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Un Sig libre para la evaluación de la compatibilidad paisajística de un incinerador (Digital mock-up for the visual impact assessment)

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Abstract—**La oportunidad de construir un incinerador es frecuentemente un motivo de discusión a causa de su impacto ambiental debido a los humos o a la fuerte caracterización del paisaje por la sola presencia de la chimenea. Estudiar, por lo tanto, la mejor localización de un incinerador es procedimiento complejo y delicado cuanto muy actual, vista la grave situación de emergencia de la provincia de Napoli. Este trabajo define un nuevo criterio para la evaluación de la compatibilidad paisajística por medio del empleo de un análisis multi-criterio. Los modelos MC han sido utilizados para confrontar los lugares donde funcionan los numerosos incineradores europeos, definir una ley común para la matriz de los impactos potenciales y codificar un procedimiento gráfico para la relativa evaluación. En particular, para la previsión de los efectos de las transformaciones del paisaje se presenta un original procedimiento que implementando un Sig libero permite importar datos espaciales en un PostGIS directamente de archivo en formato tipo xls (como ya comprobado en GvSig), con las coordenadas espaciales sacadas desde Google Maps, los innumerables servicios de geocoding utilizable en red o de nuestro portal. PostGIS es, en efecto, una extensión espacial para el database management system PostgreSQL (Spatial) distribuido con licencia GPL; una base de datos espacial según el estándar del Open Geospatial Consortium. Los primeros resultados de esta investigación, a partir de un análisis completo, proponen un Sig como herramienta libre para la gestión del territorio interesado, con el objetivo más amplio de poder representar sus aspectos materiales e inmateriales.**

***Key Words*— Free 3D Gis Model, Drawing, Landscape And Visual Impact Assessment..**

I. Introduction

To refine and set characterizing elements, required to define the image of landscapes, it may creates some problems related with the correlation of those same elements, on the way they may vary, and on how they may be computerised.

This study has been concentrated also on the possibility to represent the characterising elements engaged in the positioning of a solid waste incinerator.

At this point, it looks necessary to define a logical method based on the use of analytical digital tools and the territorial analysis, to redraw the landscape using suitable three-dimensional visualisation and render techniques.

The general problem is to identify the basic forms of the landscape and the environmental representation, assuming to find in the landscape the same correlation between sections and plans found in the architectural scale.

For this purpose, sample of representations will be provided through digital technologies and with the support of territorial informed systems, in order to supply a synthesis in one uniform platform, before the planning and transformation process.

These drafts will be used to create supporting graphical representations to safeguard the planning of the territory.

These representations are, therefore shaped, as a drawing-representation system connected to a methodology aimed to monitor territories and to estimating the different phases of planning, realization and maintenance.

The landscape will be examined within its main characterising images a long with its morphological and historical connections with related areas.

In this study, some samples of territorial representation will be codified using digital bi-dimensional, three-dimensional and cinematic technologies and the support of territorial information systems able to represent a synthesis landscapes' data.

In addiction, it is necessary to implement the right graphic instruments in order to be scientifically and technically credible, and, at the same time, comprehensible to the audience.

The complexity of the problems requires the implementation of a vast quantity of data on large dimensional scale that will have to be synthesized in a usable and meaningful way.

Everything finalised to the production of digital models of 'elevations' specific for areas densely civilized: such 3D model will be used on line in a WebGIS, finalised, for example, to the urban monitoring and to the territorial planning.

The geometrical and geographic data retrieved from the Dem will be inserted in a database structured in such manner to be able to manage and to give back usable data having different origins but contributing to describe in exhaustive manner the territory studied in its complexity and supplying also a tool of support to the landscape evaluations.

II. Materials and Methods

A. Objectives

It is necessary to specify the key aspects to define the image of the landscape, dynamic and always in transformation by nature, in order to highlight issues of correlation among elements that are mostly related with the construction of images as able to be constant in the various eras. Along with the development of the studies on the Sanitary Environmental Engineering, it is necessary to carry out a development of the acquired results related to the representation field.

To evolve from a simple procedure of a schematic two-dimensional representation, to the representation of a equivalent virtual model; getting closer to a more perceptive human system, making the immediate communication of complex information as less complex as possible is therefore an unavoidable route for this trial.

