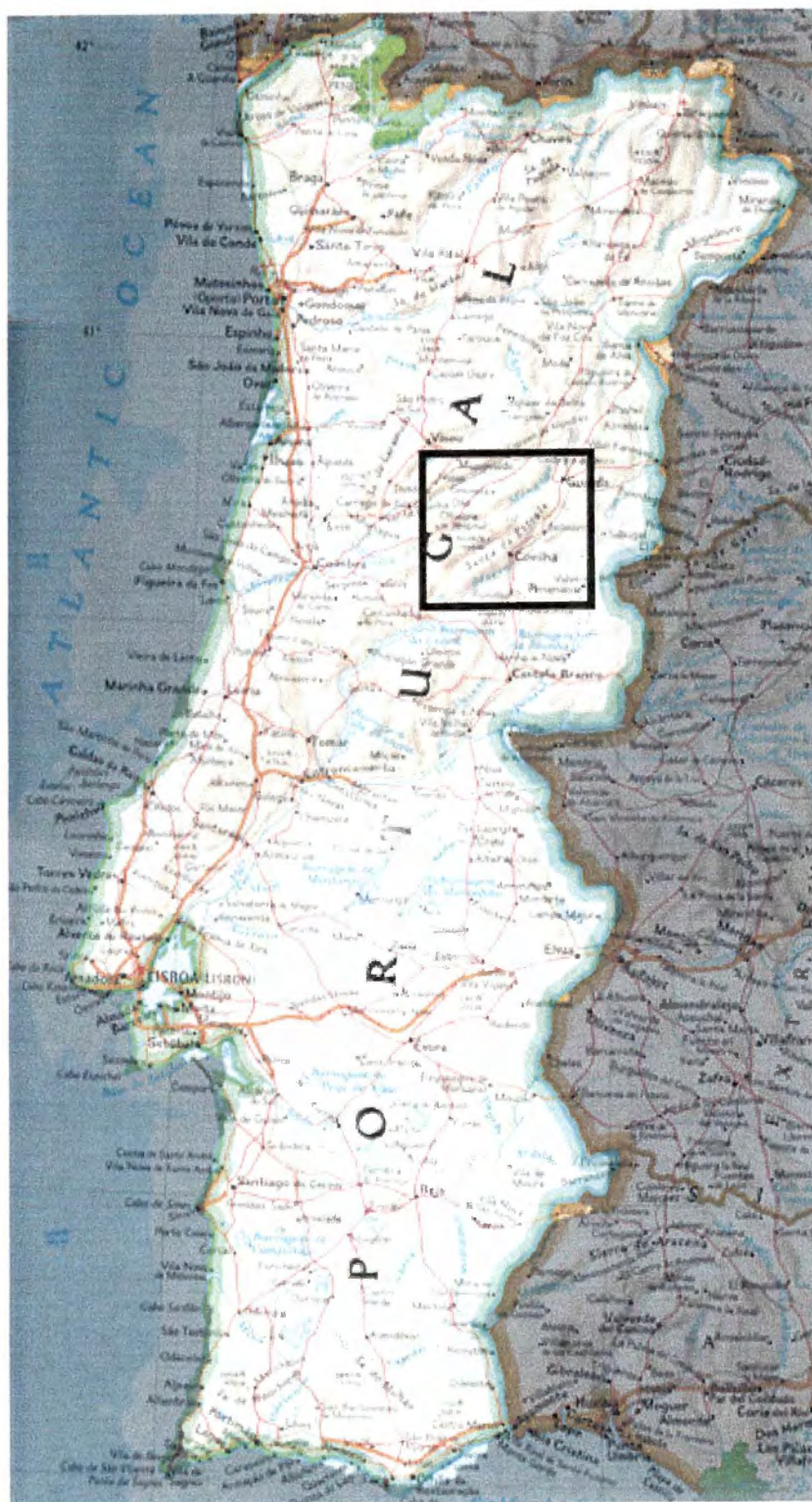


Figure 1. Map of Portugal, Area of Parque Natural da Serra da Estrela Outlined.
Source: National Geographic Society 1998.

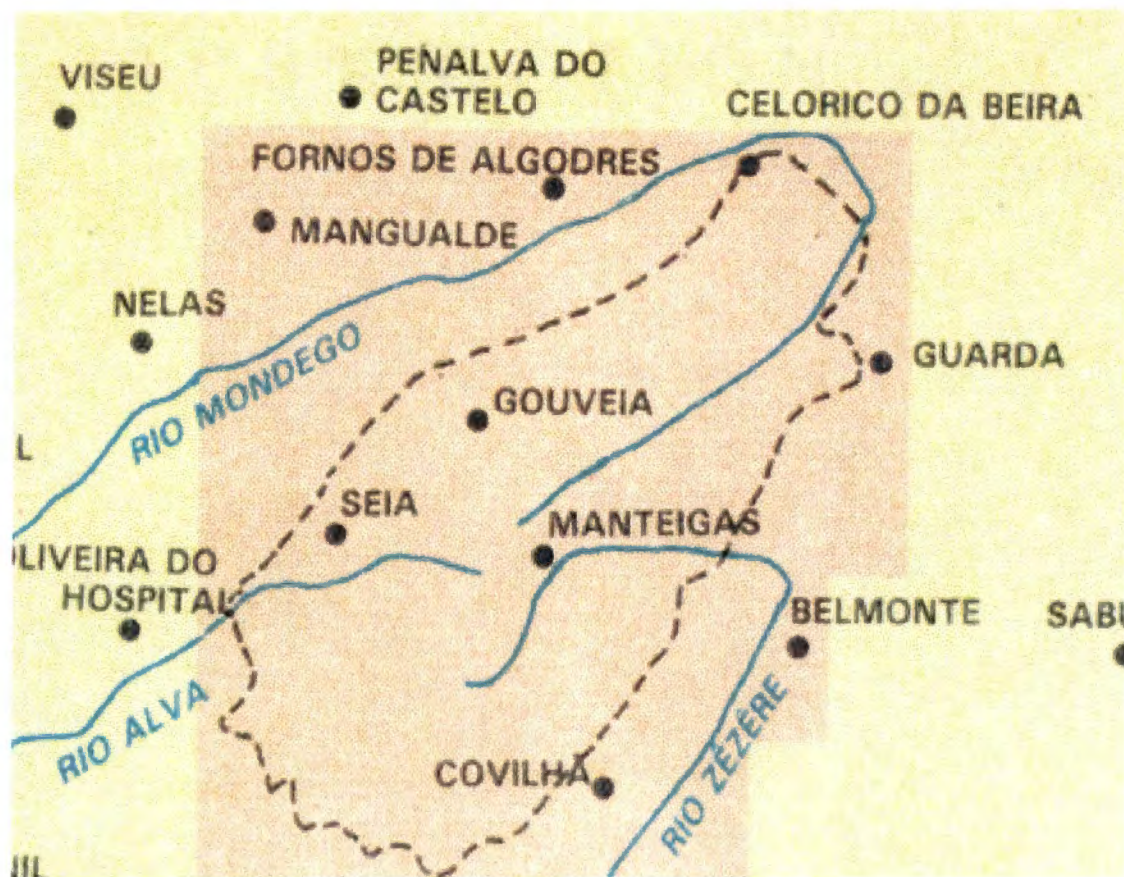


Figure 2. Map of Parque Natural da Serra da Estrela.
 Source: CCRC 1994.

area with a massif towering over the Mondego and Zêzere valleys and evolving into broader plains on the east and west parameters.

Topographically the park ranges from approximately 800 meters to 1993 meters at its highest point at Torre (PO 1987). Torre is also the highest elevation in the country and of high interest to tourists and tourism development. For the most part, the park is situated in the Estrelan sector of the Capretano-Iberian-Leonesean province and to the south and east merges into the Luso-Extremaduran province (Jansen et al. 1997). The park exhibits three distinct floors (andares) with different biotypes (PO 1987). Jansen et al. (1997) cites Rivas-Martinez and translates andares as thermoclimatic belts. The lower elevation, mesomediterranean belt, (800-900m) supports a biotype dominated by climax formations Holm oak (*Quercus rotundifolia*), Cork oak

(*Sanguisorbo-Quercetum suberis*), Pedunculate oak with evergreen elements (*Rusco-Quercetum roboris*), Pyrenean oak (*Arbuto-Quercetum pyrenaicae*) and riparian Alder (Figure 3). The intermediate elevation, supramediterranean belt, (900m-1650m) supports a biotype dominated by climax communities Pyrenean oak (*Holco-Quercetum pyrenaica*), and Birch (*Saxifrago-Betuletum celtibericae*). (Figure 4.) The upper elevation (Planalto), oromediterranean belt, (>1650m) supports today a biotype dominated by Dwarf juniper scrub (*Lycopodio-Junipeereturum*) heathlands (*Potentillo-Calluneturm*) and rare heath (*Erica tetralix*) (Jansen et al. 1997) (Figures 5 and 6).

According to Jansen et al. (1997) there is a great variety of vegetation exists because of differences in altitude, long history of land use and exposures. He also states that each belt exhibits its own climax formations, degraded stages and land use.

The Park occurs in a Mediterranean climatic zone which also exhibits an Atlantic climatic element at the higher altitudes. The region is characterized by a rainy season, with snow at elevations above 1000m between October and May and a hot, dry season between May and October. (P O, 1987) Temperatures range from 2.4°C to 12.9°C in winter with the coldest months in January and February and the hottest month in July with 17.2° temperature (Pires 1996, Jansen et al. 1997). There are two meteorological stations in the park, one at Pinhas Douradas (1600 m) and Manteigas (900m) with a third one being reactivated at Torre (1993m) (Pires 1996).

The Serra da Estrella also has two major river valleys Rio Mundego and Rio Zezere with a third minor one, Rio Alva. Rio Mundego is the only major river in the country which originates in Portugal, all the other major rivers originate in Spain. The Rio Mundego has also played a major role in the economic development of the central region. The Rio Zerzere is a major tributary to the Rio Tejo, the largest river system in Portugal (Godinho et. al. 1996) (Figure 2).

C. Land Use in Parque Natural da Serra da Estrela

The area has been heavily logged for centuries. It is thought that originally the forest type was an oak/chestnut forest. (Sousa 1996, Godinho et al. 1996). By the end of the last century, the forests of the Serra da Estrela began to lose their ability to regenerate. At the beginning of this



Figure 3. Mesomediterranean Belt in Parque Natural da Serra da Estrela.



Figure 4. Supramediterranean Belt in Parque Natural da Serra da Estrela.



Figure 5. Oromediterranean Belt in Parque Natural da Serra da Estrela.



Figure 6. Vegetation of Oromediterranean Belt in Parque Natural da Serra da Estrela.

century, Portugal began to replant its forests with exotic monocultures of conifers from Australia and the United States. Today, these forests suffer from wildfires in the dry season and even in the rainy season due to centuries old practices of slash and burn techniques to enrich the soil which are utilized by the shepherds. The Forest Service has and is actively replanting devastated areas for the most part with exotic conifers but is now beginning to plant a mixture of oak/chestnut once again. The oak/chestnut forests regenerate quickly after the wildfires whereas conifers do not. At this time the forest service is not actively involved in timber production within the Park limits. But private owners are free to continue to clear cut their land. The Forest Service employs the use of the rip-plow in their replanting practices. This practice breaks up the sub-soil and makes what might be described as small terraces in the process as a bed for replanting (Direito 1997, Matos 1997, Servico Nacional da Florestal 1997). Whatever soil structure is left after centuries of erosion is destroyed in the process. Large areas are plowed at one time and may remain bare and unplanted for a year or more which only increases the soil erosion (Coelho et al. 1997).

D. Regional Economics of the Serra da Estrela

The Serra da Estrela is a mountainous rural area with a rural economy. The economy is for the large part based on agriculture: timber, shepherding, textiles, cheese, honey, trutaculture and fruitaculture. At one time, there were 54 textile mills located throughout the Serra da Estrela. Today only three remain (Santos 1998). The textile industry, for the most part, has left Portugal for the Pacific rim (Sotave 1997).

III. METHODOLOGY

A. General Methodology

The general methodology for this study involved:

- 1) recognition of issues,
- 2) collection of relevant information,
- 3) digitize information,
- 4) integration of spatial information using Gap Analysis as a procedural guideline
(Figure 7),
- 5) analysis of results,
- 6) formation of conclusions,
- 7) recommendations for management.

