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LANDLAB PROJECT AND ARCHAEOLOGY ON-LINE. WEB-BASED SYSTEMS FOR THE STUDY OF SETTLEMENT PATTERNS AND EXCAVATION DATA IN CLASSICAL ARCHAEOLOGY

1. Introduction

This paper presents the results of a research project, LandLab Project, promoted by the University of Salento and finalized at the reconstruction of ancient landscapes (http://landlab.unile.it/) (D'Andria, Semeraro 2006). The project was co-financed by the European Union under the aegis of the National Operational Programme 2000-2006 entitled "Scientific research, technological development, higher education"; the participants include the University of Salento, Lecce (Department of Cultural Heritage, Department of Innovation Engineering, SIBA-University Library Services) in collaboration with the CNR-IBAM (Institute of Archaeological and Monumental Heritage of the Italian National Research Council), the NRC (Canadian National Research Centre) and the "Antonino Salinas" Regional Archaeological Museum in Palermo, under the scientific leadership of Prof. Francesco D'Andria.

The LandLab is designed to improve the methods and the technologies available in the field of Information and Communication Technology for data dissemination and multimedia communication in the reconstruction of ancient landscapes and cultural systems of two sample regions of southern Italy: Puglia and Sicily. While the project was in its preparation phase, various levels of cultural heritage users (i.e. target groups) were identified, for whom a differentiated set of products would be required. Broadly, a distinction was made between high level users (researchers and university students), users with a medium-to-high level of education (associated with cultural tourism) and school users (children and high school students).

For the highest level of users, there are applications that use the Internet for presenting the results of the scientific research. As part of the project, two web applications have been implemented by the Laboratory of Archaeological Computing of the Department of Cultural Heritage (http://lia.unile.it/): the WebGIS of the pre-Roman settlements of the Salento and WODOS, the on-line version of the ODOS excavation data management system. Both of the applications have their origins in the earlier off-line versions, in which GIS systems, designed to resolve problems specific to research, had been implemented. The technical aspects of both the on-line applications are shown in Fig. 1.

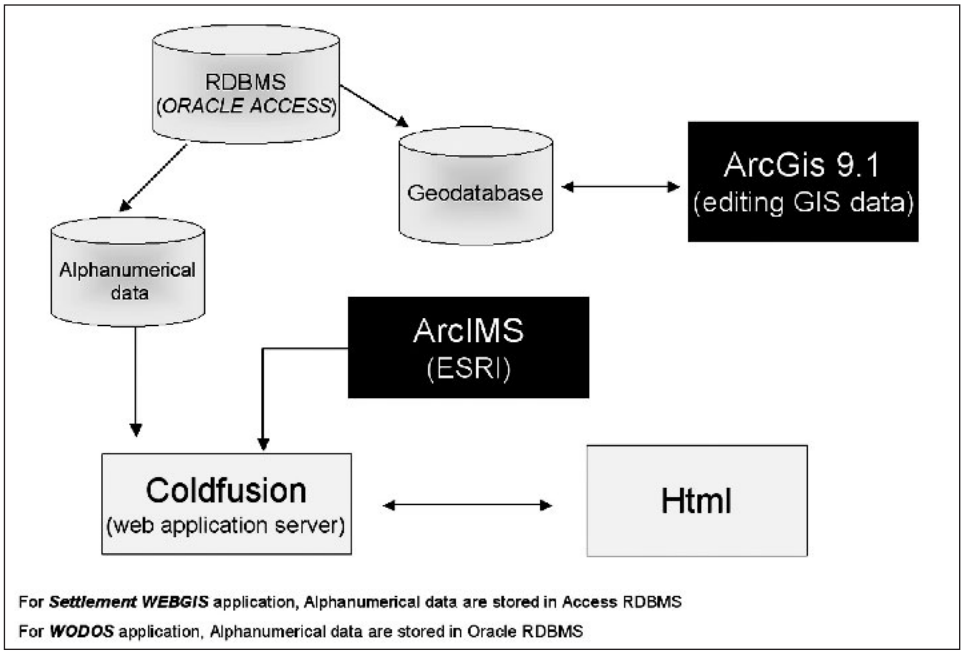

Fig. 1 – Software used for WebGIS.