The representation system becomes, therefore, capable to illustrate the connections between shape and measure in the actual scale of the territory, which becomes useful to assess the impact that the construction of a solid waste incinerator may have in the surrounding landscapes (urban or rural space).

This is used to test and try the optimisation of the whole system, in connection with the "new criteria to locate solid waste incinerator using a post-ante environmental impact assessment", for which the models can be built, according to logic of versatility, for the uses of illustrations according to the rules of the representation science.

The intent is to illustrate the landscape either in a large scale, where the problematic will be relevant to the volume of the calculations involved, or to a more reconciled scale.

The experimental stage of this study is to test the possibility to illustrate the landscape using innovative technologies, capable to highlight those volumetric connections that engineering shapes have with the space and the urban scale. The contribution that this study carries, to the scientific context, consists in demonstrating, that an approach GIS oriented to the model making, either in the territory, it can obtain, at this stage, a better result compared to the procedure commonly offered by traditional CAD systems.

To conclude, the main objective of this project of research is to plan and develop innovative methodologies of data processing, directed to the digital production of elevation models of landscapes (areas densely civilized).

B. State of the art

The proposed field of research is not particularly investigated by the scientific literature.

The normative about the environmental impact it may be considerate the bases of scientific departure about the topic; it was formed in parallel to development of the specific studies.

Today, in the national and international outline, there are only general studies but there are lacking in specific methodologies of environmental impact evaluations.

The current regulations in this field placed only a set of restrictions to draft a project for impact evaluation.

Moreover, there is an ever-growing demand for a more 'representative' and 'world widespread' digital cartography [1].

More representatives way capable in describing physical phenomena but also social, economic and cultural data that are necessarily connected to geographical aspects.

More widespread derives from the growing use of cartographic products by not specialized users. They provide geometrical and qualitative information deriving from the use of historical documents and present-day aerial and terrestrial photo that are suitably processed: such as orthophotos mapped onto Dtm for a more truthful description of territory

Data for 3D map production can be acquired by employing the most advanced and outstanding techniques, 3D digital cartography seems to be more suitable in different field of applications: to recover the historical maps content, to establish an architectural project in its surroundings, to well deals with town-planning matters, to perform simulations for environmental impact analyses, and so on.

Particularly the ISO have created a series of general rules, but, at the end, the normative situation can be widely improved, above all in connection to the open problem of the convertibility of the models: this requirement becomes even more pressing, when examining specific areas like the visual impact assessment. This is a field where those rules like 'documents that define the features of a product, process or service, according to the state of the art' according to the definition of the UNI, do not exist. The scenery of reference is by now the representation of the space, integrated with technologies of virtual reality for the realistic representation, with consequent exponential increase of the communicative capacity of the models realized full of illustrative contents reserved to the public at a large scale. Illustration systems based on the symbolic representation of the elements, as well as the exact metric representation of the consequences (*effects*).

Towards the VRLM (Virtual Reality Mark-up Language) optimisation there have been carried out interesting studies around the problematic of the display in Internet of GIS systems. These studies have been conducted by the Insa centre of Lyons. In the Italian reality [2], there can be observed reasonable activities carried out by the Italian National Research Council and by the Enea.

Inside of the software portfolio, it is possible to distinguish three different categories of software: mathematicians, the GIS and the CAD: the graphic quality of their representation leans on methodologies codified, and new updated info-graphic technologies. The discipline of the territory representation has taken advantage of some useful technological innovations merit of the exclusive use of digital technologies: the development of the GIS systems and the even more developed model for the representation of the territory.

Nevertheless, they are still incomplete with lots of problematic linked to the model-creation of the data, as well as to their management in complex database (GIS 3D) and to the transmission and utilization of the given data in the web. Problems, which are still unresolved.

III. Results and Discussion

In Campania, there is not a town or a district, without a small or a large architectural, artistic or archaeological heritage that does not merit to be exploited with appropriate methods of preservation or restoration aimed to improve their fruitions.

When considering the introduction in such landscape of an element such as a solid waste incinerator, it becomes even more important to analyse the effect and the impact that this element may cause [3].

This assessment represents the basic procedure to read as a whole all the fundamental values of any territorial entity.

The first aspect that should be described is the (structural) physical one: the plan-volumetric. The colours and materials used represent another important human-element of the landscape.

To define the most used materials, chromatic, etc., it has become indispensable to define the image of the territory: these factors and their occurrences reveal the personal image.

