

Interpreting historic and cultural landscapes. Potential and risks in Geographical information Systems building for knowledge and management

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Interpreting historic and cultural landscapes.

Potentials and risks in Geographical Information Systems building for knowledge and management.

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Abstract— *On the basis of several studies carried out on cultural landscapes in a spatial-planning perspective, this paper discusses the potential and limits of Geographical Information Systems for supporting the territorialization of multidisciplinary landscape analysis for the management of a Site of the UNESCO World Heritage List (WHL).*

On behalf of the Italian Ministry of Cultural Heritage, a multidisciplinary team of experts in architectural heritage and landscape studies has analysed the UNESCO serial Site “Residences of the Royal House of Savoy” to identify a strategic vision for the management of this complex system.

The GIS must offer a response by:

- *Representing and organizing experts’ multidisciplinary analysis without losing the additional interpretative level arising from a holistic view.*
- *highlighting historic, scenic and environmental landscape relations which go beyond the administrative boundaries of WHL properties, thus facilitating connections with broader land management.*

This paper proposes a methodological approach for a GIS responding to landscape-oriented studies calling for the consultation of the single mapped features within the complex system in which each one finds its proper meaning.

Examples concerning multiple landscape relations between the WHL Site and its landscape are given, as well as issues concerning their geographical representation.

Our final considerations will stress both the benefits and the risks of the coexistence of different data collections (strictly descriptive or management-oriented) within the same web-GIS, potentially leading to ambiguity. The proposed method is addressed to all cases of protected site management plans encompassing cultural landscapes.

Keywords— Unesco Sites, cultural landscape, historic analysis, management plan, GIS

I. Interpreting historic and cultural landscapes with GIS

This paper discusses the potential and limits of *Geographical Information Systems* (GIS) for supporting the management of cultural landscapes from a spatial-planning perspective, on the basis of several studies carried out by a multidisciplinary research team.

Composed of historians, experts in built heritage, spatial planning and landscape, our team focuses on the application of the landscape approach to different spatial contexts (urban, rural or natural areas), undertaking multidisciplinary landscape analysis, planning and land management, and geographical representation as a means to turn knowledge into proactivity. The main research applications are: analytical frameworks for Regional Landscape Plans, Protected Area Management Plans, UNESCO World Heritage Site Management Plans, and Landscape Atlases ([1], [2] and [3]).

The discussion is structured as follows:

- Challenges for GIS arising from multidisciplinary landscape research
- Potential solutions illustrated by case studies
- Research prospects and possible limits for the application of GIS within heritage landscape analysis and management.

II. Challenges for GIS arising from multidisciplinary landscape research

Landscape research is based at least on two main assumptions:

- multidimensionality: landscape is the result of the action and interaction of natural and/or human factors [4] shaping its historic, natural and aesthetic visible features.

Thus landscape analysis calls for interdisciplinarity and synthesis [5].

- holism: each landscape element acquires its significance, importance or existence not only from its intrinsic properties but also from its relationships with the context [6].

Traditionally, a GIS allows different types of geographical data to be stored, analysed, managed, and represented, but landscape analysis has to move away from such a descriptive level, which can be easily managed within databases, to a scientific-critical interpretation. The representation of landscape values as a research issue [7] and its restitution by means of GIS encompasses many scientific and technical problems (clearly systematised, for example, in Ervin [8]). Moving from such assumptions, this paper focuses on the following questions:

- how to territorialise, systematise, store and make available geo-referenced landscape elements without losing the tangible and intangible relationships between them;
- how a GIS can represent experts' multidisciplinary analysis without losing the additional interpretative level arising from a holistic synthesis; which methods and tools may help to go beyond a simple "datasets overlay";
- how analysis and interpretations can be made available to decision makers and general users; in other words, how a web-GIS can be structured in order to be communicative and management-oriented.

The following paragraphs illustrate some solutions which have been adopted in two different applied projects. The first concerns a web-GIS related to a management plan, the second an assessment process.