2. Settlement's WebGIS

The starting point of the settlements' WebGIS is represented by the experience gained from 1995 onwards in the School of Specialization in Archaeology at the University of Salento. The systematic census of the evidence of settlements, as recorded in the literature, was undertaken, providing the basis for the implementation of a GIS application aimed to support the study of settlement dynamics in the indigenous societies of southern Italy (Semeraro 2002; D'Andria, Semeraro 2003).

The interest generated by this work led to the preparation of a traditional programme of publications that subsequently became the on-line publication project – the WebGIS – implemented thanks to the LandLab. The settlements' WebGIS collects the published data and the archaeological evidence for all the settlements, in the Salento region, over a period that starts with the pre-Roman phase.

The data gathered in the on-line version are more varied than before: together with complex settlements, also isolated finds are recorded. Moreover the database include the ancient literary sources. The database records of the settlements are characterized by a highly formalized structure. The organization

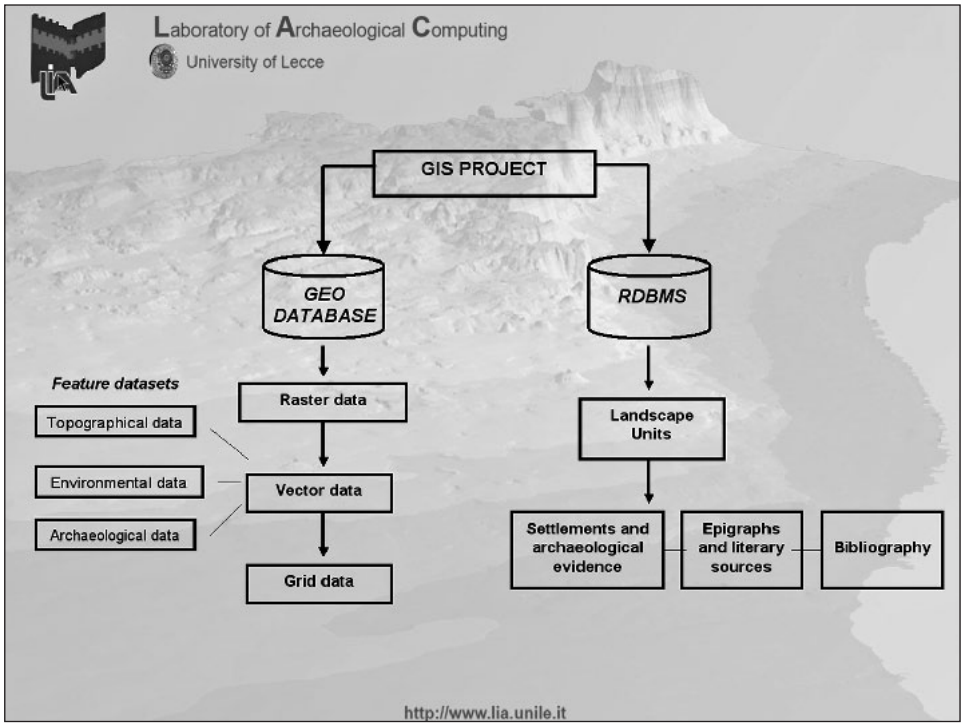

Fig. 2 – Settlement's WebGIS: the data organization.

of the data is designed with a view to the reconstruction of ancient landscapes by recognising the dynamics of settlement and the ways in which the territory was exploited by the different ethnic and cultural groups that occupied the region between the 9th and the 3rd centuries BC.

Two databases, cartographic and alphanumerical (Fig. 2), are managed by the WebGIS application, thanks to a web interface which allows the contextual consultation of data (Fig. 3). Both cartographic and alphanumerical data are divided into two categories: 1) for the territory; 2) for sites.

The territory archive shows homogenous geo-territorial units identified at the beginning by their geo-morphological, pedological and climatic character (Tav. VIIa). The objective is to classify from the point of view of resources (the earth's fertility, water resources, etc.) the territory into which the settlements fall. The environmental and altimetric characteristics are described in the various themes of the GIS, together with the archaeological themes.

