Using GIS for wildlife monitoring at the Alqueva Dam

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Large dams affect enormously the local ecology (McCully 1998). The Alqueva dam, which has recently being built in Southern of Portugal, will flood an area of 25,000ha: habitat loss and fragmentation will displace many wildlife species, while others will be attracted by the new habitats. Given the complexity of biological data, the size of the affected area, and the need to analyse temporal data, GIS turned out to be the ideal working tool. At the UMC we have built a GIS that is being fed with data from 14 projects aimed at monitoring different biological groups (small mammals, otters, birds of prey, steppe birds, passerines, butterflies, dragonflies, beetles, fish) over an area of 176,000ha. The flooding of the area is expected for 2002, the species monitoring programme started in 1999.

The data sets used to build the GIS were grouped in two types of data:

- Geographic (vector and raster formats)
- Alphanumeric data (a complete description of species' sightings)

What we did
We used a RDBMS to develop and manage a relational database that included all biological data. Each field observation (the sighted species together with a series of additional information: species identification, date, sex, number of individuals, etc) in the database has a dynamic link to its discrete spatial location in the graphic environment. Species may be grouped by ecological attributes or systematic closeness. Not all species need to be characterised by the same amount of information, therefore species tables may display a different set of fields. Each species is identified by a varcode that prevents field workers from doing errors in data entry (e.g. *tete* for *Tetrax tetrax*).

Why did the use of GIS made a difference?
The GIS built was vital in three different stages: firstly, by stratifying and directing field work (therefore saving time and money); secondly, by providing field workers with maps displaying surveying transects and data that was being assembled; thirdly, by integrating and analysing all data collected, displaying results on a spatial and easily to understand way (see Fig. 1).

Field work facilitation:

- Analysis and supervised classification of a LandSat 5 TM[1] satellite image (July 1997) with a spatial resolution of 30m. By closely assisting image classification with information being collected during field work, we succeeded identifying land use types at a fine scale
- Identification of suitable habitats for a given species/group of species
- Discrete locations of species occurrence
- Display of transects, and of other features of field surveys locations
- Providing field workers with tailor made maps to facilitate their own specific work

[1] Thanks are due to "**Rede Demeter**" for the use of the satelite image.

Outputs:

- Quick queries about species/groups of species distribution ranges
- List of species that may be found on a given grid square
- Biological information on the species that occur in a given grid square
- Data discrimination per season (which allows migrating and nesting birds not to be pulled together in some crucial analysis, for instance)
- Integration of species data with environmental data, extracting from a DTM explanatory variables (slope, hill shade, etc) for species occurrence

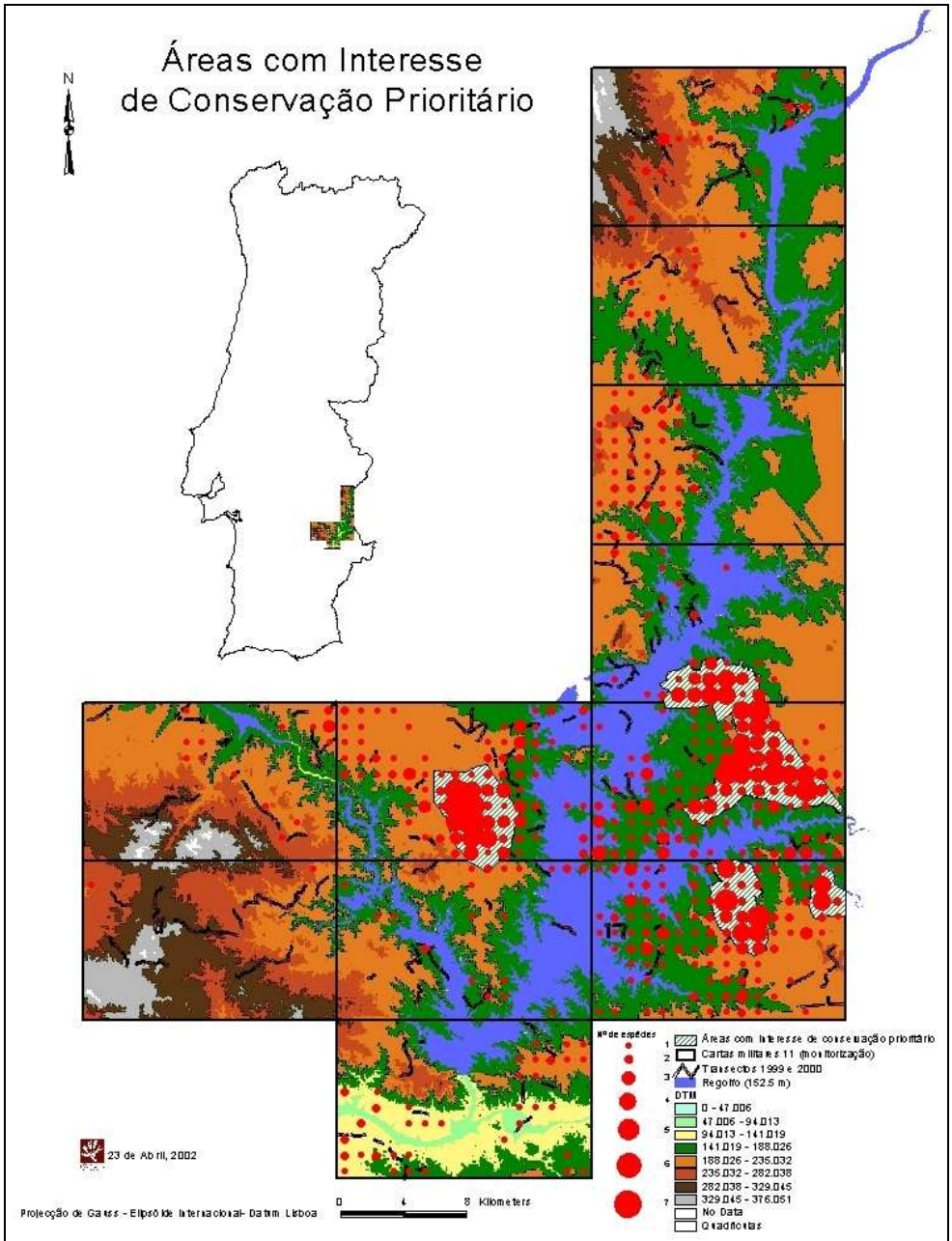

Figure 1 – Area selection for steppe birds conservation (colours prioritise conservation)

To illustrate the outputs, we chose the steppe birds as an example. These are rare species at high risk of being displaced by the foretold land use change. Figure 1 displays a classification of the study area bearing in mind its suitability to steppe birds; from there it is possible to proceed with a prioritisation of areas for conservation of this endangered group of birds. By overlaying information on the actual location of steppe birds (the database stores 5131 sightings at present), it may be possible to take measures to prevent some populations from extinction; also it is possible to stratify additional field work by establishing survey transects in areas of highest risk. GIS proved, thus, an essential tool in nature conservation and monitoring. (http://www.cea.uevora.pt/umc).

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McCully P. 1998. *Silenced Rivers: The Ecology and Politics of Large Dams*. Orient Longman, Hyderabad