B. Tourism Inventory

The tourism inventory was intended to identify and locate attractions, artisans, points of interest, tourist facilities and other public facilities. The inventory was important to this study because the tourism resource base is to be integrated with other land uses and species distributions. The inventory was also important to the park because it provides information 1) to package and sell tourism and maximize marketing efforts 2) to utilize for future planning and infrastructure development, 3) for future regional planning and development activities and 4) to tourists to provide needed information in order to visit these sites. (Trussell 1988) This process is used throughout the United States (Trussell 1988, Weaver 1996, Nuckels and Long 1993).

Tourism inventories were conducted in five concelhos (counties): Seia, Gouveia, Celorico da Beira, Covilha and Manteigas. It was not possible to conduct an inventory in the sixth concelho. The tourism inventory was designed to be a participatory process but had to be modified to include only a small panel of experts. Participants included a facilitator, a park staff member, and representatives from the tourism bureau and counties. Points of interest were listed and

SIMPLIFIED GAP ANALYSIS DIAGRAM

Análise de GAP Simples

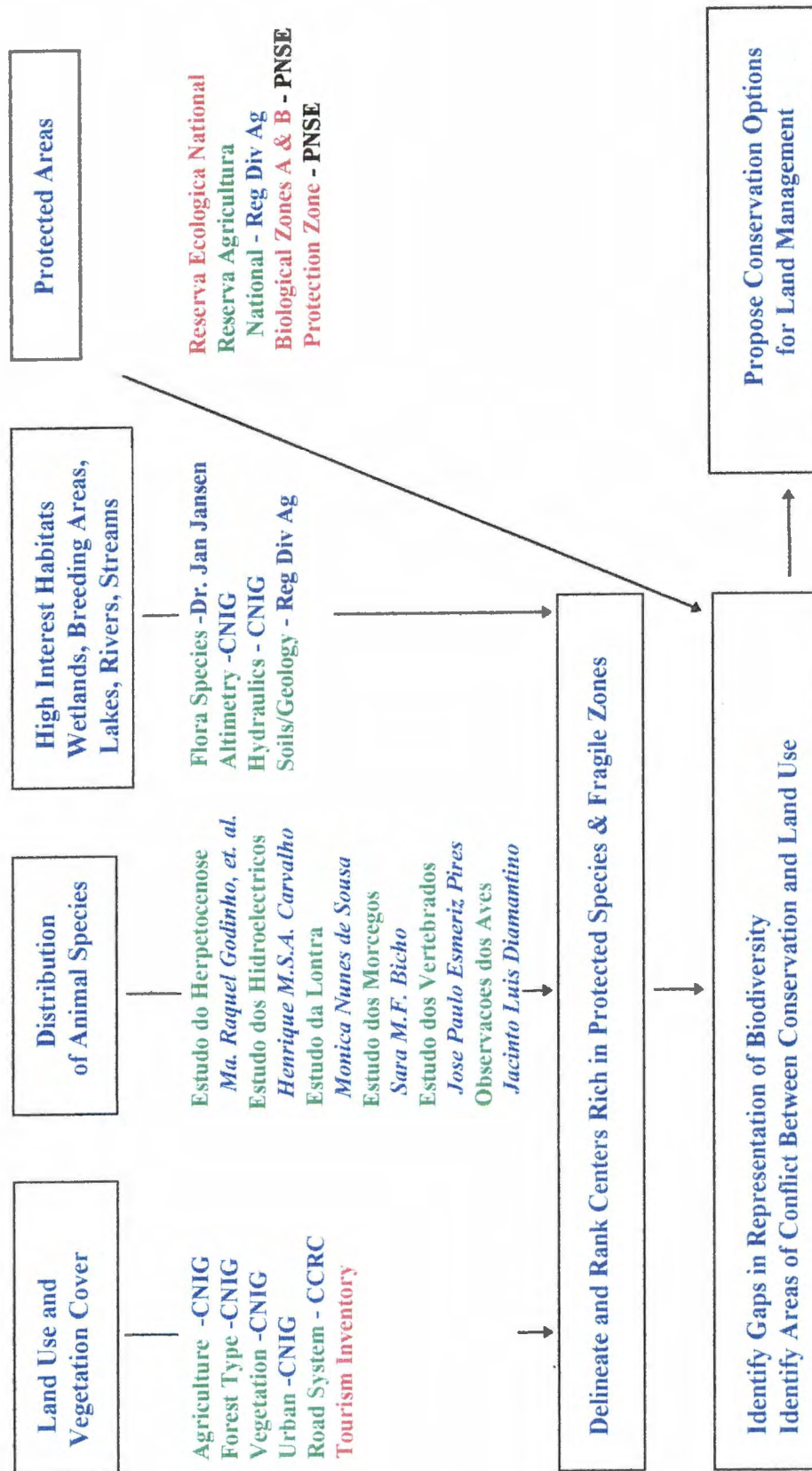


Figure 7. Simplified GAP Analysis Diagram

Source: Adapted from Castel-Branco 1997.

located on a map. Points on the map were then given Universal Transverse Mercator (UTM) coordinates and the data entered into the computer data base using Microsoft Excell. See Appendix A for a list of activities inventoried.

C. Land Use and Vegetation Cover

The literature revealed several references for the description of the biotypes of the Park. The *Plano de Ordamento de Parque Natural da Serra da Estrela* (PO 1987), legal document which is accepted into the legislation of the Park, described four biotypes: agriculture, forests, matos (shrubs) and planes of altitude. Godinho, et.al. (1996) described seven biotypes: agriculture, giestal (broom plantations), urgueiral (heath plantations), florestal de folhosas (deciduous forests), florestal de resinosas (coniferous forests), cervunal (high fields of cereals-rye) and zimbral (juniper plantations). (One must note that when Portuguese dictionaries use the word plantations, it means areas with trees). Pires (1996) relied heavily on previous works by Pinto da Silva and Teles (1986) and Naturieberica (1987). He utilized seven biotypes in his study: matos (shrubs), resinosas (coniferous), folhosas (deciduous), arboreo misto (mixture of coniferous and deciduous forest), agriculture, cereal and urbano. The body of work completed by the Centro Nacional Informatica Geografica (CNIG) for the Servico Nacional da Florestal utilized the map legend of the Carta de Ocupacao do Solo de Portugal Continental. The map legend was divided into six major landuse types: artificial areas (urban), agriculture, forests, semi-natural areas, half aquatic and surface water. These were then subdivided into nineteen subcategories with a total of 74 classifications. This study employed the classification and data provided by CNIG. CNIG data was generated from Landsat data taken in 1992 and digitized in a 2D format (Appendix B).

D. Animal Species Occurrences and Distributions

The primary objectives were to 1) identify the fauna of the Park; 2) assess the level of protection of protected species; 3) and review key studies in the Park to establish species occurrences and distributions.

The main source for identifying fauna present in Portugal was *Livro Vermelho dos Vertebrados de Portugal* (SNPRCN 1990). Another reference is *Naturieberica* (1987). These two were cited in the *Plano de Ordamento de Parque Natural da Serra da Estrela* (PO 1987) which references the species of Portugal with the potential to be located in the Park.

After the potential species for the Park were identified, three sources were consulted to establish their status of endangerment and levels of protection: *Livro Vermelho dos Vertebrados de Portugal* (SNPRCN 1990), *the Berne Convention: Annexes I & II* and *the Directives of Habitats and Aves* cited from *Diario da Republica*, (1981, 1989, 1991, 1997). The *Diario da Republica* is the daily federal register of legislation. Two experts were consulted for information pertaining to the flora and fauna in the Serra da Estrela and Portugal. These two were Dr. 's Mario Reis, an ornithologist, of Instituto Conservacao e Natureza (ICN) and Dr. Jan Jansen, a botanist, of Instituut voor Bos-en Natuuronderzoek (IBN-DLO), the Netherlands. They recommended comparing the three aforementioned documents and produce a list of the key indicator species for protection in the Park. Other references considered in this evaluation include *Guidelines: Development of National Parks and Protected Areas for Tourism* (WTO 1996) and "Developing Ecosystem Goals for Canadian National Parks," (Woodley 1993). The later two references gave guidelines for selection of a list of potential indicator species based on those that were susceptible to change in stressed ecosystems.

Identification of species presence and distributions were assisted by five major studies (Bicho 1996, Carvalho 1996, Godinho et al. 1996, Pires 1996, Sousa 1996) and observations by a guard of the park (Diamantino 1998).

Species data were examined to determine other species deserving of special consideration in the study. Woodley's (1993) list of factors to consider when determining indicator species was used as the criteria for this inclusion:

- "A. Species vulnerable to identifiable indirect or distant threats such as acid precipitation or climatic shifts.

- B. Species vulnerable to identifiable direct or local threats such as disturbance from visitor use.
- C. Rare species of all kinds.
- D. Dominant species such as summit predators or keystone species.
- E. Species adapted to "old-growth" or late successional stages of succession.
- F. K-selected species such as extreme habitat specialists or species with low fecundity or low capability for compensatory recruitment.
- G. Species with large body size.
- H. Exotic or non-native species that are successfully living and reproducing in the ecosystems.
- I. Accumulator species or those that have a tendency to accumulate toxins, such as filter-feeding bivalves."(Woodley, 1993)

E. Other Features of Significance

This analysis included flora, habitats, altimetry, hydrology, soils and geology. Two studies of Dr's Jan Jansen (1997), aforementioned, and Fernando Catarino (1997, 1998) of the Museu, Laboratorio e Jardim Botanico, Departamento of Biologia, Universidade de Lisboa, Lisboa were reviewed for their relevance to this study. Dr. Jansen's study was in cooperation with the Natura 2000 Initiative. Dr. Catarino's study was in collaboration with the Cartografia da Vegetacao Natural and Semi-natural de Territorio Continental Portugues. His group has completed classifying the vegetation for the P.N.S.E. according to guidelines for that project

F. Protected Areas

Protected areas to be considered are those which are legislated through the Plano de Ordamento of the Park (PO) and the Plano Director Municipal (PDM's) of the concelhos. There are three protected areas to be considered in this section. For the Parque Natural da Serra da Estrela this zone is designated as the Biogenetic Reserve and is delimited as a landscape protection

boundary on the published map of the park. The other two protected areas examined were the Reserva Agrícola Nacional (RAN) and the Reserva Ecológica Nacional (REN). These are all defined in the *Diario da Republica* (1989,1990).

RAN data was provided by the Regiao de Agricultura da Beira Interior. It is in an ArcInfo format. REN data had to be digitized. Maps to be digitized were provided by the CCRC and the various counties of the park. Digitization used Microsoft Microstation software.

G. Gap Analysis

Gap Analysis is an analytical procedure (Ahern 1997) comprised of the following steps:

- 1) identify protected terrestrial vertebrate species and then level of protection,
- 2) determine areas rich in protected species,
- 3) overlay protected species distributions with a map of designated protection zone,
- 4) delineate priority areas for conservation based on richness of protected terrestrial vertebrate species.

Gap Analysis was used as modified from Castelo-Branco (1997). Castel-Branco described Gap Analysis as a computer based system comprised of several steps. (1-4) Gap Analysis lends itself to a rapid and efficient evaluation of large conservation areas. Gap Analysis identifies gaps in the representation of biodiversity. The initial objective of this project was to guide tourism planning through integrated assessments of biological diversity within a park setting. Gap Analysis appeared to be a promising procedure for obtaining an integrated assessment. The usual process of Gap analysis was supplemented by the addition of one new step. The additional step was to compare locations of priority conservation areas with locations of high intensity of tourism. This analysis provides a guide to resolution of potential conflicts.

IV. RESULTS

A. Tourism Inventory

Results of tourism inventories revealed that in every concelho, points of interest, tourism facilities, etc., that were identified by the expert panel, were mostly located within towns and villages or along paved roads. Therefore, data provided by CNIG and CCRC for urban centers and roads were accepted as approximations of sites of significant tourist activities (Map 1). Accordingly, it became unnecessary to digitize and use results of the tourism inventory.