The site file (Fig. 4) is organized into various sectors which describe the different aspects of the settlement – dimensions, functional areas (residential,

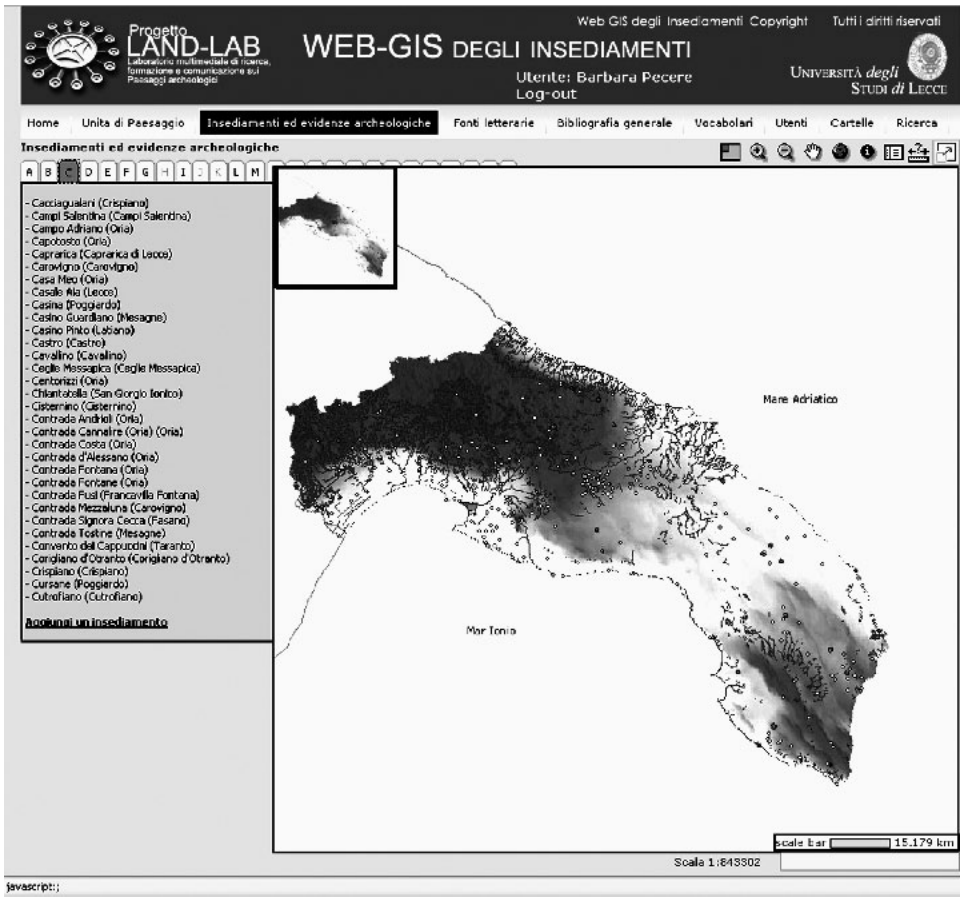

Fig. 3 – On-line GIS. Cartographical and alphanumerical contextual interface applications.

public, craft, cult, necropolis) – in relation to the various chronological phases. All the data are similarly recorded in standardized form, so that each element can form the basis of a theme within the GIS. The different alphanumerical entities are entirely managed by the application, which includes insert, cancel, modify and consult functions.

The cartographical data (Fig. 2) are organized into three different archives (raster, vector and grid). The vector data included in the geo-database are organized into three feature datasets: Topographical Data (local administrative districts, Provinces, etc.), Archaeological Data (Greek Sites, Indigenous Sites, etc.), Environmental Data (Hydrography, Morphology, Landscape Units, etc.), which hold the feature classes.

Fig. 4 – Settlement's WebGIS: the site description file.

The application enables the user to search the cartography, extrapolating the information contained in the alphanumerical data archive at the same time. It is also possible to consult the territorial data from the site records and the Landscape Units.

Another consultation aid of the WebGIS is the management by the application of the work folders. The user can construct personalized work folders (which can be exported and shared with other users) containing references to specific application content (i.e. links to records for sites, settlements, etc.) and even his/her own comments. For the graphical and photographical documentation, the "dynamic zoom" makes it possible to visualize high resolution images (Fig. 5).

