TeMA

Journal of
Land Use, Mobility and Environment

There are a number of different future-city visions being developed around the world at the moment: one of them is Smart Cities: ICT and big data availability may contribute to better understand and plan the city, improving efficiency, equity and quality of life. But these visions of utopia need an urgent reality check: this is one of the future challenges that Smart Cities have to face.

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CITIES, ENERGY AND CLIMATE CHANGE

Vol.8 n.1 April 2015

print ISSN 1970-9889 e-ISSN 1970-9870
University of Naples Federico II

TeMA

Journal of
Land Use, Mobility and Environment

CITIES, ENERGY AND CLIMATE CHANGE

1 (2015)

Published by
Laboratory of Land Use Mobility and Environment
DICEA - Department of Civil, Architectural and Environmental Engineering
University of Naples "Federico II"

TeMA is realised by CAB - Center for Libraries at “Federico II” University of Naples using Open Journal System

Editor-in-chief: Rocco Papa
print ISSN 1970-9889 | on line ISSN 1970-9870
Licence: Cancelleria del Tribunale di Napoli, n° 6 of 29/01/2008

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Cover image: digital processing Raffaella Niglio, image Paolo De Stefano

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TeMA Journal of Land Use, Mobility and Environment

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TeMA
Journal of
Land Use, Mobility and Environment

TeMA 1 (2015) 69-81
print ISSN 1970-9889, e- ISSN 1970-9870
DOI: 10.6092/1970-9870/2885

review paper received 20 January 2015, accepted 24 April 2015
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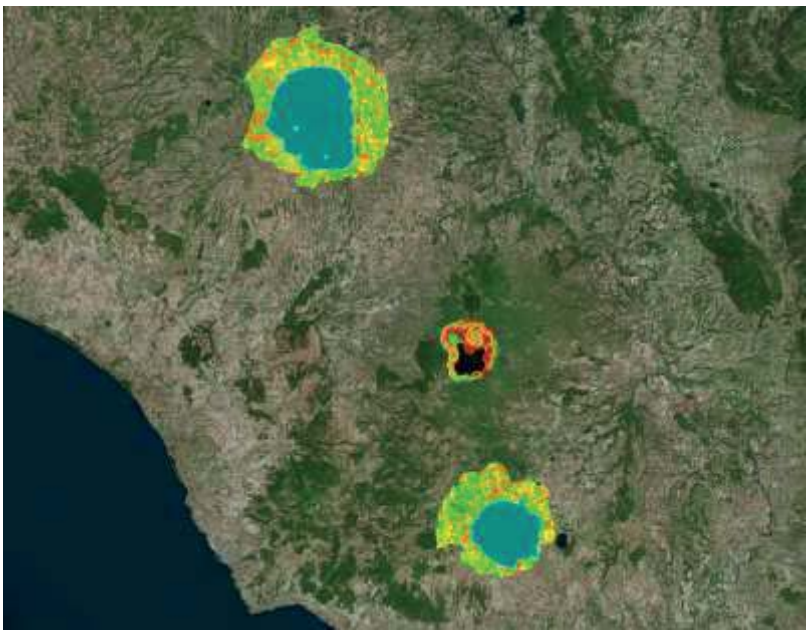
www.tema.unina.it

How to cite item in APA format:
Di Giacomo, T. V. (2015). Interactivity of webgis for the simulation of land development. *Tema. Journal of Land Use, Mobility and Environment*, 8 (1), 69-81. doi: http://dx.doi.org/10.6092/1970-9870/2885



INTERACTIVITY OF WEBGIS FOR THE SIMULATION OF LAND DEVELOPMENT

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ABSTRACT

In the definition of scenarios as key components underlying the decisions on city's and territory's transformation processes stands the comprehension of the interactions between multiple aspects that influence that dynamics.
The spatial data knowledge and the development of new ICT solutions which can guide the planner towards strategic, reliable and shared decisions are essential.
It is proposed a methodology in which to specialize the special approach established in previous projects developed by extending and implementing GIS technology Geographic Information System towards online interoperability.
The control of the effects of changes in land use in environmental quality, particularly in the water resources management, can thus become operational in the network through the application of innovative tools able to meet the new challenges of urban regeneration.

KEYWORDS:
GIS, WEBGIS, simulations, land use planning

TeMA
有关土地使用、交通和环境的杂志

TeMA 1 (2015) 69-81
print ISSN 1970-9889, e- ISSN 1970-9870
DOI: 10.6092/1970-9870/2885

review paper received 20 January 2015, accepted 24 April 2015
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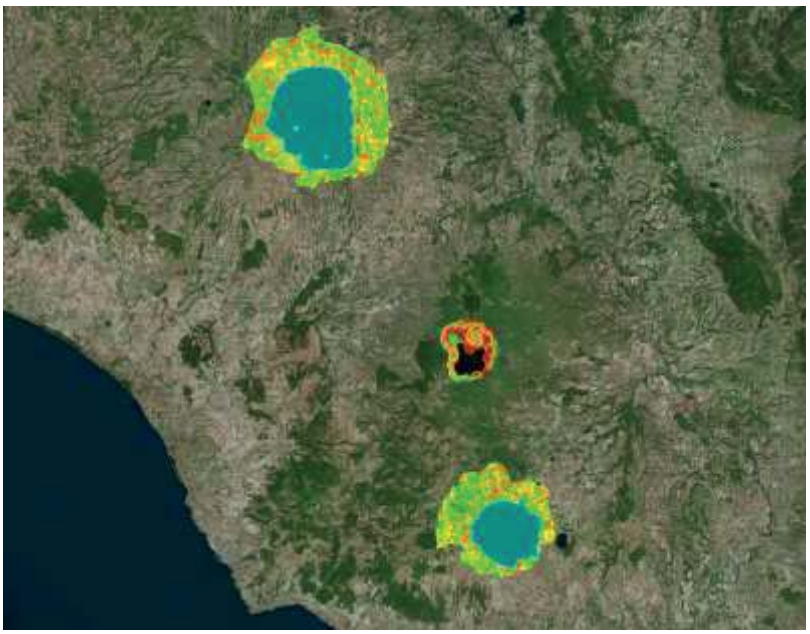

