A web application to represent spatial distribution of habitats (Annex 1, Directive 92/43/EEC)

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Abstract
A web application (www.ortobotanico.univpm.it/habitat) is presented that is easy to use for a wide audience, and which allows graphics processing of data in the standard form of the Natura 2000 sites, available in the database of the Ministry for the Environment, Land Protection and the Sea. This application allows mapping of the distribution of habitats of the Natura 2000 network in Italy, and their description using statistical centrographic analysis that highlights the centre and anisotropy of the distribution. This achieved according to the provisions of the recent Italian manual of habitat interpretation following Directive 92/43/EEC.

Keywords: Web application, Natura 2000, habitat distribution, Google Maps, centrographic analysis

Riassunto
Un'applicazione web per la rappresentazione spaziale degli habitat (Allegato I Direttiva 92/43/CEE).
Viene presentata un'applicazione web (www.ortobotanico.univpm.it/habitat) di facile utilizzo per una vasta utenza, che permette l'elaborazione grafica dei dati del formulario standard dei siti Natura 2000 disponibili presso la Banca Dati del Ministero dell'Ambiente e della Tutela del Territorio e del Mare. Tale applicazione consente di cartografare la distribuzione degli habitat della Rete Natura 2000 in Italia, di descriverla tramite analisi statistiche centrografiche che mettono in evidenza il centro e l'anisotropia della distribuzione e di adeguarla in base a quanto previsto dal recente manuale italiano di interpretazione degli habitat della Direttiva 92/43/CEE.

Parole chiave: Web application, Natura 2000, distribuzione habitat, Google Maps, analisi centrografiche

Introduction

The web is now used as a platform for the creation of web applications. In particular, the innovation of Web 2.0 is in the creative integration (with mashups most frequently used) of application program interfaces (APIs) for different applications. This allows the generation of innovative and original services (Romganoli *et al*., 2007).

In this study, we present a mashup (www. ortobotanico.univpm.it/habitat) that was set up using the Natura 2000 database on the standard formulary of the SCI (Sites of Community Interest) and SPA (Special Protection Areas) (DB cntryit.mdb ftp://ftp. scn.minambiente.it/Cartografie/Natura2000/, Ministry for the Environment, Land Protection and the Sea). This has been correctly developed and integrated with the API of GoogleMaps (http://code.google.com/ apis/maps/). This is a web application that allows monitoring of the distribution of habitats (Annex I, Directive 92/43/EEC) of the Italian SIC, visualization of some statistical centrographic analyses, such as the distribution centre (Unwin, 1981) and the ellipse of the standard deviation (Ciotoli & Finoia, 2005), and modification of the distribution of the habitats according to the recent Italian manual of habitat interpretation (Biondi & Blasi, 2009).

Materials and methods

In the GIS environment (ArcGIS ® 9.0 software), the information contained in the Natura 2000 database (MATTM) was spatially related to the Italian SCI (ftp://ftp.scn.minambiente.it/Cartografie/Natura2000/ sic_ita_32.shp), and then the distribution maps of the habitats were constructed (Annex I, Habitats Directive 92/43/EEC). These were set up through the points corresponding to the locations of the habitat in Italy, with reference to SCI centroid where the habitat is seen (Biondi et al, 2009). The size of the points is proportional to the area covered by the habitat in the SIC, estimated in hectares (Fig. 1).

The distributions have been analyzed and synthetically represented on a small scale using the methods of centrographic geostatistics (methods based on calculation of the distances between the points) of the distribution centre or centre of gravity (mean centre tool of ArcGIS) and the ellipse of the standard deviation (directional distribution tool of ArcGIS), both calculated on a weighted basis according to the area of habitat present in each SCI.