III. Proposed solutions illustrated by case studies

A. Linking datasets by Strategic Issue and binding layers for visualization

The first case study concerns the problem of how to maintain the legibility of the complex systems in which each mapped landscape feature acquires its proper meaning. On behalf of the Italian Ministry of Cultural Heritage, our multidisciplinary team has analysed the landscape of the UNESCO serial Site "Residences of the Royal House of Savoy"¹ to identify a strategic vision for the management of this complex system (12 properties, 7,000 hectares). The set of analyses has to be integrated within the ministerial open web-GIS, which includes other thematic assets, such as history and

¹ Politecnico di Torino - DIST, The landscape of the UNESCO serial Site Residences of the Royal House of Savoy, research report, 2013. Research program commissioned by MiBAC Direzione Regionale per i beni culturali e paesaggistici del Piemonte [Piedmont's Regional Direction for cultural and landscape heritage], Scientific Director M. Volpiano, research team: C. Cassatella, C. Devoti, A. Longhi, B.M. Seardo.

arts. Potential users are administrators, professionals and the general public.

The research team identified seven strategic issues for the management of the UNESCO site and its landscape. The Strategic Issues oriented the knowledge construction process, and the choice of the analyses to be considered in great depth.

The sectoral analyses concerning cultural-historic, scenic and environmental assets have produced a total of approximately 150 georeferenced layers. This amount of layers is the result of matching the scientific identification of detailed landscape elements and the GIS' technical constraint of having to subdivide the same elements according to their geometries (so, for example, historic viability, bridges and settlements have to be stored in separate point, polyline and polygon datasets, although relating to the same issue).

Moreover, each layer geographically identifies a set of landscape elements which are relevant to a strategic issue, but any web-GIS customer who has direct access to this level of information may visualize all the disaggregated elements without knowing why they have been selected from the entire universe of similar objects.

Our approach is to make the interpretative level arising from the experts' holistic view, and not merely a simple list of landscape elements, available to customers. Some examples are given to explain this strategy.

The first Strategic Issue enlightens the relationship between the Royal Residences of Savoy and their surrounding territory, shaped by the "Projection of the sovereign power". Therefore, all the mapped features (historic roads of modern and contemporary age, bridges, harbors, canals, tree-lined avenues of territorial value) are simultaneously visualized in the web-GIS.

Another Strategic Issue concerns "The aesthetic experience", which is the Royal Residences' contemporary scenic landscape, made up of panoramic views, viewsheds, visual axes. Although they are all immaterial elements, they have nonetheless been mapped. Those views towards the Royal Residences which make the historical scenes (taken from art and literature) still enjoyable, are linked to the same group of features.

Because WHL properties often coincide with natural protected areas, one of the Strategic Issue suggests managing them in a more integrated way with other natural elements (such as watersheds, riparian vegetation, streams) which are relevant within their environmental context. The mapping of these natural resources, which often go beyond the WHS boundaries, is strategic for environmental reasons (in particular, ecological continuity) but also from the perspective of touristic itineraries connecting the WHL site to its surroundings, affecting rural areas and agricultural management practices, land uses and urban planning.

In order not to lose the relationships among these landscape elements, the fundamental principle is to refer the spatial information to a given Strategic Issue, assuming the idea that information in the context of land management is not neutral [9] and that a knowledge system for management should be

oriented by a vision of the preferred future, e.g. by conservation or valorisation objectives.

As a consequence, two technical devices have been implemented within the GIS.

Linking layers by Strategic Issue

Each dataset has been structured in the same number and type of fields, so that each feature (or landscape element) is described by the following information: Municipality, Location, Royal Residence, Strategic Issue, Landscape element, Description, References.

While “Municipality” and “Location” contain the geographical information of the landscape element, “Royal Residence” relates the mapped landscape element to one of the 12 properties encompassed by the UNESCO Serial Site. “Landscape element” identifies the type of georeferenced landscape object (for example historic harbours, contemporary viewpoints, ecological corridors). The “References” field embeds hyperlinks to iconographic or cartographic resources. Finally, the “Strategic Issue” field links the single element to one of the 7 established management issues.

In this way, when interrogated by the Identify GIS tool, all the historic roads, bridges and settlements show their common belonging to the Strategic Issue “Projection of the sovereign power on the territory”, even if they are stored in separate layers (respectively in a polyline, point and polygon dataset).

Thus, thanks to a multiple-field attribute table, when customers interrogate a single georeferenced feature (landscape element), they are shown which Strategic Issue it is relevant to.

Binding layers for visualization

In order to simultaneously display all the layers which are relevant for the same Strategic Issue, a constraint to layer visualisation has been set up.

