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LDL (Landscape Digital Library):

A Digital Photographic Database of a Case Study Area in the River Po Valley, Northern Italy [*]

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Abstract

Landscapes are both a synthesis and an expression of national, regional and local cultural heritages. It is therefore very important to develop techniques aimed at cataloguing and archiving their forms. This paper discusses the LDL (Landscape Digital Library) project, a Web accessible database that can present the landscapes of a territory with documentary evidence in a new format and from a new perspective. The method was tested in a case study area of the river Po valley (Northern Italy). The LDL is based on a collection of photographs taken following a systematic grid of survey points identified through topographic cartography; the camera level is that of the human eye. This methodology leads to an innovative landscape archive that differs from surveys carried out through aerial photographs or campaigns aimed at selecting "relevant" points of interest.
Further developments and possible uses of the LDL are also discussed.

Keywords

<landscape>; <digital library>; <digital photography>.

1. Introduction

Landscape: a complex interdisciplinary object of study

The study of landscape requires an interdisciplinary approach. In the field of landscape studies there are two levels of interdisciplinarity: a "horizontal" and a "vertical" one. The horizontal dimension of interdisciplinarity comes from the fact that different fields of study analyze landscape from complementary points of view. Among other fields, geography, architecture, and art history, each with its own conceptual and methodological background, play a particular role in the tradition of landscape studies. Each discipline develops its own conception of landscape, with emphasis on

different elements and different values. The "vertical" dimension of interdisciplinarity, on the other hand, comes from the fact that a landscape is made up of different layers whose interpretation requires a specific competency in a discipline. The use of adjectives associated with the term is significant in understanding the wealth of meanings of "landscape." One can speak, for instance, of "botanical landscapes", "geological landscapes", "cultural landscapes", etc. All these characteristics make landscape a complex object of study. Specific techniques of survey and collection have to be developed in order to grasp landscape in all its richness. The revival of the scientific discussion of the concept of landscape and even the term's popular "success" (its use in mass media, tourism marketing, real estate publicity, etc.) have recently been accompanied by the promotion of the concept at an institutional level. In the Italian context, for instance, it is important to mention the first *National Conference on Landscape* held in Rome in 1999; at the European level, one should refer to the *European Convention on Landscape* signed in 2000 [**1**].

Landscapes as cultural heritage

The attention to landscape is well rooted in the western cultural tradition, and the theoretical debate on the importance of landscape runs through the twentieth century. The Italian geographer Filippo Porena wrote, in an article published more than a century ago, of «the current fashion of the term landscape» [1892: 72]. From an institutional point of view, it is important to recall a law that dates back to 1939 (Law of June 29, n. 1947) entitled "Protection of Natural Heritage" focused on «panoramic values», of a network of material «goods» characterized by «specific aspects of esthetic and traditional value». This law has recently been acknowledged in the set of laws concerning the protection of cultural heritage (October 29, 1999, n. 490). The recent shift in conservation policies from the attention given to single historic or natural monuments to the value attributed to landscape as a whole marks an important change of perspective [Veyret and Le Maître 1996]. Precisely because landscape is considered a basic expression of a national, regional or local cultural heritage, it is important to develop techniques that allow one to catalogue and to archive it.

The importance of visual inquiry in landscape studies

Studies on the concept of landscape have particularly emphasized its visual quality. A landscape exists where an eye is observing the territory [Collot 1986]. Within the vast available bibliography on landscape, a strong emphasis has been placed on its visual components and qualities, which have a primary role in shaping the way it is perceived [Bailly, Raffestin and Reymond 1980; Cosgrove 1996]. Among other attempts to classify and archive landscapes, scholars have produced maps able to portray the visual limits of an area, identifying panoramic points, ridges and obstacles [Raveneau 1977]. The result is a map of the "visibility" of a landscape. Other important studies on visual components of a landscape come from the work of the *Netherlands Soil Survey Institute* [De Veer and Burrough 1978] where a complex system of classification of landscapes according to their visual potentiality was developed. The concept of visibility lies at the basis of the very idea of landscape [Zerbi 1993: 168]. For this reason it is important to study and to critically examine the ways in which landscape can be observed and recorded by technical means.

2. Archiving landscapes?

Given the prevailing visual component of the object, photography represents a privileged means to archive landscapes. The use of photographs in this field has had two main outcomes:

a) geometrically planned and complete surveys of the territory from a zenithal point of view (satellite and aerial photographs)

b) selective archives of photographs focused on the aesthetic or cultural value of specific elements within the landscape [2].