The distribution centre (Unwin, 1981) synthetically expresses the centre of gravity, or the central tendency of the habitat, in the Natura 2000 network in Italy.
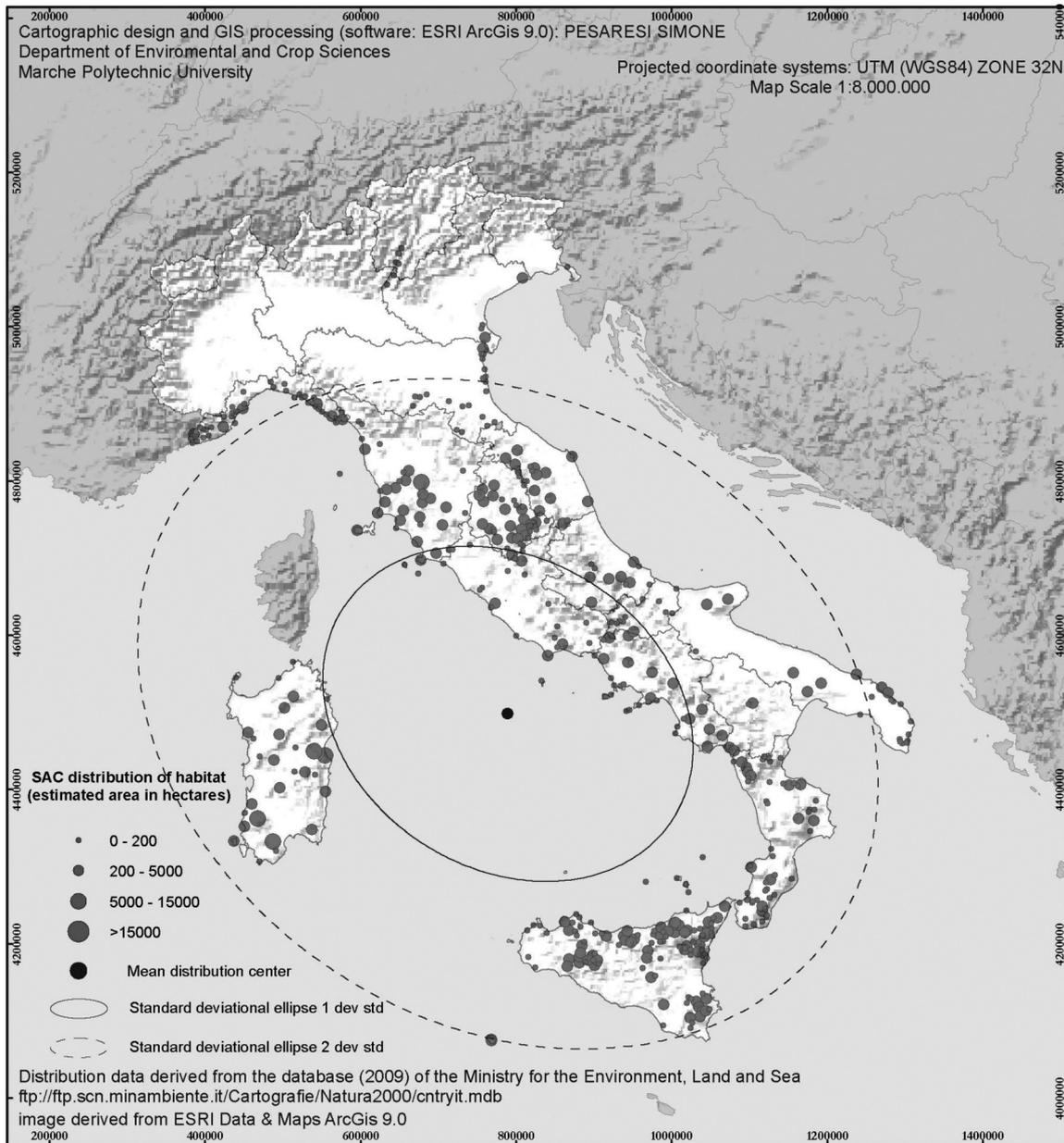
Fig. 1- Distribution of habitat 9340 in Italy (see text for details).

The ellipse of the standard deviation measures the standard deviation of each point with respect to the mean centre of distribution, along both the X axis and Y axis, defining ellipses that highlight the anisotropy of the distribution and global orientation of the points (Pebble & Finoia, 2005).

The geographical and alphanumeric information calculated in the GIS environment were processed through Visual Basic ® for Applications (VBA), ESRI ® ArcObjects ™ , SQL, and ADO Microsoft ® (Zeiler, 2002; Burke, 2003), and structured in the standard eXtensible Markup Language (XML) form.

The starting technology used to create the Web application is Asynchronous Javascript and XML (AJAX). The XML data in the Web application/site have indeed been analysed and processed, and are presented on the maps using javascript and the functionality of the API of GoogleMaps (Brown, 2006).

Results

According to the habitat and the database of the selected ministry, the web application/site displays the distribution of habitat and the results of the

centrographic geostatistical analysis on the Google maps.

Each geometric cartographic object (points and lines) displayed on the Google maps is searchable with a mouse click on the map, whereby the information appears (infowindows of Google maps) that is related to the subject question.

Where a habitat distribution point is queried, the details provided include the name of the SCI, the presence as percentage and area (ha) of the chosen habitat, and the link to the Natura 2000 formulary of the site (SCI). Clicking on the habitat distribution centre provides the metric coordinates of the centre itself, while clicking on standard deviation ellipses provides the length of the major and minor semi-axes, and the angle of rotation of the ellipse itself.

Moreover, following the selection of a habitat, the webpage activates a link that provides access to the corresponding habitat in the Italian Manual of Habitat Interpretation. All of the distribution maps can be downloaded in pdf format.

Conclusions

The application submitted is an original example in the environmental field of integration and use of information technology, in synchrony with the philosophy of Web 2.0 (Romagnoli *et al*. 2007). It is indeed a web application/ site that is easy to use for a wide audience. Furthermore, without any special technical knowledge of the GIS or WebGIS software, the user can:
- visualize the distribution of the habitats in the Natura 2000 Network in Italy, geostatistically described by the centrographic analyses;
- interpret and validate the distribution of habitats with reference to the Italian Manual of Habitat Interpretation;
- find the NATURA 2000 formulary.

The quality and consistency of the present data in the formulary that are listed in the database of the Ministry comprise the engine of the web. Therefore, until the Natura 2000 formulary has been fully updated as indicated in the Italian Manual of Habitat Interpretation (Biondi & Blasi, 2009), the distribution maps will not be completely reliable, because the data are not necessarily homogeneous. Indeed, the application represents a valid tool for adjustments to the distribution of habitats in Italy that will be gradually updated, following the periodic monitoring that is foreseen for them, and therefore the application represents the updated situation for the different habitats over time.

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