土地开发模拟中WEBGIS的交互性

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摘要

在对城市与土地转化过程进行决策时,有一些情境是支撑决策的关键组成部分. 在对这些情境解释时,需要理解对这一动态形成影响的多个方面之间的互动.空间数据知识与新信息通信技术解决方案的制定至关重要,它们可以指导规划者做出具有战略性,可靠性与共享性的决策.
这提出了一个方法, 能够将在以往项目中业已形成的特别方法专门化, 这些项目的开发是通过延伸并落实 GIS 技术地理信息系统的在线互操作性而实现的. 通过应用能够应对城市重建新挑战的创新工具, 控制用地变化对环境质量造成的影响尤其是水资源管理 在网络中将具有可操作性.

关键词
地理信息系统, 网络地理信息系统,
模拟, 土地使用规划

1 INTRODUCTION

Between 2009 and 2050, the world population is expected to increase by 2.3 billion, from 6.8 to 9.1 billion.
At the same time, urban populations are projected to increase. Thus, the urban areas of the world are expected to absorb all of the population growth over the next four decades; today around half of the people living on earth are living in urban areas and by 2050 that proportion will be 70%. Furthermore, most of the population growth expected in urban areas will be concentrated in the cities and towns and their surroundings.
The new contemporary landscapes, need special attention to the design of open spaces, of voids, of marginal or disposed areas, of interstitial spaces, of the so called SLOAP, the "Space Left Over After Planning", for urban peri-urban and regional regeneration.
Following an inter-scalar approach will allow coordinated and consistent actions from the local scale of the architectural dimension to the wide-scale of land planning.
In this perspective, it is clear the relevance of care and management processes of natural and man-made territory to counter those phenomena of degradation, abandonment or even damage of land resources and landscape.
In urban areas, for example, the phenomenon of the flow of surface water (run-off) is now considered a major source of degradation of rivers and lakes.
In the urban environment the waterproofed surface of paved areas and buildings, promoting the reduction of the time of concentration fosters the rapid run-off to the receiving bodies.
The receiving bodies gather then, from storm water, untreated waste water and water full of nutrients, sediment and solid material variously polluting.
The purification of rainwater filtered slowly through the soil, as happens in natural environments such as forests, grasslands and wetlands is prevented in urban areas from sealing terrain.
The influx of large volumes of water that occurs at prolonged or intense rainfall events, determines morphological and hydrological significant consequences on the receiving bodies related to the sudden increase of flow and velocity of runoff and erosion.
The sudden increase of the flow and the speed flow rates causes harm to fish and other aquatic life, or can make useless the body of water for which is designated (drinking water, bathing water, irrigation water).
The need for effective control and management of the flow of water of the urban areas and especially of the large metropolitan areas is evident.
Issues related to greater environmental sustainability of built areas and the conservation of soil as non-renewable resource push towards finding solutions to strategic planning for future scenarios of management and regeneration.
The European Innovation Partnership on Water - EIP Water in short - is an initiative within the EU 2020 Innovation Union. The EIP Water facilitates the development of innovative solutions to address major European and global water challenges and has identified five thematic priorities: water reuse and recycling; water and waste water treatment, including recovery of resources; water and energy integration; flood and drought risk management; and the role of ecosystem services in the provision of water related services in both urban and rural areas.
The answer to these immanent needs is the construction of appropriate ICT tools to address the greatly accelerated urban dynamics and to drive the reduction of pollution linked to the urban water cycle.
For this purpose, it is essential to know the characteristics of the present context and therefore the availability of geographic information. A Geographic Information System (GIS) can be defined as the set of technologies that can perform any operation on geographic information, from acquisition and compilation through visualization, to querying, modeling analysis, sharing and archiving. (Longley et al., 1999, 2010). As claimed by the geographer Michael F. Goodchild, the GIScience has as its challenge to find useful and

effective ways to capture and represent the infinite complexity of the geographical domain in the limited space and in the binary alphabet of a computer. Alongside this there is the challenge of characterizing what is inevitably left out, and the evaluation of its impact on the results of GIS operations.
With the Legislative Decree no. 152/99 and subsequent amendments, the legislature for the first time deals with the problem of impacts related to storm water (Article 39, paragraph 1).
The decree refers to Regions the regulation of cases where the runoff water, first rain and washing of the external areas are conveyed, collected and purified, in relation to their activities, if there is risk of pollution by hazardous substances or otherwise substances that may adversely affect the achievement of the objectives of quality of water bodies (Article 39, paragraph 3).
The issues object of this research are widely shared at European level and are in line with the principles of the Joint Programming Initiative of the European Community in the field of new challenges "Water challenges for a changing word".