Aerial photographs

Most western countries have completed surveys of their territories through aerial photographs. Series of surveys made at different times often testify to the evolution of landscapes in the last decades. Many cartographic products such as land use maps have been developed from the interpretation of aerial photographs. This kind of documentation, however, does not provide an immediately communicative image of the landscape, and the reading of the data requires quite a sophisticated interpretive ability.

Qualitative archives

Archives of landscape photographs usually collect the results of campaigns aimed at selecting "relevant" points of interests (a panoramic view, a monument, a single element of the historical and/or natural heritage of the area). The rendering of these analytic elements (single features in the landscape) has normally been considered a sufficiently realistic and adequate "portrait" of the territory [Cosgrove 1984] [3]. An example of this policy is, in the Italian context, the so-called "Archive of Space" organized by the Province of Milan (Lombardy, Northern Italy), a photographic collection of the most interesting elements of the cultural heritage of the area. The survey campaigns allowed the photographers invited to collaborate in the project a high degree of freedom in the choice of how and what to portray [4]. From this perspective, landscape is considered a system that is the sum of single noticeable elements more than an autonomous entity. What is often missing in these archives is a documentation of so-called "ordinary landscapes," spaces that do not present any particular artistic or aesthetic value but nevertheless represent the everyday theatre of common work and leisure activities (on the interpretative metaphor of landscape as a theatre see Turri, 1998).

The renewed institutional interest in landscapes creates the necessity to make a "census" of the landscape heritage both for preservation purposes and for a better understanding of its complexity and richness. The new possibilities offered by the digital techniques of data collection also open up new perspectives in this field. As Zerbi states, «the new instruments available to scholars seem to be able to renew in depth this tradition of research. The limits of this tradition have been repeatedly emphasized by contemporary researchers, while on the contrary its strengths have not been adequately recognized: the integrated approach, the logic structure of the classifying methods, certain analytic categories adopted» [1993: 143]. It is therefore important to develop new techniques of landscape archiving while at the same time keeping in mind the existing tradition of studies in this field.

3. The LDL (Landscape Digital Library)

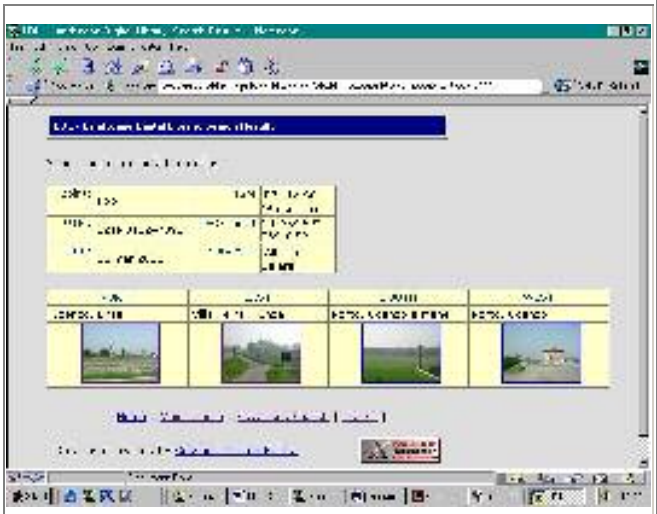
The goal of the LDL (Landscape Digital Library) project is the implementation of a Web accessible database [5] able to present a portion of a territory with documentary evidence in a new format and from a new perspective. The case study presented here as a test is related to a small area of the plain of the river Po valley (Northern Italy). In the future we plan to apply the LDL research criteria in other geographical contexts in order to test the method's validity in a variety of physical and human environments.

Aerial photography

(City of Forlì, Italy - by Aernova)

Qualitative photography

(Gabriele Basilico - image from Cityscapes)



LDL - Landscape Digital Library

(screenshot of a database record - click on it to enlarge)

Methods of data collection for the LDL

The LDL is based on a collection of photographs taken following a systematic grid of survey points. This grid is identified through topographic cartography. The encounter of two UTM (Universal Transverse Mercator; an internationally adopted system of geographical reference) coordinates identifies on the map the exact point where the pictures are to be taken. This system being based on a kilometric base, each point is one kilometer distant from the nearest other points (in the four cardinal points). Once the point has been identified (with the help of GPS instruments) the surveyor takes four photographs, directing the digital camera (with a 50 mm objective focused for infinity) to the four cardinal points. The result will be four pictures for each point, identified by both UTM and geographical coordinates of the shooting point and by the direction (North, East, South, West). The point of view is that of a human eye view, with a horizontal perspective from a height variable from 1.5 to 2 meters. A tolerance of nearly 10 meters is acceptable in the choice of the location from which to shoot the photographs (one has also to keep in mind the margin of error related to the GPS system in giving the coordinates). The goal of the database is to reproduce by specimens, taken according to a systematic grid, the appearance of the landscape in a given area, including possible obstacles and barriers.