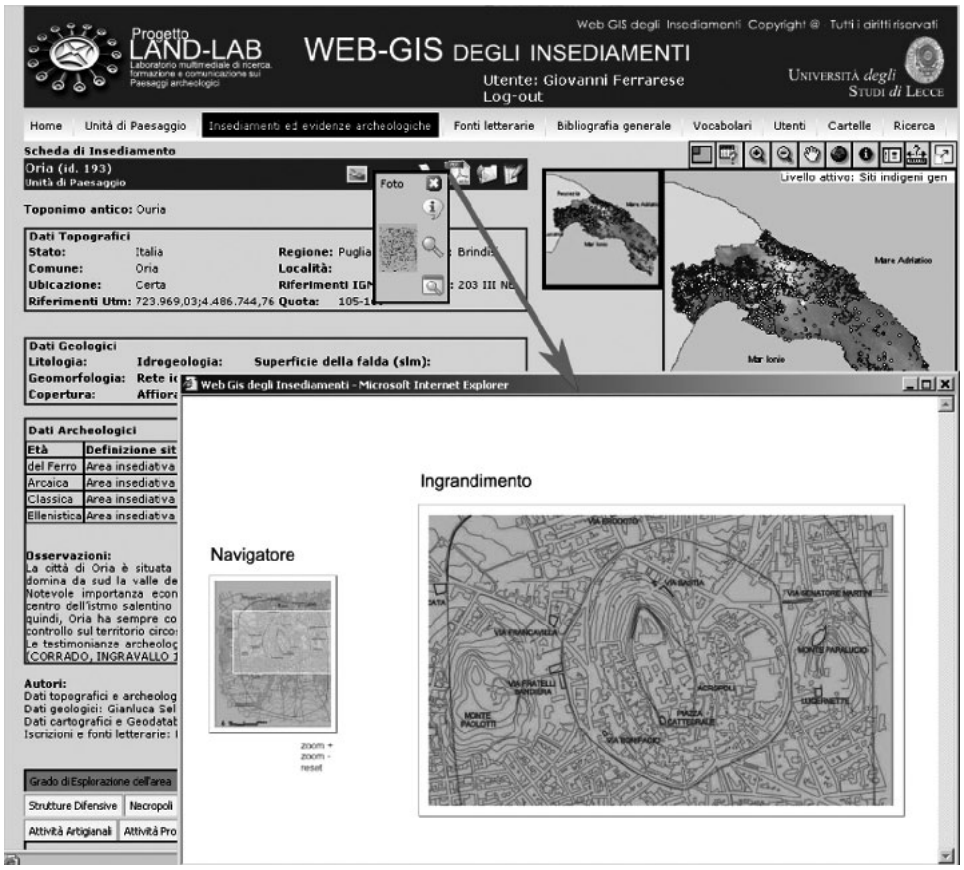

Fig. 5 – Settlement's WebGIS: dynamic zoom.

The search and advanced search functions, covering bibliographical and literary sources allow for a broad use of the data held in the database. There are two ways of searching the database, for both the sites and the literary and epigraphic sources: a free search (Fig. 6), which acts on the descriptive fields and an advanced function, associated with the codified fields. In the later case the user "drills down" through a hierarchical tree structure of research terms.

Within the descriptive fields the bibliographical references are shown in abbreviated form. The user can visualize them in their complete form because the application recognizes the abbreviation and automatically generates a link to the general Bibliography archive.

For the epigraphs and the literary sources in Greek the information is memorized in UNICODE format and visualized using a font containing the