2 STUDY AREA

As paradigmatic case studies were chosen the neighborhoods of Acilia and Infernetto in an area in the south of the city of Rome, whose surface waters are drained from the channel Palocco. Acilia Infernetto and are two of the peri-urban neighborhoods of Rome that have clear problems related to urban expansion, which began in the 50s, and related to the soils sealing. The Palocco Channel, located between the districts of Acilia and Infernetto, falls into that category of canals / ditches whose bed, a time of natural origin, was deputy to the drainage of surface water from a purely natural environment or, at most, semi - natural in the case of the presence of areas intended for farming and grazing.
Today this channel is being profoundly altered with a waterproofed riverbed that is required to perform its hydrological function in a highly urbanized environment.
Currently the Palocco Channel, which extends for a length of about 10.500 kilometers, drains the water coming from the districts of Acilia and Casal Palocco - Infernetto (approximately 100,000 residents) before crossing the Presidential Estate Castelporziano protected area and thus reaching the Tirrenian sea.
The main problems ascribable to this waterway are linked to hydrological instability, the transport of pollutants from diffuse sources of pollution and the high social and economic costs that its management put in place.
The mitigation of these problems, in addition to the increasing risk due to intense rainfall events becoming more frequent, it is now necessary to comply with Directive 2000/60/EC. The full and correct implementation of the Directive 2000/60 / EC, WFD (Water Framework Directive), which incorporates the Directive 91/271 / EEC on Urban Wastewater and the Directive 91/676 / EEC on nitrates from agricultural sources constitutes a indispensable condition for the attainment of the "good ecological status" required by 2015.
The management of surface water, is currently the only tool that can limit the system crisis.
For the natural and semi - natural protected area of Castelporziano and Infernetto, the experience gained so far leads to believe GLEAMS (Groundwater Leaching Effects of Agricultural Management Systems; Knisel, 1993) at the field scale and SWAT (Soil and Water Assessment Tool) to the basin scale, the most appropriate management models, which have had even more of an experimental evidence already experienced in the Lazio Region. GLEAMS and SWAT models (in their respective scales) simulate the mobilization of nutrients and pesticides, caused by the rains, in runoff, soil erosion and leaching.
These models are suitable for planning issues precisely because they focus on land use. Depending on land use are then simulated these environmental processes and, for this reason, although physical models, are classified in the category of managerial models.
The simulations allow the impacts' analysis of land management activities and the evaluation of environmental management decisions' performance.

3 OBJECTIVES, MATERIALS AND METHOD

The primary objective is to provide a practical contribution to the construction of the future landscape focusing on quality, well-being and environmental sustainability of the contemporary city and above all of marginal areas to contribute to the optimization of planning and urban regeneration.
Two realized projects are examined in the following to allow the detection of the computer tools able to achieve the set targets towards the definition of a proper environmental sustainability in urban and territorial transformations and in the identification of possible options for action.
The basis of the technological structure is founded on a cognitive analysis of the various aspects that are combined to make the environmental panorama complex such as the characteristics of river beds, banks and the consequent risks both in the soil conservation, in the defense of the landscape values and in the protection of natural resources.
These considerations underlie the analysis and evaluation of territorial systems and rural landscapes, examined in their environmental context and within the framework of natural and anthropogenic faced risks and socioeconomic variables from which are affected.
The acquired result concerns the design of GIS (Geographic Information Systems) for the synthesis between the urban planning needs and nature conservation and for the assessment of vulnerability and environmental risk of the examined areas.
The thematic decomposition into homogeneous layers simplifies the interpretation of both the environmental situation and the stratigraphy of skills and different existing rules leaving those who view the task of interpreting the relationships that exist in reality.
The first example concerns the Urban Planning GIS of a City of more than 65.000 residents in the Lazio Region, the second example concerns the Project created in the collaboration between one SME and some Research Institutions in the further developed of the technology utilized in the first case study.

3.1 URBAN PLANNING GIS

The GIS - Geographic Information System of the City of Viterbo was designed to provide map information, information on planning instruments and for the research of technical practices.
The GIS, allows to manage a large amount of data and is set up as the main reference for all the information and acts of planning. Therefore, the GIS makes available to all citizens, constantly updated data and allows to see the basic cartography to navigate on the interactive maps.
The integrated applications in the GIS allow access to legislation and to the factsheets for each object of interest (metadata) enabling, where necessary, to download forms and official documents.
The GIS - Geographic Information System makes environmental and territorial information available to a wide audience by exploiting the municipal information assets and appears as a chance to boost entrepreneurship and create jobs and new markets.
Transparency on the work of the institutions and the use of public resources becomes therefore possible and the heritage of the information is accessible and located in the territory.
The plurality of geographic data structured in the GIS (Fig. 1) come also from external geodatabase as the one of the National Cartographic Portal, or of the Lazio Region and of the Province of Viterbo as well as from the municipal offices and from Google Maps and Bing (Microsoft). The input data of the Urban Planning GIS cover many themes, from the Master Plan (Piano Regolatore Generale PRG) to higher-level constraints (hydrogeological plan PAI, hydrogeological constraint), cadastral information, road network, sewage system, green network..., all information that contribute to assemble land management and planning essential knowledge heritage.

Fig. 1 Geodatabase scheme

For the construction of the GIS was necessary to proceed to the re-projection of the cartographic bases of the PRG on the ED50 Zone 33 N projection to overlay the planning instrument both on technical maps and on aerial photos.