Technical characteristics of the LDL

The files of the photographs are inserted in a database accessible by way of different search criteria. A series of elements of indexing are applied to the database. These elements are not taken into consideration during the photographic campaign, but nevertheless they can be attached in the subsequent process of assigned indexing. Photographs have a resolution of 2048 X 1536 dpi (dots per inch), the image size is about 1.2 Mb. The image format used in LDL is JPEG (Joint Photographic Experts Group): even though this is a compressed format, the image resolution is adequate in order to obtain prints for paper publications and also, of course, for screen display. JPEG is the format that best fits LDL purposes, considering that "JPEG is designed to exploit known limitations of the human eye, notably the fact that small color changes are perceived less accurately than small changes in brightness. Thus, JPEG is intended for compressing images that will be looked at by humans"[6].
Photograph thumbnails are provided in order to make browsing easier between the records

retrieved.
The database is implemented using the DBMan package that is freely distributed by Gossamer Threads for non-profit use [7]. It is installed on a Linux server that uses Red Hat 7.1 (Seawolf) distribution with kernel 2.4.2-2, even if the database can run also on Windows or Mac platforms. As stated in the homepage of the product, «DBMan is a full-featured database manager that provides a Web interface to add, remove, modify or view records in a flat file ASCII database. It supports an advanced user management system, as well as powerful permission system. An SQL version is also available for very large databases».
The LDL database is made up of several files:

ldl.cfg - this is the LDL config file that defines the database.
ldl.db - this stores the textual information.
ldl.pass - this stores the user passwords and permissions.
ldl.count - this stores the counter for the next ID number to use.
ldl.log - this stores a log of all activity to the database.
ldl.pl - this is the html for the LDL database.

Another file is required in order to run LDL:
db.cgi - the CGI interface between LDL and the Web.

Finally, images and thumbnails are stored in a directory that must be accessible by Apache Web server.
Following is inserted a part of the LDL set-up file that contains the database fields definition:

field_name => ['position', 'field_type', 'form-length', 'maxlength', 'not_null', 'default', 'valid_expr']
%db_def = (

'point'	=>	[0, 'alpha',	20,	20, 1, '',	''],
'IGM'	=>	[1, 'alpha',	30,	30, 1, '',	''],
'UTM'	=>	[2, 'alpha',	20,	20, 1, '',	''],
'GEO-coord'	=>	[3, 'alpha',	45,	45, 1, '',	''],
'date'	=>	[4, 'alpha',	30,	30, 1, '',	''],
'surveyor'	=>	[5, 'alpha',	20,	20, 1, '',	''],
'north'	=>	[6, 'alpha',	20,	20, 1, '',	''],
'geo-names-north'	=>	[7, 'alpha',	'40x3',	1000, 0, '',	''],
'east'	=>	[8, 'alpha',	20,	20, 1, '',	''],
'geo-names-east'	=>	[9, 'alpha',	'40x3',	1000, 0, '',	''],
'south'	=>	[10, 'alpha',	20,	20, 1, '',	''],
'geo-names-south'	=>	[11, 'alpha',	'40x3',	1000, 0, '',	''],
'west'	=>	[12, 'alpha',	20,	20, 1, '',	''],
'geo-names-west'	=>	[13, 'alpha',	'40x3',	1000, 0, '',	''],

);

Where:
field_name = the name of the column.
position = field's position in the delimited text file.
field_type = one of 'number', 'alpha', 'date' depending on whether the information is numerical, alphabetical or a date.
form-length = the length the form field should be. Set to 0 for select, checkbox or radio buttons, and set to '40x3' to make a 40 col by 3 row text area box. Set to -1 for hidden fields. Set -2 for admin only fields. This is useful for the Userid field that will let an admin edit/view it, without other users seeing it. All these fields only apply if you are using auto_form_generation.
maxlength = maximum length of the field. The script will kick out an error if a user tries to enter a data larger then the max.
not_null = set to 1 if this field can't be blank. set to 0 if it can.
default = you can enter a value to use as a default. For example call &get_date to insert today's date.
valid_expr = enter a regular expression to validate input.