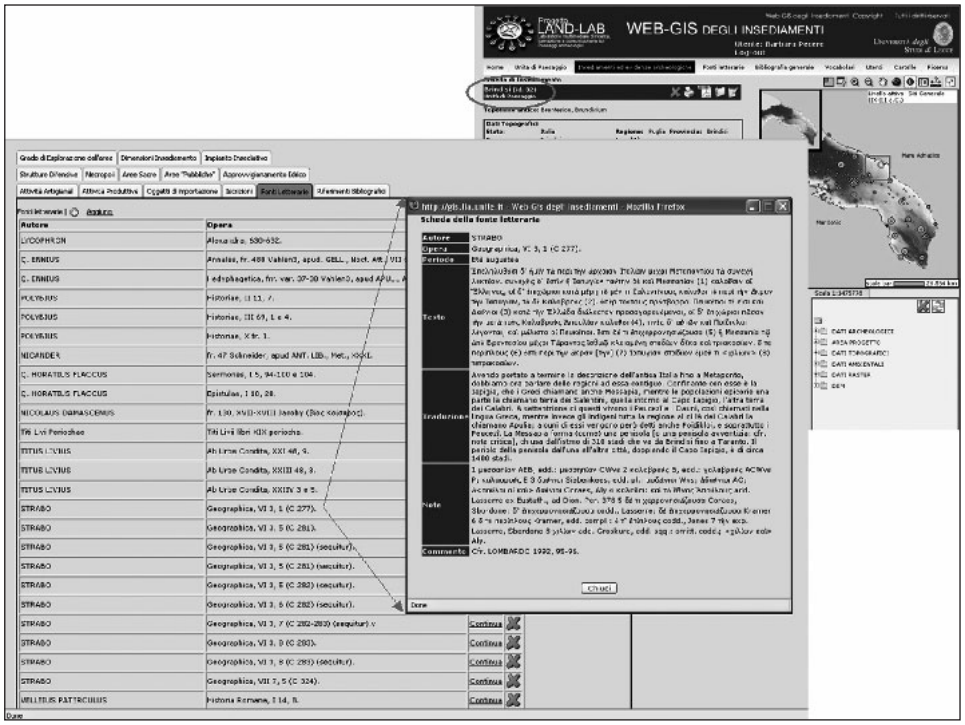

Fig. 6 – Settlement's WebGIS: example of literary sources search.

letters of the Greek alphabet. To use the application all that is needed is an Internet connection and a web browser; the installation of additional software is not required.

3. WODOS: THE WEBGIS FOR THE MANAGEMENT OF EXCAVATION DATA

The WODOS web application derived from the reengineering of the client/server ODOS application, implemented in 1991 by the Laboratory of Archaeological Computing of the University of Salento and used as a system for the management of excavation data (D'ANDRIA, SEMERARO 2003).

Both the alphanumerical database and the graphic archives, already fully integrated in the off-line version, are based on highly complex models, as complex as the stratigraphic excavations that they are required to deal with. With this application, publication on the web is – at the moment – limited to the research groups working on the project itself. Thanks to the web it is also possible to access the server containing the data from a distance (e.g. from the

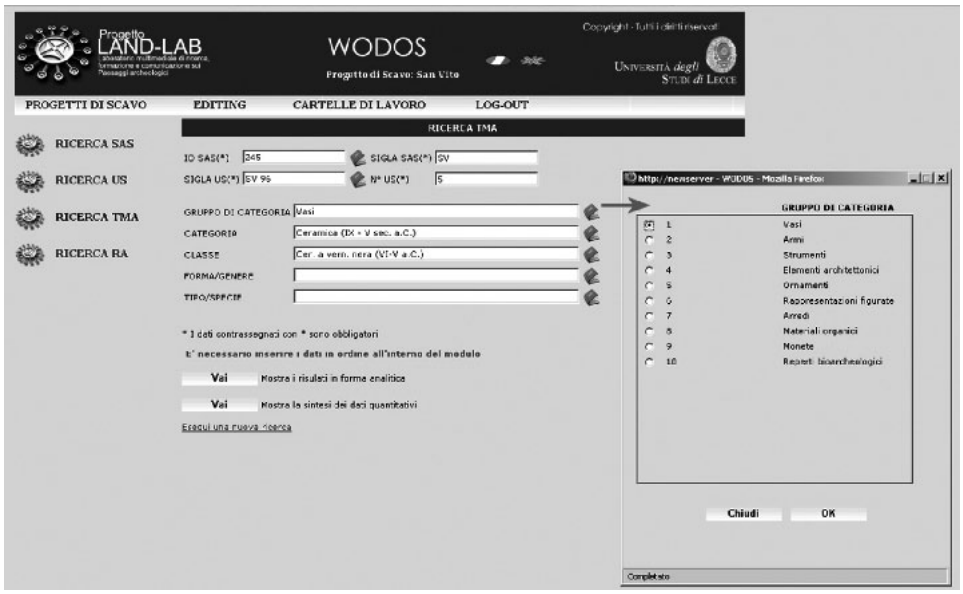

Fig. 7 – WODOS: TMA 'search' function.

excavation sites), thus avoiding the problems that arise from delayed uploading of new data from multiple terminals.