The implemented computerised representation system will have to be able to interpret these elements, which will be used therefore in the process of defining a landscape.

The varied levels of territorial interpretation can be appropriately read through the decomposition layers process of objects that belong to the same ambit.

This process is typical of Geographical Information System. Three-dimensional models, with their possibility of use, show synthetically the aspect obtained by plans/layers and sections/profiles (*map-draping*).

The complexity of the problems requires the use of a vast specific number of information on large dimensional scale that will have to be synthesized in a usable and meaningful way. Such 3D model, for areas densely civilized, will be used on line in a WebGIS finalised, for example, to the urban monitoring and to the territorial planning.

The geometrical and geographic data retrieved from the Dem will be inserted in a database structured in such manner to be able to manage and to give back usable data having different origins but contributing to describe in exhaustive manner the territory studied in its complexity and supplying also a tool of support to the landscape evaluations. The information so structured will be used like a base for the creation of a model 3D in VRML format with possible internet usage. In fact, the VRML constitutes one of the most appropriate tools for the graphic net-representation of data organized and managed in environment GIS.

A. The spanish open source gis

GvSIG is a new program for the treatment of geographic information. It has been used the software gvSIG because it is a free GIS; the software is released under a license that permits anyone to use it and supports the study; it is an open source (Fig. 1).

The gvSIG (currently at version 1.1) is the result of an ambitious project of migration towards free software, undertaken in the 2003 by the Department of Infrastructure and Transport of the Autonomous Community of Valencia.

It is designed for geographical information end users all over the world, because the interface is available in Spanish, English, German, Chinese, French, Italian and Portuguese.

One of the most important projects in this field is the development in Java language of gvSIG (where gv stands for Generalitat Valenciana); this project is co-financed by the European Union (one more interesting topic of discussion).

On the 5 December 2006 was released version 1.0 (stable) of the software, and its binary codes are freely downloadable, not only for Linux but for Windows and Macintosh.

It is able to have access to data from other programs, such as ArcView, AutoCAD or Microstation without needing to rename or change extension and format and to integrate them, even remotely connecting to different web services.

Subject to standard: it follows the rules marked for the Open GIS Consortium (OGC). It was not left out the possibility of connection to the service owner ESRI ArcIMS because of its large spread.

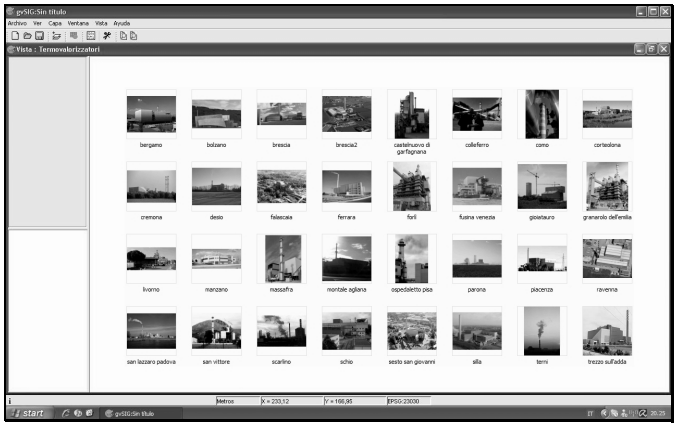

Figura 1. Shotscreen gvSIG_thermo.

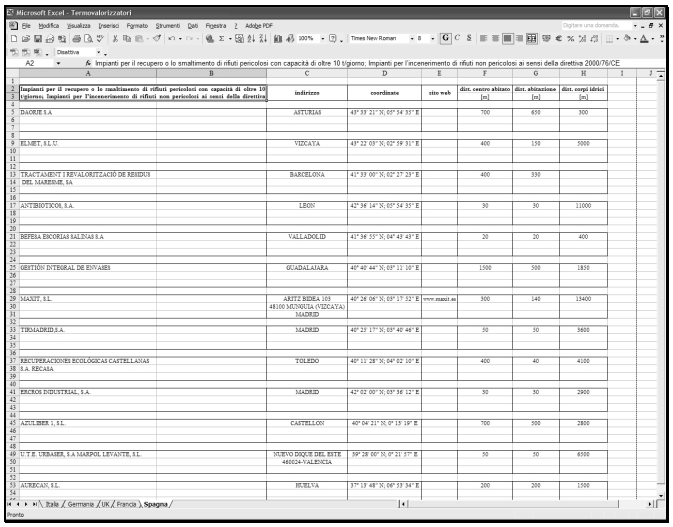

Figura 2. Report gvSIG_thermo data (http://annuario.apat.it, www.apat.gov.it, http://213.21.159.40/sportellocartografico/home.jsp, www.pcn.minambiente.it, http://stweb.sister.it/itaCorine/corine/progettocorine.htm).