B. Land Use and Vegetation Cover

Data for vegetation cover was at such a fine scale (76 subclasses) that it was impossible to interpret data at a workable and readable scale. Therefore, land use and vegetation data was not included in Gap Analysis. Road system data provided by the CCRC was paved roads only.

C. Species Occurrences

The *Plano de Ordamento de Parque Natural da Serra da Estrela* (PO 1987) identified 17 species of amphibians in Portugal with 13 referenced for the Park and 27 species of reptiles in Portugal with 18 referenced for the Park. In addition, 328 species of birds are cited for Portugal with 123 referenced for the Park: 12 falconiformes, 2 galliformes, 1 gruiformes, 8 charadiformes, 3 columbiformes, 1 cuculiformes, 6 strigiformes, 1 caprimulgiformes, 4 apodiformes, 4 coraciformes, 3 piciformes and 81 passeriformes. Results from reviewing the five studies revealed the following observations: 11 species of amphibians, 108 species of birds, 13 species of mammals and 21 species of reptiles were observed in the Park (Table 2).

TABLE 2. - Species Representation in Parque Natural da Serra da Estrela

Classe	Portugal	Serra da Estrela	Observed in Studies
Classe Amphibia	17 species cited	13 species referenced - 76%	11 species observed - 65% 0 observation points available
Classe Aves	300 species cited	123 species referenced - 41%	108 species observed - 35% 2903 observation points
Classe Mamiferos	61 species cited	27 species referenced - 44%	13 species observed - 21%
Classe Reptilia	28 species cited	18 species referenced - 64%	21 species observed - 75% 0 observation points available
Total # Species	404 species cited	181 species referenced - 45%	240 species observed - 59%
Total # Species with data points			121 species observed with data points - 29%

Source: Adapted from *Plano de Ordamento de Parque Natural da Serra da Estrela* 1987.

D. Levels of Species Protection

The three documents used to determine categories of endangerment and levels of protection: *Livro Vermelho dos Vertebrados de Portugal* (1990), *Convencao de Berne* and *Directives de Habitats e Aves* (*Diario da Republica*, 1981, 1989, 1991, 1997) were reviewed with the following results. In Portugal, species are categorized as: rare, endangered or threatened, vulnerable, insufficient evidence, undetermined and not threatened. The Berne Convention has four Annexes, two of which designations, Annex I - strictly protected and Annex II - protected, were determined relevant to this study. The Directives of Habitats and Birds is divided into five Annexes. Table 3 identifies the categories of endangerment and levels of protection for

Table 3. Definitions of Categories of Endangerment and Levels of Species Protection in Portugal

<i>Livro Vermelho de Portugal</i>	<i>Convencao de Berne</i>	<i>Directives de Habitats e Aves</i>
E - Endangered	Annex I - Plants strictly protected	Annex I - Types of natural habitats of community interest where whose conservation demand special designated zones of conservation
R - Rare	Annex II - Fauna strictly protected	Annex II - Animals and vegetation of community interest whose conservation requires designation of special zones of conservation
V - Vulnerable	Annex III - Fauna protected	Annex IV - Animals and vegetation of community interest that demand rigorous protection
K - Insufficient Evidence	Annex IV - moyens et methods de chasse	Annex V - Animals and vegetation of community interest whose capture or harvest in nature and exploitation are possible objects of measures of management
I - Undetermined		
NT - Not Threatened		

Source: Adapted from *Plano de Ordamento de Parque Natural da Serra da Estrela*, 1987 and *Diaria Noticias*, 1981, 1989, 1991, 1997.

species in Portugal. The level of protection was included for each species during subsequent analyses. For a complete list of species identified for Parque Natural da Serra da Estrela and their protection levels see Appendix C.

Twelve other species were determined to be significant for special consideration based on Woodley's criteria: Circus cyaneus, Falco tinnunculus, Strix alco (birds of prey), Sus Scrofa (large body size), Genetta genetta, Herpestes ichneumon, Meles meles, Mustella nivalis, Vulpes vulpes (Carnivores) and all Chiropteras (bats) because all Chiropteras are strictly protected under the Berne Convention.

E. Distributions of Animal Species

Analysis of the distribution of all animal species was not feasible and it proved to be too complex in use of Gap Analysis. Data were limited to distributions of protected terrestrial vertebrate species. A review of terrestrial vertebrate species observed in the park revealed 10 endangered species (E), 45 rare species (R), 15 vulnerable species (V) and 20 species with insufficient evidence or of undetermined taxa (K & I). Species locations based upon direct observations included 9 endangered species, 29 rare species, 8 vulnerable species, 19 K & I species and 12 species of special consideration (S) (Map 2).

F. Other Features of Significance

Information which Dr. Jansen made available contained insufficient linkages between plant species occurrences and distributions. Dr. Catarinho's study is too incomplete to be useful.

The altimetry (Map 3) and hydrology (Map 4) data sets were both digitized according to the military cartographic coordinates on large UNIX systems and provided through CNIG. Each was digitized into 26 files to cover the area of the park. The amount of data was so great that the files could not be merged by computer software available. Data had to be stripped before it could be plotted. Altimetry data was reduced to 100 meter contour lines (Map 3) Hydrology data was

reduced to include only the 3 major rivers, their primary and secondary tributaries and glacial lakes (Map 4).

Soil data was not made available by the *Ministério da Agricultura*. Geology data was also unavailable.

G. Protected Areas

A review of REN and RAN data revealed that the data was not appropriate for inclusion in this study. Both of these types of reserves are in the national legislation for compliance by the *concelhos* (counties). Data were collected from areas within and outside of the Park. The Park has no authority in the enforcement of these reserves and therefore the information was deemed to be inappropriate for this study.

A review of the literature for protected zones under park authority revealed three designations: 1) biological reserve A, 2) biological reserve B and 3) a zone of protection. No written definitions could be found for biological reserve zones A and B but park staff knew of their existence and where they were located. These zones are delineated on only one unpublished map belonging to the park administrator. The zone protected under authority of the park is delimited along the 1000 meter contour line. That delineation was used in this study (ICN 1993) (Figure 8, Map 5).

H. Gap Analysis

Results of Gap Analysis were severely limited due to incompatibility of several data sets. Of the several data sets listed under "Land Use & Vegetation Cover (Figure 7), the only data set which proved useful was road system. Roads were used as an estimation of the distribution of tourism and associated activities. Analysis of "Distribution of Animal Species" (Figure 7) was limited to the distribution of protected terrestrial vertebrate species and a few species of special interest. This analysis proved to be especially useful. Analysis of "High Interest Habitats" (Figure 7) was limited to analysis of altimetry and hydrology. And finally, analysis of "Protected Areas"

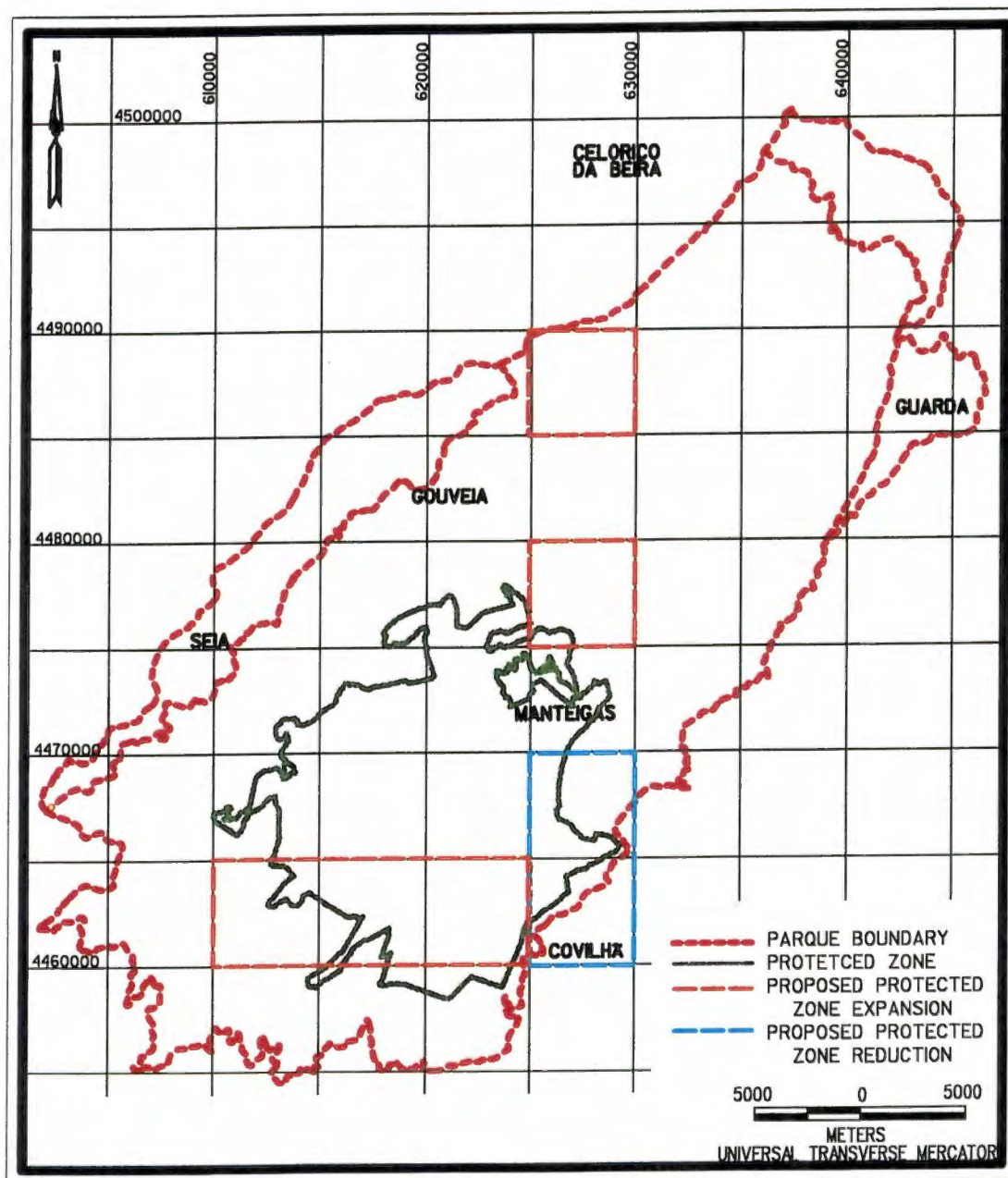


Figure 8. Protected Zone Expansion - Reduction of Parque Natural da Serra da Estrela

(Figure 7) was used to identify the original protected zone and recommended additions and deletions to that zone.

Gap Analysis involved overlaying a 5km x 5km grid over the park. There are a total of 56 grid cells in the park. Gap Analysis revealed the occurrence of protected species in forty-nine of the 56 grid cells. Analysis further revealed 22 grid cells contained five or less species present, 10 grid cells contained six to ten species present, 10 grid cells contained 11 to 15 species present, two grid cells contained 16 to 19 species present and five grid cells contained 20 or more species present (Table 4). Table 5 illustrates the categories of protected terrestrial vertebrate species in each grid cell.

Table 4. Number of Protected Terrestrial Vertebrate Species in 5Km x 5Km Grid Cells in Parque Natural da Serra da Estrela

UTM	600	605	610	615	620	625	630	635	640	645
4500									0	
4495							0	0	2	
4490						1	4	3	4	
4485				1	4	20	6	2	5	0
4480			4	8	3	9	2	4	0	
4475		2	9	12	7	22	11	6		
4470	0	13	11	17	14	11	5	1		
4465	5	19	15	13	9	2	0			
4460	1	13	26	21	23	1				
4455		11	6	10	6	1				
4450			2							

Grid cells containing 20 or more protected terrestrial vertebrate species are outlined.

UTM - Universal Transverse Mercator.

Three areas, A, B and C, stood out as being rich in protected species (Figure 9). These three areas were chosen because they contained 20 or more protected species. The largest and southwestern most area is centered around the point of highest elevation, Torre, which is surrounded by glacial lakes. These areas deserve priority for conservation (Figure 9).

One area, D, contains the nesting area of Ciconia nigra and deserves special attention (Figure 10).

Another area, E, contains so few protected species that protection of the area may not be warranted (Figure 11).