WODOS makes it possible to use the functions of a Geographical Information System for geographically locating excavation data and use the alphanumerical content at the same time. The graphical data usable on-line are implemented within the individual GIS for each excavation. The graphical data model of each GIS is organized into three different archives: a *raster* archive for managing the available graphical documentation in hard copy, acquired and geo-referenced (topographical maps, aerial photos, excavation surveys); a *vector* archive (geo-database) for managing all the graphical documentation in digital and vector format; and a *grid* archive for managing the cartographical database prepared from the interpolation of the vector data (DTM). The geo-database is organized into three feature datasets: Topographical Data (Aerial Photography, etc.), Archaeological Data (polylines, polygons, etc.) and Images.

Using a web interface in two languages (Italian, English), the application manages the graphical and alphanumerical archives at the same time. The navigation interface of the system is structured into two areas: in the central area the alphanumerical data and the graphical data of the entity being navigated are visualized. On the left appears a menu for accessing the search functions

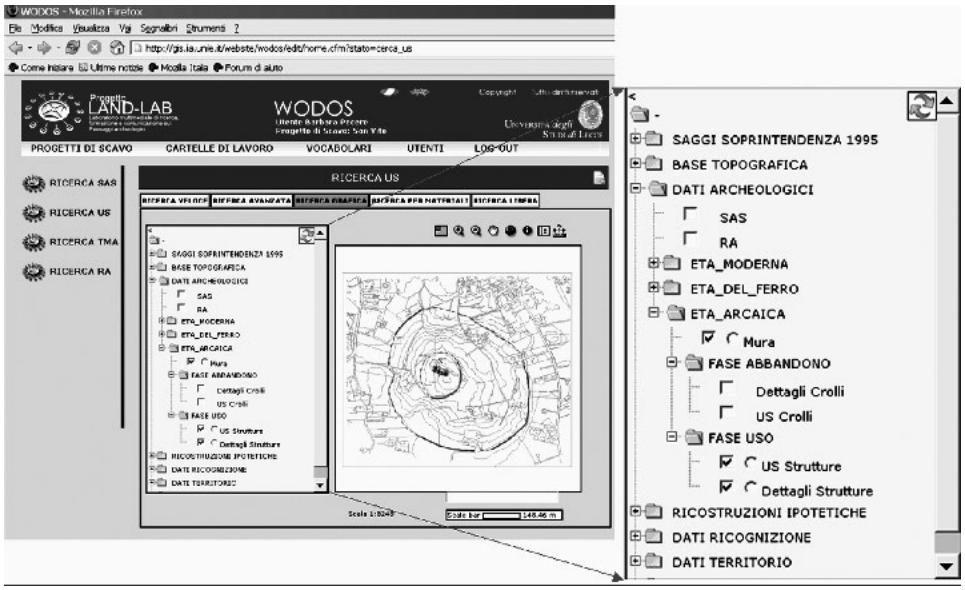

Fig. 8 – WODOS. Example of TOC (Table of Content).

of the different entities: SAS, for the description of the entire excavation area; US, for the recording of Stratigraphic Units; TMA, for the first classification of artefacts and ecofacts; RA for the cataloguing of selected pieces. The graphical data section includes the Zoom-In, Zoom-Out, Pan and Identify functions. It is also possible to visualize the legend to the graphical themes and the TOC (Table of Contents) (Fig. 7).

For the SAS, US and RA entities, there are four types of search: quick search, advanced search, graphics search and materials search. The quick search enables the user to access the entity he/she is interested in by selecting it from a list of terms relating to it; the advanced search is useful when the user knows only certain characteristics of the entity he/she is interested in and wants to use these as parameters. The graphics search (Tav. VIIb) enables the user to search the vector data of the excavation GIS (plans and drawings). The result of a search may be a list or a record for a single entity. For each entity the spatial position in the graphical data section is shown together with the alphanumerical content. In the materials search the user can identify the entities for which there exist certain materials tables, by drilling down through a hierarchical tree structure of research terms (category grouping, category, class, form, type).

For TMA searches (Fig. 8) there are two possible visualizations of the result: one in an analytical format, which is shown as a tree structure in which

each term at the end of a branch is accompanied by the quantitative data and another in tabular format ordered according to the different Stratigraphic Units (US), in which each row is a hyperlink to the corresponding TMA record.