As an example, let’s examine the Strategic Issue “Historical project of the Residences’ gardens and green spaces”, which consists of the following datasets: Tree-lined avenues, Areas historically occupied by gardens, Areas involved in gardens unrealized or not completed projects, Areas historically occupied by parks, Belvedere and other facilities for landscape observation. The scientific reason why elements have been mapped is lost if the datasets are separately visualized. For example, not every tree-lined avenue in the surroundings of the Royal Residences has been mapped, but only the ones relevant from historic point of view.

To avoid the risk of misunderstanding, all the layers referring to the same Strategic Issue have thus been then linked to one another in order to show the GIS user that they should be displayed together.

The method proposed may thus facilitate consultation by different kinds of users, whether or not they are experts in landscape issues.

B. Representing landscape synthesis

The second case study focuses on potential and limits of GIS for developing interpretative synthesis, as a step further multidisciplinary landscape analyses.

The recent development of GIS matches well with landscape research. In fact, the multi-dimensionality of the analysis involved implies a phase of interdisciplinary comparison and synthesis; therefore, the possibility to overlay different georeferenced datasets offered by the GIS is an added value for the direct comparability of the different layers of information. However, the overlay cannot represent an appropriate synthesis.

The aim of the research “Prendere Decisioni sul Paesaggio” (“Making decisions on the landscape”, [10]) is to support local administrations with strategies and intervention criteria concerning the rural vineyard landscapes of Piedmont Region, which are under examination as WHL Site. As far as agricultural practices have visible effects on the landscape, maximizing production or, on the contrary, enhancing ecosystem services (including amenity), the assessment of landscape values is an important support for decision making.

First of all, a set of agro-ecological, historic, scenic and planning analyses and assessments has been prepared, but the main focus has been put on how to make them concise and easily communicable to local actors and municipalities, and on how to use GIS for gaining and representing the landscape interdisciplinary synthesis.

In order to combine the results of sectoral interpretations in an interdisciplinary representations, the experts have been required to make a summary of their different sectoral findings, and to use a common grid of scientific criteria for selecting information and degree of detail. For example, different kinds of paths (cross-cutting roads, exploration trails, etcetera), which were identified by the study about landscape experience, are then grouped as “fruition paths”, without any distinction. This operation is neither mechanical nor automatic.

In order to develop proper GIS synthetic datasets, the main stages have been:

- a) preventive overlap (simple overlay) of the datasets produced for each sectoral analysis;
- b) collegial discussion among experts focused on specific situations, such as landscape elements which result to be relevant from a multidisciplinary of view, or, on the contrary, elements which have positive value for some expert and critical aspects for others;
- c) development of an interpretive synthesis and related datasets: merging legend entries, processing new legend entries and new layers.

At the end, the cartographic product is not a simple sum of the starting layers, but the product of a reasoned comparison.

This approach is based on experts’ qualitative interpretation rejecting the quantitative overlay. Thus, the cartographic representation is the means through which the comparison among various experts and analysis is performed [11].

IV. Conclusions

The most relevant recommendations concerning the application of GIS to cultural landscapes analysis and management are as follows.

With regard to expert analysis (par. III.B.), the paper shows that GIS can be a very useful tool for building frameworks for multidisciplinary landscape synthesis, having a valuable potential for creating databases enabling to store and make accessible the different sources supporting the landscape interpretation. This function can be related to the “identification” and “analysis” stages of the process of knowledge of the landscape, as established by the European Landscape Convention [12]. Moreover, due to its “dynamism”, GIS can register landscape changes.

The potential risks, which arise from an automatic datasets overlay, are dispelled by favouring qualitative critical interpretation. For this purpose, GIS can be a valuable platform to structure discussion among sectoral experts in a collaborative manner.

In relation to general users, the coexistence of strictly descriptive data and management-oriented information within the same web-GIS encompasses some risks:

a) losing the scientific reason landscape elements are mapped for;

b) losing the “narrative power” arising only from the simultaneous visualization of all the other pertinent landscape elements;

c) generating false interpretations or misinterpretation due to incorrect data interrogation.

The proposed methods (par. III.A.) of Grouping by Strategic Issue, and Binding layers visualization are aimed at solving these issues and can be applied to all cases of protected site management plans encompassing cultural landscapes.

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