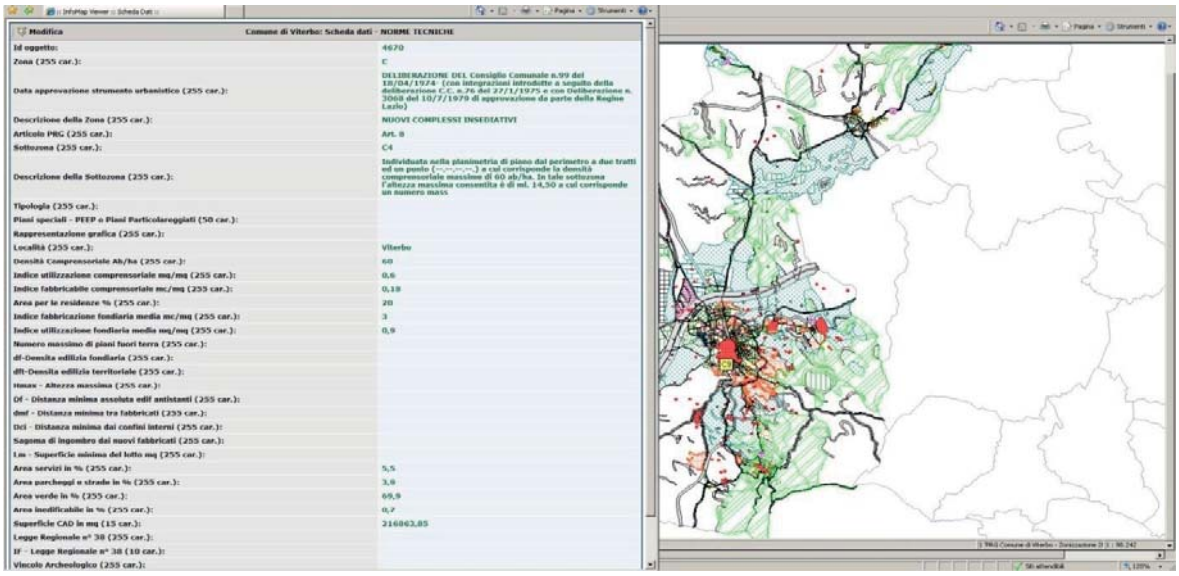

Fig. 2 Example of Web GIS with the information content

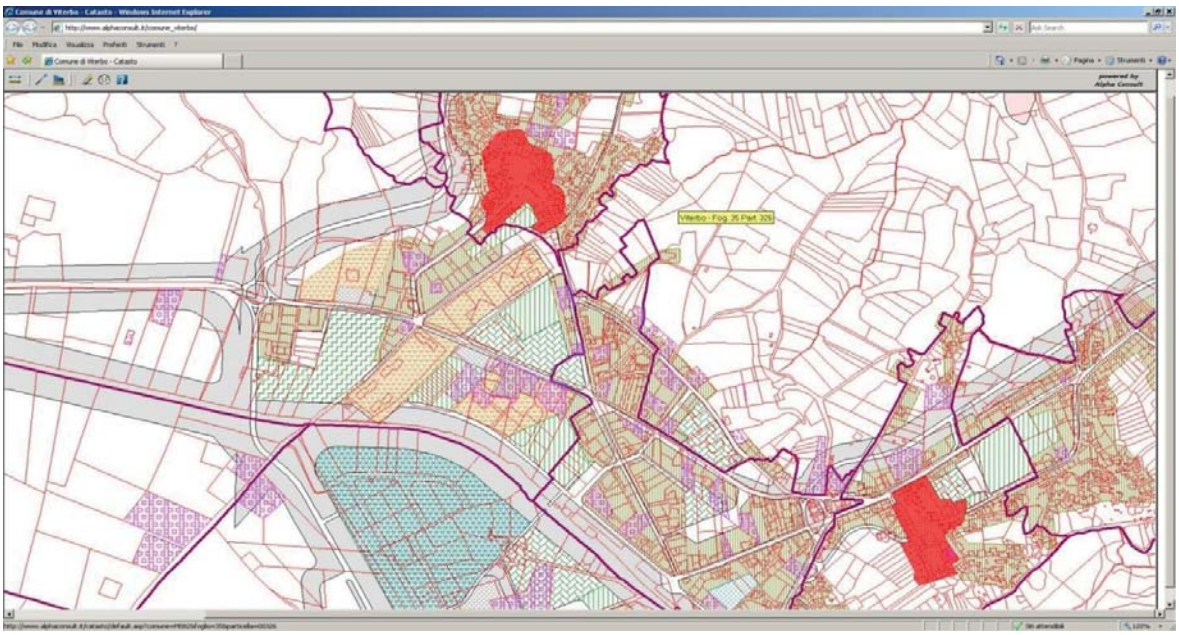

Fig. 3 Example of Web GIS with the PRG and Cadastre overlay

3.2 PROJECT FILAS CO-RESEARCH PST-CSA

The project PST-CSA Strategic Territorial Planning for a Correct Environmental Sustainability comes from the collaboration of a group composed of five research institutes coordinated by the SME Alpha Consult Ltd.
The Project Partners are therefore those listed in the following table (Tab.1).

The project aimed at testing methods of analysis to determine a sustainable planning criteria for environmental systems sensitive to anthropogenic activities which are the volcanic lakes of the Lazio Region and the Pontine plain.
The project portal collects the work of Alpha Consult to realize the on-line Geographic Information System for the dissemination of the data produced by the Research Institutes for the project PST-CSA Strategic Territorial Planning for a Correct Environmental Sustainability.

The project aimed at putting online a web service made up of geographic database queries' tools that relies on the Geographic Information System.

The web service created for the project is provided with a user interface that allows the use of online modeling for interactive study of the impacts that changing land use has on the ecosystem of lakes and reservoirs with mechanical drainage.
Through this online service, the impact of diffuse sources of pollution (mainly nitrogen and phosphorus) on surface water bodies of the Lazio Region, in particular on the volcanic lakes and the drainage canals managed with mechanic drainage, can be analyze and simulate.
The following map shows the study area, comprising the catchment areas of the five volcanic lakes of the Lazio Region and the Pontine plain: Bolsena, Vico, Bracciano, Albano and Nemi.