From the TMA record it is possible to navigate to an RA record (Ceramics, Coin and Fauna) by selecting the archaeological inventory number for the item. This also leads to the visualization, on the relevant map, of the result of the search (location of materials, etc.).

The user can print the result of the search or save it in his/her own work folder, constructing a personalized index of references to specific application content. The index thus constructed, to which comments may also be added, can be exported and shared with other users. During the navigation the user can decide to access the editing section of the application, in order to modify, cancel or insert entities.

4. Conclusive remarks

In both the applications the main GIS functions are present, with the only limit being the technology currently available for on-line implementation. The main problem concerns the difficulty of editing data and of developing the geostatistic and spatial analysis functions on-line.

As a result it has been necessary to continue to maintain the off-line version of the settlements' GIS and the excavation GISs. In the off-line environment it is in fact possible to fully use the GIS functions. Among these, reference could be made to the spatial analyses finalized to the study and to the reconstructions of ancient landscapes. An example of this are the viewsheds analyses, which are even more used in our sector to study the systems of interaction between man and the land, using a cognitive approach to the archaeology of landscape. Finally, the procedure implemented for the graphic display of quantitative data, which extracts data (numeric values) from the excavation database to represent it graphically on the GIS base, remains confined to the off-line environment.

As a consequence it is also necessary to keep going the off-line versions of the original alphanumeric databases realized in Access (for the settlements' GIS) and Oracle (for the excavation management system). As long as the on-line GIS is bound by these technological limits it is impossible to do otherwise.

Despite these limitations the on-line applications still play an important role in the field of the publication of archaeological data. They allow us to rethink the same traditional printed publications in new terms. The question posed by on-line publications is the following: can one think of systems of publication which integrate traditional formulas and Internet technologies?

For example in the cases we have presented the web applications contain analytical data which constitutes the basis of reflection and synthesis.

A comparison could be made to actual catalogues, but in electronic form, which can be accessed and used through the Internet. This means that the relationship with printed publications could be seen in dynamic terms, in the sense that future works of synthesis on ancient settlement systems in the Salento could refer to analytic data published on the web, assuming a much slimmer editorial form, concentrating only on the elements of reflection which arise from the reading of data on the web.

The question of the relationship between traditional and on-line publications is even more interesting when posed in reference to the publication of excavation data. In the future we can not exclude the possibility of studying forms of publication which integrate the analytical base available on the web with syntheses constructed using more traditional editorial methods. Consider the particularly lively debate in Europe a few years ago on the excavation edition where there were long discussions on the fate to accord analytical data, catalogues of finds, descriptions of Stratigraphic Units, in the excavation sequence edition. The problem is caused by sheer quantity of this type of data which threatens to weigh down and render unmanageable editions of complex stratigraphical sequences.

Fifteen years ago the archaeologists who were working in Italy on the publication of the Balbi Crypt proposed identifying different editorial slots for the story of the excavation and for the presentation of analytical data on the material (Manacorda, Saguì, Zanini 1990). Meanwhile, in England, publishing only brief accounts of the excavation and depositing the lists of analytical data and finds in official archives was proposed.

This debate so alive in the nineties seems today to have subsided. The problem however remains, further aggravated by the time which analytical editions take to prepare. I think that technological resources now available will help us to reformulate in a different and more dynamic way the question of the publication/diffusion of results deriving from research on the field, taking advantage of the considerable opportunities placed at our disposal by the net.

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ABSTRACT

The paper deals with the results of a research project, LandLab Project, finalized at the reconstruction of ancient landscapes. The use of Internet for presenting the results of the scientific research is discussed through the presentation of two web applications, which have been implemented by the Laboratory of Archaeological Computing of the Dept. of Cultural Heritage - University of Lecce, Italy: the WebGIS of the pre-Roman settlements of the Salento region and WODOS, the on-line version of the ODOS excavation data management system.

The web-based applications are aimed at developing new approaches to the problem of data preservation and data dissemination. They use the methods and technologies available in the field of Information and Communication Technology for the transfer of data, information management systems and multimedia communication in the reconstruction of ancient landscapes and cultural systems. The project is unique in the geographical context in question here, in that it represents the first thematic laboratory for research into the ancient landscape completely based on Web Programming and Internet Technology.