Table 5. Categories of Protected Terrestrial Vertebrate Species Distributions in Parque Natural da Serra da Estrela

UTM Coord.	600	605	610	615	620	625	630	635	640	645
4500									0	
4495							0	0	1-R 1-V	
4490						1-S	1-E 3-S	1-V 2-S	2-E 1-V 1-S	
4485				1-S	1-E 2-R 1-S	5-E 3-R 6-V 6-S	3-R 1-V 2-S	2-S	2-E 1-V 2-S	0
4480			1-E 1-V 2-S	2-E 3-R 3-V	2-V 1-S	1-E 1-R 1-V 1-K 5-S	1-V 1-S	1-E 2-V 1-S	0	
4475		1-E 1-K	2-R 3-V 2-K 2-S	4-R 4-V 1-K 3-S	1-R 3-V 3-S	3-E 4-R 5-V 2-K 8-S	2-E 2-R 3-V 4-S	3-E 2-V 1-S		
4470	0	3-E 3-R 3-V 3-K 1-S	4-R 4-V 1-K 2-S	1-E* 4-R 6-V 2-K 4-S	4-R 5-V 1-K 4-S	2-E* 1-R 2-V 6-S	1-R 2-V 2-S	1-V		
4465	1-E 1-R 3-V	5-E 4-R 5-V 2-K 3-S	1-E* 4-R 4-V 3-K 3-S	1-E* 4-R 4-V 2-K 2-S	1-E** 3-R 3-V 2-S	2-V	0			
4460	1-R	4-R 6-V 3-K	4-E 4-R 8-V 4-K 6-S	5-R 5-V 7-K 4-S	1-E 4-R 3-V 8-K 7-S	1-V				
4455		3-E 1-R 3-V 2-K 2-S	1-R 3-V 1-K 1-S	3-E 1-R 4-V 1-K 1-S	2-R 2-V 2-S	1-V				
4450			1-V 1-S							

E - Endangered, R - Rare, V - Vulnerable, K - Undetermined or Insufficient evidence, S - Special Consideration for Inclusion.
Grid cells containing 20 or more protected terrestrial vertebrate species are outlined.
UTM - Universal Transverse Mercator.

Overlaying species distributions (Map 2) with the protected zone (Map 5) revealed areas richest in protected species occurred just outside the original protected zone (Map 5, Figure 8).

Overlaying road systems (Map 1) with species distributions (Map 2) determined areas where possible conflicts between tourism development and species protection could occur (Figure 11).

Area A is assigned top priority for conservation because of possible conflicts with three nearby villages. Alvoco and Loriga, to the west, and Penhas de Saude, to the east.

Area B is deserving of priority attention because it is near the highly populated and often visited area of Monteigas. Area C is significant because the villages of Folgozinha and Linhares also present potential conflicts between tourism development and biological conservation.

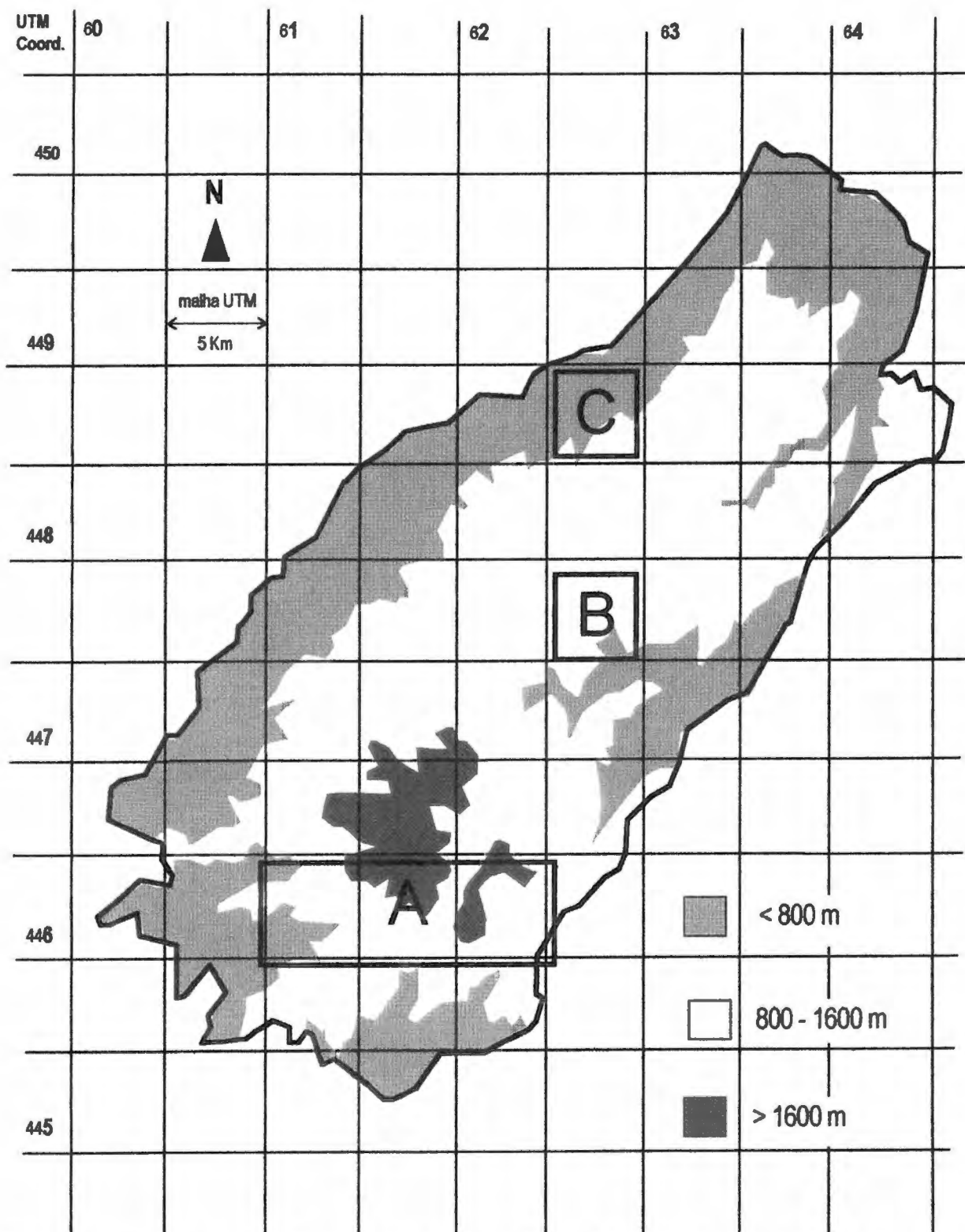


Figure 9. Priority Areas for Conservation in Parque Natural da Serra da Estrela (Table 4).
UTM - Universal Transverse Mercator.

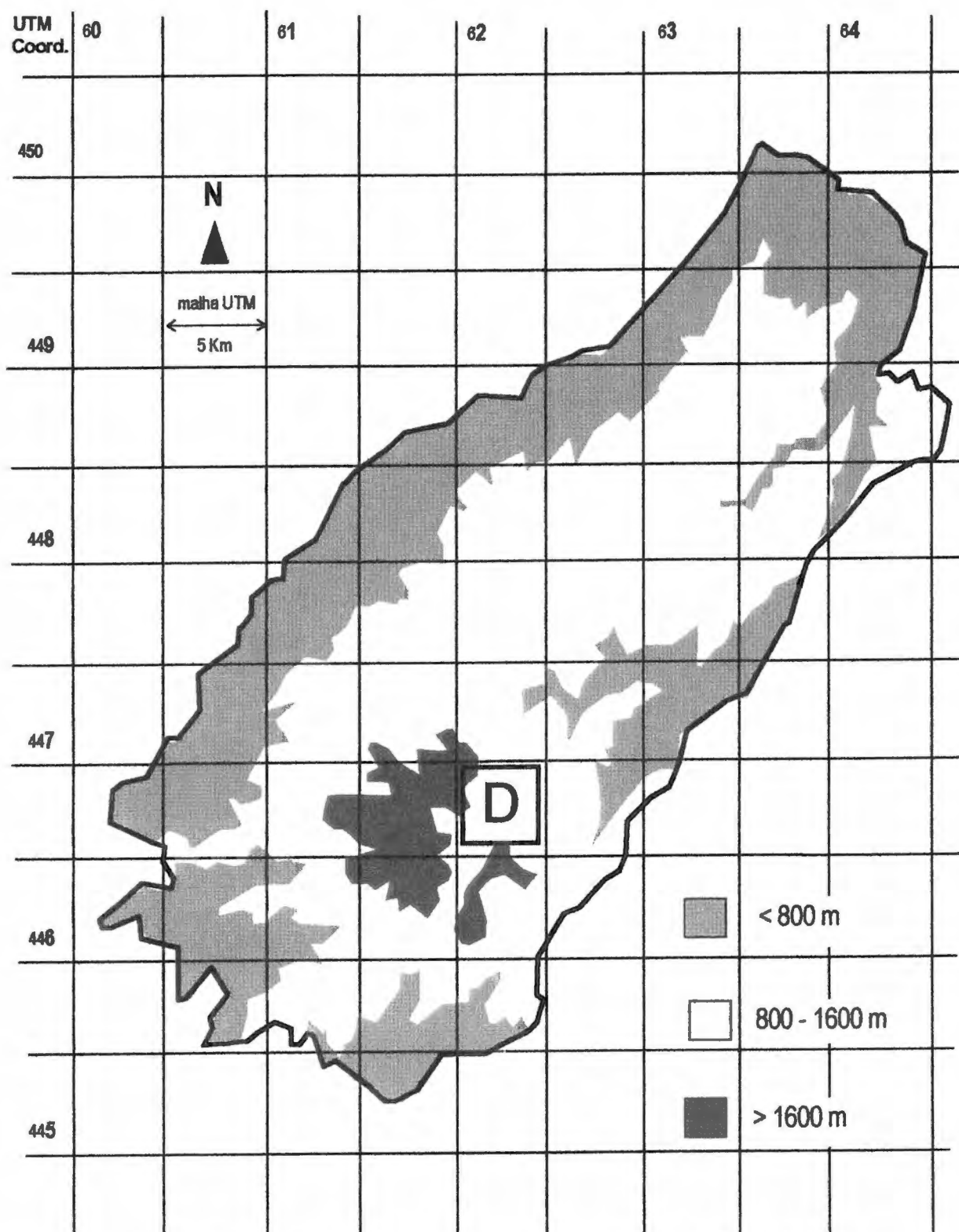


Figure 10. Area D - Nesting Area of *Ciconia nigra* in Parque Natural da Serra da Estrela.
UTM - Universal Transverse Mercator.