Using the LDL

The database is accessible in two ways: from a cartographic image and by keywords. In order to retrieve the image using the cartographic base one starts from a clickable image map (see picture n. 1). It is then necessary to identify a precise point from which the images were taken (the "shooting point," identified by an intersection of the UTM grid lines). By clicking on it one accesses a card (see picture n. 2) with the following information: UTM and geographical coordinates of the shooting point, date of the shot, previews of the four photographs taken from the point, and meaningful geographical information such as geographical names. From this cross-reference document one can visualize the full-size pictures or go back to the search screen.
The second possibility is a keyword search of the entire database (see picture n. 3). Thanks to the search options provided by DBMan, it is possible to make searches within all the cards using one or more keywords appropriately connected by Boolean operators.

The LDL characteristics and values

The LDL follows the tradition of studies mentioned above and tries to add a new technique in landscape archiving by introducing four significant innovative elements:
1) The criterion on which the photographic data collection is based is systematic and not selective. It records the "state of the art" of a landscape independently from its single features, following a predetermined pattern of frequency and orientation of the shots. In this way the LDL helps to overcome the problems created by an uneven distribution of attention: «The richest documentation is generally related to highly valued landscapes or to landscapes that are under the menace of substantial changes. On the other hand what is normally lacking is - in the great majority of cases - the study and knowledge of ordinary landscapes» [Zerbi 1993: 173]. The use of four shooting points (which means sixteen pictures) every square kilometer provides a detailed coverage of the territory. To make a comparison, the system proposed by K. D. Fines proposed two points for each square kilometer [1968].
2) The reference system is based on cartography, and specifically on one of the most abstract elements of cartography (the UTM coordinates), which is not directly recognizable on the ground. This impartial distribution of shooting points guarantees a complete "coverage" of the territory **[8]**. By choosing such an abstract grid of reference, the documentation of the landscape, as repeatedly emphasized above, avoids the dangers of a subjective selection criterion, but also encourages possible interactions between cartographic archives and photographic collections. Since the point where the pictures have been taken is easily identifiable on the maps, it is possible to give a new and easily accessible "visibility" - not mediated by symbols and by geometric scales of reproduction

- to cartographic representation, a sort of parallel text to the cartographic perspective. The reading of the maps can be systematically accompanied by samples of the landscape appearance as portrayed by photographs. The fact that the UTM grid of reference is universally adopted makes the system potentially adoptable everywhere in the world. The fact that UTM coordinates can be identified on most kinds of topographic cartography (in the Italian context both on the State cartography produced by the Geographical Military Institute (IGMI) and on the cartography produced by regional agencies) makes the LDL system a flexible tool applicable to different cartographic supports. The contemporary reference to geographical coordinates (latitude and longitude) constantly allows shifting from one system to the other when necessary. The GPS instrument used during the survey campaigns gives the possibility to mark the coordinates in both the systems.
3) The point of view of the photographs is a horizontal one, similar to the one perceived by the human eye, and not zenithal, like that of aerial photographs. The human perceptive component is therefore guided and "limited" by technical constraints, but not erased by the artificial point of view typical of an aerial photograph. The LDL provides samples of a perspective of visual perception that is "ordinary". Many scholars consider the camera lens itself (50 mm) to be close to the field of vision on which a human eye concentrates (not counting peripheral vision) [Miossec, 1977].
4) The specific characteristics of the documentation in digital format (flexibility in use, possibility to simulate different alternative scenarios through programs of landscape modeling, possibility to send the images and data through Internet) guarantee the specific "added value" of this system when compared to a traditional survey made by analogical means ("traditional" photography).

Limits of the LDL

Like any other articulated set of choices, inevitably, the LDL has some limits of its own:
1) It does not go beyond the visual inspection of the landscape. Like all the other visual records, it does not include the global sensorial perception of the landscape experienced in the field (a mix of visual, olfactory, and auditive data).
2) It records a horizontal perspective whose extension can be limited by random obstacles. It can happen that from the selected shooting point some natural or artificial obstacle blocks the perspective. It has to be remembered, however, that the LDL does not look for specific panoramic perspectives or visually privileged points. The presence of visual obstacles (such as walls, fences, hedges) is as meaningful to the data collection as a pleasant scenic view from a hill. Like aerial photographs, the LDL survey system needs a predetermined set of meteorological conditions that provide a standard of homogeneity to the shoots (atmospheric visibility, light conditions, absence of fog, snow, rain, etc.). To overcome this limit, in some cases and for specific purposes, one could think of making available in the database different shots taken from the same point of view in different seasons and with different meteorological conditions.
3) It represents a static record of the situation at a precise time and does not provide documentation on the dynamic aspects of the landscape. As Giuseppe Papagno suggests, «landscape - with this word we mean everything that is existing as well as perceived in a territory - becomes a quadri-dimensional archive, a true "time archive", in which, beyond the three classical dimensions, one has to add the fourth, time, that is inscribed in its materials in a durable way [?]» [2000: 297]. The possibility to repeat the photographic campaigns at pre-determined time intervals, though, gives the LDL the possibility to follow the evolution of a landscape through time.
4) It does not grasp directly the invisible values of landscape that, as Simon Schama states, «is constructed as an excavation below our conventional sight-level to recover the veins of myth and memory that lie beneath the surface» [1995: 14]. The LDL, in this perspective, could be used as a supporting database for the organization of related archives of paintings, literary quotations, scientific descriptions, travel diaries to which it could provide a cartographic and at the same time visual support and reference.