ALPHA CONSULT	Alpha Consult Ltd.
	University of Tuscia - Department of Agriculture, Forests, Nature and Energy (DAFNE)
CRA-CMA	National Research Unit for Climatology and Meteorology applied to agriculture (CRA-CMA)
CRA-RPS	National Research Centre for the Study of the Relationships between Plant and Soil (CRA-RPS)
	University of Rome Sapienza Department of Architecture and Design (DIAP)

Tab.1 The Project Partners

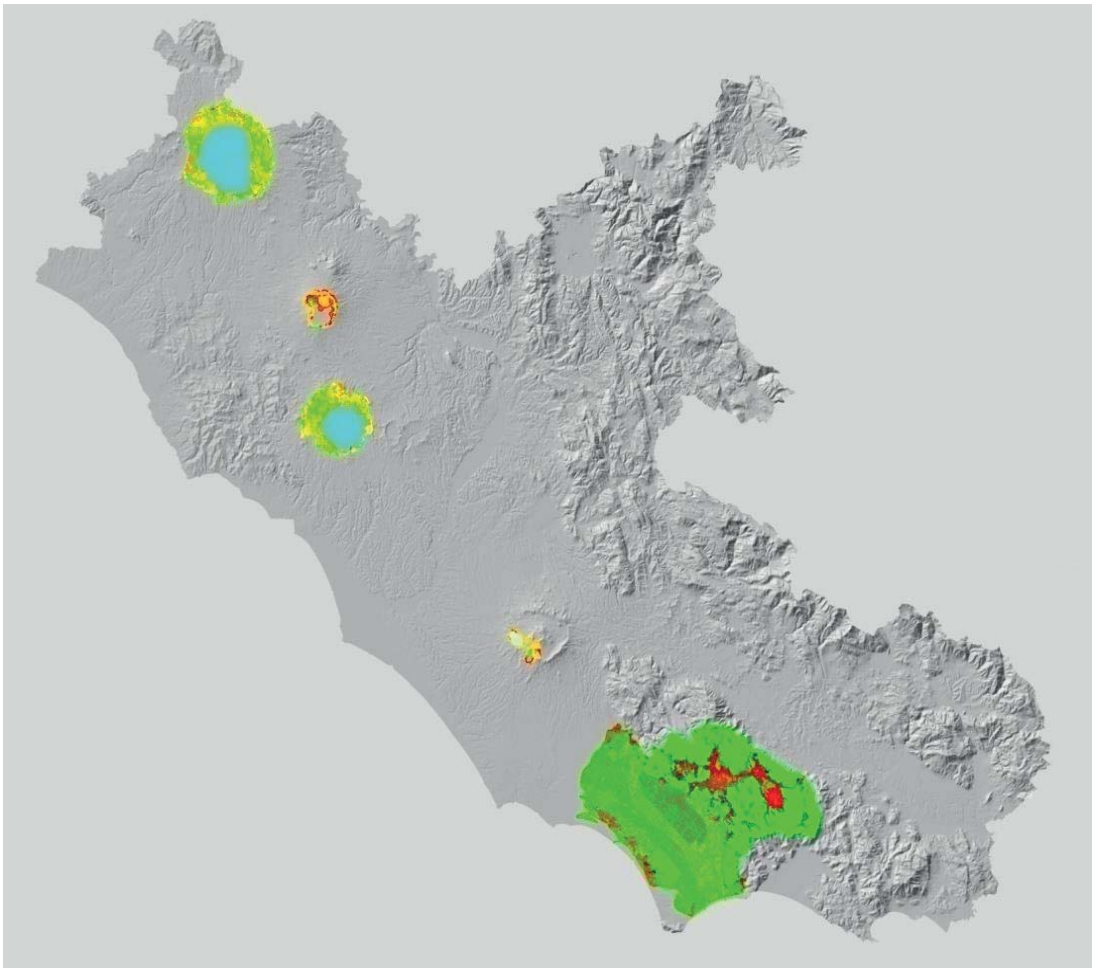

Fig. 4 The case studies: Bolsena, Vico, Bracciano, Albano, Nemi and the basins of the rivers Sisto, Rio Martino and Badino-Amaseno

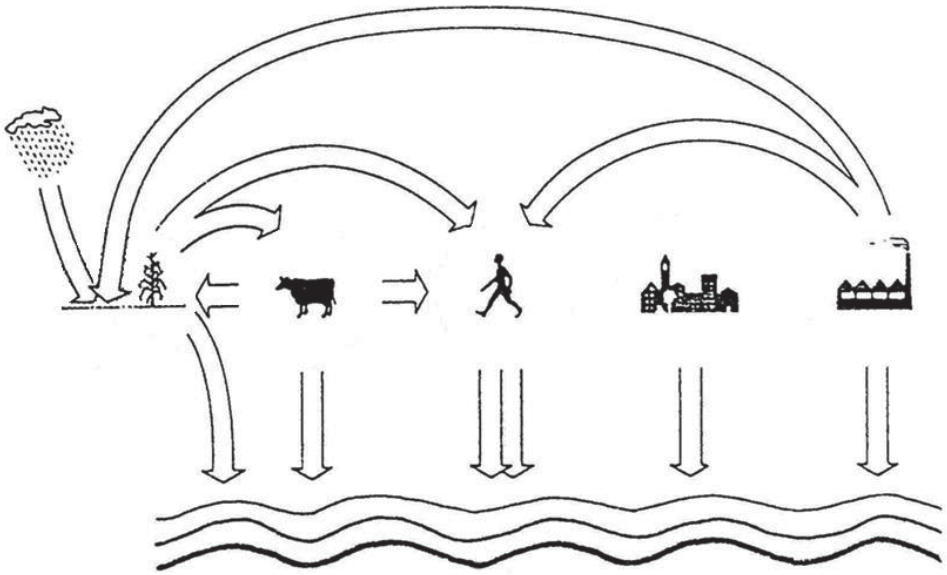

Fig. 5 The direct or indirect impacts on water bodies

The thematic geographical knowledge of the area, whose availability is one of the most challenging issue to be overcome in dealing with environmental topics, derived from years of study by the Alpha Consult and the Research Institutes, were organized in the GIS and poured in the Portal.