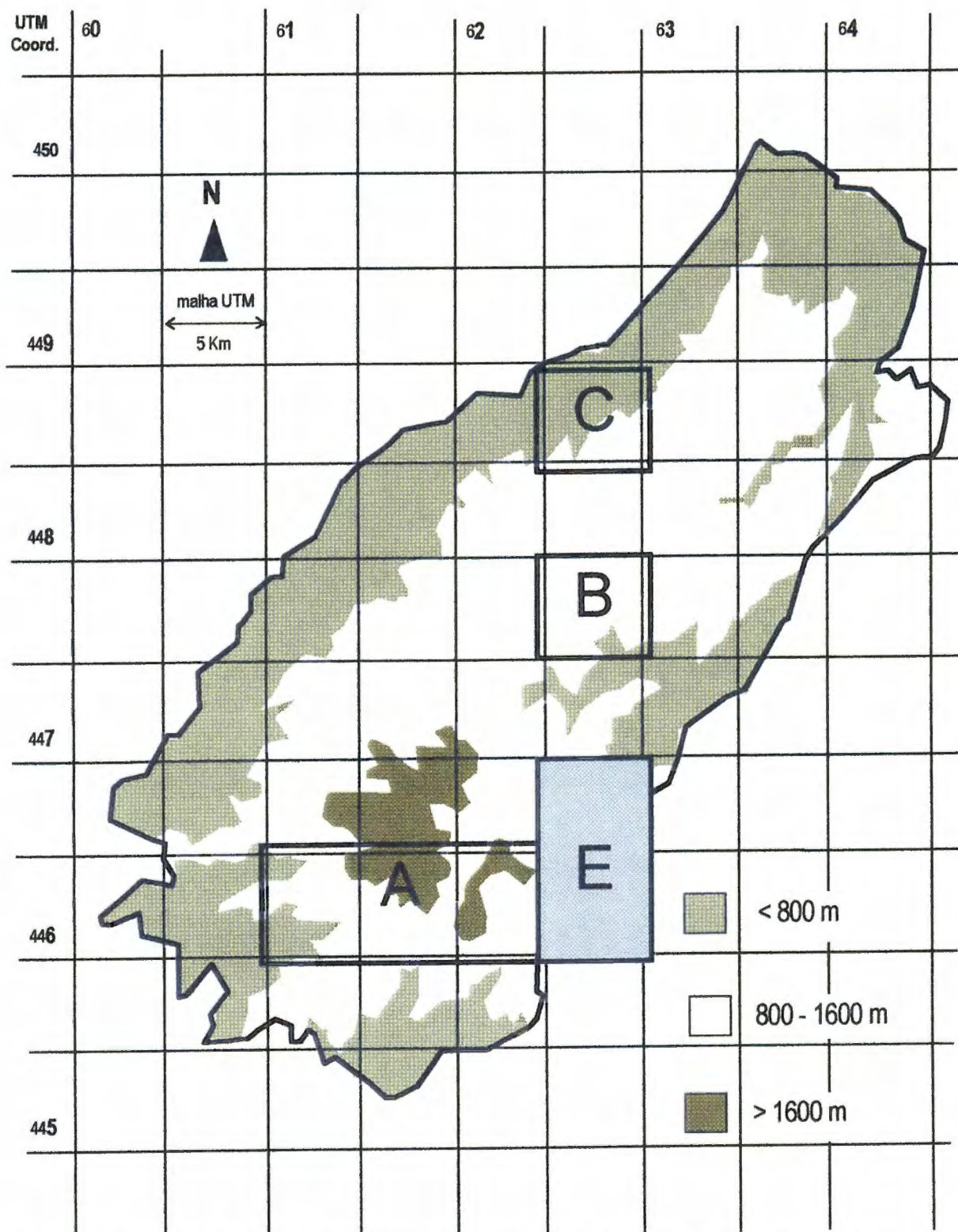


Figure 11. Proposed Expanded Protection Zone with Potential for Conflicts and Area E to be Reduced in Parque Natural da Serra da Estrela.

UTM - Universal Transverse Mercator.

V. DISCUSSION

A. Tourism Inventory

Approximations of tourism sites were limited to paved roads and villages. This limitation of information to paved roads further emphasizes the need to obtain an inventory of tourist activities on non-paved roads and trails. Back country surveys of tourists could be utilized to gain this type of information (Map 1).

B. Land Use and Vegetation Cover

Extensive data was available but not in a form which enables investigators to pull out information at an appropriate scale. It can not be used with the present 76 classifications but could be used at 6 categories with 19 sub-classes. Therefore, it was impossible to overlay this information with species distributions to evaluate habitat-species relationships.

C. Animal Species Distributions

Species distribution analysis utilized only protected species because one objective of the project was to determine if species under protection were actually within the protection zone. The abundance of non threatened species was fairly evenly distributed throughout the park and would have been a hindrance.

Overlaying Map 1 (roads) with Map 2 (species) does not allow one to make any assumptions. Areas A, B and C are less fragmented by paved roads.

Overlaying Map 2 (species) with Map 3 (altimetry) one might infer that the rich areas occur on steep slopes below plateaus in areas A, B, and C. In each case species occur either in the oromediterranean belt or the supramediterranean belt. Chiroptera (bat) distributions appear to be in the lower elevations of the mesomediterranean belt. The most abundant carnivore distributions appear to be in the supramediterranean belt and the mesomediterranean belt.

Overlaying Map 2 (species) with Map 4 (hydrology) does not reveal any apparent factors relating to species distributions. There is an abundance of water throughout the park in the form of rivers, streams and their tributaries. The several glacial lakes situated in the park are all located above the 1000 meter contour line. Area A has several of these lakes located within its boundary.

D. Other Features of Significance

Area D (Figure 10) has a potential for conflict because it is the nesting area for the endangered bird Ciconia nigra. One pair is mating within the park (Pires 1996, Diamantino 1997). These birds and their hatchlings can be greatly impacted if disturbed during their breeding and nesting season.

E. Protected Areas

Torre, in the center of area A, the highest elevation in the country, is a favorite tourist destination. This area on top of the summit has special delimitation for tourism development even though it is totally encapsulated by the protection zone. It has all ready been developed with ski slopes and a small shopping mall for crafts people and vendors of local products. Turistrela is the concessionaire for development at Torre and for the entire protected zone of the park. In the past year they have added two more ski slopes and desire to convert one of the unused buildings at Torre for a hotel. At the present time restroom facilities (one mens room and one ladies room) are inadequate to handle the volume of tourists. It could not be confirmed how effluents are disposed. The park has no surveys on how many people visit this site or the park each year. Torre has the heaviest car and bus traffic of all the areas in the park. The majority of the glacial lakes are just below this tourist area at Torre.

During World War II, Torre was a military facility that housed a weather station, two radar towers and three other large buildings for equipment and personnel. The one building was converted for the shopping mall. In addition, Turistrela constructed two smaller wooden buildings at the foot of the ski slopes for ticket sales, ski rental and rest rooms. These three buildings are

just to the side of the three of the glacial lakes. The last ski slope constructed is partially within the protected zone.

Another destination in area A developed by Turistrela is Penhas de Saude. Penhas de Saude has been developed as a hotel-sports complex. There is a hotel, youth hostel, camping area, tennis courts, swimming, and soccer fields. In addition, many illegal cottages have been built on the granite exposed area. Most of these cottages are constructed of riveted asbestos roofing material for walls and roofs. They are very unsightly. Park officials state that development there is out of control but are unable to stop it at this time (Matos 1998). There are also two small natural lakes in this area. It could not be determined where effluents from all this development are disposed.

F. Gap Analysis

Gap Analysis aided in the determination of areas rich in protected species; where these protected species were within the protection zone of the park and in prioritization of areas for conservation management practices (Table 4, Map 5).

All maps aided in the analysis of conflict between tourism and ecologically sensitive areas and species requiring protection (Figures 10 and 11). Area A has the greatest potential for conflicts between tourism and the need for species protection because of Torre and Penhas de Saude.

The village of Loriga (area A) developed a hiking trail with the help of the park. This trail goes from Torre to the village and around the village. They have converted an old estate into a bed and breakfast. This village worked very hard to develop tourism of a soft-type that would be compatible with the natural area around it.

Alvoco, one other village in area A, has begun a road to Torre. This road was approved by the park to 1000 meters elevation to facilitate the movement of bees and the shepherds with their flocks. Construction continued by the village up to 1200 meters before it was halted by the park.

During that confrontation with the park, the village stated in the newspaper that they wanted a road to Torre to accommodate tourism development.

Area B contains no villages or paved roads and is only partially encapsulated by the protected zone. It is in an area of steep slopes to the north of Manteigas.

Area C also has a potential for conflict between tourism development and biological conservation because of two villages Folgozinha and Linhares. Folgozinha is just to the southwest of the area and Linhares is in the northeast corner of area C. Linhares contains the one castle located in the park and tour buses frequent the area from May through October. A cliff for hang gliding is above the village. There are two sites within the park for hang gliding and are two major areas within the country for this event. There is an international hang gliding competition held for one week each year at each site. Both villages have plans for expanded tourism development.

The most obvious recommendation would be to expand the protected zone to bring all of areas A, B and C under protection (Figure 8. Map 5). Areas A and B are considered to be the heart or core of the park. Likewise, area E would be recommended for reduction because it exhibits so few protectect species.

Some grid cells were eliminated by pre-selection from consideration for conservation due to larger cities, population density and fragmented by roads. However, the grid cell containing Manteigas is unavoidable contained within the protected area due to its location. One grid cell, area D, was chosen for inclusion by pre-selection because it is the breeding area for Ciconia nigra which is endangered and one pair is breeding in the park (Pires 1996). Figure 11 illustrates grid cells chosen for proposed inclusion in expanded protection zone and area E to be eliminated.

VI. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

1) The initial use of the 1000 meter contour line to delineate a zone of species protection was reasonably appropriate. However, three areas richest in protected species fall outside of this zone.

2) Based upon richness of protected animal species, areas most deserving of protection are areas A, B and C (Table 4, Figure 11) totaling 125 Km². For the same reason, area E (Table 4, Figure 11) of approximately 40 Km² may be deleted from protection. The tradeoff off between addition and deletion represents an addition to the protected zone equal to only .0008% of the total area of the park.

3) The use of Gap Analysis is a potentially useful logical framework for integrating and analyzing spatial information. However, the utility of Gap Analysis is heavily dependent upon integration of multiple compatible data sets. In this study the use of secondary data collected by several different investigators with several different objectives caused Gap Analysis to be of limited value.

4) In spite of limitations, this study resulted in several useful recommendations concerning park management.

B. Recommendations

Recommendations to guide tourism planning include the following.

1) The current protected zone should be expanded in the southwest to include all of areas A and B and in the north to include area C (Figure 11, Map 5).

2) Reduce the protection zone by eliminating Area E (Figure 11, Map 5).

3) Place high priority upon protecting these additional areas A, B and C (Figure 11) which are rich in protected species and further deserve protection because of potential conflicts with expanding tourism development.

4) Special attention should be given to area D with regards to special protection for the breeding area of Ciconia nigra (Figure 10).

5) Detailed resource management plans should be developed for areas with potential conflicts between tourism and biological conservation. Resource management plans should include environmental impact assessments (EIA's) as a requirement for all development projects. Mitigation procedures should include the training of park personnel to conduct mitigation with developers, local governments and property owners.

6) Construction of roads and tourism facilities within the present and proposed expanded protection zone should be based on careful planning including environmental impact assessments and risk assessment analysis. Construction without careful planning would only further disturb protected species and cause further habitat degradation around the glacial lakes surrounding Torre.

7) Further field research in species distributions should be undertaken to enhance the understanding of wildlife - habitat relationships especially in the area of the glacial lakes (UTM coordinates 6154465, 6154460, 6204460, 6154470 and 6204470).

8) Tourist interviews should be undertaken to determine where tourists use non-paved roads and trails. This should include activities they undertake and estimates of approximate number of visitors.

9) Park management should be made aware of all studies conducted within the park and should receive progress reports and final results. A standard format should be adopted for all park studies involving collection of spatial data so that results may be integrated into a common geographic information system.

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APPENDICES

APPENDIX A.
TOURISM INVENTORY

LIST OF TOURISM ACTIVITIES

TOURISM INVENTORY *INQUÉRITO DE TURISMO*

ENGLISH

PORTUGUESE

Historic building	<i>Casa histórica</i>
Church	<i>Igreja</i>
Cemetery	<i>Cemitério</i>
Public Building	<i>Prédio publico</i>
Museum	<i>Museu</i>
Park	<i>Parque</i>
Spring, fountain	<i>Fonte</i>
Hot spring	<i>Termas, calda</i>
Pool	<i>Piscina</i>
Botanical area	<i>Area botânica</i>
Scenic area	<i>Panorama</i>
Scenic overlook	<i>Miradouros</i>
Athletic area	<i>Esportes</i>
Fishing area	<i>Locais de pesca</i>
Geologic feature	<i>Geomorfologia</i>
Country store	<i>Contos, pendas</i>
Antique store	<i>Antiquário</i>
Craft shop	<i>Artesanato</i>
Mill	<i>Moinho</i>
Vineyard	<i>Adega de vinho</i>
Historic marker	<i>Monumento</i>
Hotel, motel	<i>Hotel, pensão</i>
Campground	<i>Campismo</i>
Bed and Breakfast	<i>Turismo rural/habitação, agro-turismo</i>
Restaurant	<i>Restaurante</i>
Hospital	<i>Hospital</i>
Police	<i>Polícia</i>
Fire	<i>Bombeiro</i>
Post Office	<i>Correio</i>
Telephone	<i>Telefone</i>

LIST OF TOURISM ACTIVITIES (Continued)

Actividades no Parque Natural da Serra da Estrela

- 8) What do you plan to do on this trip in the Parque Natural Serra da Estrela
Quais as actividades que pensa realizar nesta visita ao Parque Natural da Serra da Estrela?

hike	1	caminhar
fish	2	pescar
camp	3	campismo
swim	4	nadar
hunt	5	cacar
bicycle	6	bicicleta
rock climb/repel	7	escalada/montanhismo
canoe	8	canoagem
hang glide	9	parapente
nature watch	10	observacao da natureza
photography	11	fotografia
bird watch	12	observacao de aves
star gaze	13	astronomia
local market	14	mercado
restaurant/bar/cafe	15	gastronomia/bar/cafe
picnic	16	piqueique
local crafts	17	artesanato
castles	18	castelo
churches	19	igreja
festivals	20	festas
shop	21	compras
snow skiing	22	ski
see snow	23	neve
site see	24	paisagem
special event	25	evento especial
other (specify)	26	outro (especifique)

LIST OF TOURISM ACTIVITIES (Continued)

Lugares no Parque Natural da Serra da Estrela

- 9) What places do you plan to visit on this trip in the Parque Natural da Serra da Estrela?
Quais os lugares que pensa visitar nesta visita na Parque Natural da Serra da Estrela?