In keeping in mind these limits, it should be remembered that a global inquiry on the nature of landscape goes beyond the goals of the LDL. Its systematic documentation pattern, which is more similar to a quantitative "census" of landscape appearances than to a qualitative selection, aims to provide a basic iconographic survey of the landscape. This visual archive has a value in itself as a documentation of the aspects of a territory, and also aims to support other forms of documentation already available both to scholars and to professionals, such as cartography. The LDL, while on the one hand providing a complete survey, can also represent a starting point for further analyses and inquiries that will interpret and study its data.

4. Possible uses of the LDL

There are many potential users of the digital documentation of the LDL, belonging to different fields of research: geographers who study the forms of the territory, technicians and engineers who are specialists in the evaluation of environmental impact, historians interested in architecture or in agricultural systems, landscape architects. Tourist agencies and local tourist promotion offices could also benefit from the LDL by making available to prospective visitors an "impartial" documentation of a specific region that one could browse through as in a virtual tour of the territory. Last but not least, the LDL could assume an important didactic role if used in schools: it provides an archive of pictures that can be used to study the students' area of residence, to prepare field trips, to study other regions. As mentioned above, a specific value would be added to the LDL through the repetition of the survey at pre-determined time intervals (five or more years, for example). The comparison of the images belonging to the different photographic campaigns would make an accurate portrait of the evolution of the landscape available. We plan to propose to public administrations in Italy the adoption of the LDL system of survey. The setting up of a LDL database would provide local governments with updated photographic archives of their territories and would constitute the basis of an international standard of data related to landscape: «we have also conducted an inquiry into the potential users of landscape information (State offices and local authorities, public and private consultants, agencies and institutes that are at different levels interested in landscape) and their needs. During this research we encountered a vast demand for a great variety of data at different scales and for their possible uses (indexes of landscape vulnerability, their suitability for specific uses, preferences expressed by users, evaluations for preservation and planning goals)» [Zerbi 1993: 158]. The LDL could help in satisfying part of this shared "need for landscape".

Footnotes

[1] *European Landscape Convention*, EU
URL: <http://www.nature.coe.int/english/main/landscape/conv.htm>.
[2] Zerbi distinguishes two main kinds of methods of research: "those using a real observer (with a precise position in time and space) and those referring to an abstract observer, out of a normal field of vision. The first ones adopt a "terrestrial" point of view - oblique or even horizontal - while the others adopt a "vertical" point of view" (1993: 151). This and the following translations from quotations in Italian are ours.
[3] As summarized in Zerbi: "From an analysis of the landscape as a resource the perspective was narrowed to an analysis of the resources 'in' the landscape" (1993: 152).
[4] *Archivio dello Spazio*, Museo Fotografia Contemporanea - Provincia di Milano
URL: <http://www.museofotografiacontemporanea.com/lcp_archiviodellospazio.php>.
[5] URL: <http://www.aldus.unipr.it/LDL>.
[6] *JPEG image compression FAQ*, resource homepage

URL: <http://www.faqs.org/faqs/jpeg-faq/part1/preamble.html>.
[7] *Gossamer Threads - DBMan*, product homepage
URL: <http://www.gossamer-threads.com/scripts/dbman>.
[8] The idea of using a mathematic grid was already suggested by Zerbi: "The opposite choice may be open to criticism from a conceptual point of view, but certainly it is more difficult to criticize it as an operative tool. This choice founds the analysis on dimensionally similar units or even on rigorously equal units such as the kilometric grids. The map's division into squares may also be a solution that could offer arrangements in interdisciplinary perspective. The advantages are immediately evident, primarily the possibility of exchanging primary information and secondary data coming from the work of various professionals" (1993: 174).

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URL: <http://rcdl2001.krc.karelia.ru/index.shtml>.

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