Specifically the main topics are those in the following table (Tab. 2.).

- Mapping of the CTR CTRN (scale 5.000 10.000 and 100.000);	- Hydro geological Map of the Lazio Region in 1:25.000
- Cartography IGM 1:25.000 and 100.000)	- Intersection between river basins and TCEV Maps (regionalization of rainfall map)
- Cadastral Cartography	- PRG: Local Government Master Plans
- Administrative boundaries	- Regional landscape Plan
- Aerial photos of 1996, 2000, 2005 and 2010 and from Google maps and Bing	- PAI Hydro-geological hazard plan of the Lazio Region River Basin and of the Tiber River Basin Authorities
- Agricultural soil map of the Lazio Region 250.000	- Ecosystem Services: Riding Trails, Gorges mapping and trails (taken from the planning documents of the Province of Viterbo: the project for the touristic development of the old roman roads such as: Via Cimina, Via Clodia and Via Amerina.
- Land Use maps:	- Archaeological map of the Province of Viterbo
_Corine Land Cover 1991: European land use database in scale 1:100,000;	- Project LIFE Rewetland: The REWETLAND project intends to set up a wide-scale Environmental Restoration Programme in the "Agro Pontino", an area with critical conditions of water pollution, mainly caused by an intensive agricultural activity, with the techniques of constructed wetlands
_CUS 2005: land use maps by Region Lazio 25.000	
_Detailed land use derived from direct ground soli surveys of the project areas with additional photo interpretation by the University of Viterbo "UNITUSCIA" (in progress)	
- Watershed maps by the National Printing Office	
- Geological Map of the Lazio Region in the scale of 1:25.000	

Tab.2 The main topics

The dissemination of data is obtained extending GIS technology on the internet, providing a powerful tool to share related information available to multiple users simultaneously. In the realization of the project on this platform have been developed accessory functions in order to ensure that in addition to classic queries connected to the polygons on the GIS (to select, view and edit values) the user could also operate to repeat the simulations made by the GLEAMS model highlighting the results on the cartography.

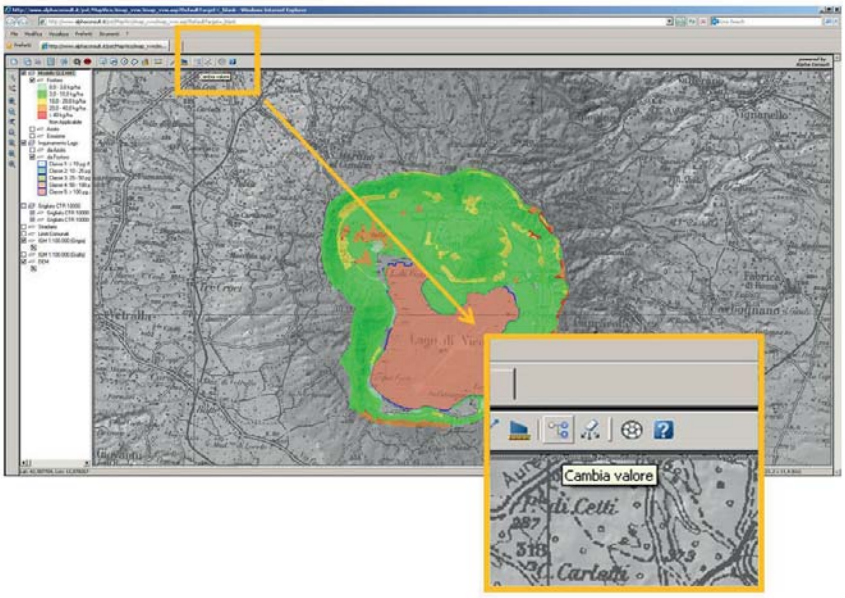

Fig. 6 Accessory functions to perform simulations

To make interactive simulations made with GLEAMS Model the selections made on the online mapping needed to be managed by a number of suitable features that produced the end result. The result is obtained as a given polygon, and as an aggregate of all the polygons in the river basin whereas taken together, provide the environmental quality of the lake.

The main difficulty has been to ensure that the user could perform a interactively simulation changing online the value of land use to view the results in the layer of the health of the lakes.

The legend of the land use map CUS 2005 was reduced to define the land use classes to be included in the model (Fig. 7). Land use classes used for modeling refer to:

- Ryegrass corn;
- Forest;
- wasteland;
- alfalfa or lucerne
- hazelnut
- Not applicable.
- Beside the simulation of the contribution of agriculture is assumed to consider the polygon "not applicable" in case the contribution to pollution of the polygon is led through a sewer system to a wastewater treatment plant (the drainage system around the lake).