- | | |
|----------------------|--------------------------------------|
| 1 Fonte da' Ametade | 19 Lagoa Comprida |
| 2 Torre | 20 Covao da Ponte |
| 3 Vale do Rossim | 21 Manteigas |
| 4 Valhelhas | 22 Penhas da Saude |
| 5 Vale do Zezere | 23 Vale d' Amoreira |
| 6 Penhas Douradas | 24 Vale de Estrela |
| 7 Famalicao da Serra | 25 Vila Soeiro |
| 8 Verdelhos | 26 Folgoso |
| 9 Linhares | 27 Gouveia |
| 10 Mondeguinho | 28 Seia |
| 11 Melo | 29 Alvoco da Serra |
| 12 Loriga | 30 Sabugueiro |
| 13 Unhais da Serra | 31 Prados |
| 14 Videmonte | 32 Cabeça da Velha (Sra do Desterro) |
| 15 Cabeça do Velho | 33 Valezim |
| 16 Vide | 34 Fragaço do Corvo |
| 17 Casal do Rei | 35 Piodão |
| 18 Covão do Boi | 36 outros (quais?) |

APPENDIX B.
LEGEND OF LAND USE AND VEGETATION COVER

LEGEND OF LAND USE AND VEGETATION COVER

LEGENDA DA CARTA DE OCUPACAO DO SOLO DE PORTUGAL CONTINENTAL

1- Areas artificiais

1.1- Espaco Urbano	
1.1.1- Tecido Urbano continuo	UU1
1.1.2- Tecido Urbano descontinuo	UU2
1.1.3- Outros espacos fora do tecido urbano consolidado	UU3
1.2- Infraestruturas e Equipamentos	
1.2.1- Zonas industriais e comerciais	SW1
1.2.2- Vias de comunicacao (Rodovias e Ferrovias)	SW2
1.2.3- Zonas portuarias	SW3
1.2.4- Aeroportos	SW4
1.2.5- Equipamentos para desporto e lazer	SL1
1.2.6- Outras infraestruturas e equipamentos	SW9
1.3- Improdutivos	
1.3.1- Pedreiras, saibreas, minas a cu aberto	JJ1
1.3.2- Lixeiros, descargas industriais e depositos de sucata	JJ2
1.3.3- Estaleiros de construo civil	JJ3
1.3.4- Outras areas degradadas	JJ9
1.4- Espacos verdes artificiais	
1.4.1- Espacos verdes urbanos (florestais)	__+5
1.4.2- Espacos verdes (nao florestais) para as actividades desportivas e	SL2

2- Areas agricolas

2.1- Terras araveis- Culturas anuais	
2.1.1- Segueiro	CC1
2.1.2- Regadio	CC2
2.1.3- Arrozaes	CC3
2.1.4- Outros (estufas, viveiros, etc)	CC9
2.2- Culturas permanentes	
2.2.1- Vinha	VV1
2.2.1/2- Vinha + Pomar	VV2
2.2.1/3- Vinha + Olival	VO1
2.2.2- Pomar	
2.2.2.1- Citrinos	AA1
2.2.2.2- Promoideas	AA2
2.2.2.3- Prunoideas (sem a amendoeira)	AA3
2.2.2.4- Amendeiras	AA4
2.2.2.5- Figueiras	AA5
2.2.2.6- Alfarrobeiras	AA6
2.2.2.7- Outros pomares	AA9
2.2.2.x- Mistos de pomares	Aax
2.2.2.0- Pomar + Cultura anual	AC(1-x)
2.2.2/1- Pomar + Vinha	AV(1-x)
2.2.2/3- Pomar + Olival	AO(1-x)
2.2.3- Olival	
2.2.3/0- Olival + Cultura anual	OO1
2.2.3/1- Olival + Vinha	OC1
2.2.3/2- Olival + Pomar	OA1

Source: Centro Nacional Informatica Geografica data

LEGEND OF LAND USE AND VEGETATION COVER (Continued)

2.2.4- Outras arbustivas	
2.2.4.1- Medronheiro	DD1
2.2.4.2- Outras arbustivas	DD9
2.3- Prados permanentes	
2.3.1- Prados e lameiros	GG1
2.4- Areas agricolas heterogeneas	
2.4.1- Culturais anuais associadas a culturas permanentes	
2.4.1/1- Culturais anuais + Vinha	CV(1-x)
2.4.1/2- Culturais anuais + Pomar	CA(1-2)
2.4.1/3- Culturais anuais + Olival	CO(1-2)
2.4.2- Sistemas culturais e parcelares complexo	CX1
2.4.3- Areas principalmente agricolas com espacos naturais importantes	CI(1-2)
2.5- Territonos agro-florestais	
2.5.1/1-8- Culturais anuais + especie floreal	C+__O
2.5.2/1-8- Especie florestal + culturas anuais	__+C(1-2)

3- Floresta

Codigo para o coberto florestal

- 0 grau de coberto inferior a 10%
- 1 grau de coberto de 10% a 30%
- 2 grau de coberto de 30% a 50%
- 3 grau de coberto superior a 50%
- 4 corte raso ou fogo
- 5 zona verde urbana ou de proteccao
- 6 especie exoptanea

3.1- Folhosas

3.1.1- Sobreiro	BB+
3.1.2- Azinheira	ZZ+
3.1.3- Castanheiro bravo	TT+
3.1.4- Castanheiro manso	NN+
3.1.5- Carvalho	QQ+
3.1.6- Eucalipto	EE+
3.1.7- Outras folhosas	FF+

3.2- Resinosas

3.2.1- Pinheiro bravo	PP+
3.2.2- Pinheiro manso	MM+
3.2.3- Outras resinosas	RR+

3.3- Povoamento florestal misto (Folhosas + Resinosas)

Combinacao das letra indicadas para cade especie (maximo de duas) em que a primeira e a dominante ocupando as duas ate 75% da superficie, seguida da indicacao do grau de coberto (de 0 a 3)

4- Meios semi-naturais

4.1- Ocupacao arbustiva e herbacea

4.1.1- Pastagens naturais pobres	II1
4.1.2- Vegetacao arbustiva baixa- matos	II2
4.1.3- Vegetacao esclerofitica- carrascal	QQ6/FF6
	ZZ6/BB6
4.1.4- Vegetacao arbustiva alta e floresta degradad ou de transicao	I__+O
	J__+O

4.2- Areas decobertas sem ou com pouca vegetacao

4.2.1- Praia, dunes, areas e solos sem cobertura vegetal	JY1
4.2.2- Rocha nua	JY2

4.3- Zonas incendiadas recientemente +4

5.1- Zonas húmidas continentais
5.1.1- Zonas pantanosas interiores e pauls HY1

- | | |
|------------------------------|-----|
| 5.2- Zonas húmidas marítimas | |
| 5.2.1- Sapais | HY2 |
| 5.2.2- Salinas | HY3 |
| 5.2.3- Zonas intertidais | HY4 |

6.1- Areas continentais	
6.1.1- Curso de agua	HH1
6.1.2- Lagoas e albufeiras	HH2

- | | |
|-----------------------------------|-----|
| 6.2- Aguas Marítimas | |
| 6.2.1- Lagunas e cordões litorais | HH3 |
| 6.2.2- Estuários | HH4 |
| 6.2.3- Mar e Oceano | HH5 |

APPENDIX C.
LIST OF SPECIES IN PARQUE NATURAL DA SERRA DA ESTRELA

**Referenced and Confirmed Species
of Parque Natural da Serra da Estrela**

CLASSE	ORDEM/FAMILIA	ESPECIE	NOME VULGAR (ENGLISH)	SP #	PROJ LEVEL	LIVRO VERM	SIT PNSE	CONVEN BERNA	DIRECT HABITAT	STUDY CITED
									AVES	# data pT
Classe Amphibia	Ordem Anura									
17 cite para Portugal	Familia Bufonidae	Bufo bufo		1	P	NT	NT	III/81		G,C #
13 ref para PNSE	Familia Bufonidae	Bufo calamita		2	R	NT	NT	II/81	IV	G,C #
76%	Familia Discoglossidae	Alytes obstetricans		3	SP	NT	NT	II/81	IV/97	G,C #
	Familia Discoglossidae	Discoglossus pictus		4	SP		I	II/89	IV/97	
	Familia Pelobatidae	Pelobates cultripes	(Potential to be in park)	5	SP			II/81	IV/97	
	Familia Hylidae	Hyla arborea		6	R	NT	NT	II/81	IV/97	G,C #
	Familia Ranidae	Rana iberica		7	SP	NT	NT	II/89	IV/97	G,C #
	Familia Ranidae	Rana perezi		8	P	NT	NT	III/81	V/97	G,C #
	Ordem Urodel				R					
	Familia Salamandridae	Chioglossa lusitana		9	R	K	R	II/81	II/97-IV/97	G
	Familia Salamandridae	Pleurodeles waltii		10	I	NT	I	III/81	II,IV	G
	Familia Salamandridae	Salamandra salamandra		11	P	NT	NT	III/81	II-97/IV-97	G,C #
	Familia Salamandridae	Triturus boscai		12	I	NT	I	III/81	IV	G,C #
	Familia Salamandridae	Triturus marmoratus		13	I	NT	I	III/81	IV/97	G,C #
Classe Aves	Ordem Accipitriformes									
300 cite para Portugal		Aquila chrysaetos	golden eagle***not in park***	14	E	E		II/81	I/AV/91	P,J #
123 ref para PNSE		Buteo buteo	buzzard	15	SP	NT		II/81		P,J #
41%		Circus gallicus	short-toed eagle	16	R	K	R		I/AV/91	P,J #
		Hieraaetus fasciatus	Bonelli eagle***not in park***	17	R	R	R	II/81	I/AV/91	P
		Hieraaetus pennatus	booted eagle	18	R	NT	R	II/81	I/AV/91	P,J #
		Accipiter gentilis	goshawk	19	R	I	R	II/81	I/AV/91	P,J #
		Accipiter nisus	sparrowhawk	20	I	I		II/81	I/AV/91	P,J #
		Circus cyaneus	hen harrier	21	S			II/81	I/AV/91	P,J #
		Circus pygargus	Montagu's harrier(in rye fields)	22	V	V		II/81	I/AV/91	P,J #
		Elanus caeruleus	black-winged kite	23	R	R				P
		Aegypius monachus		24	E	E			I/AV/91	
		Gyps fulvus	Griffon vulture *nip-colonizer*	25	V	V		II/81	I/AV/91	P,J #
		Milvus migrans	black kite	26	R	NT	R	II/81	I/AV/91	P,J #
		Milvus milvus		27	R	R		II/81	I/AV/91	J #
		Pernis apivorus		28	K	K			I/AV/91	J #

E - Endangered, R - Rare, V - Vulnerable, K or I - Undetermined or Insufficient Evidence, S - Special Consideration for Inclusion.

Convencao de Berne: AnnexI-Strictly protected flora, AnnexII-Strictly protected fauna, AnnexIII-Fauna protected, AnnexIV-Moyens et methods de chasse.

Directives de Habitats e Aves: AnnexI-Habitats deserving zones of protection, AnnexII-Flora & fauna deserving zones of protection, AnnexIII-Flora & fauna deserving rigorous protection, AnnexIV-Flora & fauna if exploited or harvested need measures of management.