B. *Data gathering*

The data, mainly gathered from the portal (www.termovalorizzatori.it), they have been gathered information regarding the location in Italy and Europe of these equipments. From these data, we have then calculated and determined: the distance from the inhabited centre; the distance from the nearer house; the distance from the water mass (lakes, rivers, dams, etc); verified the distances from zones SIC and ZPS; verified the existence of additional restrictions, in particular linked to the use of the land. An XLS file format has been compiled, based on every recovery/integration systems of dangerous waste with capacity beyond 10 ton/day and on every non-dangerous waste incinerators (according to of the directive 2000/76/CE). This XLS, Fig. 2, file contains the following information: name of the equipment; address (Road, City, Province, Region, State); coordinated in the pre-chosen geographic system; managing company (specifying if public or private); official website; year of Construction year; type of the equipment; the power of the equipment; the type of waste managed; chimney/pipes height; surfaces; aerial and perspective photos (which are not enclose in here).

C. *How to import spacial sources from a xls file*

The topic dealt with is the import of spatial sources data: not the classics shapefile, but data directly found in a text format. The aim is to import the records within a table of a PostGIS database, a spatial extension for the database management system PostgreSQL (Spatial) distributed with license GPL; a spatial database operating on Windows systems that works with the formats of specified data in the standards of the Open Geospatial Consortium. Let's take in consideration a simple file format XLS where some points of interest are stored, whose coordinate, expressed in longitude and latitude, can be easily obtained from Google Maps (Fig. 3). The successive step will be to visualize the imported spatial data directly within an OpenLayers.

```
CREATE table beni_puntuali
(
comune text,
denominazione text,
descrizione text,
longitude numeric(10,8),
latitude numeric(10,8)
)
WITHOUT OIDS;
SET CLIENT_ENCODING TO 'win1252';
COPY beni_puntuali FROM '/usr/local/pgsql/beni_puntuali.tab';
ALTER TABLE beni_puntuali ADD COLUMN id SERIAL;
ALTER TABLE beni_puntuali
ADD CONSTRAINT fid_pkey_beni_puntuali
PRIMARY KEY (id);
SELECT addgeometrycolumn
('public', 'beni_puntuali', 'the_geom', 4326, 'POINT', 2);
UPDATE beni_puntuali
SET the_geom = setsrid (makepoint (longitude, latitude), 4326);
CREATE INDEX idx_beni_the_geom ON beni_puntuali
USING GIST (the_geom);
ALTER TABLE beni_puntuali ALTER COLUMN the_geom SET NOT NULL;
CLUSTER idx_beni_the_geom ON beni_puntuali;
VACUUM ANALYZE beni_puntuali;
```

Figura 3. Importing spatial data in a PostGIS from a shapefile is, except complications, a relatively simple and immediate task that can be executed by many Desktop Gis Open Source, like demonstrated in gvSig. The issue get slightly complicated if the only data available is in text format, a possibility not so remote considering the several geocoding services available on the net. A procedure surly more interesting from a scientific and a didactic point of view, like the even less known procedure that sees the import of spatial data directly form a text file [4].

IV. CONCLUSION

This research, which is just at its start, has been preliminary concentrated on the localization of a solid waste incinerator in the vicinities of a city - and in particular on finding the necessary data, rather than in the development of a new application. The original contribution is to implement a free GIS and, successively, to make this data available to several European countries (Italy, Germany, UK, France, Spain, etc). The future developments foreseen, as anticipated, the codification of a digital protocol that will define the criterions, which will be used to assess the landscaped compatibility and to identify the relations between the environmental components (the forecast of the effects of the transformations from the landscape point of view). The data already acquired , which will be shortly available, will be used in MC models in order to compare areas where numerous European waste incinerators are already implemented, and also to define a common law for the matrix of the impacts and to codify a graphical process for the relative assessment of the environmental impacts.

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