COD	DESCRIZIONE		
11	Insediamento residenziale	urbano	NULLO
12	Insediamento produttivo, dei servizi generali pubblici e privati, delle reti e delle infrastrutture	urbano	NULLO
131	Aree estrattive	urbano	NULLO
141	Aree verdi urbane	urbano	NULLO
143	Cimiteri	urbano	NULLO
221	Vigneti	arboree (colture permanenti)	NOCCIOLETO
222	Frutteti e frutti minori	arboree (colture permanenti)	NOCCIOLETO
223	Oliveti	arboree (colture permanenti)	NOCCIOLETO
231	Superfici a copertura erbacea densa	seminativi	LOIESSA-MAIS
241	Colture temporanee associate a colture permanenti	arboree (colture permanenti)	NOCCIOLETO
242	Sistemi colturali e particellari complessi	seminativi	LOIESSA-MAIS
243	Aree prevalentemente occupate da coltura agraria con presenza di spazi naturali importanti	foraggere	MEDICA
311	Boschi di latifoglie	bosco	BOSCO
312	Boschi di conifere	bosco	BOSCO
313	Boschi misti di conifere e latifoglie	bosco	BOSCO
321	Aree a pascolo naturale e praterie d'alta quota	foraggere	MEDICA
322	Cespuglieti ed arbusteti	incolti	INCOLTO
323	Aree a vegetazione sclerofilla	incolti	INCOLTO
331	Spiagge, dune e sabbie	aree non agricole	NULLO
332	Rocce nude, falesie, affioramenti	aree non agricole	NULLO
333	Aree con vegetazione rada	foraggere	MEDICA
411	Paludi interne	aree non agricole	NULLO
421	Paludi salmastre	aree non agricole	NULLO
422	Saline	aree non agricole	NULLO
423	Zone intertidali marine	aree non agricole	NULLO
521	Lagune, laghi e stagni costieri	aree non agricole	NULLO
523	Aree al di là del limite delle maree più basse	aree non agricole	NULLO
1321	Discariche e depositi di cave, miniere, industrie e collettività pubbliche	urbano	NULLO
1322	Depositi di rottami a cielo aperto, cimiteri di autoveicoli	urbano	NULLO
1331	Cantieri e spazi in costruzione e scavi	urbano	NULLO
1332	Suoli rimaneggiati ed artefatti	incolti	INCOLTO
1421	Campeggi, strutture ricettive a bungalows o simili	urbano	NULLO
1422	Aree sportive	urbano	NULLO
1423	Parchi di divertimento	urbano	NULLO
1424	Aree archeologiche	urbano	NULLO
2111	Seminativi semplici in aree non irrigue	foraggere	MEDICA
2112	Vivai in aree non irrigue	seminativi	LOIESSA-MAIS
2113	Colture orticole in pieno campo, in serra e sotto plastica in aree non irrigue	seminativi	LOIESSA-MAIS
2121	Seminativi semplici in aree irrigue	seminativi	LOIESSA-MAIS
2122	Vivai in aree irrigue	seminativi	LOIESSA-MAIS
2123	Colture orticole in pieno campo, in serra e sotto plastica in aree irrigue	seminativi	LOIESSA-MAIS
2241	Pioppeti, saliceti, altre latifoglie	bosco	BOSCO
22412	Conifere a rapido accrescimento	bosco	BOSCO
2242	Castagneti da frutto	arboree (colture permanenti)	NOCCIOLETO
2243	Altre colture permanenti	arboree (colture permanenti)	NOCCIOLETO
3241	Aree a ricolonizzazione naturale	incolti	INCOLTO
3242	Aree a ricolonizzazione artificiale	foraggere	MEDICA
3141	Boschi percorsi da incendi	bosco	BOSCO
3142	Altre aree della classe 3 percorse da incendi	incolti	INCOLTO
3343	Aree degradate per altri eventi	incolti	INCOLTO
5111	Fiumi, torrenti e fossi	aree non agricole	NULLO
5112	Canali e idrovie	aree non agricole	NULLO
5121	Bacini senza manifeste utilizzazioni produttive	aree non agricole	NULLO
5122	Bacini con prevalente utilizzazione per scopi irrigui	aree non agricole	NULLO
5123	Bacini con prevalente altra destinazione produttiva	aree non agricole	NULLO
5124	Acquacolture	aree non agricole	NULLO

urbano	GLEAMS NON APPLICABILE
arboree (colture permanenti)	NOCCIOLETO
seminativi	MAIS
incolti	INCOLTO
aree non agricole	GLEAMS NON APPLICABILE
bosco	BOSCO
foraggere	MEDICA

Fig. 7 The reduced land use classes

The user may decide to change directly on the screen the type of land use of one or more polygons, by acting on the theme of the overlay. The system (geodatabase) identifies the selected polygons and change the value of contributions of environmental modeling parameters such as phosphorus or nitrogen.

These simulations are driven and based on predefined scenarios stored in the database that can be improved.The application allows you to view the data of the simulation based on the changed values, and then display the result of the state of health of the lake that these areas represented by polygons will provide the environment due to the changes made. That is not only to enable queries to the database but to be interactive in the use of GLEAMS model data, all without leaving the Web GIS cartographic consultation.

Thus, the portal gives access to structured data that have been placed on the Web Server and the interaction on the Web GIS determines the possibility of multiple users on a network to work on a common territorial board and simulate scenarios placed at the disposal of all. On the following image (Fig. 8) the results after changing values in the case of phosphorus.