**Referenced and Confirmed Species
of Parque Natural da Serra da Estrela**

CLASSE	ORDEM/FAMILIA	ESPECIE	NOME VULGAR (ENGLISH)	SP #	PROJ LEVEL	LIVRO VERM	SIT PNSE	CONVEN BERNA	DIRECT HABITAT	STUDY CITED
									AVES	# data pT
	Ordem Anseriformes									
		Anas clypeata	mallard blk head,beak,whit ch	29		NT				J #
		Anas platyrhynchos	mallard/reg c green head	30		NT				
	Ordem Apodiformes									
	Familia Apodidae	Apus apus		31	P	NT		III		J,C #
	Familia Apodidae	Apus melba*		32	R	R		II/81		
	Ordem Caprimulgiformes			33						
	Familia Caprimulgidae	Caprimulgus europaeus		34	K	K		II/81	II/AV/91	J #
	Ordem Charadriiformes		(water)							
		Actitis hypoleucos		35	P	NT		III		J #
	Familia Charadriidae	Charadrius dubius		36		NT				
	Familia Charadriidae	Charadrius hiaticula		37	SP	NT		II/81		
	Familia Scolopacidae	Gallinago gallinago		38						
		Himantopus himantopus		39	SP	NT			II/AV/91	
	Familia Laridae	Larus fuscus		40						
	Familia Laridae	Larus ridibundus		41		NT				
		Pluvialis sp.		42						
		Rissa tridactyla		43						
	Familia Scolopacidae	Scolopax rusticola		44	K	K		III		J #
	Familia Scolopacidae	Tringa hypoleucos		45	SP			II/81		
		Vanellus vanellus		46	P	NT		III		J #
	Ordem Ciconiiformes									
	Familia Ardeidae	Ardea cinerea		47	P	NT		III		J #
	Familia Ardeidae	Bubulcus ibis		48	SP	NT		II/81		
	Familia Ciconudae	Ciconia ciconia	stork	49	V	V		II/81	II/AV/91	
	Familia Ciconudae	Ciconia nigra	black stork (1 mating pair)	50	E	E		II/81	II/AV/91	J #
	Ordem Columbiformes									
	Familia Columbidae	Columba livia		51						
	Familia Columbidae	Columba palumbus	pigeon	52		NT		n/a		J #

E - Endangered, R - Rare, V - Vulnerable, K or I - Undetermined or Insufficient Evidence, S - Special Consideration for Inclusion.

Convenção de Berne: Annex I - Strictly protected flora, Annex II - Strictly protected fauna, Annex III - Fauna protected, Annex IV - Means et methods de chasse.

Directives de Habitats e Aves: Annex I - Habitats deserving zones of protection, Annex II - Flora & fauna deserving zones of protection, Annex III - Flora & fauna deserving rigorous protection, Annex IV - Flora & fauna if exploited or harvested need measures of management.

**Referenced and Confirmed Species
of Parque Natural da Serra da Estrela**

CLASSE	ORDEM/FAMILIA	ESPECIE	NOME VULGAR (ENGLISH)	SP #	PROJ LEVEL	LIVRO VERM	SIT PNSE	CONVEN BERNA	DIRECT HABITAT	STUDY CITED
										# data pT
	Ordem Columbiformes									
		Streptopelia turtur	dove	53	V	V		III		J #
	Ordem Coraciiformes									
	Familia Alcedinidae	Alcedo atthis		54	R	NT	R	II/81	I/Av/91	J #
	Familia Coraciidae	Coracias garrulus		55	R	R		II/81	I/Av/91	
	Familia Meropidae	Merops apiaster		56	R	NT	R	II/81		J #
	Familia Upopidae	Upupa epops		57	R	NT	R	II/81		J #
	Ordem Cuculiformes									
	Familia Cuculidae	Clamator galindarius		58	K	K		II/81		J #
		Cuculus canorus		59	P	NT		III		J #
	Ordem Falconiformes									
	Berne - todos II/81	Falco subbuteo	hobby falcon	60	R	K	R	II/81		P,C,J #
		Falco tinnunculus	kestrel falcon	61	S	NT		II/81		P,C,J #
	Ordem Galliformes									
		Alectoris rufa	partridge	62	P	NT		III		P,C,J #
		Coturnix coturnix	quail	63	P	NT		III		
	Ordem Gruiformes									
		Gallinula chloropus		64	P	NT		III		
		Porzana porzana		65						
	Ordem Passeriformes									
		Acanthis cannabina		66	P			III		J #
		Aegithalus caudatus		67	SP	NT		II/III		J #
		Alauda arvensis		68	P	NT		III		J #
		Anthus campestris		69	SP	NT		II	I/Av/91	C,J #
		Anthus pratensis		70	SP	NT		II		J #
		Anthus spinoletta		71	R	R				J #
		Anthus trivialis		72	R	R				J #

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**Referenced and Confirmed Species
of Parque Natural da Serra da Estrela**

CLASSE	ORDEM/FAMILIA	ESPECIE	NOME VULGAR (ENGLISH)	SP #	PROJ LEVEL	LIVRO VERM	SIT PNSE	CONVEN BERNA	DIRECT HABITAT	STUDY CITED
									AVES	# data pT
	Ordem Passeriformes									
	Familia Fringillidae	Carduelis cannabina		73	SP	NT		II/81		J #
	Familia Fringillidae	Carduelis carduelis		74	SP	NT		II/81		J #
	Familia Fringillidae	Carduelis chloris		75	SP	NT		II/81		J #
	Familia Fringillidae	Carduelis spinus		76	SP	NT		II/81		J #
		Certhia brachydactyla		77	SP	NT		II		J #
		Cettia cetti		78	SP	NT		II/III		J #
	Familia Cincidae	Cinclus cinclus		79	V	V		II/81		C,J #
		Cisticola juncidis		80	SP	NT		II/III		
	Familia Fringillidae	Coccothraustes coccothraustes		81	R	NT	R	II/81		
		Corvus corax		82	R	V	R	III		J #
		Corvus corone		83		NT		n/a		J #
		Corvus monedula		84				n/a		
	Familia Corvidae	Cyanopica cyanus		85	SP			II/81		
		Delichon urbica		86	SP	NT		II		J #
	Familia Eberizidae	Emberiza calandra		87	R		R	III		
	Familia Eberizidae	Emberiza cia		88	SP	NT		II/81		C #
	Familia Eberizidae	Emberiza citris		89	SP	NT		II/81		J #
	Familia Eberizidae	Emberiza citrinella		90	SP			II/81		
	Familia Eberizidae	Emberiza hortulana		91	I	I		III	I/Av/91	C #
	Familia Muscicapidae-	Erithacus rubecula		92	SP	NT		II/81		C,J #
	Turdinae	Estida astrild*		93		NT				
		Ficedula hypoleuca		94	R	R				J #
	Familia Fringillidae	Fringilla coelebs/s		95	P	NT		III		J #
	Familia Fringillidae	Fringilla montifringilla		96		NT				
		Galerda sp.		97	R		R(local)			
		Garrulus glandarius		98		NT		n/a		J #
		Hippolais polyglotta		99	SP	NT		II/III		J #

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Directives de Habitats e Aves: AnnexI - Habitats deserving zones of protection, AnnexII - Flora & fauna deserving zones of protection, AnnexIII - Flora & fauna deserving rigorous protection, AnnexIV - Flora & fauna if exploited or harvested need measures of management.

**Referenced and Confirmed Species
of Parque Natural da Serra da Estrela**

CLASSE	ORDEM/FAMILIA	ESPECIE	NOME VULGAR (ENGLISH)	SP #	PROJ LEVEL	LIVRO VERM	SIT PNSE	CONVEN BERNA	DIRECT HABITAT	STUDY CITED
									AVES	# data pT
	Ordem Passeriformes									
	Familia Hirundinidae	Hirundo daurica		100	R	NT	R	II/B1		J #
	Familia Hirundinidae	Hirundo rupestris		101	SP			II/B1		
	Familia Hirundinidae	Hirundo rustica		102	SP	NT		II/B1		J #
	Familia Laniidae	Lanius collurio*		103	V	V		II/B1		
	Familia Laniidae	Lanius excubitor		104	SP	NT		II/B1		C,J #
	Familia Laniidae	Lanius senator		105	R	NT	R	II/B1		J #
	Familia Fringillidae	Loxia curvirostra		106	SP	NT		II/B1		J #
		Lullula arborea		107	SP	NT		III	II/Av/B1	J #
	Familia Muscicapidae-	Luscinia megarhynchos		108	SP	NT		II/B1		J #
	<i>Turdinae</i>	Luscinia svecica		109	SP	NT		II/B1	II/Av/B1	
		Miliaria calandra		110	P	NT		III		
	Familia Muscicapidae-	Monticola saxatilis		111	I	I		II/B1		C,J #
	<i>Turdinae</i>	Monticola solitarius		112	R	NT	R	II/B1		
	Familia Motacillidae	Motacilla alba		113	SP	NT		II/B1		J #
	Familia Motacillidae	Motacilla cinerea		114	SP	NT		II/B1		C,J #
	Familia Motacillidae	Motacilla flava		115	SP	NT		II/B1		J #
	Familia Musciapinae	Muscicapa striata		116	SP	NT		II/B1		J #
	Familia Muscicapidae-	Oenanthe hispanica		117	R	NT	R	II/B1		J #
	<i>Turdinae</i>	Oenanthe oenanthe		118	SP	NT		II/B1		J #
	Familia Oriolidae	Oriolus oriolos		119	SP	NT		II/B1		J #
		Parus ater		120	SP	NT		II		J #
		Parus caeruleus		121	SP	NT		II		J #
		Parus cristatus		122	SP	NT		II		J #
		Parus major		123	SP	NT		II		J #
		Passer domesticus		124		NT		n/a		J #
		Passer montanus		125	P	NT		III		J #
	Familia Ploceidae	Petronia petronia		126	R	NT	R	II/B1		

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Directives de Habitats e Aves: Annex I - Habitats deserving zones of protection, Annex II - Flora & fauna deserving rigorous protection, Annex III - Flora & fauna deserving rigorous protection, Annex IV - Flora & fauna deserving rigorous protection, Annex V - Flora & fauna deserving rigorous protection.

**Referenced and Confirmed Species
of Parque Natural da Serra da Estrela**

CLASSE	ORDEM/FAMILIA	ESPECIE	NOME VULGAR (ENGLISH)	SP #	PROJ LEVEL	LIVRO VERM	SIT PNSE	CONVEN BERNA	DIRECT HABITAT	STUDY CITED
										# data pT
	Ordem Passeriformes									
	Familia Muscicapidae- <i>Turdinae</i>	Phoenicurus obscurus		127		NT				
		Phoenicurus ochrurus		128	SP	NT		II/81		C,J #
	Familia Muscicapidae	Phoenicurus phoenicurus		129	R	R		II/81		
		Phylloscopus bonelli		130	R	NT	R	II/III		J #
		Phylloscopus collybita		131	SP	NT		II/III		J #
		Phylloscopus trochilus		132		NT				J #
		Pica pica		133	R	NT	R	n/a		J #
	Familia Emberizidae	Plectrophenax nivalis		134	SP	NT		II/81		
	Familia Prunellidae	Prunella collaris		135	R	R		II/81		J #
	Familia Prunellidae	Prunella modularis		136	SP	NT		II/81		C,J #
		Ptyonoprogne rupestris		137	SP	NT		II		J #
	Familia Corvidae	Pyrhocorax graculus		138						
	Familia Corvidae	Pyrhocorax pyrrhocorax		139	V	V		II/81		
		Pyrhula pyrrhula		140	R	R		III		J #
	Familia Regulinae	Regulus ignicapillus		141	SP	NT		II/81		J #
		Riparia riparia		142	SP	NT		II		
	Familia Muscicapidae - <i>Turdinae</i>	Saxicola rubetra		143	R	R		II/81		J #
		Saxicola torquata		144	SP	NT		II/81		C,J #
	Familia Fringillidae	Serinus serinus		145	SP	NT		II		J #
	Familia sitidae	Sitta europaea		146	SP	NT		II/81		J #
	Familia Sturnidae	Sturnus unicolor		147	SP	NT		II/81		J #
	Familia Sturnidae	Sturnus vulgaris		148		NT		n/a		
	Familia Sylviinae	Sylvia articapilla		149	SP	NT		II/81		C,J #
	Familia Sylviinae	Sylvia borin		150	SP	NT		II/81		
	Familia Sylviinae	Sylvia cantillans		151	R		R	II/81		
	Familia Sylviinae	Sylvia communis		152	SP	NT		II/81		C,J #
	Familia Sylviinae	Sylvia melanocephala		153	SP	NT		II/81		J #

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Directives de Habitats e Aves: AnnexI-Habitats deserving zones of protection, AnnexII-Flora & fauna deserving zones of protection, AnnexIV-Flora & fauna deserving rigorous protection, AnnexV-Flora & fauna if exploited or harvested need measures of management.

**Referenced and Confirmed Species
of Parque Natural da Serra da Estrela**

CLASSE	ORDEM/FAMILIA	ESPECIE	NOME VULGAR (ENGLISH)	SP #	PROJ LEVEL	LIVRO VERM	SIT PNSE	CONVEN BERNA	DIRECT HABITAT	STUDY CITED
									AVES	# data pT
	Ordem Passeriformes									
	Familia Sylviinae		Sylvia undata	154	SP	NT		II/81	II/Av/91	C,J #
			Tichodroma muraria	156						
	Familia Troglodytidae		Troglodytes troglodytes	157	SP	NT		II/81	II/Av/91	C,J #
	Familia Musciapidae		Turdus iliacus	158	SP	NT		II		J #
	Familia Musciapidae		Turdus merula	159	SP	NT		II/III		C,J #
	Familia Musciapidae		Turdus philomelos	160	SP	NT		II		J #
	Familia Musciapidae		Turdus pilaris	161	R	NT/R p		II		J #
	Familia Musciapidae		Turdus torquatus	162	SP	NT		II/89		J #
	Familia Musciapidae		Turdus viscivorus	163	P	NT		III		J #
	Ordem Piciformes									
			Dendrocopos major	164	SP	NT		II/81		J #
			Dendrocopos minor	165	K	K		II/81		
			Picus viridis	167	SP	NT		II/81		J #
todos - Berne II/81	Ordem Strigiformes									
	owls-NOCTURNALS		Athene noctua	168	SP	NT		II/81	II/Av/91	P
			Asio otus	169	K	K		II/81	II/Av/91	P,J #
			Bubo bubo	170	R	R	R	II/81	II/Av/91	P
			Otus scops	171	R	NT	R	II/81	II/Av/91	P
			Strix aluco	172	S	NT		II/81	II/Av/91	P,J #
			Tyto alba	173	S	NT		II/81	II/Av/91	P
Classe Mamíferos	Ordem Artiodactyla									
	Familia Suidae		Sus scrofa	174	P	NT		II/81		P #
	Ordem Carnivora									
61 cite para Portugal	Familia Canidae		Canis lupus	175	V	V		II/81	II/97-V/97	P
27 ref para PNSE	Familia Felidae		Felis silvestris	176	V	IV(PO)		II/89		P
44%	Familia Viverridae		Genetta genetta	177	S	NT		II/81	V/97	P,C #
	Familia Viverridae		Herpestes ichneumon	178	S	NT		II/81	V/97	P,C #

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Directives de Habitats e Aves: Annex I - Habitats deserving zones of protection, Annex II - Flora & fauna deserving zones of protection, Annex III - Flora & fauna deserving rigorous protection, Annex IV - Flora & fauna if exploited or harvested need measures of management.

**Referenced and Confirmed Species
of Parque Natural da Serra da Estrela**

CLASSE	ORDEM/FAMILIA	ESPECIE	NOME VULGAR (ENGLISH)	SP #	PROJ LEVEL	LIVRO VERM	SIT PNSE	CONVEN BERNA	DIRECT HABITAT	STUDY CITED
									AVES	# data pT
	Familia Mustelidae	Lutra lutra	otter	179	V	KV		II/81	II/97	P.S #
	Familia Mustelidae	Martes foina	beech marten	180	V	NT/V		III/81		P.C #
	Familia Mustelidae	Meles meles	badger	181	S	NT		III/81		P
	Familia Mustelidae	Mustella nivalis	weasle	182	S	NT		III/81		P.C #
	Familia Mustelidae	Mustella putorius	western polecat	183	K	K		III	V/97	P.C #
		Vulpes vulpes	fox	184	S	NT				P.C #
	Ordem Chiroptera									
	Familia Vespertilionidae	Barbastella barbastellus		185	I	I		II	II/97	B
	Familia Vespertilionidae	Eptesicus serotinus		186	S	NT		II		B
	Familia Vespertilionidae	Hypsugo savii		187	K	K		II		B,C #
	Familia Vespertilionidae	Miniopterus schreibersii		188	V	V		II	II/97	B #
	Familia Vespertilionidae	Myotis blythii		189	E	E		II	II/97	B #
	Familia Vespertilionidae	Myotis daubentonii		190	S	NT		II		B #
	Familia Vespertilionidae	Myotis emarginatus		191	E	E		II	II/97	B,C #
	Familia Vespertilionidae	Myotis myotis		192	E	E		II	II/97	B #
	Familia Vespertilionidae	Myotis nattereri		193	E	E		II		B #
		Nyctalus lasiopterus/noctura		194	S					B
		Nyctalus leisleri		195	V	V		II		B
		Plecotus auritus		196	I	I		II		B,C #
		Plecotus austriacus		197	S	NT		II		B #
	Familia Rhinolophidae	Rhinolopus euryale		198	E	E		II	II/97	B #
	Ordem Chiroptera									
	Familia Rhinolophidae	Rhinolopus ferrumequinum		199	E	E		II	II/97	B #
	Familia Rhinolophidae	Rhinolopus hipposideros		200	E	E		II	II/97	B #
		Tadarida teniotis		201	R	R		II		B
	Ordem Microchiroptera									
	Familia Vespertilionidae	Pipistrellus kuhlii		202	S	NT		II	II/81	B #
	Familia Vespertilionidae	Pipistrellus pipistrellus		203	S	NT		II/81/II/81		B,C #

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**Referenced and Confirmed Species
of Parque Natural da Serra da Estrela**

CLASSE	ORDEM/FAMILIA	ESPECIE	NOME VULGAR (ENGLISH)	SP #	PROJ LEVEL	LIVRO VERM	SIT PNSE	CONVEN BERNA	DIRECT HABITAT	STUDY CITED
									AVES	# data pT
	Ordem Insectivora									
		Crocodyra russula		204	P	NT		III		C #
	Familia Erinaceidae	Erinaceus europaeus		205	SP	NT		II/81-III/81		
	Familia Talpidae	Galemys pyrenaicus		206	V	V		II/81	II/97-IV/97	
		Neomys anomalus		207	R	NT/R		III		C #
	Familia Soricidae	Sorex granarius		208	P	NT		III/81		C #
	Familia Soricidae	Sorex minutus		209	K	K		III/81		C #
		Talpa occidentalis		210		NT		none		C #
	Ordem Duplicitentata									
	Familia Leopardidae	Lepus capensis	hare***open fields***	211	V	NT/V(PO)		III/81		P,C #
	Ordem Lagomorpha			212						
		Oryctolagus cuniculus	rabbit	213		NT		none		P,C #
	Ordem Rodentia									
		Apodemus sylvaticus	rodents	214		NT		none		C #
		Arvicola sapidus		215		NT		none		C #
	Familia Gliridae	Elyomys quercinus	rat	216	P	NT		III	na/97	C #
	Familia Microtidae	Microtus agrestis		217		NT		none		C #
	Familia Microtidae	Microtus lusitanicus		218		NT		none		
	Familia Microtidae	Microtus Pitymys lusitanicus		219						C #
		Mus musculus		220		NT		none		
		Mus spretus		221		NT		none		
	Ordem Rodentia									
		Rattus norvegicus		222						
		Rattus rattus		223		NT				
Classe Reptilia	Ordem Ophidia									
26 cite para Portugal	Familia Colubridae	Coluber hippocrepis	snake	224	R	NT	R	II/81	IV/97	G
18 ref para PNSE	Familia Colubridae	Coronella austriaca		225	I	NT	I	II/81	IV/97	G,C #
96%	Familia Colubridae	Coronella girondica		226	I	NT	I	II/81		G,C #

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Directives de Habitats e Aves: AnnexI-Habitats deserving zones of protection, AnnexII-Flora & fauna deserving zones of protection, AnnexIII-Flora & fauna deserving rigorous protection, AnnexIV-Flora & fauna if exploited or harvested need measures of management.

**Referenced and Confirmed Species
of Parque Natural da Serra da Estrela**

CLASSE	ORDEM/FAMILIA	ESPECIE	NOME VULGAR (ENGLISH)	SP #	PROJ LEVEL	LIVRO VERM	SIT PNSE	CONVEN BERNA	DIRECT HABITAT	STUDY CITED
										# data pT
	Ordem Ophidia									
	Familia Colubridae	Elaphe scalaris		227	R	NT	R	III/81		G,C #
		Malpolon monspessulanus		228	I	NT	I	III/81		G,C #
	Familia Colubridae	Natrix maura		229	P	NT	NT	III/81		G,C #
	Familia Colubridae	Natrix natrix		230	I	NT	I	III/81		G,C #
	Familia Viperidae	Vipera latastei		231	I	I	I	III/81		G,C #
	Ordem Sauria									
	Familia Amphisbaenidae	Blanus cinereus		232	P	NT		III/81		G
	Familia Anguidae	Anguis fragilis		233	R	NT	R	III/81		G,C #
	Familia Gekkonidae	Tarentola mauritanica		234	P	NT		III/81		G
	Familia Lacertidae	Lacerta lepida		235	SP	NT	NT	III/81		G,C #
	Familia Lacertidae	Lacerta monticola	***found in Portugal only***	236	R	R	NT	III/89	II/97/IV	G,C #
	Familia Lacertidae	Lacerta schreiberi		237	SP	NT	NT	III/89	II/97/IV	G,C #
	Familia Lacertidae	Podarcis bocagei		238	P	NT	NT	III/81		G,C #
	Familia Lacertidae	Podarcis hispanica		239	P	NT	NT	III/81		G,C #
		Psammodromus algirus		240	P	NT	NT	III/81		G,C #
		Psammodromus hispanicus		241	P	NT		III/81		G
	Familia Scincidae	Chalcides bedriagai		242	SP	NT		III/89		G,C #
	Familia Scincidae	Chalcides chalcides		243	R	NT	R	III/81		G,C #
Unknown	Unknown	Acanthodactylus erythrus	sardanica	244						G
TOTAL										
404 cit para Portugal										
181 ref para Park										
45%										

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VITA

VITA

KayAnn Vance was born and raised in Kokomo, Indiana. After completing high school Kay entered Indiana University where she was a voice major at the renowned School of Music. She trained as a stage performer in opera and the classics and sang jazz for fun. There Kay married then moved to New Jersey where her two sons were born. In 1975 her family returned to their roots in the mid-west and settled down to life on the farm. Kay quickly realized that the same land use issues she had experienced in urban New Jersey were threatening family farms in the mid-west. Kay switched career paths and entered the university again. This time, Purdue University where she received a B.S. degree in Natural Resources and Environmental Sciences with a major in agronomy and land use. While at Purdue University, Kay worked in the Agronomy Department on the soil teaching team and later became a full-time staff person at the USDA International Soil Erosion Laboratory.

In 1980 Kay and her sons moved to east Tennessee. In 1985 she helped found the Knoxville Habitat for Humanity project and became Habitat's first director. Kay has built houses in Peru and Haiti with Habitat as well as other cities in the U.S.

In 1990 Kay returned to the university once again to pursue graduate work at The University of Tennessee. Kay has dedicated her work over the past twenty-five years to rural development and land use issues. The last five years her work has focused on tourism development in rural areas around national parks. Kay was a Ronald W. McNair Post Baccalaureate Fellow with academic achievement in statistics in 1990. In 1991 and again in 1995 she received the W. K. McClure Fund for the Study of World Affairs Scholarship to study rural development in southern Spain and Portugal. Most recently Kay was a Fulbright Scholar in Ecology to Portugal where she conducted her research for her thesis. Her future plans include time to spend with her 87 year old mother and two sons; work and teach in environmental education programs and to continue to work internationally in rural development and national park issues.