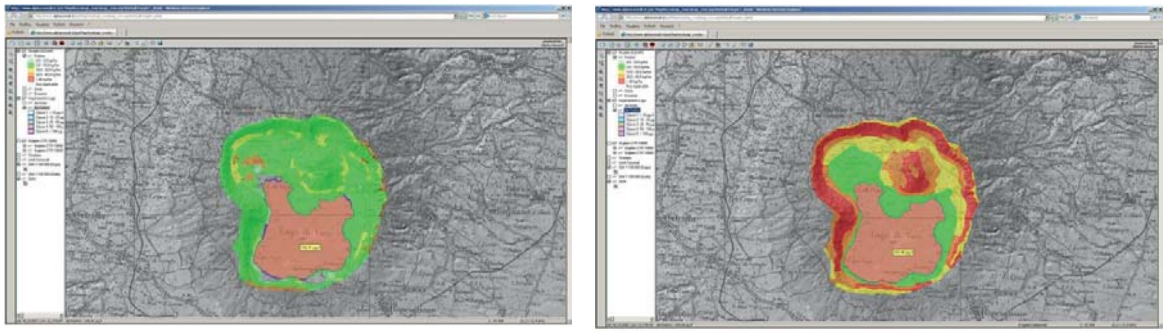

Fig. 8 Before and after the simulation

The work of the University of Tuscia produced GLEAMS model processing that have been conferred to the information system in excel format.

In order to accommodate the modeling data was necessary to perform the overlap between the basic themes (overlay) and then producing tables output in the geodatabase that describe the polygons overlay. The polygons of the overlay have been connected to modeling data processed in the SQL database .

The approach of the project PST-CSA is completely opened to the overlay of the topics considered essential for the application of the pollutants valuation models.

The value is properly given by taking into account the parameters of the polygon overlay whose waters arrive in the catchment area of the lake.

The special feature of the used method is therefore to have put on-line at the disposal of an evaluator who consults the system the layer resulting from the intersections of the types of all the issues that enter the GLEAMS model.

All themes have been traced back to a single informative level in which the polygons generated by the intersections of the various plans have the characteristic of having a single value in each thematic layer.

In this way, it is possible to graphically display the influence on the territory of a single theme but also the application of a weight due to modeling and see the results of the envelope of the information on another topic, in this case the lake's health.

This methodology allows to have discretized the modeling reality in individual thematic topological overlay where polygons represent the homogeneous characteristics of slope, land use etc.

This way you have a chance to go into detail and improve the system error more is deepening the knowledge of the specific theme.

In the case of the scale of the project was obtained an intersection of themes with a sufficient accuracy to be able to adequately represent the result of the transport of nutrients in the polygon that represents the receiving body, the lake.

The novelty of the process was to define the color changes and therefore the quality of the individual nutrient.

In this way it is possible to assess the issues of the contributions of modeling and which polygons contribute with nutrients in the lake.

This result was achieved and can be reformulated interactively online by the user by changing the values using the developed functions thanks to the simultaneous use of an on-line map server and a database server that offer a synergistic service for displaying modified modeling data.

The web GIS device then becomes a reality's interpretation tool through the use of established modeling and becomes a tool for the planner: no longer a GIS to produce risk's maps but a geodatabase on which to apply a spatial modeling to simulate alternative land use planning scenarios.
The large amount of data that a planner must keep under control now needs the help of the computer tool that extends the analytical capabilities of human mind. The planner has to set the rules of the system being able to assist in the development of modeling and being therefore capable of a critical reading of the results.
By merging the two professions of computer science and spatial planning comes the opportunity to give back to the land planner a tool to manage complex processes and to have the basis for a future environmental monitoring of what has been achieved refining results identified in modeling with field sensors.

4 CONCLUSIONS

The proposed methodology and the geographic information system (GIS) on line (WEBGIS) to be applied to the case study of the Palocco Channel will allow all governments of the region to take advantage of a methodology to perform simulations of scenarios related to territorial changes and the impact of those changes on the state of water resources.
This tool will help incisively in decision-making processes related to scheduling, planning and land management.
The main users of this tool are local governments to support the design, upgrading and management of urban and peri-urban areas; professionals and businesses for development opportunities; residents in urban and peri-urban areas as end users.
The strength of the project, in fact, is represented by the potential applications of transversal interest for local authorities, trade associations, professionals and for civil society.
The result is the provision of a flexible and upgradeable tool to support the preparation of planning instruments (for example urban planning implementation, structural plans, landscape plans, water conservancy plans, Provincial Coordinating plans, procedures for Environmental Impact Assessment, constraint plans, regional planning and landscape plans) and the study of the effects of projects to apply a careful management of water resources of rural and peri-urban areas.
The contribution in the realization of a number of tools to help the planner on handling a considerable amount of data will allow different future developments. Some of the most important future developments apply to the ability to use digital information for the territorial development, the possibility to exploit local information assets for job creation and to encourage the development of other private applications on the public data made. The new features developed specifically for the portal allow then to perform simulations on the network. These simulations are designed to aid the planner to create different planning scenarios and to show the changes that planning involves in the water quality of the lakes.
The display update is automatic and allows to extract different data scenarios, which are essential for the planner. According to Professor Bernardo Secchi: "The definition of scenarios in recent years seems to have become an essential component of the decisions on the transformation processes of the city and the territory. The fast change and the multiplicity of actors involved need to project the hypothesis of the project within the future to assess the likely impacts, reliability, sharing" (Secchi, 2000).
The proposed methodology and the online geographic information system (SIT/ GIS &WEBGIS) will allow all governments of the region to carry out simulations of a change of scenario for changes in land use and its impact on the state of water resources. Such a cognitive tool to support the decision-maker might affect , in the early stages, decision with respect to spatial planning, where now the parameters to keep in mind and the data to take into account apply to a plurality of issues to be addressed simultaneously that are outside

the range of a single expert especially in large scale, the one of the basins and then to the regional and interregional scale (district).

A similar approach is represented by the ESPON European Spatial Planning Observation Network TIA Territorial Impact Assessment where are directly analyzed the territorial impacts of EU policies.

As suggested in the ESPON network, maps are a useful and easy way to make complex information accessible to a wide audience. This kind of tools based on the multi-scalar territorial analysis concept are therefore fundamentally useful in territorial analyses, in support of successful policy.

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